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## Upgrading Nurses' Performance Regarding Care of Neonates Suffering from Pneumothorax

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### Abstract

**Background:** Pneumothorax is a critical illness that can cause a serious complication. So, early recognition and management of pneumothorax are crucial to avoid serious life-threatening issues. **Aim:** This study aimed to upgrade nurses' performance regarding care of neonates suffering from pneumothorax. **Design:** Quasi-experimental design was utilized. **Setting:** Neonatal intensive care unit at Tanta Main University Hospital and El-Mabra Hospital at El-Mahalla. **Sample:** Sixty nurses who provided direct nursing care for neonates 30 from each setting. **Tools:** Tool I: Nurses' Knowledge Questionnaire Regarding Pneumothorax, Tool II: Pneumothorax Care Observational Checklists and Tool III: Endotracheal Tube Suction Observational Checklists. **Results:** Preprogram less than half of nurses 43.3% had satisfactory practice compared to 91.7% and 85% immediately and one month post educational program respectively. There was positive correlation between nurses' knowledge and practices about care of neonates with pneumothorax post the educational program. **Conclusion:** Nurses' performance regarding care of neonates with pneumothorax is upgraded post implementation of educational program and there was significant improvement in nurses' overall knowledge and practice. **Recommendation:** Ongoing education should be provided to nurses regarding care of neonates with pneumothorax.

**Keywords:** Neonates, Nurses, Performance, Pneumothorax.

## Introduction

Pneumothorax remains a common respiratory complication that contributes to an increase in perinatal morbidities, and mortality, especially in preterm infants and critically ill newborns, however improvements in newborn critical care, including the use of prenatal steroids, and surfactant replacement therapy (**Jovandacic, Milenkovic, Dotlic, 2023**). Neonatal pneumothorax is defined as the abnormal accumulation of air between visceral and parietal pleura of the lungs in infants who have not completed the first 28 days post birth. The incidence of neonatal pneumothorax is between 0.8 and 1.9 per 1000 live births. Pneumothorax is more common in newborns, particularly in the first three days of life, compared to all other age groups (**Abed, Al-Ani & Shitran, 2022**).

According to statistical records of El-Mabra Hospital at El-Mahalla, about 30 and 35 neonates diagnosed with pneumothorax in 2023 and 2024 respectively (**Medical Statistical Records of Neonatal Intensive Care Unit at El-Mabra Hospital at El-Mahalla. 2023-2024**). Pneumothorax is more frequent in the neonatal period, and its frequency is higher in newborns with concomitant underlying lung disease or who require mechanical ventilation. Other risk factors include

preterm neonates, at as much as 5% - 7% in newborns weighting less than 1500 g, males, cesarean delivery, amniotic fluid stained with meconium, and invasive and noninvasive respiratory support (**Acun, et al., 2021**). According to reports, the incidence of spontaneous symptomatic pneumothorax ranged from 0.05% to 1%, while it was between 2.8% and 9% in NICU (**Ghenu, et al., 2023**).

Depending on its cause, pneumothorax is categorized as either primary or secondary. Presenting spontaneously shortly post birth without severe underlying lung illness or the presence of risk factors like preterm or invasive or noninvasive ventilation is known as primary pneumothorax. (**Halibullah, et al., 2023**). The use of positive pressure ventilation during resuscitation, surfactant treatment, endotracheal suctioning, pulmonary hypoplasia, congenital lung malformations, meconium aspiration syndrome, , congenital pneumonia, and traumatic injury to the pleura are risk factors for secondary pneumothorax (**Awad, Wahdan, Al-Metyazidy , Weheida.2021**).

Iatrogenic pneumothorax can happen following operations such thoracentesis, positive-pressure mechanical breathing, and central venous catheterization. Traumatic pneumothorax is typically blunt and

penetrating traumas. Diagnosis of pneumothorax can be achieved by chest X-ray or computed tomography. **(Batra, et al 2022)**. Nonspecific respiratory symptoms, such as respiratory distress, tachypnea, increased retraction, increased oxygen or pressure demand, and increased anterior–posterior chest diameter in infants on mechanical ventilators, were indicative of neonatal pneumothorax in infants admitted to the neonatal Intensive care unit. Pneumothorax was also taken into consideration in the delivery room, particularly for infants who did not react to resuscitation. An x-ray of the chest was taken of those neonates **(Aranguren, Ferrón, Ruiz et al., 2019)**.

In addition to being linked to intraventricular hemorrhage, extended hospital stays, and death, pneumothorax can impair breathing and hemodynamics. Based on the degree of respiratory support needed, radiographic features, comorbidities, and the severity of clinical symptoms, clinicians choose a course of treatment **(Osman, Reffat, Meawad, 2023)**. As a result, early identification and treatment are essential. Neonatal pneumothorax can be treated conservatively without drainage, definitively with chest tube implantation until the air leak is fixed, or with drainage and needle aspiration,

which involves temporarily inserting a needle into the pleural cavity **(Engin, Gülden & Kılıçaslan, 2022)**.

Chest tube care may seem complex, but in order to improve outcomes and lower the risk of problems, so it is crucial to have accurate understanding of the fundamentals of drain placement and system operation. Medical or surgical teams with experience caring for neonates with chest drains should provide care. To be competent nurse in providing care for this neonate, they must have undergone continuous training and education **(Kastein, Coe, Gephart & Newnam, 2023)**.

Chest tube care represents a complex and critical procedure. Serious complications, including lung perforation and local infection at the insertion site, can be avoided through careful monitoring and expert consultation during both the procedure and the ongoing management **(Campisi, et al., 2022)**. The nurses must assess patency of the chest drainage system by observing respiratory fluctuations of the fluid in the water-seal chamber when the neonate is on gravity drainage, observes air drainage from the chest tube and marked the amount of sterile water directly on the drainage chamber according to hospital policy **(Batra, et al., 2022)**.

**Significance of the study:**

Neonate pneumothorax mortality rates range from 16% to 65%. One of the more difficult tasks for nurses is caring for a neonate with a chest tube. It has been estimated that up to 30% of neonates with chest tubes experience difficulties (Kim and Lee 2019), there is a considerable avoidable morbidity associated with this operation. Insufficient training or experience can lead to complications. A delayed or insufficient evacuation of the accumulated air or fluid in the pleural space, as well as a delayed re-expansion of the collapsed lung, can result from improper management of the chest tube and its drainage systems (Awad, et al., 2021).

Nurses who possess sufficient knowledge and experience in the management of the condition in question can minimize the occurrence of severe complications and ensure optimal outcomes for neonates with chest tube. Nurse practitioners must possess a comprehensive understanding of the anatomical structure of the chest. Their scope of practice encompasses several critical components, including the assessment of the chest tube site to prevent dislodgement and infection, the management of effective suction and drainage, the administration of pain relief, the monitoring of respiratory

status, and provision of comprehensive supportive care (Ravi & Chavan 2022). Therefore, this study is focusing on upgrading nurses' performance regarding care of neonates suffering from pneumothorax.

**Aim of the Study**

Upgrade nurses' performance regarding care of neonates suffering from pneumothorax

**Research hypothesis**

Implementing an educational program on the care of neonates with pneumothorax is expected to enhance nurses' performance.

**Research design:**

A quasi-experimental research design was used in the present study.

**Setting:**

The present study was carried out at two settings:

**1-Neonatal Intensive Care Unit at Tanta Main University Hospital** which affiliated to Ministry of Higher Education and Scientific Research. It consists of three rooms, room one has five incubators, room two has twelve incubators and room three has seven incubators.

**2- Neonatal Intensive Care Unit of El-Mabra Hospital at El-Mahalla** which affiliated to Ministry of Health and Population. It consists of three rooms, room one has six incubators,

room two has eight incubators and room three has seven incubators.

**Subjects: -**

All nurses sixty nurses (n = 60), 30 nurses from each of the two previously mentioned settings who provided nursing care for neonates suffering from pneumothorax.

**Tools of data collection**

Three tools were utilized for the collection of data:

**Tool (I): Nurses' Knowledge Questionnaire** Regarding Pneumothorax: It was developed by the researcher post reviewing pertinent researches (Acun, et al., 2021; Kim & Lee 2019). It included:

**Part (1): Bio-socio-demographic Characteristics of the Studied Nurses:** It included age, sex, level of education, experience and previous attendance of pneumothorax training sessions.

**Part (2): Nurses' Knowledge Questionnaire:** It included two parts:

**A- Nurses' knowledge regarding pneumothorax:** It included 9 questions as meaning of pleural cavity and pneumothorax, types, causes, sign & symptoms, diagnosis, management and complication of pneumothorax.

**B-Nurses' knowledge regarding chest tube:** It was included 11 questions such as meaning of chest tube, aim, insertion sites, types and

component of chest drainage system, site of insertion, tests done before insertion, needed equipment, nursing care, and complication of chest tube.

**Scoring system of the knowledge:**

- Complete correct answer was scored (2)
- Incomplete correct answer was scored (1)
- Don't know or incorrect answer was scored (0).

**The total scores of nurses' knowledge were categorized as the following:**

- Low level  $\leq 60\%$
- Moderate level 60% - 80%
- High level  $\geq 80\%$

**Tool (II): Pneumothorax Care Observational Checklists:** It was developed by the researcher post reviewing the relevant literatures (Abdel-Mohsen, Shafik, & Abdel Esalam, 2023; Thomas, Rahman, Maskell, Lee, 2020; Aranguren, et al., 2019). It included the following:

**A: Nurses' practice before chest tube insertion included the following:**

It included assessment of neonates; prepare the equipment of chest tube and drainage system and assisting physician during insertion of chest tube.

**B: Nurses' practice post chest tube insertion:**

It included routine care of chest tube, nurses' practice regarding change chest



tube's bottle (collection system), and nurses' practice regarding wound care

**Nurses' practice during chest tube removal:**

It included preparation of neonates' equipment and procedure such as clamping chest tube before removal, and the nursing role after removal of chest tube.

**Scoring system for nurses' practice:**

- Correctly done was scored (1)
- Incorrectly done or not done was scored (0)

**The total scores were categorized as the following:**

- Unsatisfactory practice  $\leq 80\%$
- Satisfactory practice  $\geq 80\%$

**Tool (III): Endotracheal Tube Suctioning (ETTS) Observational Checklists.** The researcher developed the scale following a comprehensive review of the existing literatures (Tomaszek, Pawlik, Mazurek & Mędrzycka, 2021). The instrument was utilized to evaluate nurses' practices concerning the use of ETTS for neonates diagnosed with pneumothorax by using observational checklists. This procedure included preparation, procedure and after procedure.

**Scoring system for nurses' practices:**

- Correctly done was scored (1)
- Incorrectly done or not done was scored (0)

**The total scores were categorized as the following:**

- Satisfactory practice  $\leq 80\%$
- Unsatisfactory practice  $\geq 80\%$

## **Method**

### **1-Administrative process:**

An official permission clarifying the purpose of the study was obtained from the Faculty of Nursing and was submitted to the responsible authorities of the selected setting for permission to carry out the study.

### **2- Ethical consideration:**

a- Approval of the Faculty of Nursing scientific research ethical committee was obtained No. **(360-1-2024)**.

b- All participants were informed about the purpose of the study.

c- Informed consent was obtained from each participant, with assurance of their right to withdraw from the study at any time and the study posed no harm on them.

**3-** Tools of the study were developed by researcher based on related literatures and translated into Arabic language.

**4-** The tools were evaluated for **content validity** and relevance by a panel of five experts in the field, achieving a content validity index of 98.5%.

**5- Reliability of tools** was tested by using Cronbach's Alpha Coefficient Factor; values were 0.973, 0.893 and 0.897 for tool I, II and III respectively.

6- A **pilot study** was conducted on 10% of the nurses (6 nurses) to test the clarity and applicability of the tools, and they were not excluded from the total study sample to maximize overall benefit.

**Phases of the study:** The study was conducted as follow:

**Phase (I) Assessment phase:**

The researcher formally introduced herself to the selected nurses and provided a concise overview of the study's objective. Subsequently, written consent was obtained from each nurse.

The researcher met with each nurse in the nurses' room to conduct the interviews, subsequently documenting the results on the designated interview sheets. The average time required for researcher to complete the form for each nurse was between 20 and 30 minutes. The researcher conducted observations of nurses' practices during chest tube management and ETTS to complete practice checklist sheets for the nurses under study. These assessments were conducted to evaluate the nurses' baseline knowledge and practices regarding pneumothorax,

**Phase (II) Planning phase:**

- This phase included the assessment of the studied nurses to plan the program according to their needs as the following:

**Developing nursing educational program through**

- Setting objectives and preparation of the content to achieve the objective
- A simplified, colored Arabic booklet was developed for nurses to facilitate understanding of pneumothorax, chest tubes, and their management.

**Phase (III): Implementation phase:**

- The educational program was carried out in the mentioned settings within the schedule of nurses working hours.
- The nurses (n=60) were divided into 10 groups, each group consist of 6 nurses, The program included six sessions; that were obtained through 2 weeks, each session took about 30- 45 minutes.
- Diverse teaching methods were used during the sessions including; group discussion, demonstration & re-demonstration, pictures, printed booklets, and actual nursing care on the neonates.
- It took 6 months from May to the end of October 2024. The educational sessions were carried out as follow:  
**First session:** It focused on theoretical knowledge about pleural cavity, overview of pneumothorax as pneumothorax meaning, types, causes, signs and symptoms, diagnostic measures, management and complications through using power point presentation, simple explanation, and group discussion.

**Second session:** It was centered on chest tube such as meaning, aim, indications and types of chest drainage system, equipment needed, site of insertion, tests done before insertion, nursing care.

**Third session:** It included nurses' practice before chest tube insertion such as preparation of equipment and neonate, their role during insertion, assessment of chest drainage system patency and signs that reveals lung expansion.

**Fourth session:** It was centered on nurses' practice post chest tube insertion such as care of chest tube, change chest tube's bottle, bubbling assessment, wound care, method to ensure the tube inside the pleural cavity and method to avoid complication post chest tube insertion.

**Fifth session:** It included nurses' practice during chest tube removal such as clamping chest tube before removal, maneuver during chest tube removal and the nurse role post chest tube removal.

**Sixth session:** It included nurses' practice regarding ETTS of neonates with pneumothorax. Each session was ended by a summary of its content and the nurses give their feedback.

#### **4) Evaluation phase:**

The evaluation of nurses' knowledge and practice was carried out using the study tools. Immediately following the

implementation of the program and subsequently one month later, each nurse was evaluated individually. These two evaluations were then compared to the pretest results to ascertain the impact of the program on the knowledge and practices of the nurses.

#### **Statistical analysis:**

The collected data were then organized, tabulated, and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 20.0). Quantitative data were described using number and percent, and mean and standard deviations were calculated. For qualitative data, a comparison between two groups and more was conducted using the Chi-square test ( $X^2$ ) for comparison between more than two means of parametric data. For the purpose of interpreting the results of statistical tests, the significance level was established at  $p < 0.05$ . (White 2019).

#### **Results**

**Table (1):** Reveal distribution of the studied nurses according to their socio-demographic characteristics. It was observed that the mean  $\pm$  SD of nurses' age was  $32.97 \pm 7.23$ . It was observed that 85% of nurses were females. Most of the nurses (83.3%) were lived in rural areas and 80% of them were married. Regarding nurses'

educational level, it was found that more than half of them (58.4%) had technical institute of nursing while one third of nurses (33.3%) of had Bachelor of nursing science .

**Table (2):** Illustrates distribution of the studied nurses' total knowledge about care of neonates with pneumothorax pre, immediately post and one month post educational program. It was observed that one quarter (25%) of nurses had high level of knowledge regarding pneumothorax preprogram that became 93.3% & 88.3% immediately and one month post the educational program respectively. Regarding nurses' knowledge about chest tube, it was noticed that 18.3% of nurses had high level of knowledge preprogram that was improved to 95% & 91.7% immediately post and one month post the educational program. There were statistical significant difference regarding nurses' total knowledge and knowledge's parts pre & immediately post educational program and also pre & one month post educational program, while there was no statistical significant difference regarding nurses' total knowledge and knowledge's parts immediately & one month post educational program. It shows that there was a highly significant improvement regarding total nurses' knowledge where majority of nurses

(93.3% & 90%) had high level of knowledge immediately and one month post educational program respectively compared to 20% preprogram.

**Figure (1):** Shows nurses' total level of practices regarding care of neonates with pneumothorax. It reveals that preprogram less than half of nurses 43.3% had satisfactory practice compared to 91.7% and 85% immediately post and one month post educational program respectively regarding nurses' total level of practices' parts toward care of neonates with pneumothorax.

**Figure (2):** Explains nurses' total level of practices regarding endotracheal tube suctioning of neonates with pneumothorax

It indicates that less than half of nurses (45%) of nurses had satisfactory practice regarding ETTS preprogram compared to 95% & 88.3% respectively immediately post and post one month of educational program.

**Table (3):** Represents relation between nurses' total knowledge and their socio-demographic characteristics pre, immediately and one month post educational program. It was evident that there was statistically positive relation between nurses' total knowledge and their age ( $p=0.000$ ,  $p=0.007$  &  $p=0.000$ ) respectively pre,

immediately post and one month post educational program. No statistically significant relation was detected between total nurses' knowledge and sex or residence pre, immediately & one month post educational program. It was observed that there was positive highly significant relation between total nurses' knowledge and their educational level and their years of experience pre, immediately and one month post awareness program ( $p = 0.000$ ).

**Table (4):** Demonstrates relation between nurses' total practice regarding neonates suffering from pneumothorax and their socio-demographic characteristics pre, immediately and one month post the educational program. It was observed that there was positive highly significant relation between total nurses' knowledge and their age pre, immediately post and one month post awareness program ( $p = 0.000$ ). This table also revealed that there were no significant relation between nurses' total practice regarding neonates suffering from pneumothorax, sex & residence pre, immediately and one month post educational program. Also, it was cleared that there were positive significant relation between nurses' total practice regarding neonates suffering from pneumothorax with their educational level and years of

experience pre, immediately & one month post educational program  $p = 0.000$ .

**Table (5):** Demonstrates correlation between nurses' total knowledge and practice pre, immediately & one month post the educational program. It was obvious that there were highly statistically positive correlation between nurses' total knowledge, nurses' practice regarding pneumothorax and endotracheal tube suction pre, immediately & one month post the educational program ( $p = 0.000$ ).

**Table (1): Distribution of the studied nurses according to their Socio-demographic characteristics (n=60).**

| Bio-socio-demographic characteristics                   | No.                | %    |
|---------------------------------------------------------|--------------------|------|
| <b>Age/ years</b>                                       |                    |      |
| 20<25                                                   | 11                 | 18.3 |
| 25<30                                                   | 10                 | 16.7 |
| 30<35                                                   | 11                 | 18.3 |
| 35<40                                                   | 13                 | 21.7 |
| ≥40                                                     | 15                 | 25.0 |
| <b>Mean ±SD</b>                                         | <b>32.97±7.234</b> |      |
| <b>Sex</b>                                              |                    |      |
| Male                                                    | 9                  | 15.0 |
| Female                                                  | 51                 | 85.0 |
| <b>Residence</b>                                        |                    |      |
| Rural                                                   | 50                 | 83.3 |
| Urban                                                   | 10                 | 16.7 |
| <b>Marital Status</b>                                   |                    |      |
| Single                                                  | 12                 | 20.0 |
| Married                                                 | 48                 | 80.0 |
| <b>Educational level</b>                                |                    |      |
| Diplom of nursing                                       | 5                  | 8.3  |
| Technical institute of nursing                          | 35                 | 58.4 |
| Bachelor of nursing science                             | 20                 | 33.3 |
| <b>Years of experience in working</b>                   |                    |      |
| 1<3                                                     | 4                  | 6.7  |
| 3<5                                                     | 13                 | 21.6 |
| 5<10                                                    | 25                 | 41.7 |
| >10                                                     | 18                 | 30.0 |
| <b>Mean ±SD</b>                                         | <b>8.9±4.546</b>   |      |
| <b>Previous training courses regarding pneumothorax</b> |                    |      |
| No                                                      | 60                 | 100  |

**Table (2): Distribution of Total Nurses' Knowledge's about Care of Neonates with Pneumothorax Pre, Immediately Post and one Month post Educational Program (n=60).**

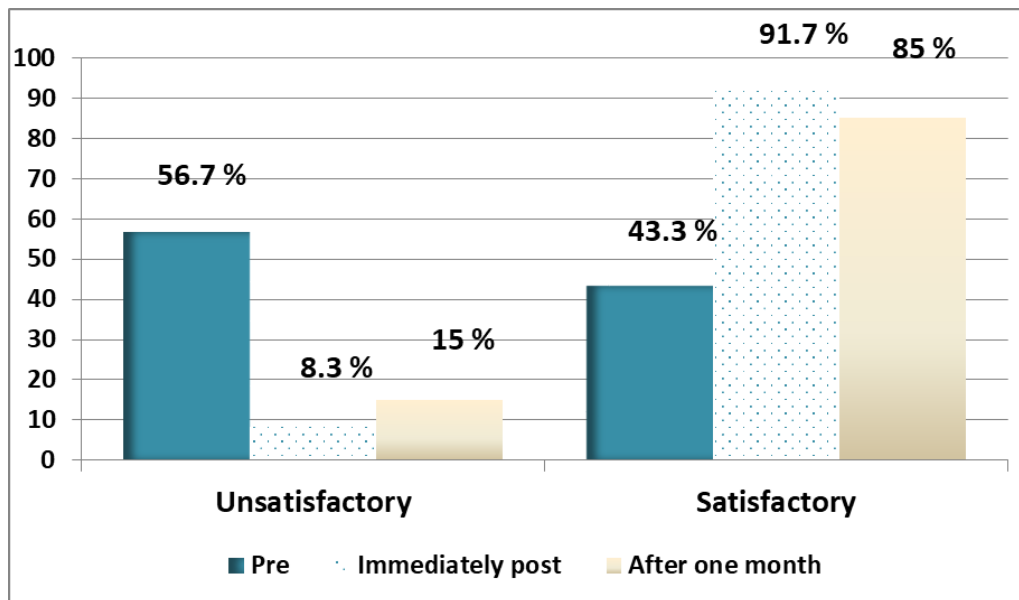
| Nurses' Total Knowledge's | Pre |      |          |      |      |      | Immediately post |     |          |     |      |      | Post one month |     |          |     |      |      | Chi-square test         |                         |                         |
|---------------------------|-----|------|----------|------|------|------|------------------|-----|----------|-----|------|------|----------------|-----|----------|-----|------|------|-------------------------|-------------------------|-------------------------|
|                           | Low |      | Moderate |      | High |      | low              |     | Moderate |     | High |      | low            |     | Moderate |     | High |      | X <sup>2</sup> 1<br>P 1 | X <sup>2</sup> 2<br>P 2 | X <sup>2</sup> 3<br>P 3 |
|                           | No. | %    | No.      | %    | No.  | %    | No.              | %   | No.      | %   | No.  | %    | No.            | %   | No.      | %   | No.  | %    |                         |                         |                         |
| Pneumothorax              | 26  | 43.3 | 19       | 31.7 | 15   | 25.0 | 2                | 3.3 | 2        | 3.3 | 56   | 93.3 | 3              | 5.0 | 4        | 6.7 | 53   | 88.3 | 3.866<br>0.049*         | 10.363<br>0.035*        | 1.351<br>0.182          |
| Chest tube                | 24  | 40.0 | 25       | 41.7 | 11   | 18.3 | 1                | 1.7 | 2        | 3.3 | 57   | 95.0 | 2              | 3.3 | 3        | 5.0 | 55   | 91.7 | 10.751<br>0.000**       | 9.857<br>0.043*         | 1.762<br>0.083          |
| <b>Total</b>              | 25  | 41.7 | 23       | 38.3 | 12   | 20.0 | 2                | 3.3 | 2        | 3.3 | 56   | 93.3 | 3              | 5.0 | 3        | 5.0 | 54   | 90.0 | 4.056<br>0.044*         | 11.456<br>0.022*        | 1.762<br>0.083          |

Chi-square test, \* statistically significance  $p \leq 0.05$ ,\*\*highly statistically significance  $p \leq 0.001$ 

P1 = between pretest &amp; immediately post program

P2 = between pretest &amp; post one month program

P3 = between immediately posttest &amp; post one month program

**Figure (1): Nurses' Total Level of Practices Regarding Care of Neonates with Pneumothorax**

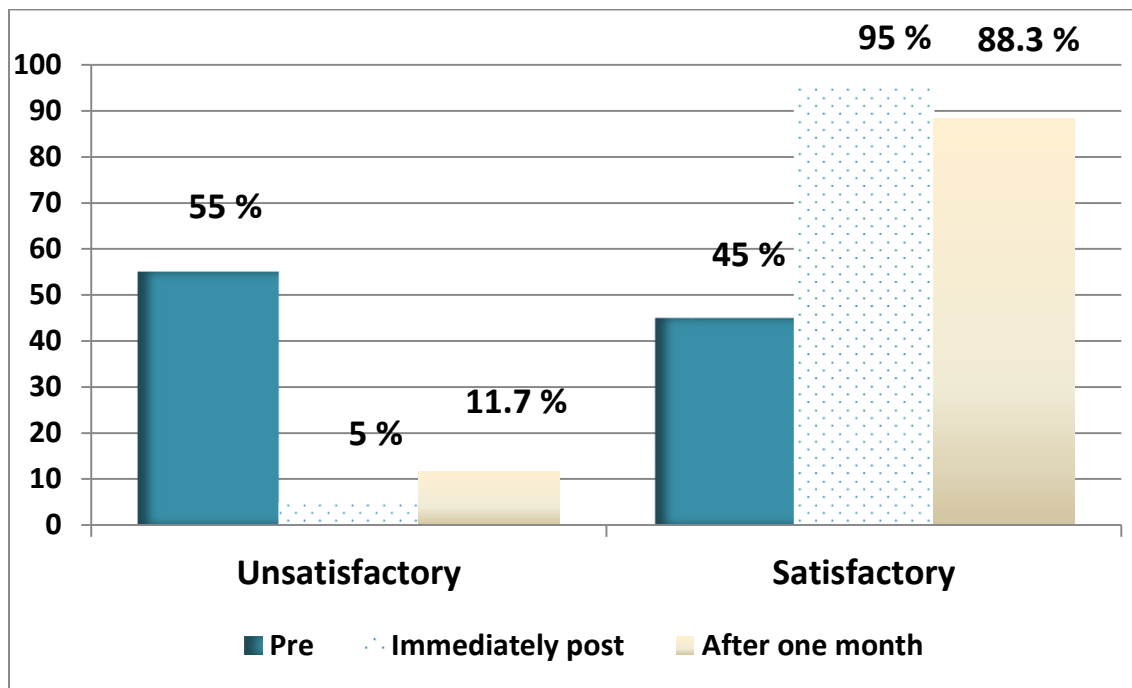


**Figure (2): Nurses' Total Level of Practices Regarding Endotracheal Tube Suctioning of Neonates with Pneumothorax**



**Table (3): Relation between Nurses' Total Knowledge and their Socio-Demographic Characteristics**

| Nurses' characteristics               | Nurses' ' knowledge |                    |                    |
|---------------------------------------|---------------------|--------------------|--------------------|
|                                       | Pre                 | Immediately        | Post one month     |
|                                       | Mean $\pm$ SD       | Mean $\pm$ SD      | Mean $\pm$ SD      |
| <b>Age/ years</b>                     |                     |                    |                    |
| 20-<25                                | 15.00 $\pm$ 6.914   | 35.36 $\pm$ 10.102 | 31.09 $\pm$ 11.493 |
| 25-<30                                | 23.90 $\pm$ 4.784   | 40.80 $\pm$ 1.476  | 39.10 $\pm$ 1.853  |
| 30-<35                                | 26.73 $\pm$ 4.714   | 41.45 $\pm$ 0.934  | 40.64 $\pm$ 1.206  |
| 35<40                                 | 26.69 $\pm$ 5.692   | 41.46 $\pm$ 0.967  | 40.92 $\pm$ 1.038  |
| >40                                   | 34.60 $\pm$ 5.235   | 41.07 $\pm$ 1.335  | 41.33 $\pm$ 0.724  |
| <b>Test of sig (p-value)</b>          | F=21.433(0.000**)   | F=3.927(0.007*)    | F=8.392(0.000**)   |
| <b>Educational level</b>              |                     |                    |                    |
| Diplom of nursing                     | 11.40 $\pm$ 8.849   | 29.80 $\pm$ 12.988 | 26.20 $\pm$ 16.084 |
| Technical institute of nursing        | 23.89 $\pm$ 5.251   | 41.06 $\pm$ 1.765  | 39.31 $\pm$ 2.763  |
| Bachelor of nursing science           | 33.55 $\pm$ 8.334   | 41.10 $\pm$ 1.294  | 41.25 $\pm$ 0.910  |
| <b>Test of sig (p-value)</b>          | F=38.785(0.000**)   | F=20.431(0.000**)  | F=20.076(0.000**)  |
| <b>Years of experience in working</b> |                     |                    |                    |
| 1<3                                   | 7.00 $\pm$ 4.243    | 24.50 $\pm$ 9.574  | 19.25 $\pm$ 10.905 |
| 3<5                                   | 20.15 $\pm$ 1.625   | 41.69 $\pm$ 0.630  | 38.69 $\pm$ 3.093  |
| 5<10                                  | 26.64 $\pm$ 4.680   | 41.36 $\pm$ 0.860  | 40.60 $\pm$ 1.291  |
| >10                                   | 33.78 $\pm$ 5.418   | 40.78 $\pm$ 1.592  | 40.94 $\pm$ 1.305  |
| <b>Test of sig (p-value)</b>          | F=50.209(0.000**)   | F=57.774(0.000**)  | F=58.45590.000**)  |

t- test/ ANOVA,\* statistically significance  $p \leq 0.05$  ,\*\* highly statistically significance  $p \leq 0.001$

**Table (4): Relation between Nurses' Total Practice Regarding Neonates Suffering from Pneumothorax and their Socio-Demographic Characteristics.**

| Nurses' Socio-Demographic Characteristics | Nurses' practice regarding neonates suffering from pneumothorax |                    |                      |
|-------------------------------------------|-----------------------------------------------------------------|--------------------|----------------------|
|                                           | Pre                                                             | Immediately        | Post one month       |
|                                           | Mean $\pm$ SD                                                   | Mean $\pm$ SD      | Mean $\pm$ SD        |
| <b>Age/ years</b>                         |                                                                 |                    |                      |
| 20-<25                                    | 3.91 $\pm$ 4.061                                                | 46.27 $\pm$ 33.130 | 2.32.18 $\pm$ 35.162 |
| 25-<30                                    | 37.70 $\pm$ 26.688                                              | 76.60 $\pm$ 2.757  | 72.60 $\pm$ 14.983   |
| 30-<35                                    | 42.73 $\pm$ 20.977                                              | 76.82 $\pm$ 1.079  | 76.82 $\pm$ 1.079    |
| 35<40                                     | 44.08 $\pm$ 29.056                                              | 77.15 $\pm$ 1.994  | 77.31 $\pm$ 1.702    |
| >40                                       | 75.93 $\pm$ 1.163                                               | 77.80 $\pm$ 0.414  | 77.87 $\pm$ 0.352    |
| <b>Test of sig (p-value)</b>              | F=21.718(0.000**)                                               | F=10.626(0.000**)  | F=16.921(0.000**)    |
| <b>Educational level</b>                  |                                                                 |                    |                      |
| Diplom of nursing                         | 3.40 $\pm$ 4.669                                                | 32.60 $\pm$ 41.543 | 31.80 $\pm$ 42.192   |
| Technical institute of nursing            | 38.29 $\pm$ 28.997                                              | 73.89 $\pm$ 11.318 | 68.43 $\pm$ 22.221   |
| Bachelor of nursing science               | 62.25 $\pm$ 22.706                                              | 77.05 $\pm$ 1.605  | 77.20 $\pm$ 1.399    |
| <b>Test of sig (p-value)</b>              | F=11.870(0.000**)                                               | F=21.124(0.000**)  | F=9.814(0.000**)     |
| <b>Years of experience in working</b>     |                                                                 |                    |                      |
| 1<3                                       | 0.25 $\pm$ 0.500                                                | 6.50 $\pm$ 8.963   | 1.00 $\pm$ 1.414     |
| 3<5                                       | 6.69 $\pm$ 3.614                                                | 72.46 $\pm$ 9.315  | 59.08 $\pm$ 27.969   |
| 5<10                                      | 52.24 $\pm$ 22.784                                              | 77.32 $\pm$ 1.547  | 77.40 $\pm$ 1.354    |
| >10                                       | 67.11 $\pm$ 16.869                                              | 77.17 $\pm$ 0.857  | 77.28 $\pm$ 0.826    |
| <b>Test of sig (p-value)</b>              | F=39.61290.000**)                                               | F=253.139(0.000**) | F=44.94390.000**)    |

t- test/ ANOVA,\* statistically significance  $p \leq 0.05$  ,\*\* highly statistically significance  $p \leq 0.001$

**Table (5): Correlation between Nurses' Total Knowledge and Practice Pre, Immediately & One Month post Educational Program.**

| Variables                       |         | Pre- program      |                                 |                        | Immediately       |                                 |                        | Post one month    |                                 |                        |
|---------------------------------|---------|-------------------|---------------------------------|------------------------|-------------------|---------------------------------|------------------------|-------------------|---------------------------------|------------------------|
|                                 |         | Nurses' knowledge | Nurses' practice (pneumothorax) | Nurses' practice (ETT) | Nurses' knowledge | Nurses' practice (pneumothorax) | Nurses' practice (ETT) | Nurses' knowledge | Nurses' practice (pneumothorax) | Nurses' practice (ETT) |
| Nurses' knowledge               | r       | -                 | 0.786                           | 0.792                  | -                 | 0.838                           | 0.908                  | -                 | 0.749                           | 0.865                  |
|                                 | p-value | -                 | 0.000**                         | 0.000**                | -                 | 0.000**                         | 0.000**                | -                 | 0.000**                         | 0.000*                 |
| Nurses' practice (pneumothorax) | r       | 0.786             | -                               | 0.967                  | 0.838             | -                               | 0.761                  | 0.749             | -                               | 0.865                  |
|                                 | p-value | 0.000**           | -                               | 0.000**                | 0.000**           | -                               | 0.000**                | 0.000**           | -                               | 0.000**                |
| Nurses' practice (ETT)          | r       | 0.792             | 0.967                           | -                      | 0.908             | 0.761                           | -                      | 0.865             | 0.865                           | -                      |
|                                 | p-value | 0.000**           | 0.000**                         | -                      | 0.000**           | 0.000**                         | -                      | 0.000**           | 0.000**                         | -                      |

Pearson Correlation Coefficient,

\* Statistically significance  $p \leq 0.05$ , \*\* Highly statistically significance  $p \leq 0.001$

## Discussion

Pneumothorax in neonates, rare, presents a significant challenge in neonatal care due to the delicate nature of this vulnerable population. The incidence of neonatal pneumothorax has been increasing, particularly in preterm infants and those with underlying respiratory conditions. Effective management of this condition is critical, as it can lead to compromised respiratory function and increased morbidity. (Joshi, Kumar, Rebekah, Santhanam, 2022). Enhancing the performance of nurses in the care of neonates suffering from pneumothorax is essential to improve clinical outcomes, reduction in

the long-term impacts associated with this condition and ensuring neonatal safety (Hendy, et al., 2024). This study aimed to upgrade nurses' performance regarding care of neonates suffering from pneumothorax.

This study presented that majority of nurses had correct complete answer about causes, and diagnosis of pneumothorax during follow up post program application compared to nearly one third and more than third of them pre-program respectively. This may be explained on the basis that that preprogram; the nurses participated in the study did not receive training in the

management of pneumothorax. However, following the implementation of the program, there was a significant improvement in their knowledge.

The current study revealed that majority of the nurses had correct complete answer regarding meaning, and medical management of pneumothorax immediately post and one month post educational program compared to less than one quarter of them pre-program.

These results were congruent with **Abdel-Mohsen, et al (2023)** who conducted a study entitled “Effect of educational intervention on nurses’ performance regarding care of critically ill children with pneumothorax” and reported that most of nurses had complete correct answer about definition, causes, diagnosis, complication, and treatment of pneumothorax post-educational intervention compared to pre-educational intervention.

Moreover, these findings were compatible with **Dhakeel & Hassan (2021)** who concluded that majority of nurses had correct answer about definition, causes, and management of pneumothorax post-educational program compared to preprogram.

**A statistically significant difference was noted in nurses’ knowledge levels about chest tubes immediately after and one month following the completion of the program.**The

majority of nurses demonstrated a high degree of accuracy in their responses, correctly identifying the significance and potential complications associated with chest tube removal, both immediately post program and one month thereafter. In contrast, less than one quarter of the nurses exhibited this level of accuracy prior to the program. This finding can be attributed to the training program’s effectiveness in enhancing nurses’ knowledge, which was subsequently reflected in the improvement of their practices.

These results were parallel with **Hamel & Ahmed (2020)** who indicated that there was high significant difference between nurses’ knowledge about meaning, and complication pre-test and post-test regarding chest tube.

These findings were in the same direction with **Jabar & Aziz (2021)** who mentioned that only less than one third of participant know meaning of chest tube pretest compared to majority of them posttest and during follow up respectively.

**Concerning nurses’ knowledge about chest tube,** the current study demonstrated that there was a significant difference between nurses’ knowledge regarding all items of chest tube pre and immediately post program and also pre and one month post program. Also, majority of them had complete correct answer about site of insertion and

complication during insertion immediately and one month post program implementation compared to less than third of them pre-program. From the researcher's perspective, the findings indicate the efficacy of the implemented program in enhancing nurses' knowledge regarding chest tubes. However, a decline in subsequent knowledge retention was observed, a phenomenon that tends to wane over time in the absence of ongoing reinforcement and periodic review.

The current result also was in the same line with **Yadav, Sahu, Tripathi, Vineeth, Naik Chakraborty, (2023)** who stated that the correct answer of the meaning, complication, and site of insertion of chest tube improved post-program with significant difference between pretest and posttest.

These results were in harmony with **Alaswad & Bahnsawy (2023)** who mentioned that nurses' correct answer about meaning, types, insertion techniques of chest tube, and complication improved post instruction than before implementation.

The present study demonstrated a significant difference in nurses' overall knowledge between the pre-program phase and both the immediate and one-month post-program phases, with notable improvements in their knowledge about pneumothorax following the program's

implementation. This result was in accordance with **Dhakheel & Hassan (2021)** who mentioned that nurses' knowledge about pneumothorax was improved post application of program.

The current study concluded that nurses' knowledge regarding chest tubes significantly improved both immediately and one month after the program's completion. This finding was matched with **Mohamed & Ibrahim (2021)** who reported that the total nurses' knowledge level about chest tube improved significantly post the intervention from 4% to 96%. Also, with **Yadav et al. (2023)** who stated that the overall level of knowledge regarding chest tubes was significantly higher after the posttest than before.

The present study showed a statistically significant improvement in nurses' overall knowledge concerning the care of neonates with pneumothorax. The majority of nurses demonstrated a high level of knowledge during both post-program assessments, compared to fewer than a quarter who achieved this level before the program. This outcome can be attributed to strong statistical evidence indicating that the training program effectively enhanced nurses' knowledge. Moreover, the program content was delivered efficiently, and nurses exhibited a quick ability to absorb and retain the information.

This finding were in agreement with conclusions reported by **Abdel-Mohsen et al. (2023)**, who indicated that nurses' comprehensive understanding of neonatal care for pneumothorax cases was enhanced following the implementation of an intervention. Also, this result was agreed with **Dhakeel & Hassan (2021)** who reported a statistically significant improvement in nurses' overall knowledge immediately and one month after the program regarding pneumothorax compared to before the program's implementation.

The present study examined nurses' practices prior to chest tube insertion. The findings indicated that approximately half of the nurses performed the assessment of respiratory status correctly and observed the alarms of mechanical ventilation. Additionally, they positioned the neonates according to the indicated insertion site. The results showed that the majority of nurses performed preprogram in comparison to the immediate and post-one-month results. This discrepancy may be attributed to the effectiveness of the program in enhancing the practical skills of nurses in this domain.

This result was matched with **Mahmoud, Ahmed, Ahmed, Abd Esalam, (2023)** who revealed that most of nurses monitor and observe respiration correctly post program implementation. Also, **Bedier, Abu-**

**Elata, Ibrahim, (2024)** who supported this finding and revealed that none of the nurses assess respiratory status preprogram compared to all of them assess respiration immediately post program and two third of them three months post-intervention.

Moreover, these results were in accordance with **Mostafa, Bahgat, Dawood (2023)** who concluded that less than tenth of nurses done the following step "Place the neonate in proper position" pre- guidelines program compared to majority immediately and one month post guidelines program. Also, less than tenth of them measure and record respiratory rate preprogram compared to nurses immediately and one month post program.

The present study demonstrated that nurses' practice exhibited significant enhancement after the implementation of the educational program in comparison to preprogram. This enhancement was accompanied by a statistically significant difference in nurses' total practices' of care for neonates with pneumothorax. This can be attributed to the efficacy of the educational program in enhancing nurses' practices and facilitating the retention of knowledge regarding the care of neonates with pneumothorax.

These findings were consistent with **Ibrahim & Elshemy (2020)** who concluded that there was significant

improvement in the nurses' practice immediately and at follow-up post the educational program implementation. Results were compatible with **Arafa et al., (2022)** who reported that the mean of daily routine care of neonate with pneumothorax, changing drainage bottle, removal of chest tube and total score of practice to chest tube care were improved post educational program.

### **Practice regarding endotracheal tube suctioning of neonates suffering from pneumothorax.**

The present study explained that less than half of nurses auscultated gurgling sound during respiration and observed presence of secretion in the endotracheal tube that became majority of them at immediately and one month post educational program with statistically significant difference between preprogram and immediate phase and between preprogram and one month post program. This may be due to effectiveness of educational program in improving nurses' practice regarding prevention and management of secretion accumulation in ETT.

This result was parallel with **Ali, Abu Salem, Amin (2023)** who reported that 40% of nurses assess neonatal need for suctioning pre-intervention compared to 100% and 93.3% immediately and 3 months post intervention respectively, and 50% of them observed presence of secretion in the endotracheal tube pre-

intervention compared to 100% and 95% immediately and 3 months post intervention respectively. Moreover, these findings were in congruent with **Ahmed & Hattab (2022)** found that nurses' practices of Endotracheal Tube Suction (ETTS) were poor in the pre-test; they improved significantly in the post-test.

This study demonstrated that the majority of nurses achieved a satisfactory level immediately and one month after the educational program implementation, compared to their performance regarding total level of ETTS before the program. This may due to that that the observed changes in practice levels are unlikely to have occurred by chance and suggest a strong relationship between the educational program and the improvement in nursing practices, in which continued evaluation and follow-up training lead to solidify these gains and address any persisting knowledge gaps or practices that need reinforcement.

This finding was in accordance with **Yas & Hattam (2022)** who conducted a study about nurses' practice toward neonatal ETTS procedure" and concluded that all nurses had an inadequate level of practice pretest, compared to posttest with high significant difference. Also, with **Ebrahim, (2018)** who concluded that the total score of ETT suctioning by

nurses were high post-program compared preprogram score.

The current study confirmed that there was a strong correlation between nurses' knowledge and their age prior to, immediately following, and one month after the program, as well as between nurses' knowledge and their sociodemographic features regarding the management of newborns with pneumothorax.

Additionally, there was a strong correlation between nurses' overall knowledge and their years of experience, education, and pre-, immediate-, and post-program knowledge. According to the researcher's perspective, this could be because nurses with more years of experience tend to know more than those with less, and their involvement in the care of these neonates has influenced their knowledge and practice. High educated nurses also acquired more information, basic practice and knowledge related pneumothorax and chest tube and more training than nurses who had diplom or technical institute of nursing.

**Elsayed, Hassanin, and Mohammed (2016)** were disagreed with these results and reported that there is no statistically significant correlation between the basic knowledge of nurses and their age, education, and years of experience. Also, these findings were inconsistent with **Jabar & Aziz (2021)** who found

that there were no relation between nurses' total knowledge about care of chest tube in children and their age, educational level, and year of experience.

**Regarding relation between nurses' practice about care of neonates with pneumothorax, and their socio-demographic characteristics,** The current study showed a significant relation between the practice of nurses, their years of experience, age, and educational attainment prior to, during, and one month post the program.

This may be due to nurses who are high qualified and with substantial practical experience were able to integrate the newly acquired information more effectively into their daily routines, showcasing the importance of experiential learning in the nursing profession and can apply this knowledge into care of the neonates with pneumothorax and this will improved more with age and years of experience.

These results were consistent with **Mahmoud, Ahmed, and Abd-Elsalam (2023)** who reported that there were a significant relation between nurses' total practice and their age, qualification, and years of experience. While, the current findings were incompatible with **Elsayed et al. (2023)** who mentioned that that there was no statistical significant relation between nurses 'age,



qualifications, experience years, and nurses' basic practice.

**Regarding the correlation between overall knowledge and practices,** the current study found a strong positive relationship between nurses' total knowledge and their overall practices related to pneumothorax and endotracheal tube suctioning. This may be explained on the basis that the nurses, who received the program, applied what they learned in their practice so this reinforcement of knowledge deeply enhances their clinical skills and confidence.

These findings were in the same line with **Mohamed et al. (2023)** who reported that there were a strong positive correlation between nurses' knowledge, and practices pre & post educational intervention implementation. Also, these findings were in harmony with **Chege, Mwaura, Kirui, (2018)** who reported that, nurses' awareness of the perceived significance of nursing management in underwater chest drainage has a demonstrable impact on their professional practice and the quality of their performance.

Furthermore, these results were congruent with **El-Senousy, Mahrous, and Abd-Al Salam (2020)** posited that a statistically significant correlation exists between the level of nurses' total knowledge and practice after program completion.

**Conclusion:** Nurses' performance regarding care of neonates with pneumothorax is upgraded post immediate and after one-month post-program and there was significant improvement in nurses' overall knowledge and practice.

**Recommendations: The following recommendations were suggested:**

- Frequent, ongoing education should be provided to nurses regarding care of neonates with pneumothorax.
- Designing handbooks and educational booklets to update nursing practices and information regarding chest tube and pneumothorax neonatal care.

## References

- Abdel-Mohsen, A., Shafik, F., & Abdel Esalam, A. (2023).** Effect of Educational Intervention on Nurses' Performance Regarding Care of Critically Ill Children with Pneumothorax. *Journal of Nursing Science Benha University*, 4(2), 482-499.
- Abed, Y., Al-Ani, M., & Shitran, F. (2022).** Predisposing factors and incidence of pneumothorax in the neonatal care unit at Al-Ramadi Teaching Hospital for Maternity and Children. *Journal of Emergency Medicine, Trauma & Acute Care*, 6(3):110-130.
- Acun, C., Nusairat, L., Kadri, A., Nusairat, A., Yeaney, N., Abu-Shaweesh, J., & Aly, H. (2021).**

- Pneumothorax prevalence and mortality per gestational age in the newborn. *Pediatric pulmonology*, 56(8), 2583-2588.
- Ahmed, A., & Hattab, K. (2022).** Effectiveness of an Intervention Program on Nurses' Practices toward Neonatal Intubation Suctioning Procedure at Neonatal Intensive Care Unit. *Pakistan Journal of Medical & Health Sciences*, 16(05), 650-650.
- Alaswad N., Bahnsawy N. (2023).** The effect of chest tube instructional package application on pediatric nurses' performance. *Assiut Scientific Nursing Journal*. 11(39): 242-252.
- Ali M., Abu Salem L., & Amin F. (2023).** Effectiveness of Educational Program on Nurses' Knowledge and Practices Regarding Neonatal Endotracheal Tube Suctioning. *Mansoura Nursing Journal*. 10(2): 139-148.
- Arafa, A., Abusaad, F., & Said, D. (2022).** Effectiveness of an Educational Program Regarding Care of Infants with Chest Tube on Nurses' Knowledge and Practice. *Mansoura Nursing Journal*, 9(1), 251-259.
- Aranguren, T., Ferrón, R., & Ruiz, C. (2019).** Endobronchial treatment of persistent pneumothorax in acute respiratory distress syndrome. *Medicina intensiva*, 43(8), 516.
- Awad, R., Wahdan, W., Al-Metyazidy, H., & Weheida, S. (2021).** Effectiveness of implementation of evidence-based educational intervention regarding chest tube on clinical patient's outcomes in cardiothoracic care unit. *Egyptian Journal of Health Care*, 12(1), 171-192.
- Batra, S., Sharma, H., Boulila, W., Arya, V., Srivastava, P., Khan, Z., & Krichen, M (2022).** An intelligent sensor-based decision support system for diagnosing pulmonary ailment through standardized chest x-ray scans. *Sensors*, 22(19), 7474.
- Bedeir N., Abo EL-Ata A. & Ibrahim N. (2024).** The Impact of an Educational Program on Nurses, Practice Related to Care of Patients with Chest Tube. *International Journal of Caring Sciences*.5 (3): 846-857.
- Campisi, A., Pompili, C., Giovannetti, R., Gabryel, P., Bonadiman, C., Dobiecki, T& Piwowski, C. (2022).** Surgical Management of Primary Spontaneous Pneumothorax without Lung Bullae. *Journal of surgical research*, 280(1), 241-247.
- Chege, A., Mwaura, J. and Kirui, A. (2018).** Evaluation of the nursing management for patients on underwater chest drainage at Kenyatta national hospital, *Scientific Research Journal*, 8(12):1222-1235.

- Available at:  
www.scirp.org/journal/PaperInformation.aspx.
- Dhakeel M & Hassan H. (2021).** Effectiveness of an Educational Program on Nurses' Knowledge toward Prevention of Pneumothorax Attendant with Mechanical Ventilation at Intensive Care Unit in AL-Hussein Medical City Hospital in Holy Karbala. *Annals of R.S.C.B.* 25(6): 3876 – 3883.  
doi:10.1177/15569845231153623.
- El- Senousy, T., Mahrous, F., Abd- Al Salam, S. and Zedan, H. (2020).** Educational guidelines for nurses' competence level caring for patients with accidental chest trauma during emergency period. *Journal in the field of pharmacy (Sys Rev Pharm)*, 11(12):440-449
- El-Sayed S., Khalil A., and EL-kazaz R. (2023).** Effect of an Educational Program for Nurses about Prevention of Ventilator Associated Pneumonia in Neonatal Intensive Care Units. *Port Said Scientific Journal of Nursing.* 10(3): 236-262.
- Engin, N., Gülden, K., & Kılıçaslan, O. (2020).** Spontaneous pneumothorax in a newborn case report: original image, treatment process and follow-up. *Journal of Lung Pulm Respiratory*, 7(1), 1-2.
- Ghenu, I., Manea, M., Timofte, D., Balcangiu, E., Ionescu, D., Tulin, R& Dragoş, D. (2023).** Critical Damage of Lung Parenchyma Complicated with Massive Pneumothorax in COVID-19 Pneumonia. *Case Reports*, 16,11795476231175644
- Halibullah, I., Hammond, F., Hodgson, K., Duffy, N., Stewart, M., & Sett, A. (2023).** Management of pneumothorax in neonatal retrieval: a retrospective cohort study. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, 108(2), 182-187.
- Hamel O & Ahmed S. (2020).** Effectiveness of an Educational Program on Nurses' Knowledge and Practices Regarding Nursing Interventions of Chest Tube Drainage System in Ibn Alnafees Teaching Hospital. *Indian Journal of Public Health Research and Development.* 15(3):840.DOI:10.37506/IJPHRD.V 11I4.9168.
- Hendy A., Alsharkawy S., Al-Kurdi Z., El-Nagger N., Hendy A., Sayed S., Al-Mugheed K., Alsenany S., & Abdelallem S. (2024).** Impact of On-the-Job Training on Nurses' Performance in Creating a Healing Environment and Clustered Nursing Care for Premature. *SAGE Open Nurs.* 20;10:23779608241255863. doi: 10.1177/23779608241255863.

- Ibrahim N (2018):** Assessment the nurses' performance in providing care to children undergoing chest tube in Suez Canal University hospital. Unpublished Master Thesis, Faculty of Nursing, Suez Canal University. Egypt.
- Ibrahim R. & Elshemy M. (2020).** Impact of an educational program on knowledge and performance of nurses about caring of child with chest tube. *IOSR Journal of Nursing and Health Science*. 5(6): 2320-1940.
- Jabar H. & Aziz H. (2021).** Effectiveness of an Education Program on Nurses Knowledge toward Care of Chest Tube in Children at Pediatric Teaching Hospital Baghdad City. *Indian Journal of Forensic Medicine & Toxicology*. 15(3): 839-845. DOI: 10.37506/ijfmt.v15i3.15414
- Joshi A., Kumar M., Rebekah G., & Santhanam S. (2022).** Etiology, clinical .profile and outcome of neonatal pneumothorax in tertiary care center in South India: 13 years' experience. *J Matern Fetal Neonatal Med*. 35(3):520-524. doi:10.1080/14767058.2020.1727880.
- Jovandaric M, Milenkovic S, Dotlic J. (2022):** Neonatal pneumothorax outcome in preterm and term newborns. *Medicina (Kaunas)*, 58(7):965.
- Kastein, K., Coe, K., Gephart, S., & Newnam, K. (2023).** Management of Air Leaks in the Newborn. *Advances in Neonatal Care*, 23(2), 160-166.
- Kim Y& Lee E. (2019).** Pneumothorax in full-term neonates transferred due to respiratory distress. *Perinatology*; 30:140-6. DOI: <https://doi.org/10.5385/nm.2022.29.1.18>
- Mahmoud, A., Ahmed S., Ahmed N., & Abd-Elsalam S. (2023).** Evaluation of Nurses Performance Regarding New Guidelines of Chest Drain. *Egyptian Journal of Health Care*. 14(4): 386-398.
- Medical Statistical Records of Neonatal Intensive Care Unit at El-Mabra Hospital at El-Mahalla. 2023-2024**
- Mohamed, S., & Ibrahim, R. (2021).** Effect of self-learning module on nurses' performance regarding care of patients with chest tube. *Egyptian Journal of Nursing and Health Science*. 7(1). ISSN 2682-2563.
- Mostafa N., Bahgat R., & Dawood B. (2023).** Effect of Educational Guidelines Program on Nurses Performance for Caring of Neonates Receiving Continues Positive Airway Pressure Ventilation. *Tanta Scientific Nursing Journal*. 30(3): 127- 143.
- Osman, M., Reffat, M., & Meawad, F. (2023).** Managing neonatal spontaneous pneumothorax: Experience in 73 neonates. *Zagazig University Medical Journal*, 29(6), 1463-1469.
- Qasim A. (2022).** Effectiveness of an Intervention Program on Nurses' Performance toward Neonatal

- Endotracheal Suctioning Procedure. *Iraqi National Journal of Nursing Specialties*. 35(2): 82-91.
- Ravi, S., & Chavan, K. (2022).** A study of clinical spectrum and outcome of patients with chest trauma in tertiary care centre. *European Journal of Molecular and Clinical Medicine*, 9(2), 246-251.
- Thomas, R., Rahman, M., Maskell, A., & Lee, Y. (2020).** Pleural effusions and pneumothorax: Beyond simple plumbing: Expert opinions on knowledge gaps and essential next steps. *Respirology*, 25(9), 963-971.
- Tomaszek, L., Pawlik, J., Mazurek, H., & Mędrzycka, W. (2021).** Automatic continuous control of cuff pressure and subglottic secretion suction used together to prevent pneumonia in ventilated patients-a retrospective and prospective cohort study. *Journal of Clinical Medicine*, 10(21), 4952.
- White S E. (2019).** Reading the medical literature: Basic & Clinical Biostatistics. Lange Medical Book/ McGraw – Hill. *Medical Publication Division, New York*. 5th ed., Ch. 3-10, PP 20 - 233,
- Yadav A., Sahu R., Tripathi M., Vineeth P Naik S. & Chakraborty S. (2023).** Impact of a structured training program regarding care of patients with chest tube drainage in terms of knowledge and practices of nurses working in a tertiary care cancer center in north India. *International Journal of Science and Healthcare Research*. 8(4): 301-309.
- Yas A. & Hattam K. (2022).** Effectiveness of intervention program on nurses' practice toward neonatal endotracheal suctioning procedure. *Iraqi National Journal of Nursing Specialties*. 35(2): 82-91.

## Effect of Nursing Health Education for Patients Undergoing Plastic Biliary Stent on Clinical Outcomes and Lifestyle

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### Abstract

**Background:** Plastic biliary stent (PBS) represents a significant advancement in endoscopic retrograde cholangiopancreatography (ERCP). **Aim:** was to assess the impact of nursing health education for patients undergoing PBS on clinical outcomes and lifestyle. **Design:** Quasi experimental research design had been utilized. **Sample and setting:** Purposive sampling of (60) adult patients of both sexes at the endoscopy unit at New Surgeries Hospital at Tanta University Hospitals, for three months; the sample was divided into two groups equally. **Tools:** three tools had been utilized: **tool (I)** A structured interview schedule and Patient's Knowledge Questionnaire, **tool (II)** Health promotion Model-Instruments to assess health-promoting lifestyle (HPL) and **tool (III)** Post Endoscopic Retrograde Cholangiopancreatography (ERCP) Patients' Clinical Outcomes. **Results:** there were highly improvement in total knowledge level, health promoting lifestyle level only for study group after giving nursing health education, there were an improvement in study and control group in post ERCP clinical outcomes but there was highly improvement in study group after giving nursing health education. Also, it was observed that there were more complications in control group compared to study group. **Conclusion:** A highly statistically significance difference existed among study and control group regarding total level of knowledge, all items of life style, post ERCP clinical outcomes and patients' complications before and after giving nursing health education. **recommendation:** Continuous educational programs to improve patient's knowledge about plastic biliary stent.

**Key words:** Biliary obstruction, Clinical outcomes, lifestyle, Nursing health education, Plastic biliary stent.

## Introduction

Biliary stricture refers to the constriction and narrowing of the lumen of the bile duct, that may result from several reasons like intraoperative biliary injury, cancer, inflammation and gallstone scarring **(Dinescu et al., 2023)**.

Biliary strictures are categorized as malignant biliary strictures (MBS) or benign biliary strictures (BBS). BBS often arises from damage to the bile duct or benign biliary disease, while MBS usually results from malignant bile duct tumors **(Bektas et al., 2024)**. Biliary strictures obstruct the passage of bile from the liver and gallbladder to the small intestine, leading to impaired digestion and potentially severe consequences like cirrhosis and jaundice **(Farani et al., 2024)**. The implementation of biliary stent (BS) placement to avert blockage throughout ERCP is one of the most significant accomplishments in the history of therapeutic pancreatobiliary endoscopy. This has been recognised as a non-surgical therapy for obstructive jaundice **(Dumonceau et al., 2023)**.

Biliary stenting involves the placement of stents, that are tubes composed of metal or plastic, to alleviate obstructions in the biliary tree or to address biliary leaks **(Chiba et al., 2024)**.

The implementation of plastic biliary stent (PBS) represents a significant advancement in ERCP, providing minimally invasive and extremely efficient alleviation of biliary obstruction **(Sohn, Park, Kim & Kim, 2022)**.

The main limitation of plastic stents is their restricted diameter. Patients experiencing early stent occlusion prior to planned replacement may encounter abrupt bile flow blockage and report manifestations indicative of recurrent biliary obstruction. This condition may also precipitate acute cholangitis and sepsis, posing a life-threatening risk **(Lyu, Ye & Wang, 2023)**.

Frequent stent replacement elevates medical expenses and diminishes the quality of life for people with chronic conditions. So, patient education and care after ERCP and insertion of plastic biliary stent is very important to prevent early and late complications **(Duman & Hulagu, 2024)**.

Patients' quality of life is affected by treatment problems and insufficient understanding about the management of their stents. So, patients need to learn nursing guidelines and also need to know what will happen and have the chance to ask questions and preparation of a patient through pre-procedure education about plastic biliary stent. Also, it is very important

for patients to take guidelines about discharge plan to prevent any complications (Taha, Sayed, Azer & Abd-Al Mageed, 2023).

### **Significant of the study**

It had been revealed that individuals who had PBS placement represented 35% of total endoscopic procedures performed every month in the endoscopy unit at New Surgeries Hospital affiliated at Tanta University Hospitals. It was shown that over fifty percent of these individuals had stent blockage and migration attributable to lack of knowledge and poor lifestyle choices. Hence, this work was performed to reduce the patient complications, promote life style and knowledge for patients with PBS.

**The aim of this work was to** assess the impact of nursing health education for patients undergoing PBS on clinical outcomes and life style.

### **Research Hypotheses**

The study group who got nursing health education is expected to have improvement of their knowledge about plastic biliary stent, better life style and have reduction of plastic biliary stent related complications contrasted to control group who receive routine hospital care.

### **Subjects and Method**

**Design:** Quasi experimental research design had been utilized to perform this work.

### **Study settings**

This study was conducted at the endoscopy unit at New Surgeries Hospital at Tanta University Hospitals, affiliated to Ministry of Higher Education and Scientific Research.

### **Study subjects**

Purposive sampling of (60) adult patients of both sexes scheduled for undergoing plastic biliary stent in the above previously mentioned setting. The sample size had been calculated depending on Epidemiological Information Program, depending on the overall number of patients per year depending on review of Tanta Main University Hospital Statistical Records, and according to inclusion and exclusion criteria.

**The subjects were divided into two groups;** each group comprised of (30) participants as follow

**The control group,** it comprised of (30) patients who got the routine hospital care by nursing staff.

**The study group** comprised of (30) patients who got the routine hospital care and nursing health education proposed by the researcher.

### **Inclusion criteria**

- Age range from 21 to 60 years old and able to participate in the work, Individuals from both sexes and undergoing endoscopic plastic biliary stent insertion (through ERCP) for the first time.



**Exclusion Criteria**

-Patients with uncontrolled coagulopathy, Inability to tolerate general anesthesia, Malignant bile duct tumors, Mental disorders and Pregnancy

**Study tools**

Three tools have been utilized in this work: -

**Tool I: A Structured Interview Schedule and Patient's Knowledge Questionnaire.**

A systematic interview schedule created by the researcher following the review of relevant literature (Kim et al.,2023); (Taha, Sayed, Azer & Abd-Al Mageed, 2023); (Bofill & Cardenas,2024). It is comprised of the following parts:

**Part I: Patient's Sociodemographic Data**

This part contained pertinent data regards to the subjects of the work like: the participant's code, sex, age, marital status, education level, occupation status, income and residence.

**Part II: Patient's Clinical Data**

It included prior medical and surgical histories, body height, weight, body mass index (BMI), causes of biliary obstruction, complain on admission, last laboratory tests and previous imaging studies.

**Part III: "Patient's Knowledge Assessment Questionnaire Regarding Plastic Biliary Stent".**

This tool had been developed via the researcher depending on literatures review (Aryanti, Mahayasa, & Mulyawan,2023); (Rudiman, Hanafi & Halim, 2023); (Shehab & Soultan,2024) to assess patient's knowledge regarding plastic biliary stent and discharge plan before and after receiving nursing health education.

**Total Scoring system**

The total numbers of questions were 30 questions. Regarding knowledge scores, Correct and complete answer scored 2, correct and incomplete scored 1 and incorrect or no answer was scored Zero.

**Total level of patients' knowledge score was calculated and categorized as follows**

- High level of knowledge—→  
> 75% of the total score
- Moderate level of knowledge —→  
≥ 50% -75% of the total score
- Low level of knowledge —→  
< 50 % of the total score

**Tool II: Health promotion Model-Instruments to measure health promoting lifestyle (HPL)**

The HPL Model-Instruments had been created and revised via (Walker, Sechrist& Pender, 1987) to assess HPL of patient with PBS. The health

promotion instrument has 52 questions designed to assess HPL subscales, categorised into six subscales: Health Responsibility, Interpersonal Relations, Physical Activity, Nutrition, Spiritual Growth, and managing stress. The researcher took on and translated it into Arabic, thereafter administering it via personal interviews with the patients.

### **Scoring system**

It comprised 52 items which are rated on a four-point Likert-type scale:

1 → (never), 2 → (sometimes),  
3 → (often), 4 → (routinely).

**Total scores for all items:** range between 52 and 208.

Poor level of HPL → <60%

Fair level of HPL → 60-80 %

Good level of HPL → >80%

### **Tool III: " Post Endoscopic Retrograde**

### **Cholangiopancreatography (ERCP)**

#### **Patients' Clinical Outcomes**

#### **Part I: Signs and Symptoms Post ERCP**

It had been created following the review of the relevant literature (Merchan et al., 2024); (Aryanti, Mahayasa, & Mulyawan,2023); (Rudiman, Hanafi & Halim, 2023). It had been evaluated to assess the existence or absence of plastic biliary stent patients' symptoms and signs for their complications such as sore throat, difficult of swallowing,

abdominal distension, tummy pain, fever, shivering, sore muscle, anorexia, yellow eye, dark urine, itching, pallor skin, nausea, vomiting, altered body movement and bleeding. It comprised of 16 items.

### **Scoring system**

- (one mark) for presence of plastic biliary stent sign and symptom.

- (zero) for absence of sign and symptom.

### **Total scoring system**

None → 0      Low level → <50%

Moderate level → 50-80 %

High level → >80%

### **Part II: Plastic Biliary Stent Complications Post ERCP After 3 Months**

It had been created following the review of the relevant literature (Aryanti, Mahayasa, & Mulyawan,2023); (Rudiman, Hanafi & Halim, 2023). It had been employed to measure the existence or absence of plastic biliary stent complications for study and control group such as stent obstruction and stent migration.

### **Scoring system**

- (one mark) for presence of plastic biliary stent complication.

- (zero) for absence of complication.

### **Method:**

### **Ethical consideration**

This work had been approved by the ethics committee on faculty of nursing university with code no 284/8/2023.

Each subject provided informed consent following the clarifying of the procedures and the objective to take a part in the work. Participants were apprised of the data collection confidentiality, their right to decline participation, and their ability to withdraw at any moment without repercussions. A code number has been employed in replacement of their names.

**An official permission** was gathered to perform this work from the faculty authorities and from the Manager of the endoscopy unit at New Surgeries Hospital that is affiliated to Tanta Main University Hospital.

### **Content validity**

Each tool was evaluated for content validity by a panel of five specialists in medical-surgical nursing from the college of nursing, as well as academics specializing in endoscopy, and necessary revisions were implemented appropriately.

### **A pilot study**

-A pilot study was performed on 10% of patients to evaluate the feasibility, clarity, and applicability of the tools, as well as to identify any challenges the researcher might face throughout data collection.

### **Reliability of the tool**

All research instruments were evaluated for reliability using Cronbach's alpha.

### **Reliability statistics**

-Cronbach's Alpha for tool I is 0.881 for 49 items, tool II is 0.922 for 52 items, tool III is 0.906 for 18 items and the sheet in total is 0.878 for 119 items established on 6 subjects.

### **Data collection**

-Data was collected over 12-months duration (beginning from the first of January, to the end of December 2024).

**- The work has been performed through four main phases which are (assessment, planning implementation and evaluation)**

#### **1-Assessment phase**

Assessment of the patient baseline data from patients and their hospital files employing tool I part (I) and (II) for both control and study groups prior the administration of the intervention. Moreover, patient's knowledge regarding plastic biliary stent was assessed three times for both study and control group; before giving nursing guidelines before endoscopic plastic biliary stent procedure, immediately after giving nursing guidelines, after three months from endoscopic plastic biliary stent procedure by using (Tool I part III).

Health promoting lifestyle of patients with plastic biliary stent was assessed two times for both study and control group; before giving nursing guidelines before endoscopic plastic biliary stent procedure and after three

months from endoscopic plastic biliary stent procedure by using (Tool II).

Assessment for presence or absence of plastic biliary stent complications for both control and study groups by employing (Tool III) three times; immediately post endoscopic plastic biliary stent procedure, after one week from endoscopic procedure and after three months from endoscopic plastic biliary stent procedure.

## **2-Planning Phase**

This phase had been formulated depending on assessment phase and literature review.

Development of the nursing health education depending on data of the phase of assessment, literature review and patient's needs. Designing nursing health education considered patients' goal, priorities and expected outcomes criteria which included improvement in patient's knowledge, lifestyle and reduce the complications.

In order to give the nursing health education to studied patients, the researcher used various methods which included power point presentation, pictures, videos which facilitate reach of information to the patient and designing a booklet containing pictures and diagrams that had been designed via the researcher in Arabic Language and distributed to each patient as teaching aids to attain comprehensive

picture of all facets pertaining to plastic biliary stent.

**Preparing the environment for patients;** had been conducted to preserve the privacy of the subjects, good ventilation was maintained and noise minimized to its minimum level.

## **Expected outcomes included:**

The main purpose of nursing health education was to enhance knowledge, lifestyle and reduce the complications for patients undergoing plastic biliary stent.

## **3-Implementation Phase:**

**Control group** got routine nursing offered to the patients via nurses, and under their prescribed hospital routine treatment.

**The study group** received nursing health education which had been designed by the researcher for each study group (represented in 6 subgroups, each group containing 5 patients) after introducing self to initiate communication.

Teaching guidelines were given to study group in 2 sessions in the same day of endoscopic plastic biliary stent insertion before ERCP; each session takes duration of 30-35 minutes, in addition to the pre assessment session.

Every session began with a recap of the last session's content and an enumeration of the current session's goals. Feedback and discussion

commenced for five minutes following each session.

### **The first session**

**The content of the session:** the researcher met each group of patients in the waiting room at the Endoscopy Unit at New Surgeries Hospital.

**The first session** covered simple anatomy of the gastrointestinal system, types of GIT endoscopies, definition, causes, signs and symptoms of biliary obstruction and specific information about biliary stent especially plastic biliary stent: (definition, types, indications, complications, patient position, type of anesthesia used, preparation of patient before ERCP and what was actually happening during the procedure). **Method:** Power point presentation and pictures. **Time:** 30-35 minutes.

### **The second session**

#### **The content of the session**

-Second session covered guidelines about nursing care and instructions after ERCP and discharge plan (Follow-up, assessing symptoms and signs of complications related to PBS, conducting laboratory tests and ultrasound, monitoring types and quantities of food and fluids, evaluating activities of daily living, engaging in exercise, and reviewing medication information regarding type, route, precautions, and side effects, along with self-management

strategies at home to prevent any complications.

**-Method:** Power point presentation, videos and booklet. **Time:** 30-35 minutes.

### **4-Evaluation Phase**

Each subject in the two groups (study and control) had been evaluated five times, **first time:** before giving nursing guidelines before endoscopic plastic biliary stent procedure by using Tool I (part I, part II and part III) and Tool II, **second time:** immediately after giving nursing guidelines employing Tool I (part III), **third time:** immediately post endoscopic plastic biliary stent procedure before patient discharge by using Tool III (Part I) , **fourth time:** after one week from endoscopic procedure by using Tool III (Part I) , and **the fifth time:** after three months from endoscopic plastic biliary stent procedure employing Tool I (part III), Tool II and Tool III (Part I and part II) to evaluate the efficiency of the nursing health education to compare between pre and post implementation of nursing health education.

### **Results**

#### **Table (1): Distribution of The Studied Patients regarding Their Socio-demographic Characteristics.**

**Regarding age,** half of the control group (50%) and (40%) of the study group were in age group of (50-60) years with mean age  $48.07 \pm 9.292$  in

control group and  $45.93 \pm 8.646$  in the study group. **Concerning marital status**, most of the studied sample (80% of control group and 73.33% of study group) were married. **Related to educational level**, less than one third in the control group (26.67%) had secondary education and in the study group (26.67%) had basic education. **As for occupational status**, < half of the studied patients in the control group had been housewives but in the study group had been farmers (46.67% and 43.33%, correspondingly).

**In relation to residence**, most of the control and study group (70% and 76.67%, respectively) were living in rural area. **Also, this result represented height and weight** of the studied sample, the mean height of control group was  $165.53 \pm 8.007$  while in study group was  $170.13 \pm 8.212$  and the mean weight in control group was  $72.23 \pm 8.316$  while in study group was  $78.67 \pm 11.059$ , and it was observed that significant difference existed between the two groups in relation to height and weight since ( $p = 0.032$  and  $p = 0.014$ , correspondingly).

**Finally, in relation to body mass index**, it represented that <half of the studied patients (46.67% of control group and 43.33% of study group) had been overweight ( $25.0 < 30$ ) with mean BMI level in control group was  $26.57 \pm 3.807$  and in study group was

$27.26 \pm 4.021$ , and it was observed that there were no significant difference existed between both groups in relation to body mass index since  $p = 0.456$ .

**Table (2): Distribution of The Studied Patients regarding their Total Knowledge Level about Plastic Biliary Stent.**

This table revealed that most of the control group (93.33%) and study group (90%) had low level of knowledge about plastic biliary stent before giving nursing guidelines. On the contrary, a highly improvement existed in total knowledge level only for study group after giving nursing health education as it was noted that majority of study group exhibited a high level of knowledge immediately after giving nursing guidelines and after three months from endoscopic plastic biliary stent procedure (80% and 73.33%, respectively), but in control group, minority of patients had high level of knowledge immediately after giving nursing guidelines and after three months from endoscopic plastic biliary stent procedure (3.33% and 6.67%, respectively).

**Generally**, there were highly significant difference among study group during the period of the work where  $P = 0.000$  ( $P < 0.01$ ) but, there were no significant difference between control group during the period of the study where  $P = 0.106$ .

**Figure 1: Distribution of The Studied Patients regarding Their Total Level of Health Promoting Lifestyle (HPL).**

This figure revealed that most of the control group (90%) and study group (83.33%) exhibited poor HPL level before giving nursing guidelines. **On the contrary**, there were highly enhancement in total health promoting lifestyle (HPL) level only for study group after giving nursing health education as it was noted that (86.67%) of study group had good level of HPL after three months from endoscopic plastic biliary stent procedure, but in control group, minority of patients (6.67%) had good level of HPL and majority of them (76.67%) had poor level of HPL after three months from endoscopic plastic biliary stent procedure.

**Generally**, there were highly significant difference among study group during the period of the work where  $P=0.000$  ( $P<0.01$ ) but there were no significant difference among control group throughout the period of the study where  $P=0.705$  ( $P>0.05$ ).

**Table (3): Distribution of The Studied Patients regarding Their Total Level of Post Endoscopic Retrograde Cholangiopancreatography (ERCP) Clinical Outcomes.**

This table found that study group had low level of total post ERCP clinical outcomes immediately post endoscopic procedure, after one week and after 3 months from endoscopic procedure (70%, 100% and 6.67%, respectively) compared to control group that had (30%, 96.67% and 40%, respectively).

Moreover, after 3 months of endoscopic procedure, it was found that (53.33%) of control group exhibited high level of post ERCP clinical outcomes (signs and symptoms of complications), but no one in study group (0%) had high level of post ERCP clinical outcomes (signs and symptoms of complications). **Generally**, there was an improvement in study and control group in post ERCP clinical outcomes, but there were highly improvement in study group after giving nursing health education about plastic biliary stent and ERCP, where  $P=0.000$ .

**Table (4): Distribution of The Studied Patients regarding Their Plastic Biliary Stent Complications of Post Endoscopic Retrograde Cholangiopancreatography (ERCP) Clinical Outcomes After 3 Months**

This table clarified that half of control group (50%) had stent obstruction after 3 months from endoscopic procedure, while minority of study group (6.67%) had stent obstruction after 3 months

from endoscopic procedure. **Also**, this table showed that (10%) of the control the group had stent migration after 3 months from endoscopic procedure, but no one in study group had stent migration after 3 months from endoscopic procedure.

**Table (5): Correlation between Knowledge Score of the Studied Patients and their Health Promotion Lifestyle**

This table revealed that a positive association existed between total knowledge score of studied groups and their level of health promotion life style.

**Table (6): Correlation between Knowledge Score of the Studied Patients and their Post Endoscopic Clinical Outcomes.**

This table showed that a negative association existed between total knowledge score of studied groups and their level of post ERCP clinical outcomes.



**Table (1): Distribution of The Studied Patients regarding Their Socio-demographic Characteristics.**

| Characteristics   | The studied patients<br>(n=60) |       |                       |       | $\chi^2$<br>P  |
|-------------------|--------------------------------|-------|-----------------------|-------|----------------|
|                   | Control group<br>(n=30)        |       | Study group<br>(n=30) |       |                |
|                   | N                              | %     | N                     | %     |                |
| Age (in years)    |                                |       |                       |       |                |
| - (21-<30)        | 2                              | 6.67  | 1                     | 3.33  | 1.231<br>0.745 |
| - (30-<40)        | 5                              | 16.67 | 7                     | 23.33 |                |
| - (40-<50)        | 8                              | 26.67 | 10                    | 33.33 |                |
| - (50-60)         | 15                             | 50.00 | 12                    | 40.00 |                |
| Range             | (28-60)                        |       | (27-59)               |       | t=0.848        |
| Mean ± SD         | 48.07±9.292                    |       | 45.93±8.646           |       | P=0.361        |
| Marital status    |                                |       |                       |       |                |
| - Single          | 2                              | 6.67  | 1                     | 3.33  | 1.272<br>0.736 |
| - Married         | 24                             | 80.00 | 22                    | 73.33 |                |
| - Divorced        | 1                              | 3.33  | 2                     | 6.67  |                |
| - Widow           | 3                              | 10.00 | 5                     | 16.67 |                |
| Educational level |                                |       |                       |       |                |
| - Illiterate      | 6                              | 20.00 | 6                     | 20.00 | 0.794<br>0.939 |
| - Read and write  | 7                              | 23.33 | 6                     | 20.00 |                |
| - Basic education | 6                              | 20.00 | 8                     | 26.67 |                |
| - Secondary       | 8                              | 26.67 | 6                     | 20.00 |                |
| - University      | 3                              | 10.00 | 4                     | 13.33 |                |
| Occupation status |                                |       |                       |       |                |
| - Not work        | 1                              | 3.33  | 1                     | 3.33  | 4.115<br>0.533 |
| - Farmer          | 11                             | 36.67 | 13                    | 43.33 |                |
| - Student         | 0                              | 0.00  | 1                     | 3.33  |                |
| - Professional    | 3                              | 10.00 | 5                     | 16.67 |                |
| - House wife      | 14                             | 46.67 | 10                    | 33.33 |                |
| - Retired         | 1                              | 3.33  | 0                     | 0.00  |                |
| Residence         |                                |       |                       |       |                |
| - Rural           | 21                             | 70.00 | 23                    | 76.67 | FE<br>0.771    |
| - Urban           | 9                              | 30.00 | 7                     | 23.33 |                |
| Height (in cm)    |                                |       |                       |       |                |
| Range             | (150-180)                      |       | (150-180)             |       | t=4.826        |
| Mean ± SD         | 165.53±8.007                   |       | 170.13±8.212          |       | P=0.032*       |

|                                 |                                   |       |                                   |       |                 |
|---------------------------------|-----------------------------------|-------|-----------------------------------|-------|-----------------|
| <b>Weight (in kg)</b>           |                                   |       |                                   |       |                 |
| Range                           | (60-90)                           |       | (60-98)                           |       | <b>t=6.485</b>  |
| Mean $\pm$ SD                   | 72.23 $\pm$ 8.316                 |       | 78.67 $\pm$ 11.059                |       | <b>P=0.014*</b> |
| <b>Body mass index level</b>    |                                   |       |                                   |       |                 |
| - Healthy weight (18.5–<25.00)  | 11                                | 36.67 | 10                                | 33.33 | 0.420           |
| - Over-weight (25.0–<30)        | 14                                | 46.67 | 13                                | 43.33 | 0.811           |
| - Obesity ( $\geq$ 30.0)        | 5                                 | 16.67 | 7                                 | 23.33 |                 |
| <b>Range</b>                    | <b>(21.45-36.89)</b>              |       | <b>(21.47-38.05)</b>              |       | t=0.562         |
| <b>Mean <math>\pm</math> SD</b> | <b>26.57<math>\pm</math>3.807</b> |       | <b>27.26<math>\pm</math>4.021</b> |       | P=0.456         |

FE: Fisher' Exact test

\* Significant at level  $P < 0.05$ .**Table (2): Distribution of The Studied Patients regarding their Total Knowledge Level about Plastic Biliary Stent.**

| Total knowledge level | The studied patients (n=60) |       |            |       |                |       |                |                    |       |            |       |                |       |                  |
|-----------------------|-----------------------------|-------|------------|-------|----------------|-------|----------------|--------------------|-------|------------|-------|----------------|-------|------------------|
|                       | Control group (n=30)        |       |            |       |                |       | $\chi^2$<br>P  | Study group (n=30) |       |            |       |                |       | $\chi^2$<br>P    |
|                       | Before                      |       | Immediate  |       | After 3 months |       |                | Before             |       | Immediate  |       | After 3 months |       |                  |
|                       | N                           | %     | N          | %     | N              | %     |                | N                  | %     | N          | %     | N              | %     |                  |
| - Low                 | 28                          | 93.33 | 27         | 90.00 | 23             | 76.67 | 4.486<br>0.106 | 27                 | 90.00 | 1          | 3.33  | 2              | 6.67  | 114.57<br>0.000* |
| - Moderate            | 1                           | 3.33  | 2          | 6.67  | 5              | 16.67 |                | 3                  | 10.00 | 5          | 16.67 | 6              | 20.00 |                  |
| - High                | 1                           | 3.33  | 1          | 3.33  | 2              | 6.67  |                | 0                  | 0.00  | 24         | 80.00 | 22             | 73.33 |                  |
| Range                 | (10-46)                     |       | (10-50)    |       | (12-50)        |       | F=19.43        | (6-46)             |       | (55-60)    |       | (51-58)        |       | F=79.88          |
| Mean ± SD             | 15.63±3.57                  |       | 16.20±3.35 |       | 20.93±3.96     |       | P=0.000*       | 16.90±4.73         |       | 58.70±1.34 |       | 54.80±1.97     |       | P=0.000*         |

&lt;50% Low

(50-75) % Moderate

&gt;75% High

 $\chi^2$ : Chi-square test\* Significant at level  $P < 0.05$ 

F: ANOVA-value test

\*\* Highly significant at level  $P < 0.01$

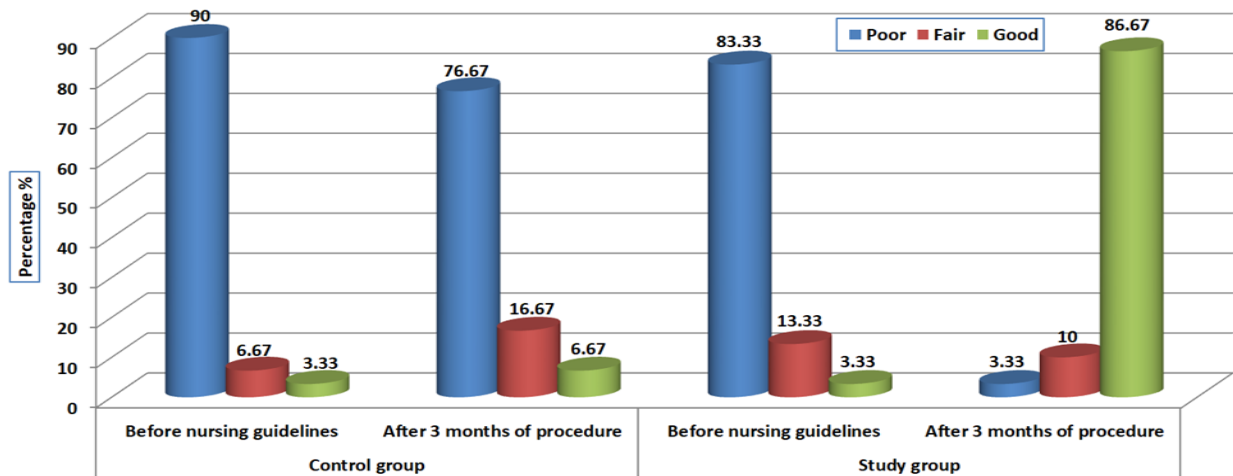


**Figure 1: Distribution of The Studied Patients regarding Their Total Level of Health Promoting Lifestyle (HPL).**

**Table (3): Distribution of The Studied Patients regarding Their Total Level of Post Endoscopic Retrograde Cholangiopancreatography (ERCP) Clinical Outcomes.**

| Total post ERCP level | The studied patients (n=60) |       |                           |       |                             |       |                 |                           |       |                           |        |                             |       |                 |
|-----------------------|-----------------------------|-------|---------------------------|-------|-----------------------------|-------|-----------------|---------------------------|-------|---------------------------|--------|-----------------------------|-------|-----------------|
|                       | Control group (n=30)        |       |                           |       |                             |       | $\chi^2$<br>P   | Study group (n=30)        |       |                           |        |                             |       | $\chi^2$<br>P   |
|                       | Post endoscopic Procedure   |       | After a week of procedure |       | After 3 months of procedure |       |                 | Post endoscopic Procedure |       | After a week of procedure |        | After 3 months of procedure |       |                 |
|                       | N                           | %     | N                         | %     | N                           | %     |                 | N                         | %     | N                         | %      | N                           | %     |                 |
| - None                | 0                           | 0.00  | 0                         | 0.00  | 0                           | 0.00  | 50.95<br>0.000* | 0                         | 0.00  | 0                         | 0.00   | 28                          | 93.33 | 21.86<br>0.000* |
| - Low                 | 9                           | 30.00 | 29                        | 96.67 | 12                          | 40.00 |                 | 21                        | 70.00 | 30                        | 100.00 | 2                           | 6.67  |                 |
| - Moderate            | 20                          | 66.67 | 1                         | 3.33  | 2                           | 6.67  |                 | 9                         | 30.00 | 0                         | 0.00   | 0                           | 0.00  |                 |
| - High                | 1                           | 3.33  | 0                         | 0.00  | 16                          | 53.33 |                 | 0                         | 0.00  | 0                         | 0.00   | 0                           | 0.00  |                 |
| Range                 | (4-11)                      |       | (0-5)                     |       | (0-8)                       |       | F=74.47         | (2-10)                    |       | (0-0)                     |        | (0-4)                       |       | F=29.04         |
| Mean ± SD             | 7.80±1.69                   |       | 1.43±1.43                 |       | 3.43±2.81                   |       | P=0.000<br>*    | 6.13±2.09                 |       | 0.00±0.00                 |        | 0.23±0.89                   |       | P=0.000<br>*    |

(0) None                      <50% Low                      (50-80)% Moderate                      >80% High

$\chi^2$ : Chi-square test

F: ANOVA-value test

\* Significant at level P<0.05

\*\* Highly significant at level P<0.01.

**Table (4): Distribution of The Studied Patients regarding Their Plastic Biliary Stent Complications of Post Endoscopic Retrograde Cholangiopancreatography (ERCP) Clinical Outcomes After 3 Months**

| Complications of Plastic Biliary Stent | The studied patients (n=60) |       |                    |       |               |
|----------------------------------------|-----------------------------|-------|--------------------|-------|---------------|
|                                        | Control group (n=30)        |       | Study group (n=30) |       | $\chi^2$<br>P |
|                                        | N                           | %     | N                  | %     |               |
| <b>1. Stent obstruction</b>            |                             |       |                    |       |               |
| - Absent                               | 15                          | 50.00 | 28                 | 93.33 | FE            |
| - Present                              | 15                          | 50.00 | 2                  | 6.67  | 0.829         |
| <b>2. Stent migration</b>              |                             |       |                    |       |               |
| - Absent                               | 27                          | 90.0  | 30                 | 100.0 | FE            |
| - Present                              | 3                           | 10.0  | 0                  | 0.00  | 0.330         |

FE: Fisher' Exact test

**Table (5): Correlation between Knowledge Score of the Studied Patients and their Health Promotion Life Style.**

|                                   | The studied patients (n=60) |       |           |   |                  |       |                       |       |               |   |                  |       |
|-----------------------------------|-----------------------------|-------|-----------|---|------------------|-------|-----------------------|-------|---------------|---|------------------|-------|
|                                   | Total knowledge score       |       |           |   |                  |       |                       |       |               |   |                  |       |
|                                   | Control group<br>(n=30)     |       |           |   |                  |       | Study group<br>(n=30) |       |               |   |                  |       |
|                                   | Before                      |       | Immediate |   | Post<br>3 months |       | Before                |       | Immedia<br>te |   | Post<br>3 months |       |
|                                   | r                           | P     | r         | P | r                | P     | r                     | P     | r             | P | r                | P     |
| Health<br>Promotion Life<br>Style | 0.327                       | 0.077 | -         |   | 0.077            | 0.687 | 0.176                 | 0.353 | -             |   | 0.084            | 0.657 |

r: Pearson' correlation coefficient

**Table (6): Correlation between Knowledge Score of the Studied Patients and their Post Endoscopic Clinical Outcomes.**

|                                    | The studied patients (n=60)<br>Total knowledge score |   |           |   |                  |       |                       |   |               |                  |       |
|------------------------------------|------------------------------------------------------|---|-----------|---|------------------|-------|-----------------------|---|---------------|------------------|-------|
|                                    | Control group<br>(n=30)                              |   |           |   |                  |       | Study group<br>(n=30) |   |               |                  |       |
|                                    | Before                                               |   | Immediate |   | Post<br>3 months |       | Before                |   | Immed<br>iate | Post<br>3 months |       |
|                                    | r                                                    | P | r         | P | r                | P     | r                     | P | r             | P                | P     |
| <b>Post ERCP Clinical Outcomes</b> | -                                                    |   | -         |   | -0.072           | 0.707 | -                     |   | -             | -0.197           | 0.296 |

r: Pearson' correlation coefficient

### Discussion

The outcomes of the current work demonstrated that half of the control group and less than half of the study group were in the age group of (50-60) years with mean age  $48.07 \pm 9.292$  in control group and  $45.93 \pm 8.646$  in study group. This may be elucidated by the fact that this age signifies the last phase of the working-age population, that is susceptible to various age-related chronic ailments, unhealthy lifestyles including stressful life events and heightened intake of fast food, spicy and high fat diets (**Jaleel et al., 2023**).

The outcomes had been in line with (**Ramadan et al., 2024**) who revealed that the median age of patients who had placed plastic biliary stents was 52 years (range =22-79). In contrast, this result was contradicted by (**Kazi et al., 2022**) who demonstrated that the mean

age of study group was  $39.26 \pm 11.13$  but in control group was  $49.20 \pm 13.31$ .

**Concerning marital status**, the present work showed that most of the studied sample had been married. From the researcher's point of view, this may be due to age factor as married patients are often older and the risk for biliary issues generally increases with age, also marriage often leads to lifestyle changes such as diet and physical activity which can contribute to obesity which is a substantial risk factor for gallstones and biliary obstruction. This result was supported by (**Rudiman, Hanafi, & Halim, 2023**) who demonstrated that nearly > two third of participants in control and study group had been married without any significant difference among both groups.

**As regard to educational level**, the current study illustrated that < one-

third of the studied patients in the control group had secondary education and in the study group had basic education, hence, there is a deficiency of knowledge as regard better health awareness, better access to healthcare services, engaging in healthier lifestyles reducing the risk of gallstones which is a major contributor to biliary obstruction. **Also**, this study represents that less than half of the studied patients in the control group were housewives but in the study group were farmers, this might be due to living in rural area. These results were supported by (Taha, Sayed, Azer, & Abd-Al Mageed, 2023) who revealed that more than half of the study group possessed a secondary education, whereas approximately one-third of the control group had primary and university education. A statistically significant difference existed between the two groups. Additionally, over half of the study group were housewives, while only one-third of the control group had been engaged in farming. However, those finding were contradicted with (Ragab et al., 2023) who reported that the majority of studied patient had high educational level, additionally, this finding was in contrast with (Petit et al., 2022) who stated that < half of the studied groups had been civil servant.

**Regarding residence**, the current present work stated that most of control and study group had been lived in rural area, this may be justified by that rural populations face challenges in accessing timely medical care which can increase the risk of complications that necessitate biliary stenting. These findings in line with (Alhaidari et al., 2024) who states that most of studied patients came from rural areas. This result contradicted to result of (Hristov et al., 2024) who found that majority of studied patients came from urban areas.

**In concern of weight and BMI**, the present work represented that less than half of the studied sample were overweight (25.0-<30) with mean body mass index level in control group was  $26.57 \pm 3.807$  and in study group was  $27.26 \pm 4.021$ , this can be justified by that increased body weight is associated with a higher risk of gallstone formation which can lead to obstruction of the bile ducts. This is in agreement with (Al-Shaleel, Thabet & Alshehri, 2020) who stated that patients with overweight had 50% more risk for having biliary obstruction than patients with normal weights. In addition, obese patients had five times more risk to have biliary obstruction than normal weighted.

**In relation to the studied patients regarding their total knowledge level**

**about plastic biliary stent**, this study illustrated that there was highly significant difference between study group during the period of the work where  $P=0.000$  ( $P<0.01$ ) but there were no significant difference between control group throughout the period of the study where  $P=0.106$ . This study also illustrates that most of the control group and study group had low level of knowledge about plastic biliary stent before giving nursing guidelines. On the contrary, there were highly enhancement in total knowledge level only for study group after giving nursing health education. These findings supported with **(Alhaidari et al., 2024)** who reported that a highly significant difference in the mean of the study group regards their knowledge about biliary stent throughout pre and post-test with  $P$  value = .000, which shown significant increase in their knowledge, while no substantial variation was seen in the control group between the pre- and post-test, with  $P = .078$ . This result was in contrast with **(Chauhan, Kumar& Thakur, 2019)** who stated that most of the studied group had good knowledge. **Concerning the Studied patients regarding their total level of health promoting lifestyle (HPL)**, results clarified that there were highly significant difference among study group during the study period where

$P=0.000$  ( $P<0.01$ ) but, there were no significant difference among control group during the period of the work where  $P=0.705$  ( $P>0.05$ ), this can be due to lack of knowledge about how to adopt a lifestyle that supports the proper function of a plastic biliary stent as empowered patients who are educated about their condition, diet, self-care and follow up are more likely to experience positive outcomes and avoid complications **(Driskill et al., 2020)**.

The findings aligned with **(Solhi et al., 2020)**, who identified a statistically significant difference among the study and control groups for all lifestyle items before and after the implementation of the nursing training protocol on lifestyle adjustments.

**According to the studied patients regarding their total level of post endoscopic retrograde cholangiopancreatography (ERCP) clinical outcomes**, the outcomes revealed that an enhancement existed in study and control group in post ERCP signs and symptoms (clinical outcomes), but there were highly improvement in study group after giving nursing health education about plastic biliary stent and ERCP, where  $P=0.000$ , also it was observed that there were more complications in control group than study group (stent obstruction and migration) as half of

control group had stent obstruction after 3 months from endoscopic procedure, while minority of study group had stent obstruction after 3 months from endoscopic procedure. Also, this result showed that (10%) of control group had stent migration after 3 months from endoscopic procedure, but no one in study group had stent migration after 3 months from endoscopic procedure. From the researcher's perspective, this might be justified by poor lifestyle and lack of knowledge can significantly affect clinical outcomes and lead to various complications in patients with plastic biliary stents. This finding had been in line with **(Meseha & Attia, 2023)** who stated that educating patients and promoting a healthier lifestyle are essential in enhancing the long-term and short-term clinical outcomes for individuals with biliary stents. These finding of current study also matched with **(Shehab & Soultan, 2024)** who noticed that there was statistical difference before and after implementation of guidelines regarded to patients' complications as abdominal distension and abdominal pain.

**Also, the correlation between knowledge score of the studied patients and their health promotion lifestyle** clarified that there was positive correlation between total

knowledge score of studied groups and their level of health promotion life style. These results in agreement with **(Taha, Sayed, Azer, & Abd-Al Mageed, 2023)** who reported that there was positive correlation between patient knowledge and their level of health promotion lifestyle.

**Moreover, correlation between knowledge score of the studied patients and their Post endoscopic clinical outcomes,** the current work revealed that a negative correlation existed between total knowledge score of studied groups and their level of post endoscopic retrograde cholangiopancreatography (ERCP) clinical outcomes. These results were supported by **(Helba, Abdelaziz, Selim & Salem, 2024)** who stated that a negative correlation existed among patient knowledge and occurrence of complications after endoscopy.

### **Conclusion**

It can be concluded that a highly statistically significant difference existed among study and control group in terms of overall level of knowledge, all items of life style, post ERCP clinical outcomes and patients' complications before and after implementing nursing health education on patients' knowledge, clinical outcomes, lifestyle modifications and patients' complications.



## Recommendations

Depending on the results of the present study, the following suggestions are proposed:

### For Patients

-Continuous educational programs to enhance the knowledge of the patients about plastic biliary stent and its types, indications and complications.

-Inform patients on the significance of consistent follow-up at scheduled intervals, which is essential for treatment efficacy and safety.

-Distribution of researcher booklet to all patients prior the endoscopic procedure at endoscopic unit at Tanta Hospitals.

### For Nurses

-Nurses ought to include the frequent review of current references (periodicals, textbooks, etc.) into their everyday responsibilities. They ought to consistently be motivated to participate in scientific meetings and conferences to be abreast of the rapidly expanding body of knowledge and practices essential for effective nursing care.

### For further research works

- Replication of the present research with an expanded cohort of patients across diverse settings is necessary for the generalization of the findings.

## References

*Alhaidari S, Alzahrani I, Alhanaee M, Decanini A, Mohamed M, Gomez S,*

*Mathura P, Zhang J & Sandha G (2024).*

Optimising the indications for biliary stent placement during endoscopic retrograde cholangiopancreatography: a quality improvement initiative to enhance patient care and reduce healthcare resource utilization. *BMJ Open Gastroenterol*,11(1),1-

8.Doi:10.1136/bmjgast-2024-001375.

*Al-Shaleel A, Thabet T& Alshehri M (2020).* The relation between obstructive jaundice and body mass index in Aseer Central Hospital, Saudi Arabia. *International Journal of Medicine in Developing Countries*,4(10), 1533-36. Doi: <https://doi.org/10.24911/IJMDC.51-1592996761>.

*Aryanti C, Mahayasa I ,& Mulyawan I(2023).* A Bayesian Network Meta-Analysis Comparing Biliary Stent Types' Outcome and Complications in Unresectable Malignant Biliary Obstructions. *Asian Pacific Journal of Cancer Prevention*,24 (3):791-800. DOI: 10.31557/APJCP.2023.24.3.791

*Bang S (2024).* Endeavors to prevent stent malfunction: new insights into the risk factors for recurrent biliary obstruction. *Clinical Endoscopy Journal*, 57(1), 56–57. Doi: 10.5946/ce.2023.274.

*Bektas H, Gurbulak B, Sahin Z, Colak S, Gunes M, & Cakar E (2024).* Multiple plastic biliary stent placement in the management of large and multiple choledochal stones. *Videosurgery Journal*, 12 (3), 231-237. DOI: 10.5114/wiitm.2022.69107.

*Bofill A, & Cardenas A(2024).* A practical approach to the endoscopic management

- of biliary strictures after liver transplantation. *Annals of Hepatology journal*, 29(2024),1-6. DOI: Annals of Hepatology 29 (2024) 101186.
- Chauhan R, Kumar R & Thaker S (2019).** A Study to Assess the Knowledge, Attitude and Pre-Procedure Anxiety Level of Patient Undergoing Upper GI Endoscopy in Krishna Hospital, Karad. *Journal of family medicine and primary care*, 5(6),243-49. Doi: <https://doi.org/10.3748/wjg.v26.i4.433>.
- Chiba M, Kato M, Kinoshita Y, Shimamoto N, Abe T, Kawahara Y, Koyama S, Sumiyama K & Tomita Y (2024).** Best period to replace or change plastic stents with self-expandable metallic stents using multivariate competing risk regression analysis. *Scientific Reports*,10(1), 1-14. DOI: <https://doi.org/10.1038/s41598-020-70081-3>.
- Dinescu B, Voiosu T, Bengus A, Mateescu R ,Voiosu A, & Radu M (2023).** The perfect biliary plastic stent. *Annals of Gastroenterology journal*,36(8),490-496. DOI: <https://doi.org/10.20524/aog.2023.0826>
- Driskill K, Pratt M, Drapek L, Lyer R, Pinheiro N & Acquisto S (2020).** Nursing Care and Education for Patients with Biliary Stents and Drains: An Ongoing Multi-Center Quality Improvement Project. *World Journal of Gastroenterology*, 26(4), 433–447. Doi: <https://doi.org/10.3748/wjg.v26.i4.433>
- Duman A, & Hulagu S (2024).** Management of migrated plastic biliary stents in patients with benign biliary diseases. *Laparosc Endosc Surg Sci journal*, 29(1),29-35. DOI: 10.14744/less.2024.95777.
- Dumonceau J, Heresbach D, Deviere J, Costamagna G, Beilenhoff U, & Riphaus A (2023).** Biliary stents: Models and methods for endoscopic stenting. *Endoscopy journal*, 43(7),617-26. DOI: 10.1055/s-0030-1256315.
- Farani M, Saldi S, Maulahela H, Abdullah M, Syam A, & Makmum D (2024).** Survival, stent patency, and cost-effectiveness of plastic biliary stent versus metal biliary stent for palliation in malignant biliary obstruction in a developing country tertiary hospital. *Journal of Gastroenterology and Hepatology Foundation*,5(2024),959-965. DOI: 10.1002/jgh3.12618.
- Helba K, Abdelaziz A, Selim M & Salem F(2024).** Effect of Nursing Instructions on Clinical Outcomes for Patients Undergoing Upper Gastrointestinal Endoscopy. *Tanta Scientific Nursing Journal*,33(2),223-44. Doi: <https://doi.org/10.21608/ejhc.2024.271424>.
- Hristov B, Doykov D, Andonov V, Doykov M, Kraev K, Valova S, Sandeva M & Kostov G (2024).** Interventional treatment of malignant biliary obstruction: Is it Time to change the paradigm?. *Gastroenterol Journal*, 15(2), 266-84. Doi: <https://doi.org/10.3390/gastroent15020020>.
- Jaleel R, Simon E, Gupta P, Patnaik I, David D & Chowdhury S (2023).** Retained biliary plastic stents-lest we forget. *SAGE Journal*, 51(2), 177-80. DOI: 10.1177/0049475520945443 .

- Kazi F, Ghosh S, Sharma J, Saravanan S & Patil S (2022).** Trends in Gallbladder Disease in Young Adults: A Growing Concern. World Journal of Gastroenterology, 14(8), 1-6. DOI: 10.7759/cureus.28555.
- Kim S, Ohanian E, Lee F, Nam B, Laine L, & Che K (2023).** Predictors and outcomes of delayed plastic biliary stent removal following endoscopic retrograde cholangiopancreatography. Scand J Gastroenterol journal, 52(10), 1128-1132. DOI: 10.1080/00365521.2017.1342138 .
- Lyu Y, Ye S & Wang B (2023).** Comparison of metal versus plastic stent for preoperative biliary drainage in patients with pancreatic cancer undergoing neoadjuvant therapy: a meta-analysis and systematic review. BMC Gastroenterology journal, 1(40), 2-8. DOI: <https://doi.org/10.1186/s12876-023-02874-5>.
- Merchan M, Moura D, Oliveira G, Proeca I, Ide E, Moll C, Luna S, Moura E, Bernardo W, & Junior E (2024).** Antibiotic prophylaxis to prevent complications in endoscopic retrograde cholangiopancreatography: A systematic review and meta-analysis of randomized controlled trials. World Journal of Gastrointestinal Endoscopy, 14(11), 718–730. DOI: 10.4253/wjge.v14.i11.718.
- Meseeha M & Attia M (2023).** Biliary Stenting. Journal of Gastroenterology, 221(3), 265-71. Doi: 10.1097/00000658-199503000-00008.
- Petit S, Puyade M, Pichon M, Wangerme M, Roblot F & Rammaert B (2022).** Risk factors for biliary stent infections in malignant biliary obstruction secondary to unresectable malignancies. HAL Science Journal, 30 (8), 6937-46. DOI: <https://doi.org/10.1007/s00520-022-07106-2>.
- Ragab L, Abdel-Hameed M, Gouda M, Katamish H, Atalla H, Shiha G, Abdallah O, Ghoneem E, & Madkour A (2023).** Endoscopic ultrasound-guided biliary drainage for distal malignant biliary obstruction: a prospective 3-year multicenter Egyptian study. Acta Gastro-Enterologica Belgica, 86(1), 26-35. DOI: 10.51821/86.1.10828.
- Ramadan N, Muhammed M, Gaffar A, Atef S, Abdelrhman N, Salib M & Azab T (2024).** Association between bacterial colonization and stent occlusion in plastic biliary stents. Benha Medical Journal, 41(5), 303-13.
- Rudiman R, Hanafi R, & Halim F (2023).** Complications of biliary stenting versus T-tube insertion after common bile duct exploration: asystematic review and meta-analysis. Plos one journal, 18(1), 1-15. DOI: e0280755. <https://doi.org/10.1371/journal.pone.0280755>.
- Shehab M & Soultan A (2021).** Impact of Application of Nursing Guidelines on Health Outcomes for Patients Undergoing Gastrointestinal Endoscopes. Egyptian Journal of Health Care, 12(2), 195-208. Doi: <https://doi.org/10.21608/ejhc.2019.271424>.
- Shehab M, & Soultan A (2024).** Impact of Application of Nursing Guidelines on Health Outcomes for Patients Undergoing

Gastrointestinal Endoscopes. Egyptian Journal of Health Care,12(2),195-208.

**Sohn S, Park J, Kim K ,&Kim T (2022).** Complications and management of forgotten long-term biliary stents . Complications and management of forgotten long-term biliary stents. *World Journal of Gastroenterol* ,23(4), 622-628.DOI: 10.3748/wjg.v23.i4.622.

**Solhi M, Azar F, Abolghasemi J, Maheri M, Irandoost S& Khalili S(2020).** The effect of educational intervention on health promoting lifestyle: Intervention mapping approach. *Journal of Education and Health Promotion* ,9(31),1-7. Doi: 10.4103/jehp.jehp\_768\_19.

**Taha A, Sayed Z, Azer S, & Abd-Al Mageed A (2023).** Effect of Implementing Nursing Teaching Protocol on Health Promotion Lifestyle for Patients with Plastic Biliary Stent. *Assiut Scientific Nursing Journal*,9(25), 165-173. DOI: 10.21608/ASNJ.2023.74259.1172.

**Walker S, Sechrist K and Pender N. (1987).** Health promotion model-instruments to measure health promoting lifestyle: Health-promoting lifestyle profile [HPLP II], (Adult version).

## The Efficacy of Hand Exercise and Splinting on Carpal Tunnel Syndrome among Pregnant Women

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### Abstract

**Background:** Carpal tunnel syndrome has a critical effect on the pregnant women's quality of life. Several non-pharmacological techniques have been used to relieve these symptoms. **The aim of this study:** was to determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women. **Subjects and Method:** Quasi experimental research design was used to conduct this study at antenatal outpatient clinic of Tanta University, El-Menshawy and EL-Mabara Hospitals. The study sample consisted of 120 pregnant women with carpal tunnel syndrome. Data collection was conducted using **three tools**, **Tool I:** Women's knowledge structured interviewing questionnaire regarding carpal tunnel syndrome, **Tool II:** Boston Carpal Tunnel Syndrome Questionnaire and **Tool III:** Numeric pain rating scale. **Results:** There was a statistically significant improvement in the overall knowledge, severity of carpal tunnel syndrome, and level of pain after implementation of hand exercise and splinting. Additionally, there were positive correlation between the studied pregnant women's total score level of knowledge and their total Boston Carpal Tunnel Syndrome Questionnaire pre and post intervention, also there is a negative correlation between knowledge scores and Numeric Pain scores pre and post intervention. **Conclusion:** The findings of the present study revealed significant improvement in the overall knowledge, severity of carpal tunnel syndrome, and level of pain after implementation of the intervention. **Recommendation:** It is recommended to develop training programs for pregnant women in order to improve their knowledge and practices regarding carpal tunnel syndrome.

**Key words:** Hand Exercise, Splinting, Carpal Tunnel Syndrome, Pregnant Woman.

**Introduction:**

The entrapment of the median nerve in the carpal tunnel of the wrist, usually accompanied by a rise in carpal tunnel pressure, is known as carpal tunnel syndrome. In the upper quadrant, it is the most common type of peripheral neuropathy. It significantly affects the pregnant women's day-to-day activities and lowers their ability for work, which has an impact on the overall health and quality of life of women **(Obuchowicz, Kruszyńska, & Strzelecki, 2021)** pregnancy-related carpal tunnel syndrome (PRCTS), also referred to as CTS, can occur in between 0.23% and 70% of cases **(Soad, Manal, & Raga, 2020)**. Carpal tunnel syndrome affects about 4% of adults in the general population and 8% of adults who work. Third trimesters (63%), second trimester (26%), and first trimester (11%), are the most likely times for CTS to occur **(Cimpeanu et al., 2024; Boehrer, 2020; Gabrielli, Lesiak, & Fowler, 2020)**. Genetic predisposition, history of repetitive wrist movements from typing, repetitive use, or machine work, obesity, diabetes, cumulative trauma disorders, tumors, hypothyroidism, fractures to the wrist spine, autoimmune disorders like rheumatoid arthritis, and pregnancy are the most common causes of carpal tunnel syndrome **(Justin, 2023)**.

Hormonal changes during pregnancy generally result in edema in several body areas, including the wrists. Fluid accumulation in the carpal tunnel may exert pressure on the median nerve. Carpal tunnel syndrome results from the compression of the median nerve. **(Ghoraba, Morsy, & Abo El-Enin, 2021)**. Those who work assembly-line jobs, such as manufacturing, sewing, finishing, and cleaning, as well as packing meat, poultry, or fish, are particularly susceptible to acquiring CTS **(Nowak et al., 2023)**. The tingling or numbness in the hands is the first sign of CTS. Particularly affected by these symptoms are the radial faces of the middle, ring, and index fingers; moreover, the palmar faces of the thumb and second finger. The palm does not experience these symptoms. This is because, prior to entering the tunnel, the branches of the median nerve that innervate the palms are divided **(Secorun et al., 2021)**.

Paresthesia, which includes burning, tingling, and numbness, appears early in the sleeping phase but later in the day in CTS women. Hand-made activations (knitting, cleaning dishes) cause pain and paresthesia during the day. The compression of the median nerve in one or both wrists causes pain, tingling, numbness, and weakness in women with CTS. Shaking the hand may help relieve it; it is frequently

worse at night, especially in the first three fingers, disrupting sleep. It might cause a decline in hand function and grip strength **(Shikha, & Biswas, 2024; Erickson et al., 2019)**. A complete history, clinical assessments, and diagnostic procedures like X-rays, nerve testing, Electromyograms (EMGs), and nerve conduction investigations are necessary for the diagnosis of CTS **(Dabbagh, MacDermid, Yong, Macedo, & Packham, 2020)**.

In order to prevent irreversible damage to the median nerve, chronic symptoms, and lifelong disability, early diagnosis and treatment are crucial. Women with CTS have several treatment options based on a number of variables, including the disease's stage, the patient's preferences, and the intensity of the symptoms. Improving hand function and symptom relief are the main objectives of CTS treatment **(Atroshi, Tadjerbashi, McCabe, & Ranstam, 2019)**. Since conservative therapy methods have a good chance of improving throughout the postpartum period, they are typically employed as the first line of treatment for mild-to-moderate instances of CTS. Education for women, employment modifications or changes, hand exercises, wrist splinting, B vitamins, non-steroidal anti-inflammatory drugs, and steroid injections are all part of it. Women

with severe CTS and those whose conservative treatment options have failed are treated surgically **(Keskin et al., 2020)**.

Immobilizing the wrist in a neutral posture to reduce its range of flexion or extension is the initial line of treatment. The justification for immobilizing the wrist to alleviate CTS symptoms is that it maintains the wrist in a neutral anatomical position, when the carpal tunnel is at its broadest, therefore reducing pressure on the carpal tunnel. Our method involves using a neutral wrist splint that has a metal bar inside to keep the wrist from moving up, down, or side to side while preserving finger mobility. Splinting allows mild to moderate nerve injury to recover by providing a respite to the median nerve and reducing edema but doing daily tasks while wearing a splint all day is difficult. It might be advised to wear it both throughout the day and while you sleep **(Unal, Umay, & Akyuz, 2023; Nadar Alotaibi, & Manee, 2023; Osiak Elnazir, Walocha, & Pasternaket, 2022; Gatheridge, 2020)**.

Gliding exercises reduce teno-synovial edema, enhance venous return, prevent or stretch tendon-median nerve adhesions, and alleviate symptoms by lowering pressure within the carpal tunnel. To glide a tendon, the exercises

essentially comprise a series of finger movements, and to glide the median nerve, they entail movements of the wrist and fingers. Each exercise was to be performed by women three to five times a day, with 10 repetitions for each. Five seconds were allowed for each position to hold (**Gasnick, 2023; McIntyre, 2022**).

Nurses play a crucial role in improving the functional status and lessen CTS symptoms. The nurse should provide the women instructions on how to perform hand exercises that help reduce the symptoms of CTS and should warm their hands slightly before doing so. In order to support and immobilize the wrist at night, the nurse should also suggest that they use a night wrist splint (**Abd Elmoniem, Abd-Elhakm, & Ibrahim, 2022**). Previous research evaluated the educational intervention's effect on CTS and found that it was successful in reducing the intensity of symptoms and enhancing functional status (**Ramadan, & Abdel Maksoud, 2021**).

### **Significance of the study**

Pregnant women's musculoskeletal systems are directly impacted by the morphological changes that occur during this time. Pregnancy-related dynamic normal changes can lead to diseases of the musculoskeletal system. One of the most common

problems during pregnancy is carpal tunnel syndrome. The quality of life for pregnant women is negatively impacted by untreated CTS. Damage to the median nerve can result in chronic discomfort, sleep disturbances, trouble with everyday tasks, and unproductive labor (**Lewis et al., 2020; Oliveira, Bernardes, Santos & Dias, 2019**).

### **Aim of the study**

The aim of this study was to determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women.

### **Research hypothesis**

The symptoms and severity of carpal tunnel syndrome will expected to be improved after implementation of the splinting and hand exercise.

### **Operational definition**

**Carpal tunnel syndrome:** It is a condition resulting from the compression of a nerve as it traverses the wrist into the hand, characterized mostly by weakness, discomfort, and sensory abnormalities in the hand and fingers.

### **Subjects and Methods**

#### **Research design**

Quasi experimental research design was used to conduct this study.

#### **Settings**

This study was conducted at antenatal outpatient clinics of:



- Tanta University hospital affiliated to the Ministry of Higher Education and scientific research.
- El-Menshawy hospital affiliated to Ministry of Health and population.
- EL- Mabara Hospital affiliated to Health Insurance.

### Subjects

A purposive sample of 120 pregnant women with carpal tunnel syndrome was selected from the previously mentioned settings.

The participants in this study were chosen based on the subsequent inclusion criteria:

- Pregnant women between the ages of 18 and 35 years.
- Women in second and third trimester of the pregnancy.
- Women diagnosed with carpal tunnel syndrome (unilateral or bilateral).
- Women who are willing to participate in the study.

### Exclusion criteria

- Women had neurological problems.
- Women with physical disability.
- Women with hypothyroidism.
- Women with diabetes mellitus.
- Women with hand or wrist deformity.
- Previous carpal tunnel syndrome surgery.
- Women with rheumatoid arthritis.

The sample size was determined using the Epi-Info statistical program developed by the World Health Organization and the Centers for

Disease Control and Prevention, Atlanta, Georgia, USA, version 2002.

- The criteria employed for sample size computation were as follows:
- 95% confidence interval.
- 80% statistical power of the study.
- Expected outcome 90% after intervention compared to 65% before intervention.

$$n = \frac{\left(\frac{z}{d}\right)^2 \times (0.50)^2}{1 + \frac{1}{N} \left[\left(\frac{z}{d}\right)^2 \times (0.50)^2 - 1\right]}$$

Where n represent the community size, Z denote the standard score corresponding to a significance level of 0.95, which is 1.96, and D signify the margin of error percentage.

### Tools of data collection:

To achieve the aim of this study, three tools were developed and used for data collection:

#### **Tool I: Women's knowledge structured interviewing questionnaire regarding carpal tunnel syndrome:**

It was designed by researchers following an assessment of recent pertinent literature. (Almajid et al., 2025; Abbas et al., 2024; Mirghani et al., 2024; Dwedar, ElShora, Ahmed, & El-Ansary, 2023) to gather fundamental data concerning the study participants. It comprised four components as outlined below:

**A.Socio-demographic****characteristics of the pregnant**

**women:** This section was designed to gather information regarding the general characteristics of the study sample, including age, current marital status, age at marriage, education, occupation, residence, telephone number, family income, and family type.

**B. Obstetrical history:** including gravidity, parity, last menstrual period, expected date of delivery, gestational weeks, timing of the initial antenatal visit, location of antenatal care, number of antenatal visits, participation in antenatal care classes, mode of previous delivery, and complications from previous pregnancies and deliveries.

**C. Medical history of carpal tunnel syndrome**

- Previous history of carpal tunnel syndrome, previous management of carpal tunnel syndrome, previous use of resting hand support.
- Current history of carpal tunnel syndrome to assess the characteristics of pain (location, severity, quality, timing and aggravating and alleviation measure of pain) and the hand swelling (location, timing and severity).

**D. Pregnant women's knowledge regarding carpal tunnel syndrome:**

This section was designed to evaluate women's understanding of carpal tunnel syndrome, including its definition, risk factors, signs and symptoms, complication, diagnostic tests, prevention, and therapeutic strategies.

**The scoring system for women's knowledge was categorized as follows**

- Correct and complete answers were scored as (2).
- Correct and incomplete answers were scored as (1).
- Incorrect and didn't know were scored as (0).

**The total score level of women's knowledge was categorized as follows**

- High level of knowledge  $\geq 75\%$
- Moderate level of knowledge 60 % - <75%.
- Low level of knowledge <60%

**Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)**

It was derived from **Levine et al., (1993)**. It was utilized to evaluate the severity of carpal tunnel syndrome. The BCTQ has two distinct scales: the symptom severity scale and the functional status scale. Two questionnaires were administered using a five-point Likert scale, and were then completed post-intervention to assess the efficacy of splinting and hand exercises in alleviating symptoms

in pregnant women with carpal tunnel syndrome.

**Part one : Symptom severity scale (SSS):** It was consisted of eleven questions such as: severity of the wrist pain at night, number of the wake up at night due to wrist pain, severity of the wrist pain during the daytime, frequency of the wrist pain during the daytime, duration of the episode of pain during the daytime, numbness in the wrist, weakness in the wrist, tingling sensations in the wrist, severity of numbness or tingling at night, number of the wake up at night due to numbness or tingling and ability of the grasping or use of small objects such as keys or pen.

Each question has five answers numbered from 1 to 5, arranged according the severity of symptoms.

- No symptoms= 1
- Mild symptoms =2
- Moderate symptoms =3
- Intense symptoms = 4,
- Severe symptoms =5.

**Part two: Function status scale (FSS):** It was utilized to assess women's capacity to execute daily living activities. It comprises eight tasks, including writing, buttoning clothing, holding a book while reading, clutching a telephone receiver, opening jars, performing household chores, carrying a supermarket basket, and washing and dressing.

Each question features five responses, numbered from 1 to 5, organized according to the capacity to execute everyday life activities:

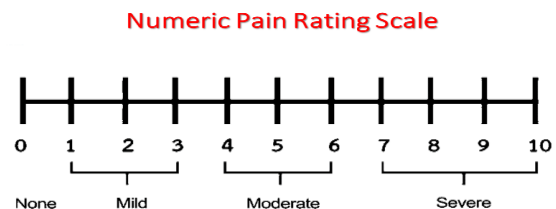
- No difficulty =1,
- Little difficulty= 2,
- Moderate difficulty=3,
- Intense difficulty=4,
- Cannot perform the activity=5.

### **Tool III: Numeric Pain Rating Scale (NPRS)**

It was adopted from (McCaffery, & Beebe, 1989). It was used to determine the severity of the wrist pain. The tool is a horizontal line with a number from zero to ten that represents the women's level of pain. On the scale from 0 to 10 women were asked to mark on point that best describes the level of pain.

### **A scoring system of numeric pain rating scale**

- Mild pain : from 1-3 cm,
- Moderate pain : from 4-6 cm
- Severe pain or worst pain: from 7-10 cm.



### **Method**

- 1. Official endorsement:** To validate the study's legitimacy, an official correspondence detailing the study's objectives was procured

from the dean of the Faculty of Nursing at Tanta University and presented to the administrators of the obstetric department at three institutions (Tanta University Hospital, El-Menshawy Hospital, and El-Mabara Hospital) to secure their consent and collaboration for the study's execution.

2. **Ethical considerations:** including the preservation of privacy, confidentiality of acquired data, the participants' right to withdraw from the study at any time, and the exclusive use of data for the current study, were meticulously addressed throughout the research. Additionally, securing Ethical approval from the Scientific Research Ethical Committee of the Faculty of Nursing at Tanta University before to commencing the project (Ethical Code: 335 -11-2023).
3. The study tool I was developed by the researcher after reviewing recent literature (**Almajid et al., 2025; Abbas et al., 2024; Mirghani et al., 2024; Dwedar, ElShora, Ahmed, & El-Ansary, 2023**), and tools (**II and III**) were adopted from (**Levine et al., 1993; McCaffery, & Beebe, 1989**) respectively after reviewing recent literature.

#### 4. **Validity and reliability of the study tools**

The face and content validity of the study tools were assessed through a jury test conducted by five experts in the field of Maternal and Neonatal Health Nursing. This evaluation aimed to determine the relevance and appropriateness of both individual items and the entire instrument in measuring the desired outcomes. The questionnaire's face validity was determined to be 92.17% based on expert opinions, while the content validity index (%) for its items was 82.9% for knowledge, 91.50% for Boston carpal tunnel syndrome questionnaire, and 87.7% for numeric pain rating scale. In terms of reliability, the questionnaire was tested among pilot subjects, and Cronbach's Alpha coefficients were calculated. The values obtained were 0.830 for knowledge, 0.841 for boston carpal tunnel syndrome questionnaire, and 0.813% for numeric pain rating scale.

5. A pilot research was done on 10% of the sample (12 pregnant women) from the specified conditions prior to the real data collection. This pilot study sought to evaluate the feasibility and applicability of the research instruments, as well as to assess the time necessary for their

completion. The data obtained from the pilot study and participants were incorporated into the final study sample, since no substantial alterations or modifications were made to the instruments.

6. Researchers attended a training program on acupressure for 3 days (18 hours) at Department of Physical Medicine, Tanta University.

## 7. Data collection

- Individual face-to-face interviews were conducted with each pregnant woman throughout the morning shifts until the target sample size was achieved. All pregnant women diagnosed with carpal tunnel syndrome at the time of data collection and meeting the specified inclusion criteria from the aforementioned settings were incorporated into the study. The data collection period for this study took place from December 2023 to the beginning of June 2024. The researchers visited the previous selected settings 3 days/week until the predetermined sample size was achieved.

- **The data was collected according to the following phases**

### A. Assessment phase

- This period occurred prior to any intervention, including hand exercises and splinting. Women

were solicited to participate in the study following an explanation of its goal. A pre-test structured questionnaire was administered individually to each lady at the outset through an interview lasting 10 to 15 minutes each participant.

- The researcher utilized a **tool. I:** Questionnaire on Women's Knowledge of Carpal Tunnel Syndrome: **Part 1:** Socio-demographic Characteristics of the Pregnant Women Studied; **Part 2:** Obstetric History of the Women; **Part 3:** Medical History of Carpal Tunnel Syndrome.

- **Tool (I) Part (4):** The knowledge of pregnant women concerning carpal tunnel syndrome was evaluated to determine their understanding before and after the intervention, which included splinting and hand exercises.

- **Tool II:** Boston Carpal Tunnel Syndrome Questionnaire (BCTQ): Part one: Symptom Severity Scale (SSS) and Part two: Functional Status Scale (FSS) were utilized to assess the impact of splinting and hand exercises on alleviating symptoms in pregnant women with carpal tunnel syndrome.

- **Tool III:** Numeric Pain Rating Scale was employed to assess the intensity of wrist pain.

## **B. Planning phase**

### **a. Setting the goals and objectives of the intervention**

#### **The goal of the intervention was to:**

- Determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women.

#### **Objectives of the program**

- Reduce the symptoms and severity of carpal tunnel syndrome.
- Improve the pregnant women's health status.

#### **Preparation of the content of the booklet**

The content of the educational booklet was developed by the researchers and distributed to the women to increase their knowledge and quality their skills to deal with carpal tunnel syndrome. Various teaching methods, power-point, demonstrations and re-demonstrations, were prepared for the women, along with instructional materials included infographics to be used during the sessions of training.

## **C. Implementation phase**

The subjects were divided into 20 groups (each group about 6 pregnant women) to receive the session of training. This division's goal is to give each group the right amount of time to complete the

training. The researchers give information about carpal tunnel syndrome (definition, risk factors, signs and symptoms, complication, diagnostic test, prevention and management) and applied the technique of hand exercise and splinting.

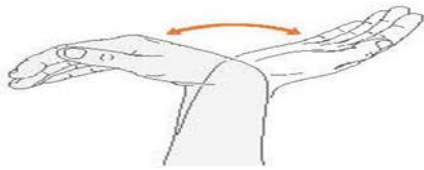
#### **Hand exercise**

- The researchers deliver vocal instructions regarding the types of exercises, their significance, and safety measures for duration of 20 to 30 minutes.
- A colored pamphlet was handed to all ladies. It was composed in straightforward Arabic and enhanced with photographs and pictures.
- The researchers exhibit hand exercises and prompt the women to replicate them until the researchers ascertain that the women have mastered the necessary skills.

#### **1. Wrist bend: (forward and back)**

- Position the elbow on a table with the arm elevated and the wrist aligned. Gradually flex the wrist forward to a right angle and maintain this position for 5 seconds. Subsequently, extend the wrist and then gently flex it backward, holding for another 5

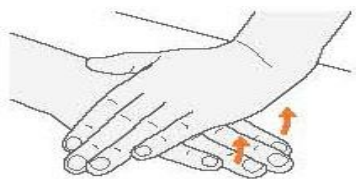
seconds. Perform 3 sets of 10 repetitions.



**American Academy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome.*

## 2. Wrist lift

- Position one palm on the table and elevate the fingers, then position the other hand across the knuckles at a 90-degree angle and apply downward pressure as the lower hand attempts to pull upward. Exchange hands and repeat the process.

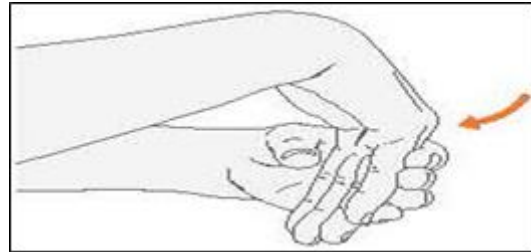


**American Academy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome.*

## 3. Wrist flex

- Maintain the arm extended forward with the palm oriented downward, slowly flex the wrist downward, employing the opposite hand to apply pressure on the stretching hand towards the body, and sustain

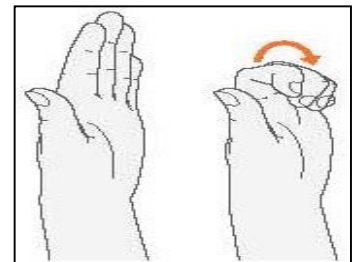
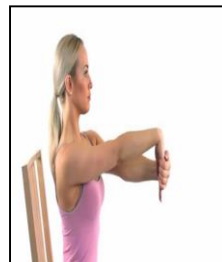
this position for 15-30 seconds, then extend the wrist. Carefully extend the stretched hand posteriorly and utilize the contralateral hand to retract the fingers, maintaining this position for 15-30 seconds and performing 3 sets for each wrist.



**American Academy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome.*

## 4. Finger bend

- Begin with the fingers extended straight, then gently flex the middle joints of the fingers downward toward the upper palm, maintaining this position for 5 seconds. Perform 3 sets of 10 repetitions.



**American Academy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome.*

- 5. Hand squeeze** Squeeze a rubber ball and hold for 5 seconds and do 3 sets of 10 repetitions.

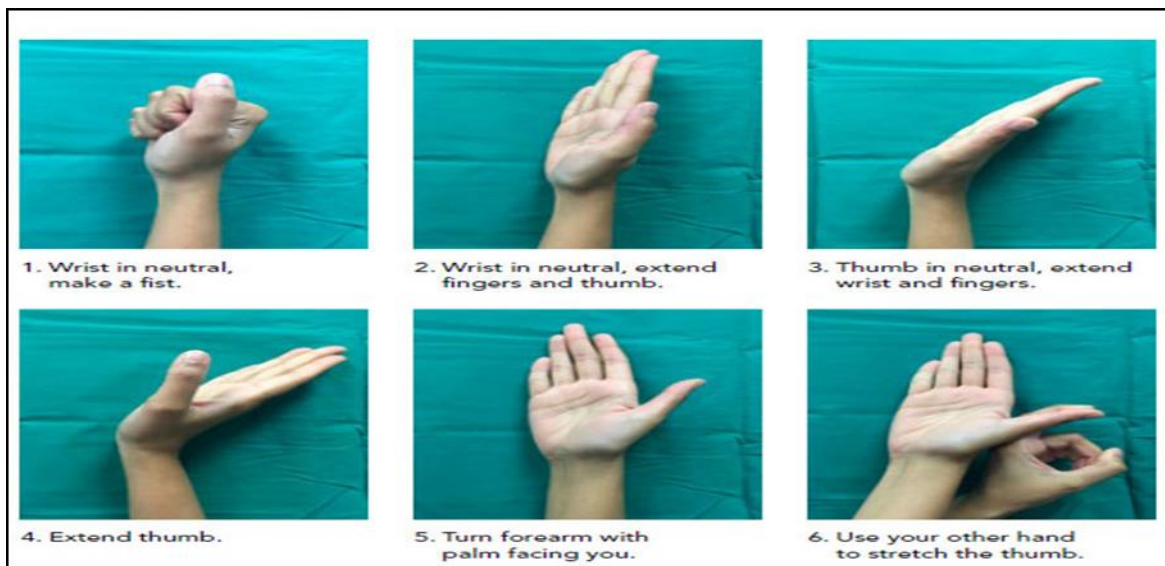


**American Academy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome.*

**6. Median nerve gliding exercises.**

- Start with the wrist in a neutral alignment, fingers and thumb curled

into a fist, with the thumb directed towards the woman. Extend the fingers and thumb into a straight, neutral posture, maintaining their alignment. Bend the wrist so that the palm faces upwards, preserving the hand's position. Extend the thumb away from the hand, keeping the hand and fingers stationary. Rotate the wrist so that the palm faces away from the woman. While in this position, gently pull down on the thumb with the opposite hand. Maintain each position for 5 seconds and repeat the series 3 to 5 times.



**Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022).** Comparison of two manual therapy protocols, incorporating tendon gliding exercises as a shared adjunct, in the treatment of individuals with persistent carpal tunnel syndrome. *Pain Research and Management*, (1), 1975803



**Hand splinting:** Keep the wrist in a neutral position and then apply the hand splinting.



**Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022).** Comparison of two manual therapy protocols, incorporating tendon gliding exercises as a shared adjunct, in the treatment of individuals with persistent carpal tunnel syndrome. *Pain Research and Management* (1), 1975803.

#### **D. Evaluation Phase (posttest)**

- Women with carpal tunnel syndrome re-assessed again after performed hand exercise and applying splint by using tool I part (4): Pregnant women's knowledge regarding carpal tunnel syndrome
- Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) to assess the impact of nocturnal splinting and hand exercises on alleviating symptoms in pregnant women with carpal tunnel syndrome.
- The severity of the wrist pain was assessed by using tool III: Numeric pain rating scale.

#### **Statistical analysis**

- **Data Analysis:** The collected data underwent a comprehensive analysis process. This involved coding, entry into a database, tabulation, and statistical analysis utilizing SPSS software (version 25).
- Quantitative data were summarized using range, mean, and standard deviation calculations. Qualitative data, characterized by categorical variables expressed as frequencies, percentages, or proportions, were compared between two or more groups using the Chi-square test.
- For comparison between related more than two means of non-parametric data (before intervention, the end of 1<sup>st</sup> week after delivery and at the end of the postpartum period), Friedman Test ( $\chi^2$  value) was calculated.
- For non-parametric data from independent samples, comparison of means between two groups was conducted using the Mann-Whitney U test (Z value). When comparing means across three or more groups, the Kruskal-Wallis test (Chi-square value) was employed. Correlation analysis between variables was performed using Pearson's correlation coefficient (r).

## Results

**Table (1): Distribution of the studied women according to their socio-demographic characteristics.** The table revealed that nearly half of the studied women (45.0%) were aged from 25 to 30 with a **mean age  $\pm$  SD =27.4 $\pm$ 4.12** and most of them (93.3%) were married. One half of the studied women (50.0%) married at the age 30-35. The table also revealed that more than half of the studied women (53.3%) had a secondary school education and three fifths of them (80.0%) were housewives. It also noticed that nearly three quarters of them (71.7%) were from urban area and 63.3% belong to extended families.

**Table (2): Distribution of the studied women according to their obstetric history.** The table presents an overview of the obstetrical history of the studied women. Among the notable findings, 45.0% had a gravidity of three, 41.7% had a parity of two, and 86.7% attended antenatal care. Regarding the mode of previous delivery, 79.1% underwent Cesarean section, and 20.0% reported previous pregnancy complications, with pre-eclampsia and placenta previa being the most common. Additionally, 9.3% experienced complications during previous deliveries, including uterine

prolapse, fetal distress, and umbilical cord prolapse.

**Table (3): Distribution of the studied women according to their medical history of carpal tunnel syndrome.** This table outlines the medical history of carpal tunnel syndrome among the studied women. Notably, 13.3% reported a previous history of carpal tunnel syndrome, with 37.5% of them having received previous management. The pain was predominantly located in the left hand (53.3%), and 58.3% experienced radiating pain. Nighttime was the most common timing for both pains (50.0%) and hand swelling (58.3%). The severity of pain was mainly moderate (58.3%), while hand swelling varied, with 58.3% having moderate severity. This information provides insights into the prevalence and characteristics of carpal tunnel syndrome in the studied population.

**Table (4): Distribution of the studied women according to their knowledge regarding carpal tunnel syndrome.** The table demonstrates a substantial improvement in pregnant women's knowledge about carpal tunnel syndrome post-intervention. Before the intervention, a significant percentage had incorrect or incomplete knowledge across various aspects of carpal tunnel syndrome. Post-intervention, there was a remarkable increase in correct and complete

knowledge, leading to highly significant chi-square values for each knowledge domain ( $P < 0.001^*$ ). This emphasizes the effectiveness of the intervention in enhancing pregnant women's understanding of carpal tunnel syndrome, covering its definition, risk factors, signs and symptoms, complications, diagnostic tests, prevention, and medical management.

**Figure (1): Distribution of the studied women according to their total knowledge scores regarding carpal tunnel syndrome.** The figure illustrated a significant improvement in knowledge levels about carpal tunnel syndrome following the intervention. Prior to the intervention, the majority had low knowledge (93.3%), but after the intervention, a substantial increase was observed, with 83.3% exhibiting high knowledge. The mean knowledge score increased from  $3.14 \pm 1.25$  to  $18.33 \pm 1.75$ , indicating the effectiveness of the intervention in enhancing understanding about carpal tunnel syndrome among the study participants. The chi-square test showed a highly significant association between the intervention and knowledge levels ( $\chi^2 = 87.125$ ,  $P < 0.001^*$ ).

**Table (5): Distribution of the studied women according to their symptom severity scale regarding carpal**

**tunnel syndrome pre intervention.**

Table displays the studied women according to their symptom severity scale regarding carpal tunnel syndrome pre intervention. The table indicated that pre-intervention show highest percentages in nighttime pain, daytime pain, numbness and tingling and difficulty with the grasping and use of small objects.

**Table (6): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention.**

Table displays the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention. The table indicated that post-intervention show highest percentages in substantial improvement in nighttime pain (43.3%), notable reduction in daytime pain (45.0%), significant alleviation of numbness and tingling (43.3%), and remarkable enhancement in grasping and small object use (38.3%), highlighting notable positive effects of the intervention

**Table (7): Distribution of the studied women according to their Functional Improvement in Carpal Tunnel Syndrome Pre and Post-Intervention.** The table shows that post-intervention assessment demonstrated statistically significant improvements in various functional

activities, including writing (43.3% without difficulty), buttoning of clothes (36.7% without difficulty), holding a book while reading (33.3% without difficulty), gripping a telephone handle (35.0% without difficulty), opening jars (38.3% without difficulty), household chores (41.7% without difficulty), carrying a grocery basket (40.0% without difficulty), and bathing/dressing (38.3% without difficulty), indicating the effectiveness of the intervention in enhancing functional abilities in patients with carpal tunnel syndrome.

**Figure (2): Distribution of the studied women according to their total Boston Carpal Tunnel Syndrome Scores Pre and Post-Intervention.** The figure showed significantly improved the Function Status Scale scores post intervention compared to pre intervention (Pre-intervention mean:  $38.45 \pm 4.26$ , post-intervention mean:  $12.54 \pm 2.78$ ,  $t = 55.797$ ,  $P < 0.001^*$ ), Symptom Severity Scale scores (Pre-intervention mean:  $27.40 \pm 3.19$ , post-intervention mean:  $4.87 \pm 1.66$ ,  $t = 68.632$ ,  $P < 0.001^*$ ), and Total Boston Carpal Tunnel Syndrome scores (Pre-intervention mean:  $62.30 \pm 5.78$ , post-intervention mean:  $17.46 \pm 2.42$ ,  $t = 78.389$ ,  $P < 0.001^*$ ), highlighting the effectiveness of the intervention in reducing symptom severity and

improving functional status in patients with carpal tunnel syndrome.

**Figure (3): Distribution of the studied women according to their total Numeric pain rating scale Pre and Post-Intervention.** The figure displays that, the intervention led to a significant reduction in pain severity among pregnant women, as evidenced by the distribution shift in the Numeric Pain Rating Scale categories. The post-intervention results show a substantial decrease in the "High" pain category (Pre-intervention: 80.0%, post-intervention: 10.0%), accompanied by an increase in the "Mild" pain category (Pre-intervention: 8.3%, post-intervention: 83.3%). The Chi-square test ( $X^2 = 140.606$ ,  $P < 0.001^*$ ) confirms the statistically significant improvement in pain levels after the intervention.

**Table (8): Correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre and Post-Intervention Pre and Post-Intervention.** The table demonstrates correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre and Post-Intervention. The correlation analysis reveals significant associations among knowledge scores, Boston scores, and Numeric Pain scores in carpal tunnel syndrome patients both before and after the intervention. Pre-intervention, there is

a negative correlation between knowledge scores and Numeric Pain scores ( $r = -0.812$ ,  $P < 0.001^*$ ), indicating that higher knowledge is associated with lower pain levels. Similarly, post-intervention, this negative correlation persists ( $r = -0.230$ ,  $P = 0.004^*$ ) alongside a negative correlation between Boston scores and Numeric Pain scores ( $r = 0.715$ ,  $P < 0.001^*$ ), suggesting that improved knowledge and lower Boston scores are associated with reduced pain severity. The correlations provide insights into the interplay between knowledge, clinical symptoms (Boston scores), and pain outcomes in the context of carpal tunnel syndrome.

**Table (9): Relation between Socio demographic characteristic and Boston Carpal Tunnel Syndrome Pre and Post-Intervention.** The table demonstrates relation between socio demographic characteristic and Boston Carpal Tunnel Syndrome Pre and Post-Intervention. The table presented a comprehensive relation of Boston Carpal Tunnel Syndrome scores across various demographic groups both before and after intervention. Significant differences are observed in Boston scores based on age groups, marital status, age at marriage, duration of current marriage, level of education, occupation, residence, family income, and type of family (all

$P < 0.001^*$ ). These findings suggest that demographic factors play a substantial role in influencing Boston scores, highlighting the need for a personalized approach in the management of carpal tunnel syndrome. The statistical tests (t-tests) provide evidence of significant variations in Boston scores within each demographic category, emphasizing the importance of considering demographic characteristics in the assessment and intervention strategies for carpal tunnel syndrome women.

**Table (1): Distribution of the studied women according to their socio-demographic characteristics (n=120).**

| Socio-demographic characteristics | Studied women      |      |
|-----------------------------------|--------------------|------|
|                                   | N                  | %    |
| Age                               |                    |      |
| 18-                               | 30                 | 25.0 |
| 25-                               | 54                 | 45.0 |
| 30-35                             | 36                 | 30.0 |
| Range<br>(Mean±SD)                | 18-35<br>27.4±4.12 |      |
| Marital status                    |                    |      |
| Married                           | 112                | 93.3 |
| Divorced                          | 6                  | 5.0  |
| Widowed                           | 2                  | 1.7  |
| Age at marriage                   |                    |      |
| <20                               | 12                 | 10.0 |
| 20-<30                            | 48                 | 40.0 |
| 30 -35                            | 60                 | 50.0 |
| Range<br>(Mean±SD)                | 19-35<br>24.16±5.2 |      |
| Duration of current marriage      |                    |      |
| Less than 5 years                 | 30                 | 25.0 |
| 5-10 years                        | 50                 | 41.7 |
| More than 10 years                | 40                 | 33.3 |
| Range<br>(Mean±SD)                | 2-17<br>11.56±3.28 |      |
| Level of education                |                    |      |
| Illiterate                        | 10                 | 8.3  |
| Read and Write                    | 20                 | 16.7 |
| Primary school                    | 8                  | 6.7  |
| Secondary school                  | 64                 | 53.3 |
| University                        | 18                 | 15.0 |
| Occupation                        |                    |      |
| Working                           | 24                 | 20.0 |
| House wife                        | 96                 | 80.0 |
| Residence                         |                    |      |
| Urban                             | 86                 | 71.7 |
| Rural                             | 34                 | 28.3 |
| Family income from women view     |                    |      |
| More than enough                  | 2                  | 1.7  |
| Enough                            | 78                 | 65.0 |
| Not enough                        | 40                 | 33.3 |
| Type of family                    |                    |      |
| Nuclear                           | 44                 | 36.7 |
| Extended                          | 76                 | 63.3 |

**Table (2): Distribution of the studied women according to their obstetric history (N=120).**

| Obstetrical history of the women                 | Studied women |      |
|--------------------------------------------------|---------------|------|
|                                                  | N             | %    |
| Gravidity                                        |               |      |
| 1                                                | 18            | 15.0 |
| 2                                                | 27            | 26.7 |
| 3                                                | 55            | 45.0 |
| 4 or more                                        | 20            | 13.3 |
| Parity                                           |               |      |
| 0                                                | 34            | 28.3 |
| 1                                                | 26            | 21.7 |
| 2                                                | 50            | 41.7 |
| 3                                                | 10            | 8.3  |
| Abortion                                         |               |      |
| Yes                                              | 28            | 23.4 |
| No                                               | 92            | 76.6 |
| Attendance of antenatal care                     |               |      |
| Yes                                              | 104           | 86.7 |
| No                                               | 16            | 13.3 |
| Gestational weeks                                | 30.45± 2.66   |      |
| Place of antenatal care                          |               |      |
| Government hospital                              | 56            | 46.7 |
| Private hospital                                 | 12            | 10.0 |
| Private clinic                                   | 30            | 25.0 |
| Maternal and child health care                   | 22            | 18.3 |
| Number of antenatal care visits                  |               |      |
| 1                                                | 30            | 25.0 |
| 2                                                | 54            | 45.0 |
| 3                                                | 30            | 25.0 |
| 4                                                | 6             | 5.0  |
| Mode of previous delivery (n=86)                 |               |      |
| Normal vaginal delivery                          | 18            | 20.9 |
| Cesarean section                                 | 68            | 79.1 |
| Previous pregnancy complications                 |               |      |
| Yes                                              | 24            | 20.0 |
| No                                               | 96            | 80.0 |
| If the answer is yes, mention the complications? | (n=24)        |      |
| Pre-eclampsia                                    | 8             | 33.3 |
| Placenta previa                                  | 10            | 41.7 |
| PROM                                             | 6             | 25.0 |
| Previous delivery complications (n=86)           |               |      |
| Yes                                              | 8             | 9.3  |
| No                                               | 78            | 90.7 |
| If the answer is yes, mention the complications? | (n=8)         |      |
| Uterine prolapse                                 |               | 25   |
| Fetal distress                                   | 4             | 50   |
| Umbilical cord prolapse                          | 2             | 25   |

Table (3): Distribution of the studied women according to their medical history of carpal tunnel syndrome (N=120).

| Medical history of carpal tunnel syndrome                                   | Studied women |      |
|-----------------------------------------------------------------------------|---------------|------|
|                                                                             | N             | %    |
| <b>Previous history of carpal tunnel syndrome</b>                           |               |      |
| Yes                                                                         | 16            | 13.3 |
| No                                                                          | 104           | 86.7 |
| <b>Previous management of carpal tunnel syndrome (n=16)</b>                 |               |      |
| Yes                                                                         | 6             | 37.5 |
| No                                                                          | 10            | 62.5 |
| <b>If the answer is yes, mention (n=6)</b>                                  |               |      |
| Medication                                                                  | 2             | 33.3 |
| Exercise                                                                    | 0             | 0.0  |
| Splint                                                                      | 4             | 66.7 |
| Surgery                                                                     | 0             | 0.0  |
| All of the above                                                            | 0             | 0.0  |
| <b>Assessment of the characteristics of the carpal tunnel syndrome pain</b> |               |      |
| <b>Location</b>                                                             |               |      |
| Right hand                                                                  | 32            | 26.7 |
| Left hand                                                                   | 64            | 53.3 |
| Bilateral hand                                                              | 24            | 20.0 |
| <b>Severity of the pain</b>                                                 |               |      |
| Mild                                                                        | 18            | 15.0 |
| Moderate                                                                    | 70            | 58.3 |
| Severe                                                                      | 32            | 26.7 |
| <b>Quality of the pain:</b>                                                 |               |      |
| Radiating                                                                   | 70            | 58.3 |
| Sharp                                                                       | 30            | 25.0 |
| Dull                                                                        | 20            | 16.7 |
| <b>Timing of the pain</b>                                                   |               |      |
| Day                                                                         | 30            | 25.0 |
| Night                                                                       | 60            | 50.0 |
| Day and night                                                               | 30            | 25.0 |
| <b>Assessment of the severity of hand swelling:</b>                         |               |      |
| <b>Location of the hand swelling</b>                                        |               |      |
| Right hand                                                                  | 32            | 26.7 |
| Left hand                                                                   | 64            | 53.3 |
| Bilateral hand                                                              | 24            | 20.0 |
| <b>Timing of the hand swelling:</b>                                         |               |      |
| Day                                                                         | 24            | 20.0 |
| Night                                                                       | 70            | 58.3 |
| Day and night                                                               | 26            | 21.7 |
| <b>Severity of the hand swelling:</b>                                       |               |      |
| Mild                                                                        | 20            | 16.7 |
| Moderate                                                                    | 70            | 58.3 |
| Severe                                                                      | 30            | 25.0 |



**Table (4): Distribution of the studied women according to their knowledge regarding carpal tunnel syndrome (N=120).**

| Pregnant women’s knowledge<br>regarding carpal tunnel<br>syndrome | Pre intervention      |     |                         |      |           |      | Post intervention     |      |                         |      |           |      | Chi-square     |         |
|-------------------------------------------------------------------|-----------------------|-----|-------------------------|------|-----------|------|-----------------------|------|-------------------------|------|-----------|------|----------------|---------|
|                                                                   | Correct &<br>complete |     | Correct &<br>incomplete |      | Incorrect |      | Correct &<br>complete |      | Correct &<br>incomplete |      | Incorrect |      |                |         |
|                                                                   | N                     | %   | N                       | %    | N         | %    | N                     | %    | N                       | %    | N         | %    | X <sup>2</sup> | P-value |
| Definition                                                        | 6                     | 5.0 | 8                       | 6.7  | 106       | 88.3 | 108                   | 90.0 | 10                      | 8.3  | 2         | 1.7  | 191.634        | <0.001* |
| Risk factors                                                      | 8                     | 6.7 | 4                       | 3.3  | 108       | 90.0 | 96                    | 80.0 | 16                      | 13.3 | 8         | 6.7  | 167.868        | <0.001* |
| Signs and symptoms                                                | 4                     | 3.3 | 6                       | 5.0  | 110       | 91.7 | 102                   | 85.0 | 12                      | 10.0 | 6         | 5.0  | 185.845        | <0.001* |
| Complications                                                     | 2                     | 1.7 | 10                      | 8.3  | 108       | 90.0 | 100                   | 83.3 | 10                      | 8.3  | 10        | 8.3  | 175.547        | <0.001* |
| Diagnostic test needed                                            | 10                    | 8.3 | 12                      | 10.0 | 98        | 81.7 | 106                   | 88.3 | 8                       | 6.7  | 6         | 5.0  | 161.633        | <0.001* |
| Prevention                                                        | 4                     | 3.3 | 14                      | 11.7 | 102       | 85.0 | 98                    | 81.7 | 12                      | 10.0 | 10        | 8.3  | 162.353        | <0.001* |
| Medical management                                                | 6                     | 5.0 | 6                       | 5.0  | 108       | 90.0 | 94                    | 78.3 | 14                      | 11.7 | 12        | 10.0 | 157.440        | <0.001* |

\*Statistically significant (P&lt;0.05)

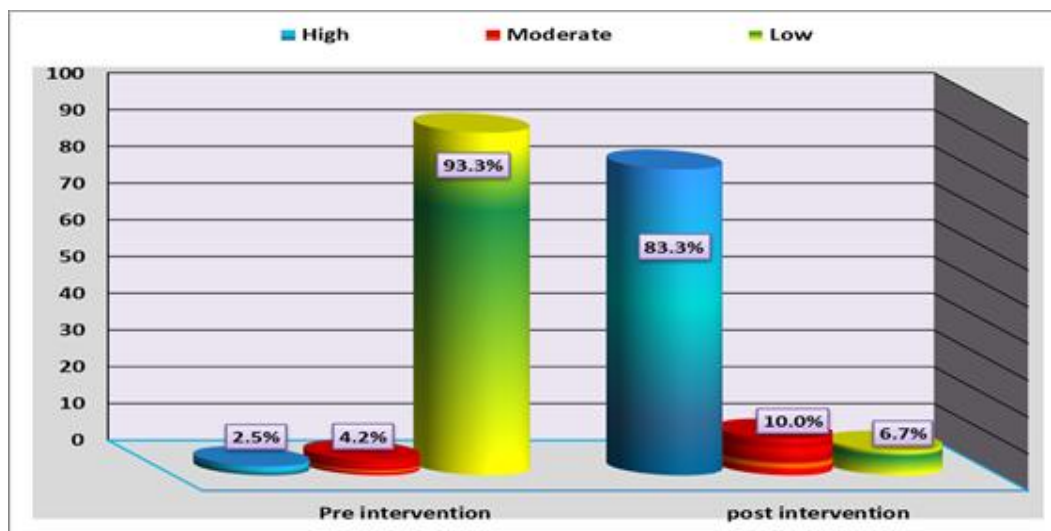
**Figure (1): Distribution of the studied women according to their total knowledge scores regarding carpal tunnel syndrome.**

**Table (5): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome Pre Intervention (N=120).**

| Symptom severity scale                                                                                   | Don't have pain                 |     | Mild pain.           |      | Moderate pain.            |      | Severe pain.            |      | Very severe pain                |      |
|----------------------------------------------------------------------------------------------------------|---------------------------------|-----|----------------------|------|---------------------------|------|-------------------------|------|---------------------------------|------|
|                                                                                                          | N                               | %   | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 1. How severe is the hand or wrist pain that you have at night?                                          | 0                               | 0.0 | 6                    | 5.0  | 24                        | 20.0 | 38                      | 31.7 | 52                              | 43.3 |
| 2. Do you typically have pain in your hand or wrist during the daytime?                                  | 0                               | 0.0 | 8                    | 6.7  | 12                        | 10.0 | 50                      | 41.7 | 50                              | 41.7 |
| 3. Do you have numbness (loss of sensation) in your hand?                                                | 8                               | 6.7 | 14                   | 11.7 | 52                        | 43.3 | 26                      | 21.7 | 20                              | 16.7 |
| 4. Do you have weakness in your hand or wrist?                                                           | 16                              | 6.7 | 30                   | 25.0 | 38                        | 31.7 | 36                      | 30.0 | 8                               | 6.7  |
| 5. Do you have tingling sensations in your hand?                                                         | 4                               | 3.3 | 26                   | 21.7 | 40                        | 33.3 | 36                      | 30.0 | 22                              | 18.3 |
| 6. How severe is numbness (loss of sensation) or tingling at night?                                      | 0                               | 0.0 | 26                   | 21.7 | 32                        | 26.7 | 28                      | 23.3 | 30                              | 25.0 |
| 7. Do you have difficulty with the grasping and use of small objects such as keys or pens?               | 0                               | 0.0 | 14                   | 11.7 | 46                        | 38.3 | 34                      | 28.3 | 26                              | 21.7 |
|                                                                                                          | Never                           |     | Once                 |      | 2 or 3 times              |      | 4 or 5 times            |      | More than 5 times               |      |
|                                                                                                          | N                               | %   | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 8. How often did hand or wrist pain wake you up during a typical night in the past two weeks?            | 0                               | 0.0 | 30                   | 25.0 | 32                        | 26.7 | 28                      | 23.3 | 30                              | 25.0 |
| 9. How often did hand numbness or tingling wake you up during a typical night during the past two weeks? | 4                               | 3.3 | 24                   | 20.0 | 34                        | 28.3 | 28                      | 23.3 | 30                              | 25.0 |
|                                                                                                          | Never                           |     | Once or twice a day  |      | Three to five times a day |      | More than 5 times a day |      | The pain is constant            |      |
|                                                                                                          | N                               | %   | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 10. How often do you have hand or wrist pain during the daytime?                                         | 4                               | 3.3 | 22                   | 18.3 | 24                        | 20.0 | 44                      | 36.7 | 26                              | 21.7 |
|                                                                                                          | I never get pain during the day |     | Less than 10 minutes |      | 10 to 60 minutes          |      | Greater than 60 minutes |      | Pain is constant throughout day |      |
|                                                                                                          | N                               | %   | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 11. How long, on average, does an episode of pain last during the daytime?                               | 6                               | 5.0 | 22                   | 18.3 | 42                        | 35.0 | 28                      | 23.3 | 22                              | 18.3 |

**Table (6): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention (N=120).**

| Symptom severity scale                                                                                   | Don't have pain                 |      | Mild pain.           |      | Moderate pain.            |      | Severe pain.            |      | Very severe pain                |      |
|----------------------------------------------------------------------------------------------------------|---------------------------------|------|----------------------|------|---------------------------|------|-------------------------|------|---------------------------------|------|
|                                                                                                          | N                               | %    | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 1. How severe is the hand or wrist pain that you have at night?                                          |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 52                              | 43.3 | 38                   | 31.7 | 4                         | 3.3  | 10                      | 8.3  | 16                              | 13.3 |
| 2. Do you typically have pain in your hand or wrist during the daytime?                                  |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 54                              | 45.0 | 10                   | 8.3  | 40                        | 33.3 | 4                       | 3.3  | 12                              | 10.0 |
| 3. Do you have numbness (loss of sensation) in your hand?                                                |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 22                              | 18.3 | 32                   | 26.7 | 66                        | 55.0 | 0                       | 0.0  | 0                               | 0.0  |
| 4. Do you have weakness in your hand or wrist?                                                           |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 70                              | 58.3 | 50                   | 41.7 | 0                         | 0.0  | 0                       | 0.0  | 0                               | 0.0  |
| 5. Do you have tingling sensations in your hand?                                                         |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 44                              | 36.7 | 36                   | 30.0 | 14                        | 11.7 | 12                      | 10.0 | 14                              | 11.7 |
| 6. How severe is numbness (loss of sensation) or tingling at night?                                      |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 44                              | 36.7 | 36                   | 30.0 | 18                        | 15.0 | 12                      | 10.0 | 10                              | 8.3  |
| 7. Do you have difficulty with the grasping and use of small objects such as keys or pens?               |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 44                              | 36.7 | 36                   | 30.0 | 18                        | 15.0 | 12                      | 10.0 | 10                              | 8.3  |
|                                                                                                          | Never                           |      | Once                 |      | 2 or 3 times              |      | 4 or 5 times            |      | More than 5 times               |      |
|                                                                                                          | N                               | %    | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 8. How often did hand or wrist pain wake you up during a typical night in the past two weeks?            |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 32                              | 26.7 | 42                   | 35.0 | 28                        | 23.3 | 10                      | 8.3  | 8                               | 6.7  |
| 9. How often did hand numbness or tingling wake you up during a typical night during the past two weeks? |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 10                              | 10.0 | 76                   | 63.3 | 24                        | 20.0 | 0                       | 0.0  | 8                               | 6.7  |
|                                                                                                          | Never                           |      | Once or twice a day  |      | Three to five times a day |      | More than 5 times a day |      | The pain is constant            |      |
|                                                                                                          | N                               | %    | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 10. How often do you have hand or wrist pain during the daytime?                                         |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 22                              | 18.3 | 32                   | 26.7 | 66                        | 55.0 | 0                       | 0.0  | 0                               | 0.0  |
|                                                                                                          | I never get pain during the day |      | Less than 10 minutes |      | 10 to 60 minutes          |      | Greater than 60 minutes |      | Pain is constant throughout day |      |
|                                                                                                          | N                               | %    | N                    | %    | N                         | %    | N                       | %    | N                               | %    |
| 11. How long, on average, does an episode of pain last during the daytime?                               |                                 |      |                      |      |                           |      |                         |      |                                 |      |
|                                                                                                          | 38                              | 31.7 | 58                   | 48.3 | 18                        | 15.0 | 0                       | 0.0  | 6                               | 5.0  |

**Table (7): Distribution of the studied women according to their functional improvement in carpal tunnel syndrome pre and post-intervention (N=120).**

| Function status<br>scale           | No difficulty |      | Little<br>difficulty |      | Moderate<br>difficulty |      | Intense<br>difficulty |      | Cannot<br>perform |      | Chi-square     |         |
|------------------------------------|---------------|------|----------------------|------|------------------------|------|-----------------------|------|-------------------|------|----------------|---------|
|                                    | N             | %    | N                    | %    | N                      | %    | N                     | %    | N                 | %    | X <sup>2</sup> | P-value |
| 1. Writing.                        |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 0             | 0.0  | 20                   | 16.7 | 46                     | 38.3 | 40                    | 33.3 | 14                | 11.7 | 88.632         | <0.001* |
| Post intervention                  | 52            | 43.3 | 30                   | 25.0 | 26                     | 21.7 | 12                    | 10.0 | 0                 | 0.0  |                |         |
| 2. Buttoning of clothes.           |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 2             | 1.7  | 38                   | 31.7 | 40                     | 33.3 | 22                    | 18.3 | 18                | 15.0 | 62.126         | <0.001* |
| Post intervention                  | 44            | 36.7 | 38                   | 31.7 | 24                     | 20.0 | 14                    | 11.7 | 0                 | 0.0  |                |         |
| 3. Holding a book while reading.   |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 1             | 0.8  | 24                   | 20.0 | 58                     | 48.3 | 30                    | 25.0 | 7                 | 5.8  | 66.739         | <0.001* |
| Post intervention                  | 40            | 33.3 | 42                   | 35.0 | 22                     | 18.3 | 12                    | 10.0 | 4                 | 3.3  |                |         |
| 4. Gripping of a telephone handle. |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 4             | 3.3  | 22                   | 18.3 | 48                     | 40.0 | 30                    | 25.0 | 16                | 13.3 | 61.165         | <0.001* |
| Post intervention                  | 42            | 35.0 | 40                   | 33.3 | 20                     | 16.7 | 14                    | 11.7 | 4                 | 3.3  |                |         |
| 5. Opening of jars.                |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 12            | 1.7  | 24                   | 20.0 | 50                     | 41.7 | 34                    | 28.3 | 10                | 8.3  | 44.532         | <0.001* |
| Post intervention                  | 46            | 38.3 | 32                   | 30.0 | 18                     | 15.0 | 16                    | 13.3 | 4                 | 3.3  |                |         |
| 6. Household chores.               |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 6             | 5.0  | 22                   | 18.3 | 44                     | 36.7 | 36                    | 30.0 | 12                | 10.0 | 61.204         | <0.001* |
| Post intervention                  | 50            | 41.7 | 32                   | 26.7 | 16                     | 13.3 | 20                    | 16.7 | 2                 | 1.7  |                |         |
| 7. Carrying of grocery basket.     |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 0             | 0.0  | 28                   | 23.3 | 44                     | 36.7 | 28                    | 23.3 | 20                | 16.7 | 74.488         | <0.001* |
| Post intervention                  | 48            | 40.0 | 34                   | 28.3 | 16                     | 13.3 | 18                    | 15.0 | 4                 | 3.3  |                |         |
| 8. Bathing and dressing.           |               |      |                      |      |                        |      |                       |      |                   |      |                |         |
| Pre intervention                   | 0             | 0.0  | 32                   | 26.7 | 38                     | 31.7 | 28                    | 23.3 | 22                | 18.3 | 66.222         | <0.001* |
| Post intervention                  | 46            | 38.3 | 32                   | 26.7 | 20                     | 16.7 | 18                    | 15.0 | 4                 | 3.3  |                |         |

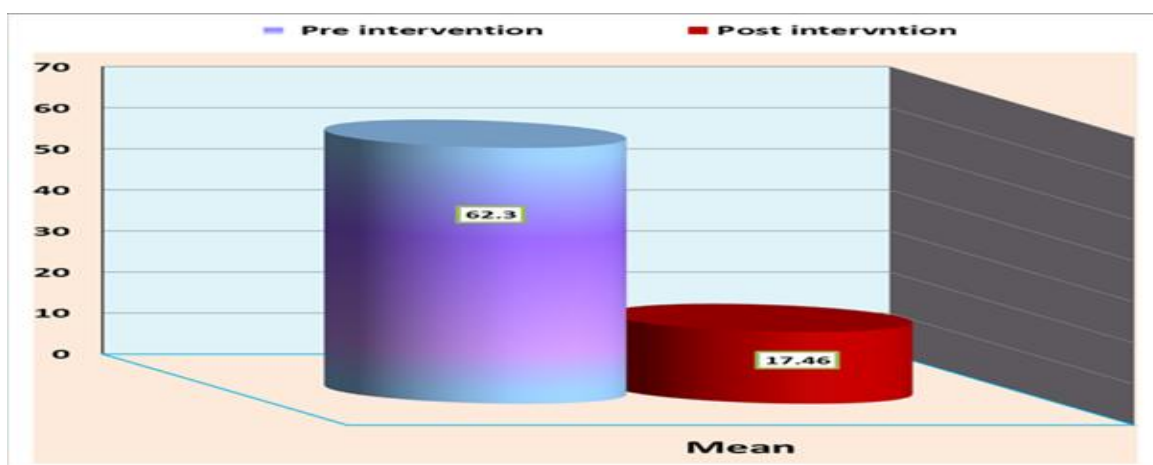


**Figure (2): Distribution of the studied women according to their total Boston Carpal Tunnel Syndrome Scores Pre and Post-Intervention.**

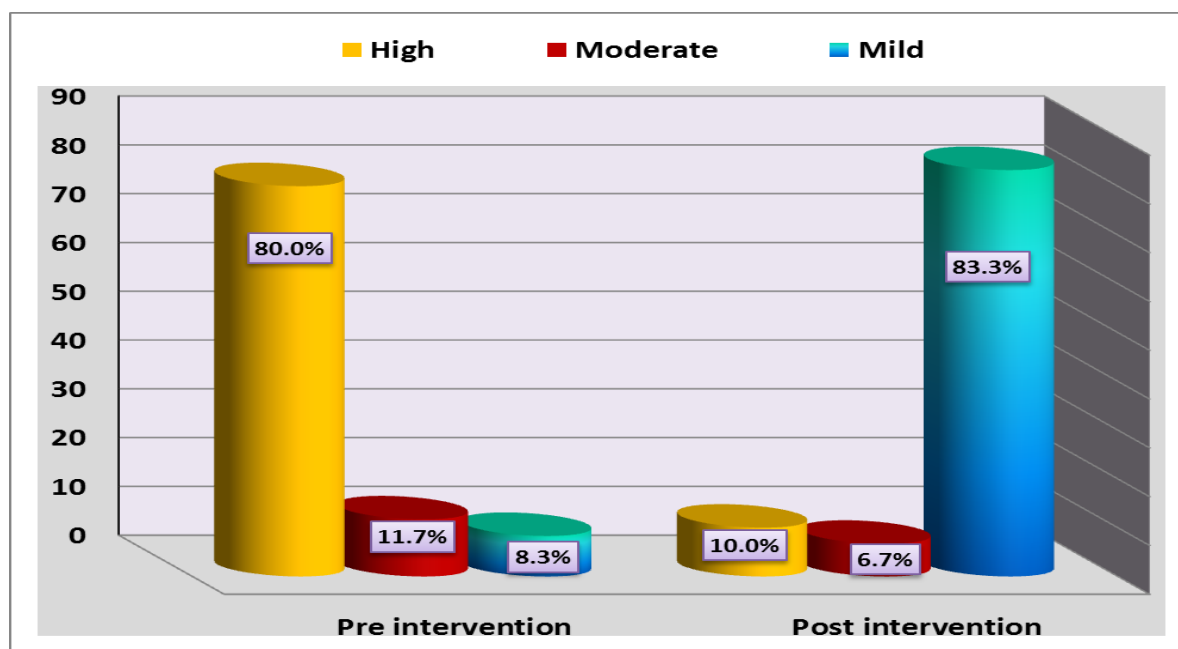


**Figure (3): Distribution of the studied women according to their total Numeric pain rating scale Pre and Post-Intervention.**

**Table (8): Correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre and Post-Intervention Pre and Post-Intervention (N=120).**

| Correlation        | Knowledge score |         | Boston score |         |
|--------------------|-----------------|---------|--------------|---------|
|                    | r               | P-value | r            | P-value |
| <b>Pre</b>         |                 |         |              |         |
| Boston score       | -0.248          | 0.039*  |              |         |
| Numeric pain score | -0.812          | <0.001* | 0.219        | 0.028*  |
| <b>Post</b>        |                 |         |              |         |
| Boston score       | -0.797          | <0.001* |              |         |
| Numeric pain score | -0.230          | 0.004*  | 0.715        | <0.001* |

\*Statistically significant (P&lt;0.05)

**Table (9): Relation between Socio demographic characteristic and Boston Carpal Tunnel Syndrome Pre and Post-Intervention (N=120).**

| Relation                            | Boston Carpal Tunnel Syndrome |       |        |         |       |      |        |         |
|-------------------------------------|-------------------------------|-------|--------|---------|-------|------|--------|---------|
|                                     | Pre                           |       | Tests  |         | Post  |      | Tests  |         |
|                                     | Mean                          | SD    | f/t    | P-value | Mean  | SD   | f/t    | P-value |
| <b>Age</b>                          |                               |       |        |         |       |      |        |         |
| 18-                                 | 46.03                         | 5.06  | 72.303 | <0.001* | 17.73 | 5.02 | 75.219 | <0.001* |
| 25-                                 | 54.15                         | 9.18  |        |         | 15.20 | 3.80 |        |         |
| 30-35                               | 68.81                         | 7.75  |        |         | 7.31  | 1.85 |        |         |
| <b>Marital status</b>               |                               |       |        |         |       |      |        |         |
| Married                             | 59.29                         | 11.27 | 13.872 | <0.001* | 12.25 | 4.95 | 11.678 | <0.001* |
| Divorced                            | 45.81                         | 9.50  |        |         | 16.56 | 5.70 |        |         |
| Widowed                             | 49.50                         | 5.28  |        |         | 18.67 | 5.69 |        |         |
| <b>Age at marriage</b>              |                               |       |        |         |       |      |        |         |
| <20                                 | 48.22                         | 6.33  | 79.098 | <0.001* | 17.16 | 4.54 | 78.234 | <0.001* |
| 20-<30                              | 53.79                         | 8.66  |        |         | 15.32 | 3.72 |        |         |
| 30 -35                              | 68.21                         | 8.50  |        |         | 7.83  | 2.17 |        |         |
| <b>Duration of current marriage</b> |                               |       |        |         |       |      |        |         |
| Less than 5 years                   | 46.03                         | 5.06  | 86.875 | <0.001* | 17.73 | 5.02 | 76.180 | <0.001* |
| 5-10 years                          | 53.10                         | 8.39  |        |         | 15.52 | 3.76 |        |         |
| More than 10 years                  | 68.65                         | 7.82  |        |         | 7.70  | 2.14 |        |         |
| <b>Level of education</b>           |                               |       |        |         |       |      |        |         |
| Illiterate                          | 42.60                         | 2.37  | 23.611 | <0.001* | 18.20 | 4.96 | 19.439 | <0.001* |
| Read and Write                      | 47.75                         | 5.21  |        |         | 17.50 | 5.16 |        |         |
| Primary school                      | 51.88                         | 4.55  |        |         | 16.13 | 3.44 |        |         |
| Secondary school                    | 58.05                         | 11.00 |        |         | 13.09 | 4.62 |        |         |
| University                          | 70.61                         | 6.13  |        |         | 6.50  | 1.69 |        |         |
| <b>Occupation</b>                   |                               |       |        |         |       |      |        |         |
| Working                             | 70.08                         | 5.94  | 7.758  | <0.001* | 6.79  | 1.64 | 10.581 | <0.001* |

|                               |       |       |        |         |       |      |        |         |
|-------------------------------|-------|-------|--------|---------|-------|------|--------|---------|
| House wife                    | 53.13 | 10.27 |        |         | 15.14 | 4.91 |        |         |
| Residence                     |       |       |        |         |       |      |        |         |
| Urban                         | 60.41 | 11.27 | 6.791  | <0.001* | 11.76 | 4.89 | 6.117  | <0.001* |
| Rural                         | 46.68 | 5.38  |        |         | 17.79 | 4.82 |        |         |
| Family income from women view |       |       |        |         |       |      |        |         |
| More than enough              | 72.30 | 6.93  | 36.540 | <0.001* | 6.00  | 1.49 | 30.765 | <0.001* |
| Enough                        | 59.05 | 10.87 |        |         | 12.43 | 4.71 |        |         |
| Not enough                    | 46.92 | 5.37  |        |         | 17.67 | 4.71 |        |         |
| Type of family                |       |       |        |         |       |      |        |         |
| Nuclear                       | 47.50 | 5.27  | 7.892  | <0.001* | 17.25 | 4.61 | 9.391  | <0.001* |
| Extended                      | 61.74 | 11.26 |        |         | 11.28 | 4.87 |        |         |

\*Statistically significant (P<0.05)

## Discussion

Carpal tunnel syndrome (CTS) is a prevalent medical ailment that continues to be one of the most commonly reported types of the median nerve compression. It happens when the median nerve is pinched or constricted while passing through the wrist. The symptoms of the syndrome include tingling in the median nerve distribution, numbness, and hand pain. Compared to men, women are more likely to have CTS (**Unal, Umay, & Akyuz, 2023**). Improving hand functionality and reducing symptoms are the main goals of CTS treatment. Physicians treat CTS with both non-surgical and surgical methods. Wrist splinting, hand exercises, shifting positions, taking medicine, and using non-vibrating equipment at work are examples of non-surgical treatments (**Pourmokhtari, Mazrooyi, & Vosoughi, 2021**).

The aim of the current study was to determine the efficacy of hand exercise

and splinting on carpal tunnel syndrome among pregnant women. The present study's socio-demographic features of the pregnant women under investigation revealed that, with a mean age of  $27.4 \pm 4.12$ , less than half of the women were between the ages of 25 and 30. Additionally, over three-quarters of the pregnant women in the study were married and over half of the expecting mothers had completed secondary school, indicating their level of education.

In relation to occupation, most of the studied pregnant women were housewife and less than three quarters of the study women come from urban area.

In terms of gravidity, fewer than half of the women in the study get pregnant three times. This finding is inappropriate with the finding of a study done by **Dwedat, ElShora, Ahmed, & El-Ansary (2023)** & **Abd Elmoniem, Abd-Elhakm, & Ibrahim (2018)** who said that nearly two-thirds

became pregnant. Over two-fifths of them were having two births in terms of parity. Of them, less than three-quarters had one or two children.

The majority of pregnant women were receiving routine antenatal care, according to antenatal care. Also, in the same line with **Abd Elmoniem, Abd-Elhakm, & Ibrahim (2018)** stated that more than three quarters received proper antenatal care. Additionally, this study showed that pregnant women's knowledge generally got better after the intervention in all items linked to their knowledge which include definition, risk factors, signs and symptoms, complications, diagnostic test, prevention, and medical management of CTS as compared to before intervention. While no prior study has explicitly assessed the impact of educational intervention addressing CTS on pregnant women's knowledge or health behavior, our findings demonstrate a lack of community awareness and the implementation of educational programs regarding CTS. However, a literature review supported these findings, stating that education for women should include self-management skills such as sleep positions that prevent excessive wrist bending and a home therapy program that includes splinting, stretching exercises, and heat treatment to relieve

symptoms. Furthermore, it is recommended that pregnant women with CTS get conservative measures, reassurance, and adequate health education (**Sevy, Sina, Varacallo, 2023; Genova, Dix et al., 2020**).

Consequently, most of the women in our research had never had pregnancy problems before. This result aligns with **Dwedat, ElShora, Ahmed, & El-Ansary (2023)** who disclosed that over three-quarters of expectant mothers had never had pregnancy difficulties before.

The carpal tunnel syndrome symptom severity scale indicated a reduction in the severity of hand or wrist pain, nocturnal pain episodes, instances of pain, numbness, tingling, and difficulties with grasping following hand exercises and splinting interventions. This finding is consistent with **Kokubo, & Kim (2021) ; Walker, Metzler, Cifu, & Swartz (2020) and Ahmed, & Khatab (2020)** who asserted that hand exercises alleviate symptoms by preventing or stretching the adhesions between the tendons and median nerve, reducing teno-synovial edema, enhancing venous return, and reducing pressure within the carpal tunnel.

When it came to functional status, the majority of women had moderate trouble with writing, buttoning clothes, reading while holding a book, grasping



a phone handle, opening jars, doing household chores, carrying a shopping basket, bathing, and dressing pre intervention, and it enhanced after intervention. The functional status scale's overall score showed a strong correlation. According to **Unver, & Akyolcu (2018)**, hand and finger exercises with a ball are effective in reducing CTS symptoms and improving patients' functional status. Similar findings were made by **Keskinet et al., (2020)**, who found that nerve and tendon-slip exercises were simple and efficient methods to enhance function and decrease the severity of CTS in pregnant women with mild to moderate symptoms during the second and third trimesters of pregnancy. Similar to **Abd Elmoniem, Abd-Elhakm, & Ibrahim (2018)**, who examined how an educational program affected pregnant women's knowledge, the intensity of their symptoms, and their functional status, they discovered that physical activity and the use of a night splint during pregnancy helped the women's symptoms decrease.

Furthermore, **Ajrout, Younis, & Elzahaf (2020)** found that home physiotherapy is a conservative way to manage CTS symptoms during pregnancy. Along the same theme, in a randomized, placebo-controlled experiment, **Atroshi et al., (2019)**

showed that wrist splinting was examined as a conservative therapy method for CTS and provided evidence of hand splinting's efficacy in CTS patients.

According to the current study, the majority of pregnant women experienced mild pain after the intervention, while the majority experienced high discomfort before. CTS is often treated by splinting. Along with exercise, splinting as much as possible throughout the day improves quality of life, functioning, pain, and nocturnal symptoms **Unal, Umay, & Akyuz (2023)** and **Sosic, Bojnec, Lonzaric, & JesensekPapez (2020)**. Also, exercises that strengthen the wrist's supporting muscles also enhance wrist health generally and may reduce pain associated with CTS **Lewis et al., (2020)**.

In relation to the present study, there is statistically significant difference between Boston scores and Numeric Pain scores in carpal tunnel syndrome women both before and after the intervention. This result corresponds to **Ahmed, & Khatab (2020)** who discovered Boston scores and Numerical Pain scores in patients with carpal tunnel syndrome before and after the intervention differed statistically significantly.

## Conclusion

The results of the current study indicated that hand exercises and splinting are helpful ways for alleviating the symptoms of carpal tunnel syndrome. Additionally, a positive correlation was observed between the overall knowledge score of the studied pregnant women and the total Boston Carpal Tunnel Syndrome score, whereas a negative correlation existed between the overall knowledge score, the total Boston Carpal Tunnel Syndrome score, and the pain levels both pre-intervention and post-intervention. Consequently, the research hypothesis was validated following the execution of hand exercises and splinting.

### Recommendations

In light of the findings of the current investigation, the following recommendations are proposed:

1. Designing and implementing training programs for women with carpal tunnel syndrome to enhance, update, and refine their knowledge and skills.
2. Conduct replication of the study under varied conditions, incorporating bigger sample sizes and other contexts throughout Egypt, to ascertain the generalizability of the findings.

### References

- Abbas, G., Ahmed, M., Almohannadi, F., Elzawawi, K., Ahmed, A., Alsherawi, A., & Almohannadi, F. (2024).** Prevalence and Risk Factors Associated With Carpal Tunnel Syndrome Among Sudanese Females: A Cross-Sectional Study. *Cureus*, 16(11). DOI: 10.7759/cureus.72943
- Abd Elmoniem S., Abd-Elhakm E., & Ibrahim H. (2022).** The Effect of an Educational Intervention about Carpal Tunnel Syndrome on Pregnant Women' Knowledge, Symptoms Severity, and Function Status. *IOSR Journal of Nursing and Health Science*, 14(1):1030-1041. DOI:10.21608/EJHC.2023.293038.
- Ahmed H., & Khatab H. (2020).** The Effect of Night Splinting and Hand Exercise on Reducing the Symptoms in Patients with Carpal Tunnel Syndrome. *Egyptian Journal of Health Care*, 11(4):615-633.
- Almajid, W., Alkhars, H., Alalwan, A., Albalawi, T., Alazzmi, H., Alnougidan, H., & Alkhars, A. (2025).** Awareness and knowledge of carpal tunnel syndrome in the Eastern province of Saudi Arabia. *International Journal of Medicine in Developing Countries*, 9(3), 647-647. doi: [10.24911/IJMDC.51-1739515537](https://doi.org/10.24911/IJMDC.51-1739515537)
- American Academy of Orthopaedic Surgeons. (2018).** *Therapeutic exercise program for carpal tunnel syndrome.*
- Atroshi, I., Tadjerbash, K., McCabe, S and Ransam J. (2019).** Treatment of

carpal tunnel syndrome with wrist splinting: study protocol for a randomized placebo-controlled trial. BMC Open Access. 20 (531),1-2. <https://doi.org/10.1186/s13063-019-3635-6>.

- Boehrer R., (2020).** Carpal tunnel syndrome and pregnancy go hand in hand. <https://utswmed.org/medblog/carpal-tunnel-syndrome-pregnancy>.
- Cimpeanu M., Roman N., Grigorescu S., Grigorescu O and Miclăus R. (2024).** Management of “De Novo” Carpal Tunnel Syndrome in Pregnancy: A Narrative Review. *Journal of Personalized Medicine*. 14 (240), 1-8. <https://doi.org/10.3390/jpm14030240>.
- Dabbagh, A., MacDermid C., Yong J., Macedo G., & Packham L. (2020).** Diagnosing carpal tunnel syndrome: diagnostic test accuracy of scales, questionnaires, and hand symptom diagrams - a systematic review. *Journal of Orthopedic & Sports Physical Therapy*, 50(11): 622-631. <https://www.jospt.org/doi/10.2519/jospt.2020.9599>
- Dwedat L., ElShora S., Ahmed A., and El-Ansary E. (2023).** Effect of Nursing Instructional Program on Neurophysiologic Parameters of Carpal Tunnel Syndrome among Pregnant Women. *Egyptian Journal of Health Care*, 14(1),1034-39. DOI: [10.21608/ejhc.2023.293038](https://doi.org/10.21608/ejhc.2023.293038)
- Erickson M., Lawrence M., Stegink C., Coker D., Amadio P and Cleary C. (2019).** Carpal Tunnel Syndrome: A Summary of Clinical Practice Guideline Recommendations-Using the Evidence to Guide Physical Therapist Practice. *Journal of Orthopedic & Sports Physical Therapy*.49, 359-60. DOI: [10.21608/asnj.2022.164830.1434](https://doi.org/10.21608/asnj.2022.164830.1434)
- Gabrielli S., Lesiak C and Fowler R. (2020).** The direct and indirect costs to society of Carpal tunnel release. 15:1-5. <https://doi.org/10.1177/155894471881085>
- Gasnick K. (2024).** Carpal Tunnel Massage Techniques and Exercises. <https://www.verywellhealth.com/carpal-tunnel-syndrome-massage-5095474>
- Gatheridge M., Sholty E., Inman A., Pattillo M., Mindrup F and Sanderson D. (2020).** Splinting in carpal tunnel syndrome: the optimal duration. *Military Medicine*. 185:2049-51. <https://doi.org/10.1093/milmed/usaa222>.
- Genova A., Dix O., Saefan A., Thakur M., & Hassan A. (2020).** Carpal Tunnel Syndrome: A Review of Literature. *Cureus*, 12(3):e7333. doi: 10.7759/cureus.7333.

- Ghoraba D., Morsy M and Abo El-Enin M. (2021).** Effect of Phonophoresis on Carpal Tunnel Syndrome during Pregnancy: A Randomized Clinical Trial. *Medical Journal of Cairo University*. 89(7). 2893-94. DOI: [10.21608/mjcu.2021.225222](https://doi.org/10.21608/mjcu.2021.225222)
- Justin O., Sina R and Varacallo M. (2023).** Carpal Tunnel Syndrome. <https://www.ncbi.nlm.nih.gov/books/NBK448179>.
- Keskin Y., Kilic G., Taspinar O., Posul S., Halac G., Eren F., Erol E., Urkmez B and Aydin T. (2020).** Effectiveness of home exercise in pregnant women with carpal tunnel syndrome: Randomized Control Trial. *Journal of the Pakistan Medical Association*. 70(2);202-204. <https://doi.org/10.5455/JPMA.1846>.
- Kokubo R., & Kim K. (2021).** Carpal tunnel syndrome: diagnosis and treatment. *National Library of Medicine*, 49(6):1306-1316. <https://doi.org/10.11477/mf.1436204516>.
- Levine, D., Simmons, B., Koris, M., Daltroy, L., Hohl, G., Fossel, A., & Katz, J. (1993).** A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *JBJS*, 75(11), 1585-1592. DOI: 10.2106/00004623-199311000-00002
- Lewis K., Coppieters M., Ross L., Hughes I., Vicenzino B., and Schmid A. (2020).** Group education, night splinting and home exercises reduce conversion to surgery for carpal tunnel syndrome: a multicentre randomised trial. *Journal of physiotherapy*, 66(2), 97-104. DOI: 10.1016/j.jphys.2020.03.007
- McCaffery, M., & Beebe, A. (1989).** Pain: Clinical manual for nursing practice.
- McIntyre K. (2022).** Six exercises to help manage carpal tunnel syndrome. <https://www.lifemark.ca/blog-post/6-exercises-help-manage-carpal-tunnel-syndrome>.
- Mirghani, H., Aljohani, A., Alharbi, A., Alatawi, B., Alanazi, F., Alzahrani, M., & Alhwiti, H. (2024).** Prevalence and Awareness of Carpal Tunnel Syndrome Among Adults in Tabuk City of Saudi Arabia: A Cross-Sectional Study. *Cureus*, 16(2). DOI: 10.7759/cureus.54076
- Nadar M., Alotaibi N and Manee F. (2023).** Efficacy of splinting the wrist and metacarpophalangeal joints for the treatment of Carpal tunnel syndrome: an assessor-blinded randomized controlled trial. *BMJ Open*. 13,1-2. doi:10.1136/bmjopen-2023-076961.
- Nowak W., Znamirska P., Szmigielska N., Zemsta K., Miśkiewicz J., Plata H., Pałatyńska M and Kulesza B. (2023).** Risk factors for

- carpal tunnel syndrome. *Journal of Pre-Clinical and Clinical Research*.17(3).167.doi:10.26444/jpccr/168 559.
- Obuchowicz R., Kruszyńska J., & Strzelecki M. (2021).** Classifying median nerves in carpal tunnel syndrome: Ultrasound image analysis. *Biocybernetics and Biomedical Engineering*, 41(2):335-351.<https://doi.org/10.1016/j.bbe.2021.02.01>
- Oliveira G., Bernardes J., Santos E., & Dias A. (2019).** Carpal tunnel syndrome during the third trimester of pregnancy: prevalence and risk factors. *Archives of gynecology and obstetrics*, 300(3): 623-631. <https://doi.org/10.1007/s00404-019-05233-6>.
- Osiak K., Elnazir P., Walocha A and Pasternak A. (2022).** Carpal tunnel syndrome: state of the art review. *Via Medica Journal*, 81(4),851-62. DOI: 10.5603/FM.a2021.0121
- Pourmokhtari M., Mazrooyi M., & Vosoughi AR. (2021).** Conservative or surgical treatment of carpal tunnel syndrome based on the severity and patient risk factors. *Musculoskeletal Surgery*, 105(3):315–319. <https://doi.org/10.1007/s12306-020-00663-x>.
- Ramadan Shaheen S., & Abdel Maksoud Mohamed M. (2021).** The Effect of Nursing Rehabilitation Program on Symptoms Severity and Functional Status in Patients with Carpal Tunnel Syndrome Undergoing Surgery. *Egyptian Journal of Health Care*, 12(3), 1028-1046. Doi: 10.21608/ejhc.2021.193553.
- Secorun M., Cortes R., Garcia C., Sanz J., Ballan S., Alcober S., Moreno J and Lopez M. (2021).** Effectiveness of Conservative Treatment According to Severity and Systemic Disease in Carpal Tunnel Syndrome: A Systematic Review. *International Journal of Environmental Research and Public Health*.18,1-2. <https://doi.org/10.3390/ijerph18052365>.
- Sevy J., Sina R; &Varacallo M. (2023).** Carpal Tunnel Syndrome. *National Library of Medicine*, Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK448179>.
- Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022).** Comparison of two manual therapy programs, including tendon gliding exercises as a common adjunct, while managing the participants with chronic carpal tunnel syndrome. *Pain Research and Management*, 2022(1), 1975803. DOI: 10.1155/2022/1975803
- Shikha L and Biswas A. (2024).** A Comparative Study of Effectiveness of Splinting and Splinting Plus Local Corticosteroid Injection in Patients

- with Carpal Tunnel syndrome: A Randomized Controlled Trial. Open Access Original Article. 16(1): e52868. DOI 10.7759/cureus.52868.
- Soad A.; Manal Y.; Raga E. (2020).** An epidemiological study of carpal tunnel syndrome among pregnant women at Al-Wahda hospital Derna. *International Journal of Clinical Obstetrics and Gynecology*. 4, 30–33. DOI:10.33545 /gynae.2020.v4.i1a.438
- Sosic L., Bojnec V., Lonzaric D., & JesensekPapez B. (2020).** An advanced stage of carpal tunnel syndrome- is night-time splinting still effective? *International Journal of Occupational Medicine and Environmental Health*, 33(6):771-780. <https://doi.org/10.13075/ijomeh.1896.01611>.
- Tsai C., Kuo H., Muo H., Chou W., & Lu Y. (2019).** Characteristics of Traditional Chinese Medicine Use for Carpal Tunnel Syndrome. *International Journal of Environmental Research and Public Health*, 16(21), P. 4086. DOI: [10.3390/ijerph16214086](https://doi.org/10.3390/ijerph16214086)
- Unal Z., Umay E., and Akyuz E. (2023).** Splinting in carpal tunnel syndrome-should we use it during the daytime? *Egyptian Rheumatology and Rehabilitation*, 46-50. <https://doi.org/10.1186/s43166-023-00214-9>.
- Unver S., & Akyolcu N. (2018).** The Effect of Hand Exercise on Reducing the Symptoms in Hemodialysis Patients with Carpal Tunnel Syndrome, *Asian Journal of Neurosurgery*, 13(1), P. 31. doi: 10.4103/ajns.AJNS\_343\_16
- Walker C., Metzler M., Cifu X., & Swartz Z. (2020).** Neutral wrist splinting in carpal tunnel syndrome: a comparison of night-only versus full-time wear instructions. *Archives of Physical Medicine and Rehabilitation*, 81(4):424–429. <https://doi.org/10.1053/mr.2000.3856>.

## Revitalizing Oral Health: Effects of Oral Exercise and Salivary Gland Massage on Oral Function among Elderly

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### Abstract

**Background:** Oral exercises and salivary gland massage benefit oral function among the elderly, particularly in enhancing saliva production and overall oral health. **Aim:** This study aimed to appraise the effects of revitalizing oral health by oral exercise and salivary gland massage on oral function among the elderly. **Research design:** A quasi-experimental research design was used. **Sample:** A purposive sample of 90 elderly people. **Setting:** This study was conducted at the Hoda Talaat Harb Specialized Center for the Treatment and Rehabilitation of the Elderly in Helwan City in Cairo Governorate, Egypt. **Tool for data collection:** Three tools used in study, **tool 1:** Structure interview sheet composed of three parts; **part 1:** Socio-demographic characteristic, **2<sup>nd</sup> part:** Medical health history, **3<sup>rd</sup> part:** Knowledge of elderly about oral exercises and salivary gland massage. **Tool II:** Observation checklist for Elderly's practices. **Tool III:** Assessment of oral health function. **Results:** Studied elderly's Knowledge and reported practices regarding oral health revealed statistically significant improvements post implementation an intervention than pre. Also, there was a statistically significant enhancement in oral function tests post-implementation of the interventions, with p-values indicating strong significance. **Conclusion:** The study concluded that revitalizing oral health for studied elderly was an appropriate way of improving oral function. **Recommendation:** A continuous educational program for older adults about oral exercise, saliva gland massage, and oral hygiene practices.

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**Key words:** *Elderly People, Oral Exercise, Oral Function & Salivary Gland Massage*



## Introduction

The quality of life for older adults has gained more attention due to the global acceleration of population aging. Physiological resilience declines with age, resulting in adverse health consequences of these; dental health has become a vital component of general health. Elderly people who have poor oral health are much more likely to become frail. Oral frailty includes age-related changes, such as tooth loss, decreased oral function, and declining hygiene. This frequently leads to poorer oral hygiene, trouble eating, and a subsequent decline in cognitive and physical functioning in older adults **(Zhou, et al., 2024)**

Xerostomia, or dry mouth, is common among older adults, affecting around 30% of individuals over 65 and up to 40% of those aged 80 and above. It is primarily associated with the side effects of medications, particularly in those taking more than four prescription drugs daily. Additionally, xerostomia may be linked to underlying health conditions such as diabetes, Alzheimer's disease, and Parkinson's disease. The condition can result in various oral health issues, including mucosal inflammation (mucositis), dental caries, cracked lips, and a fissured tongue, significantly impacting the quality of life and oral functionality in the elderly **(American Dental Aging, 2025)**.

Saliva is vital in multiple physiological functions and holds considerable clinical significance. Produced by the three major salivary glands and numerous minor glands, it is essential for maintaining oral homeostasis. Saliva initiates the digestive process through the enzymatic breakdown of starch, regulates oral pH to prevent dental caries, and contains antimicrobial proteins that help defend against pathogens. Additionally, it contributes to oral wound healing and tissue regeneration. A reduction in salivary flow below the normal range of 0.3–0.4 mL/min results in a condition known as hypo salivation **(Cong, Mao, Wu, & Yu, 2024)**.

The term "dry mouth" is often broadly used to refer to both xerostomia and hypo salivation, although these represent distinct concepts. Xerostomia refers to the subjective sensation of oral dryness, while hyposalivation denotes an objective reduction in salivary flow. Despite these differences, the terms are frequently used interchangeably in clinical and research contexts. In older adults, dry mouth is commonly regarded as a symptom associated with aging, with approximately 30% of the elderly reporting this condition. It can interfere with essential functions as swallowing and eating, contribute to oral discomfort, and lead to poor oral hygiene practices **(Seo & Kim, 2020)**.



Older adults are particularly vulnerable to poor oral health due to age-related reductions in salivary flow, compounded by factors such as limited self-care capacity, multiple comorbidities, polypharmacy, compromised immune function, and inadequate oral hygiene practices (**Schoppmeier, et al., 2024**). Typical oral health problems among the elderly include tooth loss, diminished periodontal support, decreased salivary secretion, periodontitis, and poor oral hygiene. One of the primary contributors to these issues, particularly in geriatric care settings, is the lack of awareness and education regarding oral health. Recent studies indicate that only 47.6% of older adults possess adequate oral health knowledge, 42.1% brush their teeth less than twice daily, 27.7% fail to brush correctly, and a mere 0.8% report consistent use of dental floss (**Li & Yao, 2021**).

Various approaches are available for treating and managing dry mouth symptoms, including salivary stimulants, topical agents, systemic sialogogues, and saliva substitutes. However, research on the effectiveness of salivary gland massage remains limited. Two studies in Japan demonstrated that an oral function enhancement program, including facial and tongue exercises and salivary gland massage, significantly improved salivary flow rates among independent older adults (**Jeamanukulkit, Vichayanrat, &**

**Samnieng, 2023**). A basic oral exercise program conducted in Korea, which included mastication, salivation, and swallowing activities, demonstrated that performing the 2-minute routine twice daily significantly enhanced unstimulated salivary flow and swallowing function both immediately after the intervention and one week later (**Jiang, et al., 2022**).

Revitalization is a strategy to improve oral health and wellness. Strategic measurements must be taken to deal with dental health problems through shaping behavior. An innovative model is needed to foster the elderly's oral and dental hygiene habits. The model is created by establishing older adults' habits of choosing oral and dental hygiene, 2 minutes of tooth brushing, and tooth brushing at least twice a day (**Santoso, Susanto, Widyawati, Rahman, & Rajiani, 2020**).

One of the most pressing public health concerns is improving the health of older people, which leads to a higher quality of life for them. Evidence indicates that oral and dental health issues among the elderly have historically received less attention compared to conditions such as cardiovascular diseases or malignancies. Oral and dental health encompasses the well-being of the oral cavity and its surrounding structures, playing a vital role in enabling individuals to eat, speak, and socially interact. Among older adults, compromised oral health is associated

with increased psychological distress, reduced mood, and diminished quality of life. A range of oral and dental problems, such as tooth loss, periodontal disease, and oral discomfort, can negatively influence both the physical and psychosocial well-being of elderly individuals (**Bashirian, et al., 2023**).

Nurses play a crucial role in preserving oral wellness and preventing associated infections when applying evidence-based practices. Nurses with updated knowledge and skills can provide high-quality care and accurate decision-making, eliminating risks for older adults. Therefore, continuous teaching programs are recommended (**Abd Allah, Hussein, & Abdel-Aziz, 2020**).

#### **Significance of the study:**

By 2030, one in every six individuals globally will be aged 60 years or older. The global population in this age group is projected to increase from 1 billion in 2020 to 1.4 billion. By 2050, the number of people aged 60 and above will reach approximately 2.1 billion. In Egypt, the elderly population is also growing rapidly. Between 2020 and 2050, the number of adults aged 70 and older in Egypt is anticipated to triple, reaching approximately 326 million. Moreover, the proportion of the Egyptian population aged 65 years and above is projected to rise from 4.3% in 2020 to 7.4% by 2025, with an average annual growth rate of 0.50% (**Mahmoud, et al., 2022**).

Poor oral health among older adults is attributed mainly to global disparities in oral health care. In many healthcare systems, oral health is treated separately from general health, often receiving less attention, funding, and policy prioritization. As a result, oral diseases in the elderly are frequently diagnosed at advanced stages, which leads to suboptimal treatment outcomes and accelerated functional oral decline. Recently, the deterioration of oral function has been recognized as a critical issue affecting the overall oral health of older adults. Although this decline typically occurs gradually and may be reversible through timely interventions, routine screenings in primary healthcare settings often fail to assess oral function. Consequently, early-stage oral functional impairments may go unnoticed, delaying appropriate management and increasing the risk of irreversible damage (**Fukai, Darteville, & Jones, 2022 ; Chan et al., 2024**).

Although various oral health programs have been developed to enhance oral function in older adults, limited research has specifically evaluated the effectiveness of oral exercises and salivary gland massage in this population. Moreover, there is a noticeable lack of evidence regarding the efficacy of salivary gland massage interventions tailored exclusively for the elderly, highlighting a critical gap in geriatric oral

health care research. Thus, the present study aimed to appraise the effects of oral exercise and salivary gland massage on oral function among the elderly.

### **Aim of the study**

This study aimed to appraise the effects of revitalizing oral health through oral exercise and salivary gland massage on oral function among the elderly.

### **Research hypothesis**

**H (1):** Revitalizing oral health will significantly improve knowledge and practices, salivary flow, and reduce the risk of mouth dryness among the elderly.

**H (0):** Revitalizing oral health will not significantly improve knowledge and practice, salivary flow, and reduce the risk of mouth dryness among the elderly.

### **Operational definition**

#### **Revitalizing Oral Health**

Revitalizing oral health refers to the comprehensive efforts to improve and integrate oral health through oral exercise and salivary gland massage on oral function among the elderly (Santoso, et al., 2020).

### **Subjects and Method**

#### **Research design**

A quasi-experimental research design was used to operate this study and appraise the effects of revitalizing oral health by oral exercise and salivary gland massage on oral function among elderly people. The design involved a one-group pretest and posttest approach for this study.

### **Research Setting**

This study was conducted in the dental, internal medicine, and physiotherapy clinics at the Hoda Talaat Harb Specialized Center for the Treatment and Rehabilitation of the Elderly in Helwan City in Cairo Governorate, allied with the Secretariat of Specialized Medical Centers. The participating elderly were selected from the dental, internal medicine, and physiotherapy clinics affiliated with the center. Al-Huda Center is the only center dedicated to the elderly in Helwan City, which has the highest influx rate of elderly people.

### **Study Subjects**

A purposive sample of 90 elderly individuals (both males and females) was recruited from the previously mentioned setting. The non-probability sampling technique was used to select the studied sample. Studied elderly were selected based on the researchers' specific inclusion and exclusion criteria.

### **Inclusion criteria**

Elderly aged 60 years and above, of both sexes, who could communicate effectively and provided informed consent were included in the study. Willingness to participate voluntarily was also considered essential.

### **Exclusion Criteria**

Elderly individuals were excluded from the study if they had been diagnosed with dementia, experienced head or neck trauma, undergone radiation therapy, practiced

habitual mouth breathing, or were diagnosed with severe periodontal disease through oral examination. Additionally, those with thyroid disorders, a history of smoking, or who were taking medications as antipsychotics, sedatives, muscle relaxants, angiotensin-converting enzyme (ACE) inhibitors, alpha and beta-blockers, anticholinergics, antidepressants, or antihistamines were also excluded.

### Sample size

Based on data from the literature (Simarjeet, 2022), and considering a significance level ( $\alpha$ ) of 5% and a study power ( $1-\beta$ ) of 80%, the required sample size was calculated using the following formula:

$$n = \frac{p(1-p)}{(SE \div t) + [p(1-p) \div N]}$$

$$N = 200$$

$$t = 1.96$$

$$SE = 0.05$$

$$P = 0.50$$

$$0.50 (1-0.50)$$

$$n = \frac{0.50 (1-0.50)}{(0.05 \div 1.96) + [0.50 (1-0.50) \div 200]}$$

$$n = 90$$

**Tools for data collection:** Data for this study were collected using three tools, including:

**Tool I:** The researchers developed a structure interview sheet after an extensive review of relevant literature. It was

designed in simple Arabic to ensure clarity and ease of understanding for studied elderly. The questionnaire consisted of the following parts

### Part 1

**Socio-demographic** characteristics of elderly people (e.g., their age, sex, education levels, occupation, residence, who lives with them and Monthly income)

### Part 2

**Medical Health History of elderly** This structure interview sheet involved the past & current medical history of elderly people and consists of 8 closed-end questions about (previous medical diseases, previous oral cavity surgery, sense of bad breath, presence of dentures, route of washing of teeth, tooth brushing (times/day), tongue wash during brushing, and current medication.

### Part 3: Elderly knowledge

Older adults' knowledge about oral exercise & salivary gland massage involved 17 closed-end questions, including the concept of oral functions, definitions, causes, risk factors of dry mouth, consequences, anatomical site of saliva gland, function of saliva gland, age related oral cavity change, methods for decreasing dryness of mouth, medications that cause dry mouth, complications of dry mouth, prevention, management, and treatment, benefits, role of the salivary glands in oral health, and saliva is important for oral health.

**The Scoring system** included 17 closed-end questions; the correct answer scored 1 point, and zero points were given for a wrong answer or not knowing. The total knowledge scores were 17 point for 17 questions. Knowledge answers were classified into three categories.

The grades for each item were summed and then converted into a percent score

**(Abd Allah, et al., 2020)**

- Poor knowledge < 50% (< 8.5 point)
- Average knowledge 50- < 75 % (8.5- less 12.75 point)
- Good knowledge  $\geq 75\%$  ( $\geq 12.75$  point)

#### **Tool II: Observation Checklist about Elderly practices**

It included oral hygiene and exercise & salivary massage aimed to assess for studied elderly practices adapting from **(Shirobe, et al., 2022)**, these exercises reinforce the muscles of the lips, cheeked, tongue, and surrounding oral structures. The lip-focused component included two specific items designed to enhance the mobility and strength of the lip muscles, contributing to improved oral function and salivary flow in studied elderly. Lip and Cheek Muscles Exercise comprised (2 items). Tongue Exercise: (3 items). Patakara Exercise: It contained four items. Mouth Opening Exercise: (2 items). Tongue Out Exercise: (2 items). Forehead Exercise: (2 items). Mastication Exercise: (4 items). Counting Exercise is (3 items). Tongue Twister Exercise is (3 items).

Tongue Training involved (5 items). Massage Salivary Glands were (5 items).

**The scoring system** reported that the practices of older adults consisted of 36 steps; with a total score equal 36 point. One score was given for completed practices, and zero for incomplete practices. All scores of practices were summed up and then converted into percentages and calculated as follows:

The grades for each item were summed and then converted into a percent score:

**Competent practices  $\geq 60\%$**   
( $\geq 21$  point)

**Incompetent practices < 60**  
(<21 point)

#### **Tool III: Assessment of oral function:**

This tool evaluates mouth health status and the program's effect on revitalizing oral function health for older adults after applying it. This tool consisted of four parts as follows;

**Part 1: Summated Xerostomia Inventory (SXI):** This part was developed by **Thomson et al. (2011)**.

**Aim** to assess the severity of xerostomia, or dry mouth, particularly among older adults. SXI consists of a series of questions that focus on the frequency and severity of xerostomia symptoms. It was a shortened version of the original Xerostomia Inventory (XI), which included 11 items using a Likert scale. It is directly related to the sensation of dry mouth and its impact on daily activities.

Each item on the sheet was rated based on the frequency of xerostomia-related symptoms, using a 5-point Likert scale: 1 = Never, 2 = Hardly ever, 3 = Occasionally, 4 = Fairly often, 5 = Very often. This scoring method enables a quantitative assessment of symptom severity, where higher scores indicate more pronounced symptoms of dry mouth.

**The scoring system:** The total score is derived by summing the responses across all items, with the minimum total score representing the absence of symptoms (all items rated as "Never") and the maximum score reflecting the highest frequency of symptoms (all items rated as "Very often") (Wimardhani, Rahmayanti, Maharani, Mayanti, & Thomson, 2021).

**Part 2: Measuring the Flow of Saliva by using Oral Schirmer's test.** The Oral Schirmer's test was a method used to measure salivary flow rates, particularly useful in assessing salivary gland function, including the elderly and those with conditions like xerostomia. Standardized filter paper strips typically had dimensions of 35 mm in length and 5 mm in width. They were designed to absorb saliva and measure the amount of moisture collected during the test. To assess unstimulated salivary flow for 1 to 5 minutes, the strip is usually placed on the floor of the mouth, close to the submandibular gland. After this period, the length of the wet portion of the strip is

measured to determine the salivary flow rate. The saliva is categorized as Hypo Salivation: the salivary flow rate is less than 15 mm in 3 minutes. This condition indicates reduced saliva production, which can lead to symptoms such as dry mouth (xerostomia). Normal Salivation: Characterized by a salivary flow rate greater than 15 mm/min. Hyper Salivation: a salivary flow rate greater than 35 mm/min. This indicates an increased production of saliva, which may be associated with various conditions or stimuli (Wróbel-Dudzińska, et al., 2021).

### **Part 3: Organoleptic test for halitosis**

This tool was developed by Murata et al. (2002). Oral malodor, commonly referred to as halitosis, can be measured using an organoleptic test, a widely recognized **gold-standard scale** employed to assess oral malodor. During the procedure, participants were instructed to take deep breaths by inhaling through the nose, holding their breath for a few seconds, and then exhaling slowly through the mouth. This standardized method allows for consistent evaluation of halitosis levels and is commonly used in clinical and research settings for objective assessment. The examiner inhaled the odor from a distance of 20 cm and assessed the category of malodor on an organoleptic scale of 0 to 5, where: 0 = absence of odor, 1 = Barely noticeable odor, 2 = Slight

malodor, 3 = Moderate malodor, 4 = Strong malodor and 5 = Severe malodor.

#### **Part 4: Subjective symptoms of xerostomia consisted of 4 closed-end questions**

Four specific questions were utilized to assess the presence and severity of oral dryness, which was measured in response to saliva secretion from the study by (Abdelaziz, et al., 2024). The researcher asked the patients to select "Yes" or "No" if any of the following circumstances applied: (I) "Does the amount of saliva in your mouth seem to be too little?"; (II) "Do you have any difficulty swallowing?"; (III) "Does your mouth feel dry when eating a meal?"; and (IV) "Do you sip liquids to aid in swallowing dry food?"

#### **Validity of the Tools**

The content validity of the tool was tested by a panel of five experts, three in Geriatric Nursing and two in the Community Health Nursing field. The necessary modifications were done according to base on their responses; the tools were proved to be valid.

#### **Reliability of the Tools**

The internal consistency of the items verified using the Cronbach's alpha coefficient test in order to demonstrate the dependability and reliability of the instruments. The reliability of knowledge was 0.86, and for practice was 0.80. The reliability of the SXI tool using the test-retest method was  $r = 0.79$  to 0.85, which

suggests strong internal consistency for this version of the inventory. The reliability of measuring the Oral Schirmer's test ranged from 0.72 to 0.85. The organoleptic test's reliability was confirmed using the interrater method, and the reliability scores were 0.63 and 0.982, respectively. Overall, these scales demonstrate strong reliability, making them valuable tools for research and clinical practice in geriatric assessments.

#### **The study was conducted in three phases**

##### **Field Work Phase**

Permissions for data collection were generated from the Hoda Talaat Harb Specialized Center director by submitting a formal letter from the Faculty of Nursing, Helwan University. This letter included permission to carry out the study, explaining the purpose and nature of the study, and the date and time of starting data collection.

Once the researchers were granted approval and older adults fulfilled the inclusion criteria, written informed consent was obtained from each subject before participating in the study.

The study covers six months from the beginning of July till the end of December 2024.

The interview took approximately 15–30 minutes, depending on the elderly person's understanding and comfort level. This phase covers three months, from the

beginning of July till the end of December 2024.

Then the researchers interviewed them individually face-to-face in the waiting area of the clinics mentioned (dental, internal medicine, and physiotherapy clinics affiliated with the center) by using the tools to obtain baseline data, assess oral functions such as dry mouth symptoms, amount of salivary secretion, halitosis, and oral motor function using the summated xerostomia inventory, and measure saliva flow rates by standardized filter paper strips is typically positioned on the floor of the mouth, near the submandibular gland to measure unstimulated salivary flow 1 to 5 minutes. After this period, the length of the wet portion of the strip is measured to determine the salivary flow rate.

### **Implementation phase**

Ninety participants were recruited using the nonprobability sampling technique (purposive sample). Considering the sampling criteria, the pretest was conducted with 5 participants per day, two days a week. They were offered oral exercises and salivary gland massage in a quiet environment. The intervention concentrated on the expression muscles, tongue, salivary glands, and swallowing, explaining the study's purpose and the benefits of oral exercises.

The intervention was divided into two stages: First, the learning stage, in which the investigator taught oral exercises for

an hour using lecture cum one-to-one demonstration. Seven to ten elders attended the demonstration per day. Each participant was invited to perform a return demonstration, with corrections provided as appropriate. At this stage, pamphlets were provided to the participants.

### **Stage I: Learning phase**

The oral exercises and salivary gland massage involved one-to-one demonstrations **Ibayashi, et al., (2008)** that included expression muscles (orbicularis oculi, buccinators, and orbicularis oris), tongue, salivary glands, and swallowing. This was followed by a one-hour return demonstration on the first day and pamphlet distribution.

### **Stage II: Performance phase**

Following the learning phase, the second phase (performance phase) was completed. During this phase, participants were requested to perform oral exercises and salivary gland massage every day for about 30 minutes for 30 days under the supervision of the investigator. The participants were divided into groups of five members, each performing oral exercises to maintain one-to-one supervision. The intervention consists of:



## 1. Oral Exercise Technique

| <b>Oral Exercise to Prevent Oral Function Decline</b>              |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Items of Oral Exercise                                             | Step                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>1. Improve mouth and tongue movements and saliva production</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Mouth Muscles Exercise focusing on the lips                        | <ol style="list-style-type: none"> <li>1. Purse your lips.</li> <li>2. Open your mouth horizontally while pronouncing the sound “Eee”. Repeat 10 times.</li> </ol>                                                                                                                                                                                                                                                                           |
| Lip and Cheek Muscles Exercise                                     | <ol style="list-style-type: none"> <li>1. Puff your cheeks with air or water.</li> <li>2. Purse your lips several times.</li> </ol>                                                                                                                                                                                                                                                                                                          |
| Tongue Exercise:                                                   | <ol style="list-style-type: none"> <li>1. Press your tongue firmly against the inside of your cheek.</li> <li>2. From the outside of the cheek, press your finger against the tip of the tongue.</li> <li>3. Resist by slowly pressing your tongue against the inside of your cheek.</li> </ol> <p>Repeat 10 times for the left and right cheeks.</p>                                                                                        |
| Patakara Exercise                                                  | <ol style="list-style-type: none"> <li>1. Pronounce “Pa” while smacking your lips together.</li> <li>2. Pronounce “Ta” while placing the tip of your tongue behind your upper front teeth.</li> <li>3. Pronounce “Ka” while placing the base of your tongue against the back of your upper jaw.</li> <li>4. Pronounce “Ra” while curling your tongue.</li> </ol> <p><i>Perform two sets of eight repetitions for each pronunciation.</i></p> |
| <b>2. Improve swallowing power</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Mouth Opening Exercise                                             | <ol style="list-style-type: none"> <li>1. Slowly open your mouth as wide as possible and hold for 10 seconds.</li> <li>2. Firmly close your mouth and rest for 10 seconds. <i>Repeat this cycle 10 times.</i></li> </ol>                                                                                                                                                                                                                     |
| Tongue Out Exercise:                                               | <ol style="list-style-type: none"> <li>1. Slightly stick out your tongue.</li> <li>2. Close your mouth and swallow the saliva. <i>Repeat 10 times.</i></li> </ol>                                                                                                                                                                                                                                                                            |
| Forehead Exercise                                                  | <ol style="list-style-type: none"> <li>1. Open your hand and press your palm firmly against your forehead.</li> <li>2. Count to five while slowly lowering your gaze toward your navel (belly button). <i>Repeat 10 times.</i></li> </ol>                                                                                                                                                                                                    |
| <b>3. Improve chewing power</b>                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Mastication Exercise:                                              | <ol style="list-style-type: none"> <li>1. Sit down and maintain correct posture.</li> <li>2. Chew gum at a steady rhythm for 2 minutes, then continue chewing freely for 3 minutes.</li> <li>3. Keep your lips closed and chew firmly.</li> <li>4. Chew evenly on both the left and right sides of your mouth.</li> </ol>                                                                                                                    |
| Counting Exercise:                                                 | <ol style="list-style-type: none"> <li>1. While eating, count to 30 as you chew each bite of food.</li> <li>2. Whenever possible, choose chewy foods cut into slightly larger pieces.</li> <li>3. Focus entirely on chewing and try to avoid distractions like watching TV.</li> </ol>                                                                                                                                                       |
| <b>4. Improve pronunciation</b>                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tongue Twister Exercise:                                           | <ol style="list-style-type: none"> <li>1. Peter Piper picked a peck of pickled peppers.</li> <li>2. Betty Butter bought some butter.</li> <li>3. How much wood would a woodchuck chuck if a woodchuck could chuck wood?</li> </ol>                                                                                                                                                                                                           |
| <b>5. Improve tongue power</b>                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tongue Training:                                                   | <ol style="list-style-type: none"> <li>1. Stick out your tongue.</li> <li>2. Try to touch the tip of your lower jaw with your tongue.</li> <li>3. Try to touch the tip of your nose with your tongue.</li> <li>4. Move your tongue in a circular motion.</li> <li>5. Press a spoon against your tongue and push your tongue firmly against the spoon. Hold for a few seconds. (Shirobe, et al., 2022)</li> </ol>                             |

## **Oral Exercise Technique and Salivary Gland Massage Technique**

**For the parotid gland**, the patient performed a massage routine starting with rubbing the front of both ears using four fingers—the index, middle, ring, and little fingers—on each side, repeating this 10 times. Next, the patient used both thumbs to massage the submandibular glands located beneath the chin, performing 10 massages on each side. Finally, to stimulate the sublingual glands, the patient pressed their thumbs under the jawline, massaging from the area beneath the ears toward the chin on both sides. This massage was to be done on both sides for approximately 2 minutes, three times daily.

This method differs slightly from the technique described by the Sjögren's Foundation Patient Education Sheet, which recommends using two fingers instead of four. Additionally, it contrasts with an earlier study that used the palm to massage the parotid gland (**Kim, et al., 2012**).

## 1. Salivary Gland Massage Technique (How to Massage Salivary Glands) Sjögren's Foundation (2025)



**Figure 1A:**  
The parotid glands are located bilaterally in the cheek area in front of your ear and have a “tail” area that can extend over the lower jaw.

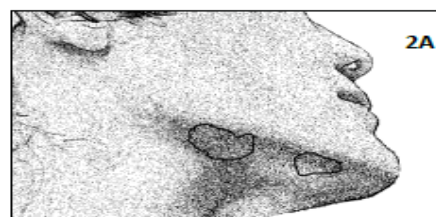
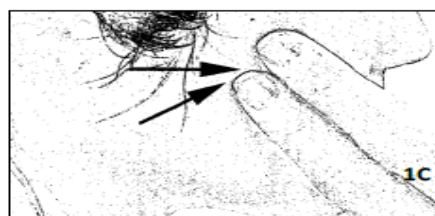


**Figure 2A:**  
The submandibular and sublingual glands are located bilaterally under your jaw and tongue with the sublingual gland closer to the chin.



**Figures 1B and 2B:**  
Place two fingers on the body or tail area of the parotid, Or under the jaw for the submandibular/sublingual glands.



**Figures 1C and 2C:**  
Sweep fingers forward with gentle pressure as indicated by the black arrows. This will encourage movement of saliva past a possible obstruction or constriction and into the oral cavity.



### Evaluation phase

To evaluate the patients' practices, the researchers placed a cotton roll on the floor of the mouth and assessed its wetness after the oral exercises and salivary gland massage. The researchers also motivated the participants and their caregivers to perform daily massages by maintaining regular telephone follow-ups. Oral function was reassessed (posttest) on the 30th day using the same evaluation tools.

### Ethical consideration

The Ethics Committee of Helwan University's Faculty of Nursing, number (40), approved the study on

March 18, 2024. Informed consent was obtained from all participants after clearly explaining the purpose of the study. The confidentiality of all collected data was strictly maintained. Participants' privacy, anonymity, and the right to withdraw from the study were fully ensured.

### Statistical analysis

After the collection, the data were coded and moved into forms created explicitly for computer-feeding. SPSS software, version 22, was used to statistically analyze the data (IBM Corporation, Armonk, NY, USA). The Wilcoxon signed-rank test, the  $\chi^2$ -test, and the Mann–Whitney U-test were

employed when necessary. The significance level was set at  $P < 0.05$ .

### Data analysis

**Table 1** reveals that 75.5% of the studied elderly were aged between 70 to 79 years, with a mean age of  $74.4 \pm 0.4$  years. Males constitute 73.3% of the studied elderly, most of them with relatively high education, with 67.8% having a university education. 78.9% of the elderly were working and resided in urban areas, 73.3%. 78.9 % live with their family, and 65.6 % of them had insufficient monthly income.

**Table 2** clarifies that hypertension and diabetes mellitus, 53.3% and 48.2 %, respectively, were the most frequent diseases among the studied elderly participants. 53.3% of them reported a sense of bad breath, and 64.5% used partial dentures. A substantial number, 97.8%, washed their teeth using rinse water, but only 44.4% used a toothbrush. Among those who brushed their teeth ( $n=40$ ), most do so 1-2 times per day, 62.5%, and 75.0% washed their tongue during brushing. 60.0% of studied elderly took antihypertensive drugs and oral hypoglycemic agents, 25.6%

**Figure 1** shows that 82.0 % of the studied older adults had poor levels, and pre-practicing Oral Exercise and Salivary Gland Massage decreased to 5.50 % post-implementation of oral exercise. 11.50 % had a good level, pre-

practicing Oral Exercise and Salivary Gland Massage, which improved and became 76.20 % post-implementation of oral exercise. Also, there were statistically significant differences between total knowledge scores pre- and post-implementation of Exercise and Salivary Gland Oral Massage ( $P = .001$ ).

**Figure 2** illustrates that 55.8% of the studied elderly had unsatisfactory oral hygiene, exercise and salivary gland massage practices before the intervention. Following the implementation of the oral exercise and salivary gland massage program, this improved significantly, with 82.2% demonstrating satisfactory practices. Furthermore, there was a highly statistically significant difference between the total practice scores before and after the intervention ( $P = 0.001$ ).

**Table 3** demonstrates the mean  $\pm$  SD scores of studied elderly people pre- and post-implementation of Oral Exercise and Salivary Gland Massage. There is a statistically significant difference in improvement in all oral function tests post-implementation of Oral Exercise and Salivary Gland Massage. Also, revitalizing oral function health for the studied elderly post-implementation of Oral Exercise and Salivary Gland Massage improved ( $P = 0.001$ ).

**Table 4** reveals the logistic regression analysis of several factors significantly impacting oral function among studied elderly. Sex, chronic disease, Previous

oral cavity surgery, Route of washing of teeth, current medication, oral exercise, and salivary gland massage ( $P= 0.004$ ,  $P= 0.003$ ,  $P= 0.007$ ,  $P= 0.004$ ,  $P= 0.003$ ,  $P= 0.001$ ,  $P= 0.004$ ), respectively. While the occupation, place of residence, who lived with you, and presence of dentures ( $p = 0.784$ ,  $p = 0.283$ ,  $p = 0.215$ ) respectively did not significantly impact oral function among the elderly participants.

The logistic regression analysis in **Table 5** identifies several highly significant factors that predict the effect of salivary gland massage on oral function among the elderly participants. Sex, chronic disease, route of washing of teeth, oral exercise, current medication, and salivary gland massage ( $p=0.005$ ,  $p=0.004$ ,  $p=0.003$ , and  $p=0.002$ ), respectively. On the other hand, several factors were found to be non-significant in predicting the effect of salivary gland massage on oral function among the studied elderly. Education levels, place of residence, who lived with you, and sensed of bad breath ( $p=0.214$ ,  $p=0.748$ ,  $p=0.321$ ,  $p=0.283$ ), respectively.

The mediation analysis in **Table 6** indicates that oral exercise has a direct effect on health oral function ( $p=0.007$ ); however, the indirect effect through Salivary gland massage is not significant ( $p=0.323$ ). The results suggest that the implications should

focus on oral exercises as an intervention to improved oral function without relying on salivary gland massage as an intermediary step.

**Table 1: Distribution of the Studied Elderly's Socio-demographic Characteristics (n=90).**

| Item                              | No. | %           |
|-----------------------------------|-----|-------------|
| <b>Elderly People age</b>         |     |             |
| - 60 to 69 years                  | 9   | 10.0        |
| - 70 to 79 years                  | 68  | <u>75.5</u> |
| - ≥ 80 years                      | 13  | 14.4        |
| <b>Mean ± SD 74.4 ± 0.4 years</b> |     |             |
| <b>Sex</b>                        |     |             |
| - Male                            | 66  | <u>73.3</u> |
| - Female                          | 24  | 26.7        |
| <b>Education levels</b>           |     |             |
| - Read and Write                  | 4   | 3.6         |
| - Secondary education             | 25  | 27.8        |
| - University education            | 61  | <u>67.8</u> |
| <b>Previous occupation</b>        |     |             |
| - Working                         | 71  | <u>78.9</u> |
| - Not working                     | 19  | 21.1        |
| <b>Residence</b>                  |     |             |
| - Urban                           | 66  | <u>73.3</u> |
| - Rural                           | 24  | 26.7        |
| <b>Who lives with you</b>         |     |             |
| - With family                     | 71  | <u>78.9</u> |
| - Alone                           | 19  | 21.1        |
| <b>Monthly income</b>             |     |             |
| - Sufficient                      | 31  | 34.4        |
| - Insufficient                    | 59  | <u>65.6</u> |

**Table 2. Distribution of Medical History for Studied Elderly (n =90)**

| Past and current medical history         | No. | %            |
|------------------------------------------|-----|--------------|
| <b>Previous medical disease</b>          |     |              |
| - Yes                                    | 90  | <b>100.0</b> |
| <b>Chronic disease: *</b>                |     |              |
| - Hypertension                           | 13  | 14.4         |
| - Diabetes mellitus                      | 44  | 48.2         |
| - Digestive disease                      | 23  | 25.6         |
| - Coronary artery disease                | 15  | 16.7         |
| - Respiratory disease                    | 30  | 33.3         |
| - Circulatory disease                    | 15  | 16.7         |
| - Renal diseases                         | 30  | 33.7         |
| - Ophthalmological diseases              | 48  | 53.3         |
| - Endocrine disease                      | 25  | 27.8         |
| - Cancer                                 | 10  | 11.2         |
| <b>Previous oral cavity surgery</b>      |     |              |
| - Yes                                    | 15  | 16.7         |
| - No                                     | 75  | 83.3         |
| <b>A sense of bad breath<sup>5</sup></b> |     |              |
| - Yes                                    | 48  | 53.3         |
| - No                                     | 42  | 46.7         |
| <b>Presence of dentures</b>              |     |              |
| - No                                     | 11  | 12.2         |
| - Complete                               | 21  | 23.3         |
| - Partial                                | 58  | 64.5         |
| <b>Route of washing of teeth *</b>       |     |              |
| - No use                                 | 30  | 33.4         |
| - Toothbrush                             | 40  | 44.4         |
| - Flossing                               | 30  | 33.4         |
| - Rinse water                            | 88  | <b>97.8</b>  |
| <b>Tooth brushing (times/day) n =40</b>  |     |              |
| - 1-2                                    | 25  | 62.5         |
| - ≥ 3                                    | 15  | 37.5         |
| <b>Tongue wash during brushing</b>       |     |              |
| - Yes                                    | 30  | 75.0         |
| - No                                     | 10  | 25.0         |
| <b>Current medication *</b>              |     |              |
| - Antihypertensive                       | 54  | 60.0         |
| - Oral hypoglycemic agent (OHGA)         | 23  | 25.6         |
| - Anti-ulcerative drugs and digestive    | 13  | 14.4         |
| - Analgesics                             | 11  | 12.3         |
| - Respiratory drugs                      | 16  | 17.7         |
| - Antibiotic drugs                       | 2   | 22.3         |

\*More than one answer

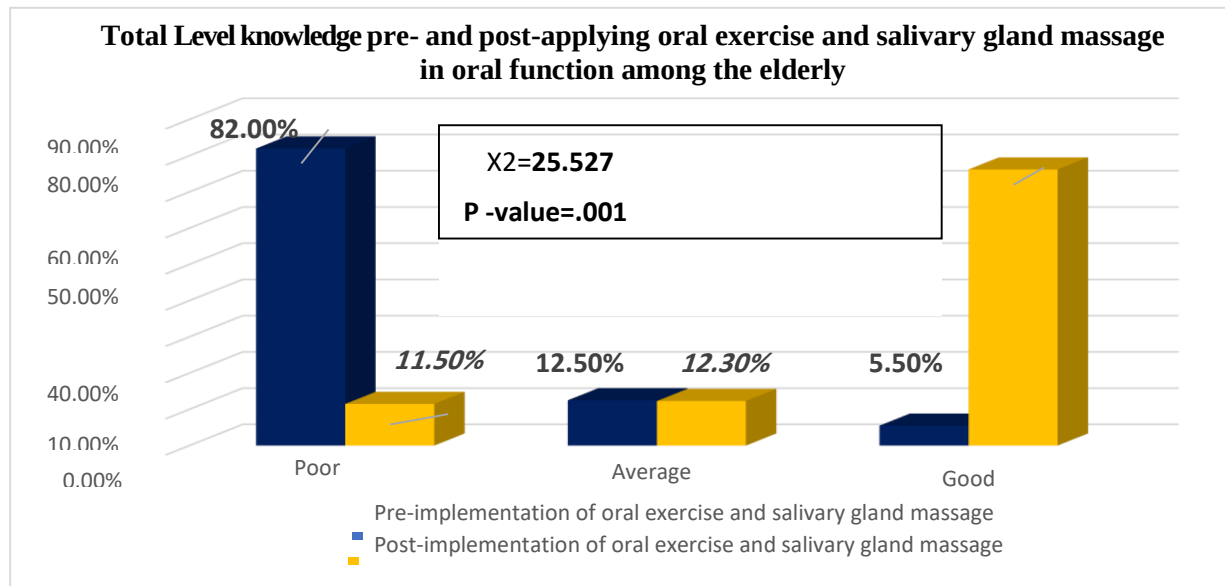


**Figure 1. Distribution of Studied Elderly's Level of Knowledge about Oral Exercise and Salivary Gland Massage on Oral Function pre- and Post-Implementation Oral Exercise and Salivary Gland Massage (No =90)**

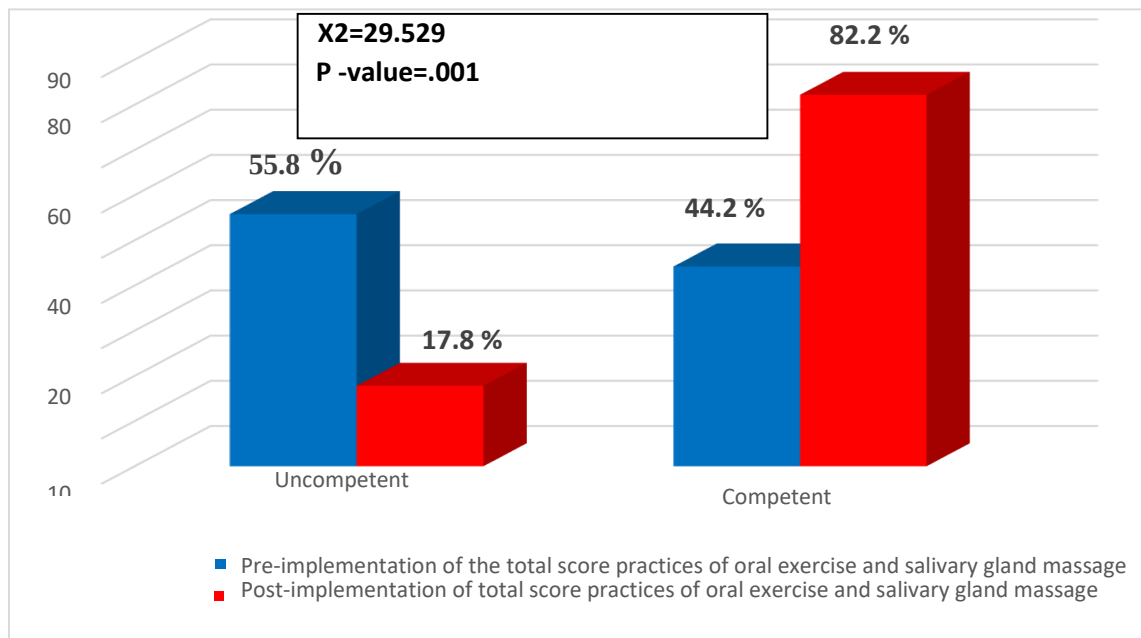


**Figure 2. Distribution of Studied Elderly's Total Practices Score about Oral Exercise and Salivary Gland Massage on Oral Function Pre and Post Implementation (n=90)**



**Table 3: Distribution of Mean  $\pm$  SD for Studied Elderly Oral Function Pre & Post Implementation (n=90)**

| Items                                                        | Pre-Exercise    | Post-Exercise   | Difference<br>(post-pre) | Paired t | P value |
|--------------------------------------------------------------|-----------------|-----------------|--------------------------|----------|---------|
|                                                              | Mean $\pm$ SD   | Mean $\pm$ SD   | Mean $\pm$ SD            |          |         |
| Summated Xerostomia Inventory                                | .875 $\pm$ .693 | 1.66 $\pm$ .654 | 0.785 $\pm$ .654         | 6.612    | .001    |
| Measuring the flow of saliva by using the oral Schirmer test | .802 $\pm$ .651 | 1.33 $\pm$ .606 | 0.528 $\pm$ .606         | 35.851   | .001    |
| Organoleptic test for halitosis                              | .524 $\pm$ .574 | 1.12 $\pm$ .921 | 0.596 $\pm$ .566         | 37.161   | .001    |
| Subjective symptoms of xerostomia                            | .323 $\pm$ .457 | 1.41 $\pm$ .552 | 0.785 $\pm$ .551         | 14.252   | .000    |

**Table 4: Logistic Regression Analysis for Factors Predicting Oral Function among Studied Elderly (n=90)**

| Items                        | Unstandardized Coefficients |            | Standardized Coefficients | Paired t | P      |
|------------------------------|-----------------------------|------------|---------------------------|----------|--------|
| Model                        | B                           | Std. Error | Beta                      | T        | Sig    |
| (Constant)                   | 82.988                      | 7.012      |                           | 7.758    | <0.001 |
| Elderly People age           | 0.041                       | 0.712      | -0.012                    | -0.061   | 0.021  |
| Sex                          | 1.103                       | 1.321      | 0.181                     | 0.847    | 0.004  |
| Education levels             | 1.884                       | 1.031      | 0.332                     | 1.871    | 0.042  |
| Occupation                   | 0.151                       | 0.821      | 0.074                     | 0.183    | 0.784  |
| Place of Residence           | 0.214                       | 0.458      | 0.122                     | 1.210    | 0.283  |
| Who lives with you           | 0.589                       | 0.214      | 0.147                     | 0.987    | 0.215  |
| Monthly income               | 0.576                       | 0.124      | 0.041                     | 0.613    | 0.044  |
| Chronic disease              | 1.103                       | 1.321      | 0.181                     | 0.847    | 0.004  |
| Previous oral cavity surgery | 0.151                       | 0.021      | 0.064                     | 0.183    | 0.003  |
| A sense of bad breath        | 1.014                       | 0.542      | 0.247                     | 1.245    | 0.007  |
| Presence of dentures         | 0.589                       | 0.214      | 0.147                     | 0.987    | 0.215  |
| Route of washing of teeth    | 0.576                       | 0.124      | 0.041                     | 0.613    | 0.004  |
| Current medication           | 1.014                       | 0.542      | 0.247                     | 1.245    | 0.003  |
| Oral exercise                | 0.021                       | 0.012      | -0.002                    | -0.021   | 0.001  |
| Salivary gland massage       | 1.013                       | 1.211      | 0.181                     | 0.847    | 0.004  |

**Table 5: Logistic Regression Analysis for Factors That Predict the Effect of Salivary Gland Massage in Oral Function among the Studied elderly (n=90)**

| Items                        | Unstandardized Coefficients |            | Standardized Coefficients | Paired t | P     |
|------------------------------|-----------------------------|------------|---------------------------|----------|-------|
| Model                        | B                           | Std. Error | Beta                      | T        | Sig   |
| Elderly People age           | 0.661                       | 0.654      | 0.011                     | 0.051    | 0.754 |
| Sex                          | 5.147                       | 2.450      | 0.311                     | 2.142    | 0.005 |
| Education levels             | 1.204                       | 1.247      | 0.123                     | 0.651    | 0.214 |
| Occupation                   | 2.585                       | 0.963      | 0.348                     | 2.685    | 0.010 |
| Place of Residence           | 0.321                       | 1.241      | 0.054                     | 0.214    | 0.748 |
| Who lives with you           | 1.478                       | 1.547      | 0.123                     | 0.547    | 0.321 |
| Monthly income               | 1.401                       | 0.849      | 0.247                     | 1.729    | 0.090 |
| Chronic disease: *           | 1.201                       | 1.321      | 0.181                     | 0.847    | 0.004 |
| Previous oral cavity surgery | 1.151                       | 0.021      | 0.040                     | 0.183    | 0.002 |
| A sense of bad breath        | 0.414                       | 0.458      | 0.122                     | 1.210    | 0.283 |
| Presence of dentures         | 1.489                       | 0.816      | 0.147                     | 0.987    | 0.012 |
| Route of washing of teeth *  | 0.576                       | 0.124      | 0.041                     | 0.613    | 0.004 |
| Current medication *         | 1.014                       | 0.542      | 0.247                     | 1.245    | 0.003 |
| Oral exercise                | 1.103                       | 1.321      | 0.281                     | 0.857    | 0.004 |
| Salivary gland massage       | 0.143                       | 0.031      | 0.054                     | 0.183    | 0.002 |

**Table 6. Mediation analysis summary of the Studied Elderly (n=90)**

|                                                               | B     | T     | P     | 95% CI (LL-UL) |
|---------------------------------------------------------------|-------|-------|-------|----------------|
| Oral Message                                                  |       |       |       |                |
| a1                                                            | 0.078 | 3.062 | 0.002 | 0.020-0.131    |
| b1                                                            | 0.306 | 0.458 | 0.467 | 0.942-0.436    |
| Direct Effect                                                 | 0.327 | 2.683 | 0.007 | 0.057-0.307    |
| In direct Effect                                              | 0.026 | 0.352 | 0.323 | 0.085-0.054    |
| Oral exercise-> Salivary gland massage-> Oral function health |       |       |       |                |
| <b>Total Effect</b>                                           | 0.230 | 2.704 | 0.007 | 0.053-0.276    |

Oral exercise: Independent variable

Salivary gland massage: Mediator

Oral function health: Dependent variable

a1: Oral exercise ->Salivary gland massage

b1: Salivary gland massage->Oral function health

## Discussion

Elderly individuals over the age of 65 often experience tooth loss, and the remaining teeth are frequently affected by decay or disease. Additionally, the muscles involved in mastication tend to

weaken, leading to increased fatigue during eating. The functional capacity of taste buds to differentiate flavors also diminishes with age. Furthermore, salivary secretions decrease in volume

and become more alkaline. This weakening of oral muscles with advancing age contributes to difficulties in maintaining oral functions, such as effective chewing (**Zhou, et al., 2024**). Therefore, this study aimed to appraise the effects of revitalizing oral health by oral exercise and salivary gland massage on oral function among the elderly.

The current study founded that three quarters of the studied elderly were aged between 70 to 79 years, with a mean age of  $74.4 \pm 0.4$  years and males, most of them with relatively high education . Also, most of the studied elderly were working and resided in urban areas, live with their family, and 65.6 % more than two third of them had insufficient monthly income.

Regarding route of washing of teeth, the results of the present study demonstrated that most of the studied elderly wash their teeth using rinse water, and less than half use a toothbrush. This finding may be due to these tooth brushing methods because they are considered the easiest and most comfortable tooth brushing technique for the elderly, and the roll method in cases of gingivitis. This result is confirmed with a study carried out in Korea, published by **Bok and Lee (2020)** titled “Proper tooth-brushing technique according to patient’s age and oral status,” which displayed that the most common method of washing teeth among the studied elderly is rinsing with water and a toothbrush.

Concerning total knowledge, the results of the current study revealed that older adults had poor levels, and pre-practicing Oral Exercise and Salivary Gland Massage decreased to 5.50 % post-implementation of oral exercise. This may be attributed to the high levels of illiteracy and the lack of oral health education among the elderly. Furthermore, the use of audiovisual materials such as videos and posters that encourage self-learning demonstrated effectiveness in this study by reducing oral dryness and improving overall oral health. This finding is consistent with a study by **Abd Allah, et al. (2020)**, who revealed that more than three-quarters of the studied elderly had inadequate knowledge about oral health and recommended an educational program about oral health for elderly patients. Moreover, this finding is supported by **Ki, et al. (2021)** titled “. Effect of oral health education using a mobile app (OHEMA) on the oral health and swallowing-related quality of life in community-based integrated care of the elderly” done in Korea and showed improved knowledge level after applying oral health education program among the studied elderly.

Regarding the total practices score of the studied elderly toward oral hygiene and exercise and salivary gland massage on oral function, the current finding illustrated that more than half of the studied elderly had unsatisfactory practices pre-implementation of oral hygiene and exercise and salivary gland massage which improved to the majority of them had satisfactory practice post-

implementation of oral exercise and salivary gland massage. Also, there are significant differences between total practice scores and post-implementation of Oral exercise and Salivary Gland Massage. This result might be due to the revitalizing oral health program, which has been simplified and improved to increase the awareness and interest of the elderly in oral health. This learning mode allows for greater flexibility and application of the learning information in real practice. This finding is consistent with prior studies conducted in Thailand by **Keyong, et al. (2019)** titled “Effectiveness of an oral health promotion program for the elderly in Khiri Mat district, Sukhothai province”, who displayed that improvement level of practices among the elderly in the experimental group with significantly oral health practices. Also, this finding was supported by a study by **Wongm et al. (2024)** titled “Educational programmed on knowledge, attitudes, and practices of oral care/hygiene provision by healthcare providers to older residents in long-term care institutions” in China, which illustrated that practices level were significantly higher even after the intervention group received training.

The present study demonstrated a statistically significant improvement in all oral function tests post the implementation of Oral Exercise and Salivary Gland Massage. Also, it has been improved in revitalizing oral function and health for elderly people after the implementation of oral exercise and salivary gland massage. The study

demonstrated that oral exercises effectively improve oral functions, included a reduction in dry mouth symptoms, increased salivary secretion, maintenance of normal salivary pH, adequate mouth opening size, elimination of halitosis, and restoration of normal oral motor function, which supported the research hypothesis. This result may be because oral exercises stimulate salivary secretion and oral function in older people, revitalize oral health with facial muscle exercises, tongue movements, and massage of the salivary glands. Salivary secretion increased significantly after exercising the function of stretching the lips, tongue, and cheeks. This finding is matched with previous study in India published by **Raj, et al., (2020)** titled “Effectiveness of oral exercise on oral function among the elderly who showed that there was a statistically significant difference noted in the mean scores of dry mouth symptoms, number of salivary secretions, halitosis, and oral motor before and after oral exercise. Moreover, this result is supported by a study by **Irayani, et al. (2025)** titled “Facial Exercises Effect to Increase Salivary Secretion in the Elderly” in Indonesia, which displayed that average salivary volume also increased from 1.56 ml before the exercise to 2.84 ml after the exercise.

The current study displayed that several factors have a highly significant impact on oral function among elderly participants, such as sex, chronic disease, previous oral cavity surgery, route of washing of teeth,

current medication, oral exercise, and salivary gland massage. This finding may be due to the oral cavity, which serves as a critical indicator of overall health, with its pathological conditions frequently exerting a more profound impact on systemic health. Chronic diseases, especially diabetes, impact periodontal disease, encompassing vascular alterations in the gingiva, immune responses, collagen metabolism disorders, and specific microbiological profiles within periodontal pockets. This result is the same as the line with **Fu, et al. (2025)** titled “Connection between oral health and chronic diseases” study in China, which reported a significant impact on oral function among studied participants with chronic disease. Moreover, these findings were supported by a study by **Janto, et al. (2022)** titled “Oral health among elderly, impact on life quality, access of elderly patients to oral health services and methods to improve oral health “in Romania. They showed that there were significant impact of oral exercise, techniques of washing, and oral exercises on oral function.

The current study found that demonstrated oral exercise and saliva gland massage had a direct effect on improvement of oral health function for studied elderly. These rustles were consistent with a study by **Kim, et al. (2019)** titled “Improvements in oral functions of the elderly after simple oral exercise” in Korea, and confirmed that oral exercise has a direct impact on oral health function. From the researchers point of view this may be due to oral

exercise focused on enhancing salivation and swallowing function; notably, the intervention immediately improved oral function. Oral exercise intervention with several key motions is preferred over a conventional, complex oral. The new method can be performed continuously because it is easier for elderly individuals to remember and appears to be highly utilized

### Conclusion

The study concluded that revitalizing oral health, especially oral exercise, improved the oral function of elderly people. Also, there was a significant improvement in elderly people's knowledge and reported practices after the program. Also, salivary gland massage enhanced salivary flow and reduced the risk of dryness in the mouth of elderly people.

### Recommendations

- Continuous educational program for elderly people about oral exercise, saliva gland massage, and oral hygiene practices.
- Promote regular dental check-ups for elderly people, particularly those with chronic conditions.
- Develop rehabilitation programs that incorporate oral exercises into daily routines for the elderly.
- Encourage further research on the long-term effects of oral exercise and salivary gland massage.

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**Conflict of interest**

No

**Reference**

- Abd Allah, E., Hussein, S., & Abdel-Aziz, H. (2020).** Assessment of oral health, oral health knowledge and oral self-care practices among rural elderly. *Mansoura Nursing Journal*, 7(2), 184-204.
- Abdelaziz, H., Abbas, H., Sobhy, O., & Ahmed, S. (2024).** Assessment of an educational program for oral health in a group of Egyptian elderly population: before and after study. *Egyptian Dental Journal*, 70 (4), 3045-3052.
- American dental aging, (2025).** Aging and Dental Health. <https://www.ada.org/resources/ada-library/oral-health-topics/aging-and-dental-health>
- . International Egyptian Journal of Nursing Sciences and Research**, 5(1), 189-210.
- Bashirian, S., Khoshravesh, S., Ayubi, E., Karimi - Shahanjarini, A., Shirahmadi, S., & Solaymani, P. F. (2023).** The impact of health education interventions on oral health promotion among older people: a systematic review. *BMC geriatrics*, 23(1), 548.
- Bellander, L., Andersson, P., Nordvall, D., & Hägglin, C. (2021).** Oral health among older adults in nursing homes: A survey in a national quality register, the Senior Alert. *Nursing open*, 8(3), 1262-1274.
- Bok, H. J., & Lee, C. H. (2020).** Proper tooth-brushing technique according to patient's age and oral status. *Korean Academy of Preventive Dentistry*, 16(4), 149-153.
- Chan, Y., Chu, H., Ogawa, H., & Lai, H. (2024).** Improving oral health of older adults for healthy ageing. *Journal of Dental Sciences*, 19(1), 1-7.
- Cong, X., Mao, D., Wu, L., & Yu, Y. (2024).** The role and mechanism of tight junctions in the regulation of salivary gland secretion. *Oral Diseases*, 30(1), 3-22.
- Fu, D., Shu, X., Zhou, G., Ji, M., Liao, G., & Zou, L. (2025).** Connection between oral health and chronic diseases. *MedComm*, 6(1), e70052.
- Fukai, K., Darteville, S., & Jones, J. (2022).** Oral health for healthy ageing: a people-centred and function-focused approach. *international dental journal*, 72(4 Suppl), S2
- Ibayashi, H., Fujino, Y., Pham, T. M., & Matsuda, S. (2008).** Intervention study of exercise program for oral function in healthy elderly people. *The Tohoku journal*

of experimental medicine, 215(3), 237-245.

**Irayani, S., Lesmana, H., Sitanaya, R., Ab, S., Widyastuti, N., Aida, W. N., & Achmad, H. (2025).** Facial Exercises Effect to Increase Salivary Secretion in the Eldery. *Journal of International Dental and Medical Research*, 18 (1), 291-295.

**Janto, M., Iurcov, R., Daina, M., Neculoiu, C., Venter, C., Badau, D., & Daina, G. (2022).** Oral health among elderly, impact on life quality, access of elderly patients to oral health services and methods to improve oral health: a narrative review. *Journal of personalized medicine*, 12(3), 372.

**Jeamanukulkit, S., Vichayanrat, T., & Samnieng, P. (2023).** Effects of the salivary gland massage program in older type 2 diabetes patients on the salivary flow rate, xerostomia, swallowing and oral hygiene: A randomized controlled trial. *Geriatrics & Gerontology International*, 23(7), 549-557.).

**Jiang, N., Zhao, Y., Stensson, M., & Mårtensson, J. (2022).** Effects of an integrated supportive program on xerostomia and saliva characteristics in patients with head and neck cancer radiated with a low dose to the major salivary glands: a randomized controlled trial. *BMC Oral Health*, 22 (1), 199.

**Keyong, E., Thitasomakul, S., & Tianviwat, S. (2019).** Effectiveness of an oral health promotion program for the elderly in Khiri Mat district, Sukhothai province: A randomized control trial. *Journal of International Society of Preventive and Community Dentistry*, 9(3), 225-231.

**Ki, Y., Jo, R., Cho, S., Park, E., Cho, W., & Jang, H. (2021).** Effect of oral health education using a mobile app (OHEMA) on the oral health and swallowing-related quality of life in community-based integrated care of the elderly: a randomized clinical trial. *International journal of environmental research and public health*, 18(21), 11679.

**Kim, J., Lee, Y., Lee, S., Jung, J., Ahn, J., & Kim, I. (2019).** Improvements in oral functions of elderly after simple oral exercise. *Clinical Interventions in Aging*, 915-924.

**Kim, W., Ahn, C., Lee, W., & Lee, J. (2012).** Effect of parotid gland massage on parotid gland Tc-99m pertechnetate uptake. *Thyroid*, 22(6), 611-616.

**Li, C., & Yao, A. (2021).** Socio-economic disparities in dental health and dental care utilisation among older Chinese. *International dental journal*, 71(1), 67-75.)

- Mahmoud, A., El Moshly, S., Rady, D., Radwan, A., Abbass, M., & Al Jawaldeh, A. (2022).** The effect of unhealthy dietary habits on the incidence of dental caries and overweight/obesity among Egyptian school children (A cross-sectional study). *Frontiers in Public Health*, 10, 953545.
- Murata, T., Yamaga, T., Iida, T., Miyazaki, H., & Yaegaki, K. (2002).** Classification and examination of halitosis. *International dental journal*, 52 (S5P1), 181-186.
- Raj, T., Sreelekha, B., & Manjula, A. (2020).** Effectiveness of oral exercise on oral function among the elderly. *Journal of Family Medicine and Primary Care*, 9(4), 1896-1903.
- Santoso, B., Susanto, E., Widyawati, N., Rahman, A., & Rajiani, I. (2020).** Revitalizing School Dental Health Effort through " Model 222" as a Strategy to Achieve Caries-Free Indonesia 2030. *Systematic Reviews in Pharmacy*, 11(2).
- Schoppmeier, M., Janson, M., Höfer, K., Graf, I., Wicht, J., & Barbe, G. (2024).** Use of the modified Schirmer test to measure salivary gland hypofunction/hyposalivation: Systematic review and meta-analysis. *European Journal of Oral Sciences*, e12977.
- Seo, K., & Kim, N. (2020).** Effects of oral health programmes on xerostomia in community dwelling elderly: A systematic review and met analysis. *International Journal of Dental Hygiene*, 18(1), 52-61.)
- Shirobe M, Watanabe Y, Tanaka T, Hirano H, Kikutani T, Nakajo K, Sato T, Furuya J, Minakuchi S, and Iijima K. (2022).** Effect of an Oral Frailty Measures Program on Community-Dwelling Elderly People: A Cluster-Randomized Controlled Trial. *Gerontology*; 68 (4): 377–386.
- Simarjeet, K. (2022).** Sample Size Determination (For Descriptive Studies). *Int. J. Curr. Res*, 9, 48365-48367.
- Sjögren's Foundation, (2025).** *Salivary Glands Massage Patient Education Sheet*. Retrieved January 24, 2025, from <https://sjogrens.org/sites/default/files/inline-files/Salivary%20Glands%20Massage%20Patient%20Education%20Sheet.pdf>
- Thomson, M., van der Putten, J., de Baat, C., Ikebe, K., Matsuda, I., Enoki, K., & Ling, Y. (2011).** Shortening the xerostomia inventory. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 112(3), 322-327.
- Wimardhani, S., Rahmayanti, F., Maharani, A., Mayanti, W., &**



**Thomson, M. (2021).** The validity and reliability of the Indonesian version of the Summated Xerostomia Inventory. *Gerodontology*, 38(1), 82-86.

**Wong, M., Shie, W., Kao, E., Tsoi, M., & Leung, K. (2024).** Educational program on knowledge, attitudes, and practice of oral care/hygiene provision by healthcare providers to older residents in long-term care institutions: A case-control study. *Geriatrics*, 9(1), 16.

**Wróbel-Dudzińska, D., Kubik-Komar, A., Rykwa, D., Kosior-Jarecka, E., Żarnowski, T., & Chałas, R. (2021).** The use of Schirmer strips to measure salivary and lacrimal flow in non-Sjögren patients. *Clinical oral investigations*, 25, 4107-4114.

**Zhou, Y., Zhou, L., Zhang, W., Chen, Y., She, K., Zhang, H., & Yin, X. (2024).** Prevalence and Influencing Factors of Oral Frailty in Older Adults: A Systematic Review and Meta-analysis. *Frontiers in Public Health*. 12. 1457187.

## Mothers' Preventive Measures for Preschool Children Home Accidents

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### Abstract

**Background:** Home accidents are becoming more widely acknowledged as a public health concern that can be prevented with more knowledge, safe behaviors, and home environment enhancements. **Aim:** to assess the mothers' preventive measures for preschool children home accidents. **Design:** A descriptive study. **Setting:** The study was carried out in the pediatric outpatient clinic at Fayoum General Hospital. **Sample:** A Convenience sample of 150 mothers who have children aged from 3-6 years. **Tool:** Two tools were used for data collection, **1st tool** was an interviewing questionnaire. consists of **3 parts: part 1**, mothers' demographic data, **part 2**, mothers' knowledge about home accidents and its prevention, **part 3**, mothers' practice about home accidents and its prevention. **2nd tool:** Likert scale (1932) to assess mothers' attitudes about home accidents and its prevention. **Results:** The findings revealed that (32%) of all studied samples reported satisfactory knowledge regarding home accidents prevention, (39.3% ) of all studied samples had acceptable practice regarding home accidents prevention, while (34.7%) of mothers hold a positive attitude towards home accidents prevention. **Conclusion:** A significant positive correlation is observed between knowledge and practice scores, and a strong positive correlation is found between attitude and practice scores. **Recommendation:** Enhancing mothers' awareness about safety measures and first aid to ensure a safe home environment.

**Keywords:** Home accidents, Preschool children, Preventive measures.

## Introduction

Accidents are a global public health concern that can be caused by a variety of risk factors, including the socioeconomic status of the parents, age, education, immigration status, and sociodemographic traits, all of which have been associated with a higher risk of unintentional injuries, their severity, and accidents at home. Since children spend the majority of their time at home, many of these injuries take place there (**Alkhamis & Abdulkader 2020**).

Accidents are among the top five leading causes of death in developing countries each year. In both developed and developing nations, the World Health Organization estimates that home accidents affect the lives of 830,000 children worldwide each year. risks are not limited to roads but are also prevalent within the home environment. Mortality due to home-related injuries often exceeds that caused by other diseases, as these accidents typically occur unexpectedly and without prior planning, often resulting in serious harm or death (**Brahman.,etal 2020**).

Home accidents account for 12% of deaths globally, About ten million children worldwide suffer injuries from home accidents each year, with a 10% mortality rate, the prevalence of home accidents in Iran is 44%; the

prevalence among children is estimated to be 25%; among the children who survive these accidents, some may need permanent care; and disabilities resulting from accidents not only endanger the child's health but also impact their education and other aspects of life, placing a significant financial burden on the healthcare system (**Jalilian, Shahbazi, Chenary, Mirzaei & Kakaei, 2024**)

The types of home accidents most commonly affecting preschool children at home include falls, burns, poisoning, choking, suffocation, wounds, and drowning. These incidents often occur in seemingly safe and familiar spaces, such as the kitchen, bathroom, and living room. Falls, for example, are the most frequent type of injury, and they account for a large portion of emergency room visits among young children. Despite the commonness of these incidents, many parents do not have an adequate understanding of the risks or fail to implement preventative measures effectively. This gap between awareness and action contributes significantly to the persistent nature of the problem (**Aysu, Kadan, Aral & Gürsoy, 2023**).

The preschool stage (ages 3-6) is characterized by slower physical growth and accelerated psychosocial and cognitive development. Children

become more curious and improve their communication skills, often asking "why" to support their learning. They begin to expand their environment through play, which helps them learn and build relationships. This stage also involves emotional exploration, with children alternating between stubbornness and playfulness, while developing independence and social interaction skills **(Mansur& Farlina, 2023).**

Mothers, especially those with limited resources or education, may struggle to implement preventive measures. In many cases, mothers might not have access to information or resources that would help them childproof their homes adequately. Socioeconomic factors such as low income can limit the ability to purchase safety products like childproof locks, gates, and other safety devices. Additionally, cultural attitudes and norms may influence mothers' perceptions of what constitutes a safe home environment, which could lead to underestimating the dangers posed by certain household items or practices **(Altundağ & Körükçü, 2023).**

Even though child safety is becoming more and more important, many mothers may still find it difficult to reconcile keeping their kids safe and creating an atmosphere that lets them explore and learn. A child's growth can

also be hampered by overprotection, which limits their autonomy, while improper safety precautions can lead to preventable mishaps. The likelihood of mishaps is further increased by the fact that some mothers may not realize how simple it is for preschoolers to obtain hazardous materials or items, such as cleaning supplies, prescription drugs, or sharp cooking implements. In this sense, helping mothers to practice efficient preventative measures requires both education and helpful advice **(Nsaif & Al-Joborae, 2022).**

The Community health nurses play a key role in preventing and managing home accidents in children through the three levels of prevention. At the primary level, they work to reduce risk factors by educating families about common household hazards and promoting safer home environments, such as poor housing infrastructure, the absence of safety barriers in cooking or washing areas, the use of paraffin stoves, and unsafe storage of hazardous substances. The secondary level involves early detection and prompt intervention, where nurses provide first aid training and support caregivers during home visits. At the tertiary level, they assist in rehabilitation efforts, guide families through the recovery process, and coordinate healthcare services, particularly when the child suffers from long-term

consequences or disability (**Shaban, Sharaa & Nashwan, 2023**).

### **Significance of the study**

Home accidents have become a significant public health issue worldwide, contributing to both morbidity and mortality. In Egypt, home accidents, particularly among children under the age of six, have emerged as a leading public health concern, with disabilities in this age group being the primary consequence. While accidents can occur in various environments, studies show that approximately 40% of fatalities and half of all accidents happen within or around the home, with a higher incidence among boys. (**Mahmoud & Hassan, 2021**).

Accidents are a global community health concern because they result in morbidity and mortality. Although they can occur in a variety of contexts, 40% of deaths and 50% of injuries occur in and around the house, especially among boys. One of the most important objectives for advancing children's health and wellness is preventing injuries at home. preschoolers are especially vulnerable to accidents due to their natural interest in their surroundings and their inability to comprehend the dangers of their actions,. Establishing safety limits, getting First Aid training, keeping a tight eye on things, and creating a safe

environment can all help reduce risks (**Al Anazi, Mureh, Al Sulimani, Al Arfaj, Habeeb, & Kofi, 2022**).

### **Aim of the study:**

This study aims to assess mothers' preventive measures for preschool children home accidents through:

- Assessing mothers' level of knowledge regarding preventive measures for home accidents.
- Assessing mothers' level of practices regarding preventive measures for home accidents.
- Assessing mothers' level of attitude regarding preventive measures for home accidents.

### **Research Questions:**

- 1- What is the level of mothers' knowledge regarding preventive measures for home accidents?
- 2- What is the level of mothers' practice regarding preventive measures for home accidents?
- 3 - What is the level of mothers' attitude regarding preventive measures for home accidents?
- 4- Is there a relation between mothers' knowledge and socio-demographic characteristics?
- 5- Is there a relation between mothers' practice and socio-demographic characteristics?
- 6- Is there a relation between mothers' attitude and socio-demographic characteristics?

## Subjects and Method

The subjects and methods for this study were portrayed under the following four main items:

- I- Technical design.
- II- Operational design.
- III- Administrative design.
- IV- Statistical design.

### I- Technical design:

It includes research design, setting of the study, subjects of the study, and tools for data collection.

**Research design:** A descriptive research design was utilized in this study.

**Setting:** The research study was conducted in the pediatric outpatient clinic at Fayoum General Hospital, in Fayoum governorate, Egypt, which is affiliated with the Ministry of Health. The setting was selected due to the high prevalence of clients.

### Subjects of the study:

#### Sampling

A Convenience sample of 150 mothers in the pediatric outpatient clinic at Fayoum General Hospital.

#### Sample size:

The sample was composed of about 150 mothers. According to this power analysis equation, the sample size was calculated using (Steven K. 2012)

$$n = \frac{N \times p(1-p)}{\left[ \left[ N - 1 \times \left( d^2 \div z^2 \right) \right] + p(1-p) \right]}$$

N: population target

n: sample

z: The standard score corresponding to the significance level 0.95 is equal to 1.96

d: The error rate is equal to 0.05

p: Property availability and neutral ratio = 0.50

$$n = \frac{248 \times 0.50(1-0.50)}{(248 - 1 \times (0.05)^2 \div (1.96)^2) + 0.50(1-0.50)} = 150$$

### Type of sampling:

A Conventional sampling technique was used in the study.

### Inclusion criteria:

Mothers who have children experienced home accidents aged between 3-6 years.

### Exclusive criteria:

Mothers will be excluded from the study if they have children less than 3 years or more than 6 years.

### Tools of Data Collection:

The data collection tools used to achieve the study were two tools: -

#### Tool 1: A questionnaire

It was written in plain Arabic, adjusted by the researcher, and adapted from Afefey (2015). It involved three parts:

#### Part I: Socio-demographic data:

To assess socio-demographic data for mothers, it included data about mothers' age, marital status, educational level, working conditions, economic status, etc.

#### Part II: Assessment of mothers' knowledge about home accidents and its prevention.

It was composed of **20 questions**, including (4 questions ) about the characteristics of the child's motor development, child, child's physical development, and child's mental development at pre-school age, and (16 questions) about the meaning, causes, types, and prevention of home accidents.

**Scoring system:**

For knowledge using (Correct response was scored =1 and incorrect response =0), the total score of knowledge was 20 points. A score of less than 60% (<12) was unsatisfactory, and a score equal to or more than 60% (12- 20) was satisfactory.

**Part III: Assessment of mothers' practice about home accidents and its prevention.**

It was composed of **120 questions**, Includes (55 questions) about mothers' preventive measures for medication, Insecticides, rat poison, fertilizer, Household cleaners and Food poisoning, (8 questions) about preventive measures for wound, (22 questions) about preventive measures for burn, (21 questions) about preventive measures for falls and (14 questions) about preventive measures For small objects and suffocation.

**Scoring system:**

For practice using (done =1, not done =0), the total score of reported practice was 120 points. Score of less than 60%

(<72) was not done, and scores equal to or more than 60% (72-120) were done.

**Tool 2:** An attitude rating scale was constructed. It was composed of **28 questions** Includes (6 questions) about mothers' attitude toward children's Risk of home Accidents, (5 questions) about falls, (3 questions) about burns, (3 questions) about suffocation, (2 questions) about choking, (2 questions) about drowning, and (7 questions) about poisoning.

**Scoring system:**

For attitude using (2 agree, Sometimes=1, I do not agree=0), the total score of attitude was 54 points. Scores of less than 60% (<34) were negative, and scores equal to or more than 60% (34-56) were positive.

**II-Operational design:**

Includes preparatory phase, Content validity and reliability, Pilot study, and Field work.

**A) The preparatory Phase:**

It includes reading relevant literature and learning about the study's different facets theoretically through books, papers, scientific journals, and the internet in order to gain an extensive knowledge of the study.

**b) Pilot study:**

A pilot study was conducted on 10% (15 mothers) to test the tools' viability, applicability, and clarity. The study sample included a number of pilot studies.

**c) Content validity:**

Five experts from Fayoum University's faculty of nursing reviewed the data collection tool and tested its validity: two from pediatric nursing and three from community health nursing, and the required adjustments took place.

**d) Content reliability:**

The tools' reliability was examined to ascertain how the questionnaire items connected to one another.

| Items     | Alpha Cronbach | f      | P-value |
|-----------|----------------|--------|---------|
| knowledge | 0.751          | 35.179 | <0.001* |
| Practice  | 0.826          | 28.230 | <0.001* |
| Attitude  | 0.874          | 21.411 | <0.001* |

**Alpha Cronbach Reliability Analysis of the Used Tool**

This table shows reliability in knowledge, practices, and attitude when alpha Cronbach was  $>0.5$ . The reliability was scaled as follows:  $<0.25$  weak reliability,  $0.25-0.75$  moderate reliability,  $0.75-1$  strong reliability, and  $1$  is optimum. The reliability for the total questionnaire was  $0.82$ .

**Field work:**

- Verbal approval was obtained to conduct the study after explaining the aim of the study.
- Collection of data started from the beginning of October 2023 and ended in January 2024.

- The researcher visited the selected setting in the morning shifts 2 days per week on Sunday and Wednesday, from 9 Am to 12 pm.
- Interviews were conducted with 150 mothers in an outpatient clinic who had children aged three to six.
- The time needed from each mother to complete the interview sheet was 30-35 minutes.
- It took longer to complete the structured interviewing questionnaire sheet for participants who were illiterate.

**III. Administrative Design:**

Permission from the dean of the Faculty of Nursing, Fayoum University, A written letter was acquired from the director of Fayoum General Hospital to conduct the study.

**Ethical considerations:**

The research approval was obtained from Fayoum University Supreme Committee for Scientific Research, ethical before starting the study. The researcher gained the trust and confidence of the mothers who were part of the study by explaining the purpose of the study to them. The researcher guaranteed the confidentiality and anonymity of the subjects' information. It was explained to the mothers that they can opt out of the study at any moment and that they could choose not to participate.



#### IV. Statistical Design:

The statistical presentation and analysis of the current study was carried out using the mean, standard deviation, chi-square test to compare between groups in qualitative data, and linear correlation coefficient to detect correlation between two quantitative variables in one group by (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

#### Significant level:

$>0.05$  Non significant,  $<0.05^*$  significant and  $<0.001^*$  High significant.

#### Results:

**Table (1)** : illustrates the highest percentages observed in the age group of 31-40 years, 46.7%, those with high school education, 40.0%, an equal split between housewives and employed mothers, 50.0% each, married social status of 90.7%. Concerning the residence of mothers come from urban areas 64.0% while 36.0% come from rural areas. sufficient family income 65.3%, a nuclear family type 64.0%, and households with a crowding rate of 1 to 2 individuals per room 66.0%.

**Table (2):** shows that the highest percentages are in children aged from 5 to 6 years, 50.7%, male gender, 57.3%, and having 1 to 2 brothers, 56.0%.

**Figure (1):** Indicated that only 32% of the studied sample reported

satisfactory knowledge about child safety measures.

**Figure (2)** shows that 39.3% of mothers have implemented safety practices, while 60.7% have not, indicating a significant portion of caregivers may need further education or support in implementing child safety measures.

**Figure (3)** indicates that 34.7% of mothers hold a positive attitude towards child safety measures, while 65.3% have a negative attitude, suggesting a significant portion may require additional education or support to promote a proactive approach to child safety.

**Table (3):** presents the distribution of total knowledge among mothers based on various socio-demographic characteristics. findings include a significant association between mothers' age and knowledge level ( $\chi^2 = 19.178$ ,  $p < 0.001^*$ ), with mothers aged 20-30 years having the highest satisfactory knowledge percentage, 56.8%. Moreover, there is a substantial association between education and knowledge level ( $\chi^2 = 46.691$ ,  $p < 0.001^*$ ), with university-educated mothers showing the highest percentage of satisfactory knowledge, 68.0%. Additionally, there is a significant association between mothers' occupation and knowledge level ( $\chi^2 = 17.647$ ,  $p < 0.001^*$ ), with

working mothers having a higher percentage of satisfactory knowledge, 48.0%, compared to housewives, 16.0%. Furthermore, a notable association is observed between residence and knowledge level ( $\chi^2 = 31.047$ ,  $p < 0.001^*$ ), with urban mothers having a higher percentage of satisfactory knowledge, 47.9%, compared to rural mothers, 3.7%.

**Table (4):** showed that there was a statistically significant relation between mothers' practice level and socio-demographic characteristics ( $p = p < 0.001$ ). Key findings include a significant association between mothers' age and practice level ( $\chi^2 = 15.474$ ,  $p < 0.001^*$ ), with mothers aged 20-30 years showing the highest percentage of completed practices, 63.6%. Additionally, a substantial association is observed between education and practice level ( $\chi^2 = 37.912$ ,  $p < 0.001^*$ ), with university-educated mothers having the highest percentage of completed practices, 72.0%. The table reveals a significant association between mothers' occupation and practice level ( $\chi^2 = 20.367$ ,  $p < 0.001^*$ ), where working mothers have a higher percentage of completed practices, 57.3%, compared to housewives, 21.3%. Furthermore, a notable association is found between residence and practice level ( $\chi^2 = 24.589$ ,  $p < 0.001^*$ ), with urban

mothers having a higher percentage of completed practices, 54.2%, compared to rural mothers, 13.0%. No significant associations are observed between social status, family income, and practice level.

**Table (5):** indicated that there was a significant relation between mothers' attitude and their socio-demographic characteristics ( $p < 0.001^*$ ). Notable findings include a significant association between mothers' age and attitude ( $\chi^2 = 21.924$ ,  $p < 0.001^*$ ), with mothers aged less than 20 years having the highest percentage of positive attitudes, 66.7%. A significant association is also observed between education and attitude ( $\chi^2 = 38.972$ ,  $p < 0.001^*$ ), with university-educated mothers having the highest percentage of positive attitudes, 68.0%. The table reveals a significant association between mothers' occupation and attitude ( $\chi^2 = 16.954$ ,  $p < 0.001^*$ ), where working mothers have a higher percentage of positive attitudes, 50.7% compared to housewives, 18.7%. Furthermore, a significant association is found between residence and attitude ( $\chi^2 = 24.048$ ,  $p < 0.001^*$ ), with urban mothers having a higher percentage of positive attitudes, 49.0%, compared to rural mothers, 9.3%. But no significant associations are observed between social status, family income, and attitude ( $p = 0.776$ , 0.774).

**Table (6):** displays correlation coefficients and p-values for the relationships between knowledge, practice, and attitude scores. **A significant positive correlation is observed between knowledge and practice scores** ( $r = 0.427, p < 0.001^*$ ), indicating that individuals with higher knowledge scores tend to exhibit better practices related to the studied subject. Similarly, **a strong positive correlation is found between attitude and practice scores** ( $r = 0.425, p < 0.001^*$ ), suggesting that individuals with positive attitudes are more likely to adopt better practices. These findings emphasize the interconnectedness of knowledge, attitude, and practice in the context of the studied subject and underscore the importance of considering all three aspects when designing interventions or educational programs.

**Table (1): Socio-demographic characteristics of Mothers Participating in the Study (N=150)**

| Items                                          | N          | %    |
|------------------------------------------------|------------|------|
| Mother's age                                   |            |      |
| Less than 20 years                             | 6          | 4.0  |
| From 20 – 30 years                             | 44         | 29.3 |
| From 31-40 years                               | 70         | 46.7 |
| More than 40 years                             | 30         | 20.0 |
| Mean ±SD                                       | 32.47±5.62 |      |
| Level of education                             |            |      |
| Illiteracy                                     | 12         | 8.0  |
| Read and write                                 | 12         | 8.0  |
| High school                                    | 60         | 40.0 |
| University                                     | 50         | 33.3 |
| Basic education                                | 16         | 10.7 |
| Mother's occupation                            |            |      |
| Housewife                                      | 75         | 50.0 |
| Works                                          | 75         | 50.0 |
| Social status                                  |            |      |
| Married                                        | 136        | 90.7 |
| Divorced                                       | 10         | 6.7  |
| Widow                                          | 4          | 2.7  |
| Residence                                      |            |      |
| Rural                                          | 54         | 36.0 |
| Urban                                          | 96         | 64.0 |
| Family income                                  |            |      |
| Insufficient                                   | 34         | 22.7 |
| Sufficient                                     | 98         | 65.3 |
| Sufficient and can be saved                    | 18         | 12.0 |
| Family type                                    |            |      |
| the nucleus of the husband, wife, and children | 96         | 64.0 |
| Extended “family home”                         | 50         | 33.3 |
| A family with only one parent                  | 4          | 2.7  |
| number of family members                       |            |      |

|                                     |    |      |
|-------------------------------------|----|------|
| 2 to 3                              | 32 | 21.3 |
| 3 to 5                              | 82 | 54.7 |
| 5 to 7                              | 26 | 17.3 |
| More than 7                         | 10 | 6.7  |
| <b>Number of rooms in the house</b> |    |      |
| One room                            | 4  | 2.7  |
| Two rooms                           | 32 | 21.3 |
| Three rooms                         | 70 | 46.7 |
| Four rooms                          | 44 | 29.3 |
| <b>Crowding rate</b>                |    |      |
| From 1 to 2                         | 99 | 66.0 |
| From 2 to 4                         | 46 | 30.7 |
| More than 5                         | 5  | 3.3  |

**Table (2): Demographic Characteristics of Children in the Study Population (N=150)**

| Items              | N        | %    |
|--------------------|----------|------|
| Child's age        |          |      |
| From 3 to 4 years  | 74       | 49.3 |
| From 5 to 6 years  | 76       | 50.7 |
| Mean±SD            | 4.42±1.5 |      |
| Child's gender     |          |      |
| Male               | 86       | 57.3 |
| Female             | 64       | 42.7 |
| Number of brothers |          |      |
| From 1 to 2        | 84       | 56.0 |
| From 3 to 4        | 58       | 38.7 |
| 5 and more         | 8        | 5.3  |

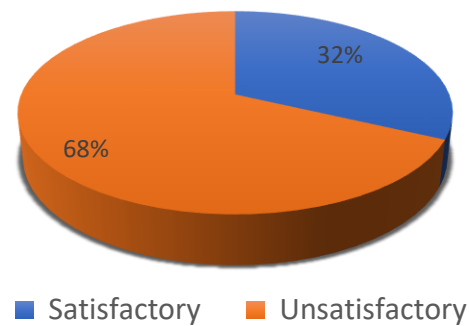


**Figure (1): Knowledge of Study Sample About Child Safety Measures Among Mothers (N=150)**

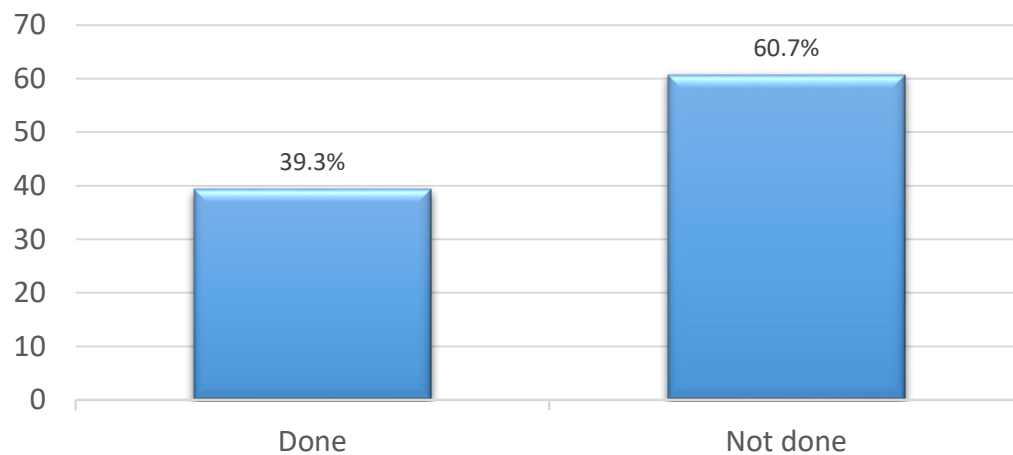


**Figure (2): Mothers' Practice in Child Safety Measures(N=150)**

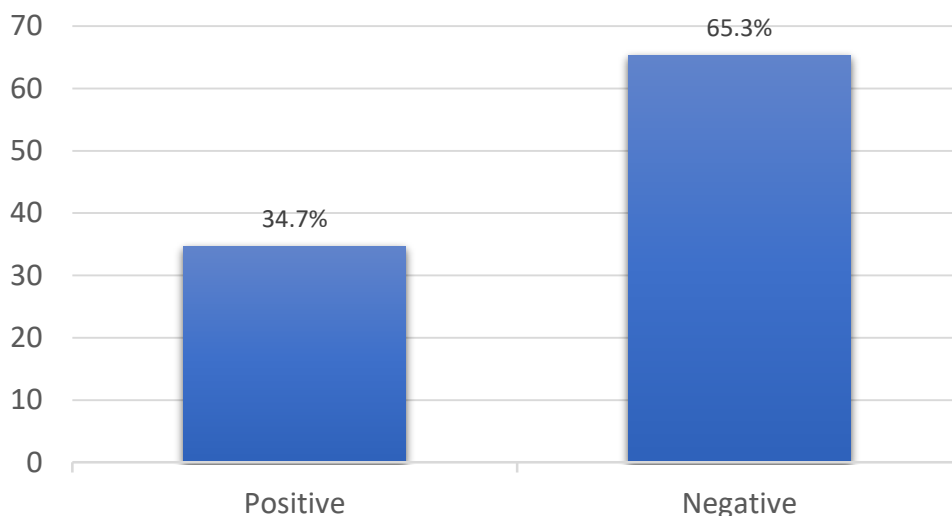


**Figure (3): Mothers' Attitude Towards Child Safety Measures(N=150)**

**Table (3): Relation Between Mothers' Knowledge Based on Socio-Demographic Characteristics (N=150)**

| Items               | Total knowledge |      |                |       |                |         |
|---------------------|-----------------|------|----------------|-------|----------------|---------|
|                     | Satisfactory    |      | Unsatisfactory |       | Chi-square     |         |
|                     | N               | %    | N              | %     | X <sup>2</sup> | P-value |
| Mother's age        |                 |      |                |       |                |         |
| Less than 20 years  | 2               | 33.3 | 4              | 66.7  | 19.178         | <0.001* |
| From 20 - 30 years  | 25              | 56.8 | 19             | 43.2  |                |         |
| From 31-40 years    | 17              | 24.3 | 53             | 75.7  |                |         |
| More than 40 years  | 4               | 13.3 | 26             | 86.7  |                |         |
| Level of education  |                 |      |                |       |                |         |
| Illiteracy          | 0               | 0.0  | 12             | 100.0 | 46.691         | <0.001* |
| Read and write      | 2               | 16.7 | 10             | 83.3  |                |         |
| Basic education     | 4               | 25.0 | 12             | 75.0  |                |         |
| High school         | 8               | 13.3 | 52             | 86.7  |                |         |
| University          | 34              | 68.0 | 16             | 32.0  |                |         |
| Mother's occupation |                 |      |                |       |                |         |
| housewife           | 12              | 16.0 | 63             | 84.0  | 17.647         | <0.001* |
| works               | 36              | 48.0 | 39             | 52.0  |                |         |
| Social status       |                 |      |                |       |                |         |
| Married             | 43              | 31.6 | 93             | 68.4  | 0.623          | 0.732   |
| divorced            | 3               | 30.0 | 7              | 70.0  |                |         |
| Widow               | 2               | 50.0 | 2              | 50.0  |                |         |

| Residence                   |    |      |    |      |        |         |
|-----------------------------|----|------|----|------|--------|---------|
| Rural                       | 2  | 3.7  | 52 | 96.3 | 31.047 | <0.001* |
| Urban                       | 46 | 47.9 | 50 | 52.1 |        |         |
| Family income               |    |      |    |      |        |         |
| Insufficient                | 11 | 32.4 | 23 | 67.6 | 0.481  | 0.786   |
| Sufficient                  | 30 | 30.6 | 68 | 69.4 |        |         |
| Sufficient and can be saved | 7  | 38.9 | 11 | 61.1 |        |         |

**Table (4): Relation of Total Practice Based on Socio-Demographic Characteristics (N=150)**

| Items                       | Total practice |      |          |       |                |         |
|-----------------------------|----------------|------|----------|-------|----------------|---------|
|                             | Done           |      | Not done |       | Chi-square     |         |
|                             | N              | %    | N        | %     | X <sup>2</sup> | P-value |
| Mother's age                |                |      |          |       |                |         |
| Less than 20 years          | 2              | 33.3 | 4        | 66.7  | 15.474         | <0.001* |
| From 20 - 30 years          | 28             | 63.6 | 16       | 36.4  |                |         |
| From 31-40 years            | 20             | 28.6 | 50       | 71.4  |                |         |
| More than 40 years          | 9              | 30.0 | 21       | 70.0  |                |         |
| Level of education          |                |      |          |       |                |         |
| Illiteracy                  | 0              | 0.0  | 12       | 100.0 | 37.912         | <0.001* |
| Read and write              | 2              | 16.7 | 10       | 83.3  |                |         |
| Basic education             | 6              | 37.5 | 10       | 62.5  |                |         |
| High school                 | 15             | 25.0 | 45       | 75.0  |                |         |
| University                  | 36             | 72.0 | 14       | 28.0  |                |         |
| Mother's occupation         |                |      |          |       |                |         |
| Housewife                   | 16             | 21.3 | 59       | 78.7  | 20.367         | <0.001* |
| Works                       | 43             | 57.3 | 32       | 42.7  |                |         |
| Social status               |                |      |          |       |                |         |
| Married                     | 54             | 39.7 | 82       | 60.3  | 0.564          | 0.754   |
| Divorced                    | 3              | 30.0 | 7        | 70.0  |                |         |
| Widow                       | 2              | 50.0 | 2        | 50.0  |                |         |
| Residence                   |                |      |          |       |                |         |
| Rural                       | 7              | 13.0 | 47       | 87.0  | 24.589         | <0.001* |
| Urban                       | 52             | 54.2 | 44       | 45.8  |                |         |
| Family income               |                |      |          |       |                |         |
| Insufficient                | 12             | 35.3 | 22       | 64.7  | 0.438          | 0.803   |
| Sufficient                  | 39             | 39.8 | 59       | 60.2  |                |         |
| Sufficient and can be saved | 8              | 44.4 | 10       | 55.6  |                |         |



**Table (5): Relation of Total attitude Based on Socio-Demographic Characteristics(N=150)**

| Items                       | Total attitude |      |          |       |                |         |
|-----------------------------|----------------|------|----------|-------|----------------|---------|
|                             | Positive       |      | Negative |       | Chi-square     |         |
|                             | N              | %    | N        | %     | X <sup>2</sup> | P-value |
| Mother's age                |                |      |          |       |                |         |
| Less than 20 years          | 4              | 66.7 | 2        | 33.3  | 21.924         | <0.001* |
| From 20 - 30 years          | 26             | 59.1 | 18       | 40.9  |                |         |
| From 31-40 years            | 17             | 24.3 | 53       | 75.7  |                |         |
| More than 40 years          | 5              | 16.7 | 25       | 83.3  |                |         |
| Level of education          |                |      |          |       |                |         |
| Illiteracy                  | 0              | 0.0  | 12       | 100.0 | 38.972         | <0.001* |
| Read and write              | 2              | 16.7 | 10       | 83.3  |                |         |
| Basic education             | 4              | 25.0 | 12       | 75.0  |                |         |
| High school                 | 12             | 20.0 | 48       | 80.0  |                |         |
| University                  | 34             | 68.0 | 16       | 32.0  |                |         |
| Mother's occupation         |                |      |          |       |                |         |
| Housewife                   | 14             | 18.7 | 61       | 81.3  | 16.954         | <0.001* |
| Works                       | 38             | 50.7 | 37       | 49.3  |                |         |
| Social status               |                |      |          |       |                |         |
| Married                     | 47             | 34.6 | 89       | 65.4  | 0.512          | 0.774   |
| Divorced                    | 3              | 30.0 | 7        | 70.0  |                |         |
| Widow                       | 2              | 50.0 | 2        | 50.0  |                |         |
| Residence                   |                |      |          |       |                |         |
| Rural                       | 5              | 9.3  | 49       | 90.7  | 24.048         | <0.001* |
| Urban                       | 47             | 49.0 | 49       | 51.0  |                |         |
| Family income               |                |      |          |       |                |         |
| Insufficient                | 13             | 38.2 | 21       | 61.8  | 0.508          | 0.776   |
| Sufficient                  | 32             | 32.7 | 66       | 67.3  |                |         |
| Sufficient and can be saved | 7              | 38.9 | 11       | 61.1  |                |         |

**Table (6): Correlation Analysis between Knowledge, Practice, and Attitude Scores**

|                       | Knowledge score |         | Practice score |         |
|-----------------------|-----------------|---------|----------------|---------|
|                       | r               | P-value | r              | P-value |
| <b>Practice score</b> | 0.427           | <0.001* |                |         |
| <b>Attitude score</b> | 0.784           | <0.001* | 0.425          | <0.001* |

## Discussion

### Part I: Assessment of Mothers' Socio-demographic Characteristics

As regards Mothers' socio- demographic characteristics the present study shows that the mean age of the studied mothers was  $32.47 \pm 5.62$  (**Table 1**). This finding agreed with (**Çetintaş, Akgün, Kostak , Cumur, 2022**) who studied The safety measures against home accidents of mothers of 0-6 age group children and related factors found that the mean age of the mothers included in the study was  $30.13 \pm 5.60$  years.

Regards educational level, above two quarters of the study sample received a high school education (**Table 1**). This finding agreed with (**Doğan & Öztürk 2021**) who studied the prevention of non-traumatic home accidents among children aged 0-6 year. They found that two quarters of the study sample had received a high school education.

Regarding the mother's occupation, half of the study sample had an equal split between housewives and employed

mothers (**Table 1**). This result agreed with (**Gouda, Sorour, & Abdelaziz, 2022**), who studied knowledge and practice of mothers regarding first aid of home injuries among preschool children, reporting that half of the study sample were working.

Regarding types of families, the current study found that about two-thirds of the study sample live in nuclear families (**Table 1**). This result disagreed with (**Nageh, El-Raouf, Samar, El-Mouty Samia., 2020**) who studied mothers 'knowledge and subjective practice toward most common domestic injuries among under-five children. Nearly less than two quarter of the studied sample had lived in a nuclear family. From the researcher's point of view, it may be due to the sociocultural characteristics of the region where the research was conducted.

Regarding the child's age, this study shows that the mean age of the children was  $4.42 \pm 1.5$ , with more than half in boys (**Table 2**). This result agrees with(

**Heidari, Naseri Akhavan, Rafiee, ., Rajaei& Pouyanfar 2022)** who study the epidemiological pattern of childhood injuries and accidents among Iranian children and report that the mean age is  $2.5 \pm 1.5$  years, with a higher rate more than half observed in boys. From the researcher's point of view, this may be due to boys being more physically active, curious, and liking hard games, and taking more risks than girls.

**According to question (1),** As regards to Knowledge of Study Sample About Child preventive Measures Among Mothers this study found that about one third of the study sample had satisfactory knowledge regarding accident prevention (**figure 1**) this result disagreed with ( **Divya Deepa, Malagi, & Yattoo 2024**) who studied Child Safety and Accident Prevention: A Study on Mothers' Knowledge and Practices in Bengaluru Communities report that majority of mothers have a satisfactory understanding of child safety and accident prevention. From the researcher's point of view, this may be due to mothers' level of education and their work time, which could be factors that affect mothers' health-related behavior with their children.

**According to question (2),** Regarding Mothers' reported practice Towards Child preventive Measures the study found that above half of the study sample don't have good practice towards child

preventive measures (**Figure 2**). This result disagreed with (**Kadke, Chunduri&**

**Kudpi 2020**) who studied A study on home safety practices to prevent childhood injuries among mothers, reporting that the majority of the study sample had a good level of practice in injury prevention. From the researcher's point of view, this may be due to a lack of access to proper education and training.

**According to question (3),** Regarding mothers' attitude toward child Safety Measures, the study found that nearly two-quarters of the study sample have a positive attitude toward child preventive measures (**Figure 3**). This result agreed with ( **Al-Hajj, El Haj, Chaaya, Sharara Chami& Mehmood, 2023**) who studied Child injuries in Lebanon: assessing mothers' injury prevention knowledge attitude and practices. report that two quarters of the study sample have a good attitude toward the prevention of home accidents. From the researcher's point of view, this could be a sign of a lack of understanding or a poor internalization of the concepts of preventing accidents at home among certain mothers.

**Statistical relations according to research questions regarding to Relation between Mothers' Knowledge Based on Socio-Demographic Characteristics (Research question 4).**

**According to question (4),** Regarding the relationship between mothers' socio-demographic data and their knowledge, a statistically significant relationship was found between the mother's knowledge and her age, education, occupation, and place of residence; however, there was no statistically significant relationship between family income and social status. These findings were in line with those of **(John, 2021)** who study Knowledge, attitude and practices of mothers towards home accident among children, and discovered a statistically significant relationship between the mother's knowledge and her age, education, occupation, and place of residence, but not between family income. From the researcher's point of view, the findings imply that factors other than employment status may be linked to accidents; working mothers leave their children under the supervision of others, and caregivers' skills and attentiveness may be a more important issue.

**As regards the Relation of Total Practice Based on socio-demographic characteristics (Research question no 5).**

**According to question (5),** Regarding the relationship between mother's socio demographic data and their practice, a statistically significant relationship was found between the mother's practice and her age, education, occupation, and place of residence while no statistically

relation between family income this finding agreed with **(Jaber Qasim Jaber, & Hashem, 2021)** who study Knowledge, Attitude And Practices Of Mothers Towards Home Accidents Among Children In Holy Kerbala City. Reported a statistically significant relationship between the mother's practice and her age, education, occupation, and place of residence while disagreed to relation between practice and family income. From the researcher's point of view, this may be due to other factors, such as educational level, which have a greater impact on practices than income, as the degree of knowledge increases with higher education.

**As regards to Relation of Total attitude based on Socio-Demographic Characteristics (Research question no 6).**

**According to question (6),** Regarding the relation between mother's socio demographic data and their attitude, a statistically significant relation was found between the mother's attitude and her age, education, occupation and place of residence this study agreed with **(Anwar, Mostafa, & Elareed 2021)** who studied Maternal knowledge and attitude about home related injuries in children under five years reported that there is a positive relation between mother's attitude and her age, education, occupation, and place of residence while

disagreed in relation between attitude and family income. From the researcher's point of view, mothers' attitudes regarding home accident prevention are significantly influenced by sociodemographic characteristics like age, education, and occupation. On the other hand, variables like marital status and family income may not have the expected direct impact on mothers' attitudes.

### **Regards to Correlation Analysis between Knowledge, Practice, and Attitude Scores**

this study found that A significant positive correlation is observed between knowledge and practice scores disagreed with **(Wang, Klunklin & Jintrawet 2021)** who studied Knowledge, attitude, and practices of unintentional home injury prevention among parents of preschoolers in the People's Republic of China report that no relationship between parent's knowledge and practice on unintentional home injury prevention among preschoolers while there is a strong positive correlation is found between attitude and practice scores agreed with **(Wang,etal.,2021)** who report that there is positive correlation between parent's attitude and practice on unintentional home injury prevention among preschoolers this may be due to the level of knowledge leading to higher level of practice.

### **Conclusion:**

Based on the current study's findings and responses to the research questions, it was determined that nearly above one quarter of the study sample had satisfactory knowledge regarding home accidents prevention, less than two quarter of the study sample practiced acceptable child safety measures, and that nearly two quarter of the study sample had positive attitude toward home accident prevention.

### **Recommendation:**

**The study recommended the following:**

1. Health education initiatives to enhance mothers' awareness, behavior, and mindset on accident prevention, first aid, and home accidents.
2. Educating mothers on first aid and safety precautions to provide a secure home environment.
3. Additional research is necessary to evaluate the impact of implementing training programs on parents and children in order to lower the frequency and seriousness of home accidents.

### **References:**

**Al Anazi, R., Mureh, B., Al Sulimani, H., Al Arfaj, G., Habeeb, K., & Kofi, M. (2022).** Impact of health education on maternal knowledge regarding choking prevention and first aid in children, Riyadh, Saudi Arabia. Age (Mean, SD), 30, 5-18.

- Al-Hajj, S., El Haj, R., Chaaya, M., Sharara-Chami, R., & Mehmood, A. (2023).** Child injuries in Lebanon: assessing mothers' injury prevention knowledge attitude and practices. *Injury epidemiology*, 10(1), 27.
- Alkhamis, K. N., & Abdulkader, R. S. (2020).** Assessment of unintentional childhood injuries and associated factors in the pediatric clinics of a tertiary care hospital in Riyadh, Saudi Arabia. *Journal of family and community medicine*, 27(3), 168-177.
- Altundağ, S., & Körükçü, Ö. (2023).** Risk reduction education to prevent Preschool Children's Home accidents: a pilot study. *Disaster medicine and public health preparedness*, 17, e115.
- Anwar, M. M., Mostafa, Z. M., & Elareed, H. R. (2021).** Maternal knowledge and attitude about home related injuries in children under five years. *The Egyptian Family Medicine Journal*, 5(2), 91-105.
- Aysu, B., Kadan, G., Aral, N., & Gürsoy, F. (2023).** Investigation of the effectiveness of the training given on home accidents and safety precautions. *European Early Childhood Education Research Journal*, 31(4), 592-604.
- Brahaman, S., Chhetri, S., Banik, T. D., HA, V., Adhikari, S., Yadav, P., & PV, S. (2020).** Knowledge regarding Prevention of Home Accidents among mothers of under five children in Pediatric Department, Bangalore. *RGUHS Journal of Nursing Sciences*, 10(2).
- Çetintaş, İ., Akgün Kostak, M., & Cumur, E. (2022).** The safety measures against home accidents of mothers of 0-6 age group children and related factors. *J Educ Res Nurs*, 19(4), 429-36.
- Divya Deepa, H. P., Malagi, V., & Yattoo, S. Q. (2024).** Child Safety and Accident Prevention: A Study on Mothers' Knowledge and Practices in Bengaluru Communities. *Saudi J Nurs Health Care*, 7(12), 414-419.
- Doğan, M., & Öztürk, M. A. (2021).** The prevention of non-traumatic home accidents among children aged 0-6 year. *GÜNcel Pediatri*, 19(1), 23-29
- Farouk Mahmoud, S., & Awadin Ali Hassan, L. (2021).** Effect of educational interventions regarding home accidents among children under age of six on mothers in rural areas. *Egyptian journal of health care*, 12(3), 1632-1652.
- Gouda, A. A., Sorour, A. S., & Abdelaziz, M. M. (2022).** Knowledge and Practice of Mothers Regarding First aids of Home Injuries Among Preschool Children. *Zagazig Nursing Journal*, 18(2), 206-218.
- Heidari, S. M., Naseri, M., Akhavan, H., Rafiee, M., Rajaei, M., & Pouyanfar, A. (2022).** The Epidemiological Pattern of Childhood

Injuries and Accidents among Iranian Children: A Systematic Review. Health Providers, 2(2), 65-75.

**Jaber Qasim Jaber, D. J., & Hashem, H. J. (2021).** Knowledge, Attitude And Practices Of Mothers Towards Home Accidents Among Children In Holy Kerbala City. Journal of Cardiovascular Disease Research, 12(3), 2845-2854.

**Jalilian, M., Shahbazi, S., Chenary, R., Mirzaei, A., & Kakaei, H. (2024).** Effect of a Health Education Program on Empowering Rural Mothers in Preventing Home Accidents of Children Under Five. Health Education and Health Promotion, 12(1), 125-130.

**John, N. (2021).** A Study to Assess the Knowledge of Mothers of Preschoolers regarding Home Accidents and Their Prevention in a Selected Rural Community of Moradabad, UP. Int. J. Nurs. Midwif. Res, 5(1).

**Kadke, S. A., Chunduri, S., & Kudpi, V. S. (2020).** A study on home safety practices to prevent childhood injuries among mothers. Journal of Nepal Paediatric Society, 40(3), 172-177.

**Mansur, A. R., & Farlina, M. (2023).** Growth And Development Of

Preschool-Aged Children.

**Nageh, H. M., El-Raouf, A., Samar, E. L., El-Mouty, A., & Samia, M. (2020).** MOTHERS' KNOWLEDGE AND SUBJECTIVE PRACTICE TOWARD MOST COMMON DOMESTIC INJURIES AMONG UNDER-FIVE CHILDREN. Mansoura Nursing Journal, 7(1), 19-35.

**Nsaif, A. K., & Al-Joborae, S. F. F. (2022).** Medical and social analysis of preschool children under the age of six years at secondary and tertiary care after home accidents in Hilla City. Medical Journal of Babylon, 19(2), 169-175.

**Shaban, M. M., Sharaa, H. M., & Nashwan, A. J. (2023).** Effect of community-based intervention on knowledge and practice of rural mothers toward children home injuries. International Journal of Africa Nursing Sciences, 19, 100593.

**Wang, Z., Klunklin, P., & Jintrawet, U. (2021).** Knowledge, attitude, and practices of unintentional home injury prevention among parents of preschoolers in the People's Republic of China. Nursing Journal CMU, 48(4), 67-79.





## Effect of Interactive Online Preventive Program Regarding Osteoporosis on Female Students' Knowledge, Health belief, Self-efficacy and Behavior

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### Abstract

**Background:** Osteoporosis, a common chronic disease associated with higher mortality and lower quality of life, is a major global health issue but largely preventable with early intervention. Adolescence is a key period for prevention, as lifestyle choices made during this stage greatly influence bone development. Promoting knowledge, positive health beliefs, and protective behaviors during adolescence is crucial for lifelong bone health. **Aim:** The aim of the study was to evaluate the effect of interactive online preventive program regarding osteoporosis among female students at Suez Canal University. **Subjects and Method:** A quasi-experimental one-group pretest-posttest design was employed in this study, which was conducted at Suez Canal University across four randomly selected faculties. A total of 192 female students were selected from these faculties using a multistage stratified random sampling technique. **Tools:** One tool was used to collect the data: a self-administered questionnaire comprising five parts; Part I: Demographic data, Part II: Osteoporosis Knowledge Test, Part (III): Osteoporosis health belief scale, Part (IV): Osteoporosis Self-Efficacy Scale, Part (V): Osteoporosis Preventing Behaviors Survey. **Results:** A statistically significant improvement ( $p < .001$ ) was found in female students' knowledge, health beliefs, self-efficacy, and behaviors related to osteoporosis after participating in the interactive online preventive program, including greater perceived benefits of calcium and vitamin D intake, fewer barriers to healthy behaviors, and higher health motivation. **Conclusion:** The program revealed strong positive correlations among health beliefs, knowledge, self-efficacy, and preventive practices. **Recommendations:** Continue and regularly update the interactive osteoporosis prevention program to reinforce knowledge and sustain healthy behaviors among students.

**Keywords:** Behavior, Health belief, Knowledge, Osteoporosis, Self-efficacy.

## Introduction

Osteoporosis (OP) represents a significant and increasingly concerning public health challenge that can be effectively prevented through the adoption of healthy lifestyle practices during adolescence (*Khazaeian, Sanavi, Ansari & Mirshekari, 2021*).

Osteoporosis is a chronic condition characterized by a decrease in bone density and deterioration of bone microarchitecture, leading to compromised bone strength and an elevated risk of fractures. Although it affects people of all age groups, genders, and ethnicities, Caucasians (white people) and older people and women experience it more frequently (*Moradnejad et al., 2020*).

This disease, often referred to as the "silent thief," is a progressively advancing disorder characterized by the deterioration of both bone mass and structural integrity. It progresses insidiously, typically without noticeable symptoms, and often becomes clinically apparent only through fractures in the absence of preventive measures or treatment. The hazard of osteoporosis lies in its propensity to cause fractures of the hip, vertebrae, and wrist, which may result in permanent disability (*Sekiya, 2023*). Multiple predisposing factors can potentiate the risk of developing

osteoporosis. Non-modifiable risk factors include Caucasian ethnicity and a positive family history of the disease, while modifiable factors encompass inadequate dietary intake of calcium and vitamin D, insufficient physical activity, low body mass index, excessive alcohol consumption, and tobacco use (*Özmen et al., 2024*).

Though osteoporosis remains incurable, preventive measures can effectively mitigate its development across the lifespan. These preventive strategies encompass regular physical activity alongside optimal consumption of calcium and vitamin D, and implementation of fall prevention techniques. Cessation of alcohol consumption and tobacco use contributes significantly to risk reduction. Furthermore, regular participation in weight-bearing physical activities, including exercises like running and stair ascent, aerobics, isometric exercises, and swimming—for a minimum duration of 30 minutes daily serves as a valuable preventive measure against bone density deterioration (*Valenzuela-Martínez, Ramírez-Expósito, Carrera-González, & Martínez-Martos, 2023*).

Adolescence represents a pivotal developmental phase characterized by substantial biological, cognitive, and social transformations. During this

critical period, individuals attain significant cognitive maturation, enabling complex reasoning capabilities. This developmental window constitutes a formative interval during which both health-promoting and health-compromising behavioral patterns crystallize, frequently persisting throughout the lifespan. Given that structured educational engagement represents a defining characteristic of adolescent experience, it presents an optimal vehicle for behavioral intervention implementation. Since education is an important characteristic of them, it can be used as a useful tool to encourage protective behavior at this age (*Khazaeian et al, 2021*).

Increasing factual health knowledge, addressing incorrect health beliefs, and promoting bone-protective practices are effective measures for building and supporting bone resilience throughout life a person's life, especially in adolescent females who are believed to be not only more vulnerable but are also future mothers. Consequently, maternal health metrics exhibit substantial influence on familial health indicators through intergenerational pathways (*Chan, Mohamed, Ima-Nirwana, & Chin, 2018*).

The Health Belief Model (HBM) represents a well-established theoretical framework extensively

utilized to elucidate health-related behavioral patterns. Interventions structured according to HBM principles demonstrate efficacy and cost-effectiveness in augmenting knowledge acquisition and behavioral implementation necessary for facilitating sustainable lifestyle modifications, including enhanced calcium consumption and participation in weight-bearing physical activities—both critical components for prevention of osteoporosis (*Ali, Mekhamier, & El Sayed, 2020*). Therefore, the Health Belief Model can serve as a framework for osteoporosis prevention by focusing on two key strategies: enhancing awareness about osteoporosis and promoting preventive actions and self-efficacy, which support attitude shifts and behavior change. (*Ahmed, Elsayied, Mohamed, & Salama, 2022*).

### **Significance of the study**

Preventing osteoporosis in adolescents, particularly girls, is of paramount importance for lifelong skeletal health. Adolescence represents a critical window for bone mass accumulation, with approximately 40% of total adult bone mass acquired during this period, (*Tian & Yu, 2022*). Globally, osteoporosis affects a significant portion of the population. Epidemiological data demonstrate that osteoporotic fractures impact

approximately 33.3% of females and 20% of males over the age of 50 during their remaining lifespan. Specifically, within the Egyptian demographic context, research indicates osteoporosis prevalence rates of 28.4% among females and 21.9% among males. Additionally, osteopenia has been documented in 53.9% of females and 26% of males according to established diagnostic criteria (*El Miedany, Gadallah, & Toth, 2022*).

A systematic review by *Matsumoto, Hagino, Wada, and Kobayashi (2022)*, found that lifestyle interventions during adolescence, incorporating sufficient intake of calcium and vitamin D, as well as engaging in regular weight-bearing exercise, can increase peak bone mass by 5-10%. This increase translates to a potential 50% reduction in fracture risk later in life, underscoring the long-term benefits of early prevention strategies (*Matsumoto et al., 2022*).

### **Aim of the study**

The aim of the study was to evaluate the effect of interactive online preventive program regarding osteoporosis among female students at Suez Canal University.

### **Objectives**

- Assess knowledge, health belief, self-efficacy and behavior regarding osteoporosis prevention among

female students (Pre\Post) implementation of the program.

- Design interactive online preventive program regarding osteoporosis among female students according to their needs.
- Implement interactive online preventive program regarding osteoporosis among female students according to their needs.
- Evaluate interactive online preventive program among female's knowledge, health belief, self-efficacy and behavior regarding prevention of osteoporosis.

### **Research hypothesis**

**H0:** There is no significant difference in knowledge, health belief, self-efficacy, and behavior regarding osteoporosis among female students pre- and post-participation in the interactive online preventive program.

**H1:** There is a significant difference in knowledge, health beliefs, self-efficacy, and behaviors regarding osteoporosis among female students pre- and post-participation in the interactive online preventive program.

### **Subjects and Methods**

**Study design:** A one-group quasi-experimental design with (pre-post) evaluation was used in the study.

**Setting:** This study was applied at Suez Canal University, in four faculties that were randomly selected (faculties of

Nursing, Agriculture, Al-Alsun, and Tourism and Hotels).

**Sample:** A multistage stratified random sampling technique was utilized to select the study sample through the following stages

**Stage 1:** Out of 21 faculties at Suez Canal University, 4 faculties (Nursing, Agriculture, Al-Alsun, and Tourism and Hotels) were randomly selected, representing approximately 20% of the total.

**Stage 2:** Within the selected faculties, first-year students were identified as the target population.

**Stage 3:** A random sample comprising 25% of female students from the first academic year was selected from each of the four faculties.

**Stage 4:** Students with musculoskeletal disorders were excluded based on predefined purposive exclusion criteria, resulting in a final sample of 192 female students.

The sample size was determined using G-power analysis software

**A priori:** Compute required sample size (G power analysis)

Effect size  $f$  0.25

$\alpha$  err probability 0.05

Power ( $1-\beta$  err probability) .90

Number of groups 4

**Total sample size 192**

### **Inclusion Criteria**

Female students enrolled in the first academic year of the four previously

selected faculties at Suez Canal University.

### **Exclusion Criteria**

Female students who had been diagnosed with musculoskeletal disorders (MSDs) were excluded to eliminate potential confounding health-related factors.

**Tools for data collection:** Data was collected by using one tool.

**Tool (1): A Self-Administered Questionnaires, It was include five parts as the following:**

**Part I:** This part was developed by the researchers following an extensive review of the literature, particularly that of **Althobiti, Al Nagshabandi, and Mohamed (2020)**. It focuses on demographic data of female students, including: age (in years), marital status, faculty name, prior knowledge of osteoporosis, and family history of the condition....etc.).

**Part II: Osteoporosis Knowledge Test (OKT).** It was adopted from **Kim, Horan, & Gendler, (1991a)**. The OKT has been revised in 2012 and validated by **(Gendler et al., 2015)**. After the validation OKT has 32 questions leading to possible total score of 0-32. OKT has two scales: nutrition and exercise. Questions from 1-11 are about general knowledge on OP. While questions 12-17 and 30-32 are about exercise. The nutrition section included questions from 18-29. A score of 1 was

assigned for each correct answer, whereas incorrect responses and “don’t know” answers were scored as “zero”. The maximum attainable score for this tool was 32; this score calculated and categorized as

| Knowledge Level | Score Range | Percentage Range | Points (out of 32) |
|-----------------|-------------|------------------|--------------------|
| Poor            | 0-12.7      | < 40%            | < 12.8             |
| Moderate        | 12.8-17.9   | 40-59%           | 12.8 – 17.9        |
| Good            | 18-32       | ≥ 60%            | ≥ 18               |

### Part (III): Osteoporosis health-belief scale (OHBS)

This scale was adopted from **Kim et al, (1991)**. The original Osteoporosis Health Belief Scale (OHBS) is a 42-item instrument comprising seven subscales: Susceptibility (items 1–6), Seriousness (items 7–12), Benefits of Exercise (items 13–18), Benefits of Calcium Intake (items 19–24), Barriers to Exercise (items 25–30), Barriers to Calcium Intake (items 31–36), and Health Motivation (items 37–42). The scale was later modified to include two additional subscales—Benefits of Vitamin D (items 43–48) and Barriers to Vitamin D (items 49–54)—which were adapted from the calcium-related items, resulting in the OHBS-D version. The OHBS employs a 5-point Likert scale ranging from “strongly disagree” to “strongly agree.” Responses are scored from 1 (strongly disagree) to 5 (strongly agree). Each

subscale yields a score between 6 and 30, with lower scores reflecting low perception and higher scores reflecting high perception. The total possible score for the modified scale ranges from 54 to 270.

### Part (IV): Osteoporosis Self-Efficacy Scale (OSES)

Self-efficacy refers to an individual’s belief in their capacity to successfully perform a specific task (**Insel & Roth, 2010**). The Osteoporosis Self-Efficacy Scale (OSES) is a 12-item tool comprising two subscales: the Exercise Self-Efficacy Subscale (items 1–6) and the Calcium Intake Self-Efficacy Subscale (items 7–12). The OSES is grounded in constructs such as perceived susceptibility and seriousness, perceived barriers and benefits, health motivation, and an individual’s confidence in their ability to engage in osteoporosis-preventive behaviors, serving as a predictor of potential health behavior (**Ford, Bass, Zhao, Bai, & Zhao, 2011**). The exercise subscale evaluates an individual's confidence across different aspects of an exercise regimen, including initiating a new program, modifying exercise habits, exerting appropriate effort, completing challenging exercises, managing time, and adhering to recommended routines (**Ford et al., 2011**). Initially, participants rated their confidence by

placing a mark on a continuum between “not at all confident” and “very confident.” However, **Edmonds (2009)** found this format potentially confusing for participants and revised the scale to a Likert-type format with response options ranging from “strongly disagree” to “strongly agree,” while maintaining the original items. This study adopted the modified version developed by **Edmonds (2009)**. Higher scores on the scale indicate greater perceived self-efficacy in performing osteoporosis-related preventive behaviors.

#### **Part (V): Osteoporosis Preventing Behaviors Survey (OPBS)**

The Osteoporosis Preventing Behaviors Survey (OPBS), developed by **Doheny and Sedlak in 1995**, was originally a 39-item instrument aimed at evaluating behaviors related to osteoporosis prevention, such as physical activity, calcium intake, and risk factors like smoking and medication use. In **2009**, **Edmonds** revised the tool into a streamlined eight-item version focused specifically on young adults by removing items related to menopause. The revised OPBS assesses dietary calcium intake, calcium supplement use, and both weight-bearing and non-weight-bearing physical activity through multiple-choice and yes/no questions. It also includes a seven-day physical activity recall (7dPAR) to

estimate weekly MET-minutes, aligning with WHO physical activity guidelines. Scoring is based on intake adequacy and exercise frequency, with higher scores indicating healthier behaviors. The final item captures perceived changes in physical activity over time, summarized by frequency and percentage.

#### **Tools validity and reliability**

The validity of the translated study tool was evaluated by a panel of three experts from Suez Canal University, including two assistant professors specializing in Family and Community Health Nursing and one from Medical and Surgical Nursing. They evaluated the tool's lucidity, relevance, comprehensiveness, and construction. This thorough validation process, focusing on language clarity, applicability to study objectives, inclusion of essential elements, and overall structure, took two weeks to complete. The experts' collective assessment confirmed the tool's validity for research use.

Reliability was determined through the calculation of Cronbach's alpha coefficient, which demonstrated that the tool possessed acceptable internal consistency, as indicated by the following results:

Tool (1) Part II, Osteoporosis Knowledge Test (OKT) for female students, confirmed acceptable internal consistency with Cronbach's  $\alpha$  of 0.79.

The reliability of Tool (1) Part III, namely Osteoporosis Health Belief Scale (OHBS), was good with  $\alpha = 0.88$ , and Tool (1) Part IV, namely Osteoporosis Self-Efficacy Scale (OSES), showed highly acceptable internal consistency with  $\alpha = 0.87$ . Additionally, the Cronbach's alpha coefficient for Tool (1) Part V, Osteoporosis Preventing Behaviors Survey (OPBS), was acceptable with  $\alpha = 0.70$ .

**Pilot study:** A pilot study was conducted on 10% ( $n = 19$ ) of the randomly selected female students to evaluate the relevance, clarity, and feasibility of the study tool, as well as to estimate the time required to complete it. These participants were subsequently excluded from the main study sample. The preliminary study was carried out over a two-week period, starting on October 1, 2021.

**Procedure:** The program was initiated following the receipt of official authorization, conveyed through a letter from the Dean of the Faculty of Nursing to the deans of the respective faculties. Subsequently, the program was implemented. The entire study spanned approximately six months, covering the phases of preparation, data collection,

implementation, and evaluation. It began in early October 2021 and concluded at the end of March 2022. The program was conducted in four sequential phases, as outlined below:

**Assessment Phase:** Data collection was initiated by the researchers following the acquisition of official approval to conduct the study and the completion of the development and finalization of the data collection tool. To facilitate communication with the participating female students, a WhatsApp group was established that included all of them. This allowed the researchers to share information about meeting times and address any questions or concerns the students might have. The data was collected through online questionnaires sent to the female students, but only after obtaining their consent to participate in the study and clearly explaining its purpose. The initial assessment phase (pre-test) was completed over two weeks.

**Planning Phase:** Based on the findings from the pre-test phase and insights drawn from recent scholarly literature, an interactive online osteoporosis prevention program was designed and developed. The program covered an overview of osteoporosis, its risk factors, the benefits and barriers of calcium intake and exercise,



calcium-rich foods, the body's calcium requirements, and preventative measures to prevent osteoporosis. Additionally, a simple booklet on the same topic was created as a preventive resource for the target audience. The researchers also prepared the program content in PowerPoint presentations and videos. The planning phase took approximately two weeks.

**Implementation Phase:** To implement the program, students were divided into four groups, with each group attending four electronic sessions (Zoom and Microsoft Teams Meetings), each lasting 30 to 45 minutes.

#### **Implementation Technique**

1. **First Session (Knowledge Development):** This session focused on enhancing awareness of osteoporosis, including its nature, severity, susceptibility, preventive behaviors, complications, the importance of exercise, sun exposure, and health beliefs.
2. **Second Session (Dietary Education and Training):** The goal of this session was to educate female students on making healthy dietary choices. It included video demonstrations on proper nutrition and calcium intake. Additionally, students were shown pre- and post-treatment images of patient bones to reinforce their understanding of osteoporosis susceptibility.

3. **Third Session (Exercise and Osteoporosis Prevention):** This session emphasized the contribution of physical activity in preventing osteoporosis, highlighting the benefits and challenges of exercise, adherence to recommended routines, and self-efficacy in maintaining a proper exercise regimen.

4. **Fourth Session (Review and Educational Resources):** A summary of the previous sessions was provided, and female students received educational pamphlets for further learning and reinforcement. The implementation phase lasted approximately four months, spanning from mid-November 2021 to mid-March 2022.

**Evaluation Phase:** The effectiveness of the interactive online preventive program on osteoporosis among female students was evaluated immediately after its implementation (post-test) using the previously mentioned tools. The evaluation phase (post-test) was conducted for all groups and took two weeks to complete.

**Ethical considerations:** The researchers obtained ethical approval to conduct this study from the Scientific Research Ethics Committee at the Faculty of Nursing, Suez Canal University, with code 112 and approved date 6/2021. Informed

consent was acquired from the female students after a detailed explanation of the study's objectives and nature. Participants were assured that their information would be kept confidential. Additionally, the students were clearly informed that their participation was completely voluntary, and were explicitly told that they could withdraw from the study at any time without facing any consequences. Upon the completion of the study, the scientific materials for the program were sent to the students.

**Statistical analysis:** Data entry and analysis were performed using version 25.0 of the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were computed, including means and standard deviations for quantitative variables, and frequencies and percentage distributions for qualitative variables. To assess changes between pre- and post-program measurements, paired sample t-tests were conducted, with statistical significance set at  $p \leq 0.05$ . The magnitude of program effects was quantified using Cohen's d effect size measurements. After confirming normal distribution of continuous data, Pearson correlation coefficients were computed to examine relationships between quantitative variables. Statistical significance was considered

at  $p < 0.05$ , with high significance designated at  $p < 0.001$ .

## Results

**Table 1**, the studied sample primarily consisted of female students, with a mean age of  $19.22 \pm 0.55$  years and an age range of 18 to 20 years. Regarding faculty distribution, 30.2% were from the Faculty of Agriculture, followed by 27.6% from Nursing and 25.0% from Language, while 17.2% were from Tourism. Moreover, 69.3% of female students resided in urban areas, and approximately 98.4% were single. Additionally, 16.1% of them reported a family history of osteoporosis.

**Figure 1** illustrates that 58.3% of the studied female students reported having information about osteoporosis, while 41.7% indicated they had no knowledge of the condition.

**Table 2** indicates a statistically significant difference ( $p < .001$ ) was observed in the studied female students' total mean knowledge score about osteoporosis post-implementation of the program compared to pre-implementation.

**Table 3** demonstrates that a statistically significant improvement ( $p \leq 0.05$ ) in the perceptions of the studied female students regarding the benefits of calcium and vitamin D intake, a reduction in barriers to exercise, calcium, and vitamin D intake, as well as an increase in health motivation.

However, perceived seriousness and susceptibility to osteoporosis slightly decreased.

**Table 4** shows that the total self-efficacy score increased from  $42.41 \pm 6.73$  to  $44.78 \pm 5.28$  following the program's implementation, indicating a moderate overall effect on improving osteoporosis-related self-efficacy. This increase was statistically significant ( $p \leq .05$ ), highlighting the program's effectiveness in encouraging positive health behaviors.

**Table 5** indicates that a highly statistically significant ( $p < .001$ ) in the osteoporosis preventive behaviors (OPBS) of the studied female students post implementation of the program.

**Table 6** presents the correlation among Osteoporosis Preventive Behaviors (OPBS), Health Beliefs (HBS), knowledge, and self-efficacy in the studied female students ( $n=192$ ) following the implementation of the program. As illustrated in the table, a strong positive correlation is evident between HBS and self-efficacy ( $r = 0.400$ ,  $p < 0.001$ ) and a moderate correlation between knowledge and self-efficacy ( $r = 0.375$ ,  $p < 0.001$ ). Also, A moderate positive correlation exists between OPBS and knowledge ( $r = 0.259$ ,  $p < 0.001$ ) and OPBS and self-efficacy ( $r = 0.369$ ,  $p < 0.001$ ).

**Table (1): Percentage distribution of studied female students according to their demographic data (n=192)**

| Items                                                                 | No.       | %    |
|-----------------------------------------------------------------------|-----------|------|
| <b>Age (Years)</b>                                                    |           |      |
| Mean ± SD                                                             | 19.22±.55 |      |
| Range                                                                 | 18-20     |      |
| <b>Faculty</b>                                                        |           |      |
| Nursing                                                               | 53        | 27.6 |
| Agriculture                                                           | 58        | 30.2 |
| Tourism                                                               | 33        | 17.2 |
| Language                                                              | 48        | 25.0 |
| <b>Residence</b>                                                      |           |      |
| Urban                                                                 | 133       | 69.3 |
| Rural                                                                 | 59        | 30.7 |
| <b>Marital status</b>                                                 |           |      |
| Single                                                                | 189       | 98.4 |
| Married                                                               | 3         | 1.6  |
| <b>Family history of osteoporosis as the female students reported</b> |           |      |
| Yes                                                                   | 31        | 16.1 |
| No                                                                    | 161       | 83.9 |

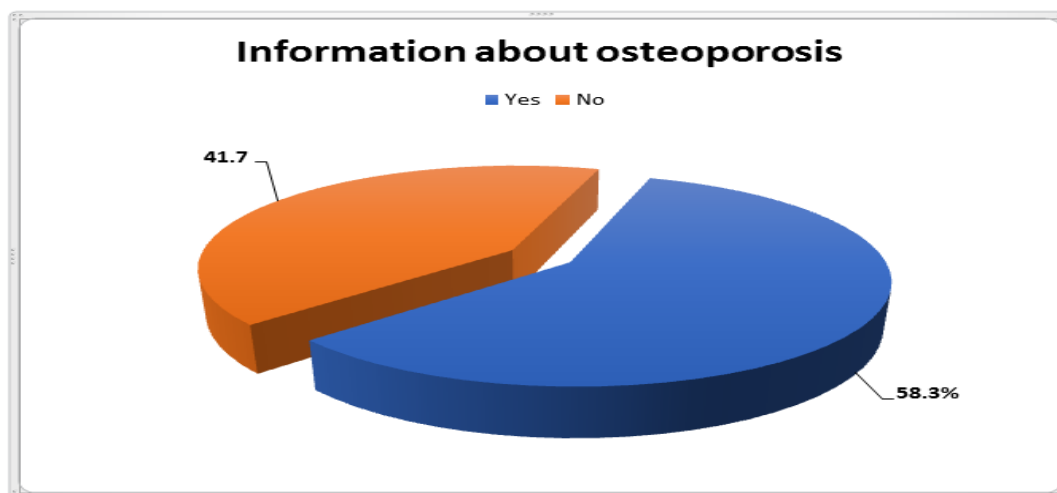
**Figure (1): Distribution of studied female students according to their information about osteoporosis (n=192)**

**Table (2): Mean scores of the studied female students according to their knowledge regarding osteoporosis pre and post implementation of the program (n=192)**

| Items                             | Pre-program<br>implementation | Post-program<br>implementation | Test  | P value |
|-----------------------------------|-------------------------------|--------------------------------|-------|---------|
|                                   | Mean $\pm$ SD                 | Mean $\pm$ SD                  |       |         |
| 1. General knowledge              | 1.33 $\pm$ .81                | 2.45 $\pm$ .68                 | 18.76 | <.001*  |
| 2. Risk factors                   | 2.88 $\pm$ 2.32               | 7.94 $\pm$ 1.77                | 37.27 | <.001*  |
| 3. Exercise                       | 2.49 $\pm$ 1.22               | 4.93 $\pm$ 1.06                | 25.73 | <.001*  |
| 4. Nutrition                      |                               |                                |       |         |
| a. Calcium                        | 3.09 $\pm$ 1.32               | 5.89 $\pm$ .92                 | 30.96 | <.001*  |
| b. Vitamin D                      | 2.33 $\pm$ 1.28               | 4.03 $\pm$ .95                 | 19.99 | <.001*  |
| <b>Total Score (32 Questions)</b> | 12.12 $\pm$ 2.18              | 25.24 $\pm$ 3.60               | 17.07 | <.001*  |

Test is paired sample t test \*: Statistically significant at  $p \leq 0.05$

**Table (3): Mean scores of female students' osteoporosis health beliefs (OHBS): pre and post implementation of the program (n=192)**

| Items                           | Pre                | Post               | t test | P value | Effect size (d) |
|---------------------------------|--------------------|--------------------|--------|---------|-----------------|
|                                 | Mean $\pm$ SD      | Mean $\pm$ SD      |        |         |                 |
| 1. Susceptibility               | 16.23 $\pm$ 4.74   | 15.12 $\pm$ 3.97   | 7.367  | <.001*  | .25             |
| 2. Seriousness                  | 18.04 $\pm$ 4.43   | 15.98 $\pm$ 3.50   | 10.246 | <.001*  | .52             |
| 3. Benefits exercise            | 23.69 $\pm$ 4.08   | 24.03 $\pm$ 2.82   | 1.408  | .161    | .1              |
| 4. Benefits of calcium intake   | 22.55 $\pm$ 3.61   | 23.71 $\pm$ 2.91   | 7.805  | <.001*  | .36             |
| 5. Benefits of vitamin D intake | 22.31 $\pm$ 3.89   | 24.17 $\pm$ 3.34   | 8.427  | <.001*  | .55             |
| 6. Barrier exercise             | 16.31 $\pm$ 4.09   | 15.27 $\pm$ 3.22   | 7.144  | <.001*  | .30             |
| 7. Barrier calcium intake       | 15.97 $\pm$ 4.11   | 14.33 $\pm$ 3.30   | 9.994  | <.001*  | .47             |
| 8. Barrier vitamin D intake     | 17.22 $\pm$ 3.15   | 16.17 $\pm$ 2.29   | 5.563  | <.001*  | .40             |
| 9. Health motivation            | 20.70 $\pm$ 3.45   | 22.05 $\pm$ 2.75   | 11.417 | <.001*  | .46             |
| <b>Total</b>                    | 173.03 $\pm$ 18.71 | 170.83 $\pm$ 13.48 | 3.098  | .002*   | .14             |

t is paired sample t test \*: Statistically significant at  $p \leq 0.05$  ; d is Cohen's effect size

**Table (4): Mean scores of female students' osteoporosis self-efficacy: pre and post implementation of the program (n=192)**

| Items                                                      | Pre              | Post             | t test | P value          | Effect size (d) |
|------------------------------------------------------------|------------------|------------------|--------|------------------|-----------------|
|                                                            | Mean $\pm$ SD    | Mean $\pm$ SD    |        |                  |                 |
| 1. Begin a new or different exercise program               | 3.54 $\pm$ .83   | 3.68 $\pm$ .68   | 3.500  | <b>.001*</b>     | .20             |
| 2. Change exercise habits                                  | 3.33 $\pm$ .95   | 3.42 $\pm$ .84   | 3.498  | <b>.001*</b>     | .11             |
| 3. Put forth the effort required to exercise               | 3.63 $\pm$ .82   | 3.72 $\pm$ .64   | 3.641  | <b>&lt;.001*</b> | .14             |
| 4. Do exercises even if they are difficult                 | 3.46 $\pm$ .91   | 3.55 $\pm$ .81   | 4.054  | <b>&lt;.001*</b> | .11             |
| 5. Exercise for appropriate length of time                 | 3.72 $\pm$ .84   | 3.81 $\pm$ .67   | 3.657  | <b>&lt;.001*</b> | .13             |
| 6. Do the type of exercise that I am supposed to do        | 3.65 $\pm$ .76   | 3.71 $\pm$ .69   | 2.944  | <b>.004*</b>     | .10             |
| 7. Increase calcium intake                                 | 3.46 $\pm$ .91   | 3.77 $\pm$ .91   | 5.692  | <b>&lt;.001*</b> | .44             |
| 8. Change my diet to include more calcium foods            | 3.53 $\pm$ .81   | 3.81 $\pm$ .79   | 5.688  | <b>&lt;.001*</b> | .35             |
| 9. Eat calcium rich foods as often as I am supposed        | 3.42 $\pm$ .91   | 3.85 $\pm$ .87   | 6.440  | <b>&lt;.001*</b> | .49             |
| 10. Select appropriate foods to increase my calcium intake | 3.55 $\pm$ .80   | 3.81 $\pm$ .71   | 5.848  | <b>&lt;.001*</b> | .37             |
| 11. Stick to diet which gives an adequate amount of        | 3.53 $\pm$ .91   | 3.81 $\pm$ .83   | 5.137  | <b>&lt;.001*</b> | .34             |
| 12. Obtain foods that give an adequate amount of calcium   | 3.58 $\pm$ .79   | 3.83 $\pm$ .73   | 5.162  | <b>&lt;.001*</b> | .32             |
| <b>Total self- efficacy</b>                                | 42.41 $\pm$ 6.73 | 44.78 $\pm$ 5.28 | 10.640 | <b>&lt;.001*</b> | .40             |

t is paired sample t test \*: Statistically significant at  $p \leq 0.05$  ; d is Cohen's effect size

**Table (5): Total mean scores of female students' osteoporosis preventing behaviors (OPBS): pre and post implementation of the program (n=192)**

| Item                                   | Pre mean±SD | Post mean±SD | 95% Confidence Interval of the Difference |       | t test | P value |
|----------------------------------------|-------------|--------------|-------------------------------------------|-------|--------|---------|
|                                        |             |              | lower                                     | Upper |        |         |
| <b>Total mean scores</b>               | 11.41±4.17  | 13.28±3.75   | 1.56                                      | 2.17  | 12.102 | <.001*  |
| <b>Effectiveness (Mean difference)</b> | 1.86±2.13   |              |                                           |       |        |         |

t is paired sample t test ; \*highly statistically significant at p <.001

**Table (6): Correlation between OPBS, OHBS, knowledge and self-efficacy of studied female students' post implementation of the program (n=192)**

| Items                |                     | OPBS   | HBS    | knowledge | Self-efficacy |
|----------------------|---------------------|--------|--------|-----------|---------------|
| <b>OPBS</b>          | Pearson Correlation |        | .092   | .259**    | .369**        |
|                      | Sig. (2-tailed)     |        | .204   | <0.001    | <0.001        |
| <b>HBS</b>           | Pearson Correlation | .092   |        | .215**    | .400**        |
|                      | Sig. (2-tailed)     | .204   |        | .003      | <0.001        |
| <b>knowledge</b>     | Pearson Correlation | .264** | .215** |           | .375**        |
|                      | Sig. (2-tailed)     | <0.001 | .003   |           | <0.001        |
| <b>Self-efficacy</b> | Pearson Correlation | .282   | .400   | .375      |               |
|                      | Sig. (2-tailed)     | <0.001 | <0.001 | <0.001    |               |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## Discussion

Osteoporosis is a chronic, asymptomatic condition that often remains undiagnosed until a fracture occurs. Consequently, routine screening and adherence to Osteoporosis Preventive Behaviors (OPB) are fundamental to effective for disease prevention and management. The adoption of OPB is significantly influenced by an individual's level of knowledge and health beliefs (*Elgzar, Nahari, Sayed, & Ibrahim, 2023*).

Bone strength is determined by various factors throughout an individual's lifespan. Non-modifiable determinants include age, sex, genetic predisposition, and ethnicity, whereas modifiable factors encompass dietary intake, physical activity, and sunlight exposure. Therefore, individuals at elevated risk must possess comprehensive knowledge and well-informed health beliefs regarding osteoporosis to implement proactive preventive strategies (*Mortada, El Seifi, & Abdo, 2020*).

The aim of this study was to evaluate the effect of interactive online preventive program regarding osteoporosis among female students at Suez Canal University.

Based on the demographic data of the female students included in the study, it's revealed that the mean age of them was  $19.22 \pm 0.55$  years. The majority

was single, and approximately one-fifth reported a family history of osteoporosis. These findings are in agreement with those reported by *Mohammed & Shehata (2019)*, who studied "Evaluation of Health Education Program on Knowledge, Attitude and Practice of Female adolescents regarding Osteoporosis Prevention, Egypt" Who found a mean age of  $19.07 \pm 0.7$  years, with most participants being single.

The findings of the current study revealed a significant increase in overall osteoporosis knowledge among the studied female students after the implementation of the program ( $P < .001$ ). This finding is similar to the results reported by *Abdolalipour & Mirghafourvand, (2021)*, who studied "Effect of education on preventive behaviors of osteoporosis in adolescents: A systematic review and meta-analysis" found significant differences in knowledge between the education and control groups ( $SMD = 1.76$ ,  $95\% \text{ CI} = 1.10 \text{ to } 2.42$ ,  $P < 0.0001$ ).

Additionally, a study performed in Iran by *Pakyar, Poortaghi, Pashaeypoor, and Sharifi (2021)* titled "Effect of educational program based on theory of planned behavior on osteoporosis preventive behaviors: a randomized clinical trial" noted that the intervention group showed a substantial increase in



knowledge scores after the program ( $p < 0.05$ ).

From the researchers' point of view; the limited knowledge of osteoporosis among the studied female students may stem from a general lack of awareness about the disease and its prevention. Their knowledge improved following the implementation of the program due to active engagement in structured learning. Furthermore, interactive learning strategies, such as discussions, facilitated cognitive processing and enhanced memory retention, reinforcing their knowledge acquisition.

Results of the existing study presented that, a statistically significant difference ( $p \leq 0.05$ ) was observed in most items of the Osteoporosis Health Belief Scale (OHBS) after the program's implementation. The mean scores showed improvements in perceived susceptibility, perceived seriousness, barriers to exercise, barriers to calcium intake, and barriers to vitamin D intake. Additionally, higher scores were noted for the perceived benefits of exercise, calcium intake, vitamin D intake, and health motivation. These findings may suggest that most of the studied female students recognize the significant impact of osteoporosis on their health. The increased mean scores indicate an improved understanding of the benefits

of exercise, calcium intake, and vitamin D consumption.

These results corresponded with the study conducted in Turkey by Pinar & Pinar (2020), titled "The impact of health belief model based educational intervention on women's knowledge, beliefs, preventive behaviors and clinical outcomes about osteoporosis" The study reported a significant increase in knowledge and health belief scores in the intervention group ( $p < 0.05$ ).

Similarly, a study executed in Qazvin, Iran by **Panahi et al. (2021)** titled "Promoting the adoption of behaviors to prevent osteoporosis using the health belief model integrated with health literacy: quasi-experimental intervention study" documented significant improvements after the educational intervention. An increase in the average score for perceived benefits and a decrease in perceived barriers were noted within the intervention group. These outcomes were statistically significant, demonstrating clear distinctions between the intervention and control groups.

Contrary to the results of this study, the study by **Peksoy-Kaya, Kaplan, and Başkaya (2024)** titled "A survey of the effect of an information-motivation-behavioral model-based intervention on university students' osteoporosis knowledge, health beliefs, and self-

efficacy" in Turkey determined that no statistically significant differences were observed between the pretest and follow-up scores on both the Osteoporosis Health Belief Scale and the Osteoporosis Self-Efficacy Scale ( $p > .05$ ).

The improvement in Osteoporosis Health Belief Scale scores observed after the implementation of osteoporosis prevention programs could be attributed to enhanced knowledge about the condition, increased awareness of personal susceptibility and disease severity, a clearer understanding of the benefits of preventive behaviors, and a reduction in perceived barriers to adopting such behaviors. These changes align with the Health Belief Model framework, which posits that modifying these beliefs increases the likelihood of adopting preventive health behaviors (**Panahi et al., 2021**).

Regarding female students' osteoporosis self-efficacy, the present study demonstrated a moderate overall effect of the program on improving osteoporosis-related self-efficacy. The observed increase revealed a statistically significant difference ( $p \leq .05$ ).

In the same vein, the study titled "Self-efficacy of osteoporosis preventive behaviors and its predictors in Iranian adolescents" by **Ghelichkhani,**

**Mirghafourvand,** **Bahrami-Vazir,** **Vali,** and **Mohammadi (2021)** reported findings suggesting most of the students possessed a moderate level of knowledge and self-efficacy concerning osteoporosis preventive behaviors.

The results of the **Peksoy-Kaya et al. (2024)** study differed from the results established in this study; they reported that their intervention did not improve participants' self-efficacy in performing weight-bearing exercises, taking calcium, and engaging in physical activity.

The moderate improvement in self-efficacy scores after the osteoporosis prevention program may be due to multiple factors such as the complexity of changing several health behaviors simultaneously; adolescents' perception of osteoporosis as a distant concern; persistent practical barriers to maintaining preventive behaviors; and the developmental stage of adolescents regarding self-efficacy formation. Despite being moderate, the improvement was statistically significant, confirming the program had a meaningful positive impact.

The current study results discovered a highly statistically significant ( $p < .001$ ) in the osteoporosis preventive behaviors (OPBS) of the studied female students after the implementation of the program.

In the similar context, the study by **Panahi et al. (2021)** titled "Promoting the adoption of behaviors to prevent osteoporosis using the health belief model integrated with health literacy: quasi-experimental intervention study" found that the intervention group showed a significant increase in mean scores for osteoporosis-related preventive behaviors following the intervention.

The study titled "Promotion of osteoporosis-preventive behaviors in adolescents: Application of protection motivation theory" by **Khazaeian et al. (2021)** also supports the results of this study. They mentioned that post-intervention period, a significant difference was detected between the groups regarding their preventive behaviors (specifically calcium consumption, exercise habits, and sun exposure) compared with the pre-intervention ( $P = 0.001$ ). This suggests a higher likelihood among female students to participate in behaviors conducive to osteoporosis prevention, encompassing nutritional adequacy, physical activity, and lifestyle optimization.

Better health beliefs and knowledge are likely to have higher self-efficacy regarding osteoporosis prevention. Furthermore, higher knowledge and self-efficacy are associated with better osteoporosis preventive behaviors

(**Armstrong, 2021**). Therefore, the current study illustrated that a strong-positive correlation is evident between HBS and self-efficacy ( $r = 0.400$ ,  $p < 0.001$ ) and a moderate-correlation between knowledge and self-efficacy ( $r = 0.375$ ,  $p < 0.001$ ). Also, a moderate positive correlation exists between OPBS and knowledge ( $r = 0.259$ ,  $p < 0.001$ ) and OPBS and self-efficacy ( $r = 0.369$ ,  $p < 0.001$ ).

In alignment with the current study's results, the study by **Althobiti et al., (2020)** titled "Knowledge, Beliefs and Preventive Behaviours Regarding Osteoporosis Among Female Health Colleges' Students at King Abdulaziz University" reported that a statistically significant positive correlation was observed between students' osteoporosis knowledge and their health beliefs.

The finding of the existing study is consistent with a study titled "Gender Disparities in Osteoporosis Knowledge, Health Beliefs and Preventive Behaviors" conducted in Najran City, Saudi Arabia by **Ibrahim, Nahari, Al-Khadher, Ismail, and Elgzar (2023)**. Statistically positive correlations ( $p < 0.001$ ) were found between OPB and various factors, including osteoporosis knowledge ( $r = 0.26$ ), perceived susceptibility ( $r = 0.33$ ), perceived severity ( $r = 0.53$ ), perceived benefits of exercise ( $r = 0.54$ ) and calcium intake ( $r$

= 0.33), perceived barriers to exercise ( $r = 0.40$ ) and calcium intake ( $r = 0.81$ ), as well as health motivation ( $r = 0.37$ ).

### **Conclusion**

In deduction, based on the findings of the current study and its hypotheses, there was a statistically-significant difference in knowledge, health beliefs, self-efficacy, and behaviors regarding osteoporosis among female students pre- and post-participation in the interactive online preventive program.

### **Recommendation**

**Based on the results of the present study, the following recommendation is proposed:**

- Continue and regularly update the interactive osteoporosis prevention program to reinforce knowledge and sustain healthy behaviors among students.
- Establish a structured, continuous prevention program each academic year to ensure long-term engagement and impact on students' health beliefs and practices.
- Create interactive mobile applications for students to track calcium intake, vitamin D levels, and weight-bearing exercise activities.
- Implement bone health campaigns with regular screening opportunities, particularly targeting female students who face higher risk factors.
- Develop specialized programs for students with family history of

osteoporosis, eating disorders, or amenorrhea.

### **Conflict of interest:**

The authors confirm no conflicts of interest related to this study.

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### **References:**

- Abdolalipour, S., & Mirghafourvand, M. (2021).** Effect of education on preventive behaviors of osteoporosis in adolescents: A systematic review and meta-analysis. *International Quarterly of Community Health Education*, Vol. 41, NO. (3), Pp. 325-347.
- Ahmed, M. A. E. S., Elsayied, H. A. E., Mohamed, N. A., & Salama, T. R. A. (2022).** Assessing Health Beliefs, Knowledge and Practices of Adolescent Girls Regarding Osteoporosis. *Egyptian Journal of Health Care*, Vol. 13, No. (4), Pp. 572-586.
- Ali, R. A. E. S., Mekhamier, H. A., & El Sayed, H. A. E. (2020).** The effect of application of health belief model on

- osteoporosis' knowledge and preventive behaviors among childbearing women. *American Journal of Nursing*, Vol. 8, No. (4), Pp. 442-451.
- Althobiti, E. S., Al Nagshabandi, E. A., & Mohamed, A. H. (2020).** Knowledge, Beliefs and Preventive Behaviours Regarding Osteoporosis Among Female Health Colleges' Students at King Abdulaziz University. *Journal of Biomedical Science*, Vol. 2, No. (5), Pp. 523-534.
- Armstrong, K. A. (2021).** Osteoporosis Knowledge, Health Communication, and Prevention Behaviors Among College Students: A Cross-Sectional Study Among Male and Female College Students (Master's thesis, The University of Mississippi).
- Chan, C. Y., Mohamed, N., Ima-Nirwana, S., & Chin, K. Y. (2018).** A review of knowledge, belief and practice regarding osteoporosis among adolescents and young adults. *International journal of environmental research and public health*, Vol. 15, No. (8), Pp. 1-28.
- Doheny, M., & Sedlak, C. (1995).** Osteoporosis preventing behavior survey. Kent, OH: Kent State University.
- Edmonds, E. T. (2009).** Osteoporosis knowledge, beliefs, and behaviors of college students: utilization of the health belief model. The University of Alabama.
- El Miedany, Y., Gadallah, N. A., & Toth, M. (2022).** Optimizing osteoporosis management: targeting to treat—an initiative by the Egyptian Academy of Bone Health. *Egyptian Rheumatology and Rehabilitation*, Vol. 49, No. (1), Pp. 61.
- Elgzar, W. T., Nahari, M. H., Sayed, S. H., & Ibrahim, H. A. (2023).** Determinant of osteoporosis preventive behaviors among perimenopausal women: a cross-sectional study to explore the role of knowledge and health beliefs. *Nutrients*, Vol. 15, No. (13), Pp. 3052.
- Ford, M. A., Bass, M., Zhao, Y., Bai, J. B., & Zhao, Y. (2011).** Osteoporosis knowledge, self-efficacy, and beliefs among college students in the USA and China. *Journal of osteoporosis*, Vol. 2011, No. (1), Pp. 1-8.
- Gendler, P. E., Coviak, C. P., Martin, J. T., Kim, K. K., Dankers, J. K., Barclay, J. M., & Sanchez, T. A. (2015).** Revision of the osteoporosis knowledge test: Reliability and validity. *Western journal of nursing research*, Vol. 37, No. (12), Pp. 1623-1643.
- Ghelichkhani, F., Mirghafourvand, M., Bahrami-Vazir, E., Vali, E., & Mohammadi, A. (2021).** Self-efficacy

- of osteoporosis preventive behaviors and its predictors in Iranian adolescents. *International journal of adolescent medicine and health*, Vol. 33, No. (1).
- Ibrahim, H. A., Nahari, M. H., Al-Khadher, M. A., Ismail, N. I., & Elgzar, W. T. (2023).** Gender disparities in osteoporosis knowledge, health beliefs and preventive behaviors in Najran City, Saudi Arabia. *Nutrients*, Vol. 15, No. (16), Pp. 1-13.
- Insel, P. M., & Roth, W. T. (2010).** Wellness Worksheet 66. Core Concepts in Health, 11th ed. Copyright© 2010 The McGraw-Hill Companies, Inc <http://highered.mcgrawhill.com/sites/dl/free/0078022584/947562/SampleChapter08.pdf>.
- Khazaeian, S., Sanavi, F. S., Ansari, H., & Mirshekari, F. (2021).** Promotion of osteoporosis-preventive behaviors in adolescents: application of protection motivation theory. *Journal of Education and Health Promotion*, Vol. 10, No. (1), Pp. 469.
- Kim KK, Horan ML & Gendler P., (1991a):** Osteoporosis Knowledge Test, Osteoporosis Health Belief Scale, and Osteoporosis Self-efficacy Scale. Allendale: MI: Grand Valley State University.
- Matsumoto, H., Hagino, H., Wada, T., & Kobayashi, E. (2022).** Effect of a school-based intervention program on bone mass accrual in adolescents: A systematic review and meta-analysis. *Osteoporosis International*, Vol. 33, No. (5), Pp. 1021-1033.
- Mohammed, A. F., & Shehata, N. S. (2019).** Evaluation of Health Education Program on Knowledge, Attitude and Practice of Female adolescents regarding Osteoporosis Prevention. *IOSR J Nursing Health Sci*, Vol. 8, No. (2), Pp. 35-45.
- Moradnejad, S., Montazeri, A., Sadeghi, R., Tol, A., Yekaninejad, M. S., & Mohebbi, B. (2020).** The effectiveness of educational intervention to improve health promoting behavior on prevention of osteoporosis among women: Application of BASNEF model. *Hayat*, Vol. 26, No. (3), Pp. 309-326.
- Mortada, E. M., El Seifi, O. S., & Abdo, N. M. (2020).** Knowledge, Health Beliefs and Osteoporosis Preventive Behaviour Among Women of Reproductive Age in Egypt. *Malaysian Journal of Medicine & Health Sciences*, Vol. 16, No. (1), Pp. 9-16.
- Özmen, S., Kurt, S., Timur, H. T., Yavuz, O., Kula, H., Demir, A. Y., & Balci, A. (2024).** Prevalence and Risk Factors of Osteoporosis: A Cross-

- Sectional Study in a Tertiary Center. *Medicina*, Vol. 60, No. (12), Pp. 1-13.
- Pakyar, N., Poortaghi, S., Pashaeypoor, S., & Sharifi, F. (2021).** Effect of educational program based on theory of planned behavior on osteoporosis preventive behaviors: a randomized clinical trial. *BMC musculoskeletal disorders*, Vol. 22, Pp. 1-10.
- Panahi, R., Siboni, F. S., Kheiri, M., Ghoozlu, K. J., Shafaei, M., & Dehghankar, L. (2021).** Promoting the adoption of behaviors to prevent osteoporosis using the health belief model integrated with health literacy: quasi-experimental intervention study. *BMC Public Health*, Vol. 21, Pp. 1-11.
- Peksoy-Kaya, S., Kaplan, S., & Başkaya, E. (2024).** A survey of the effect of an information-motivation-behavioral model-based intervention on university students' osteoporosis knowledge, health beliefs, and self-efficacy. *Women & Health*, Vol. 64, No. (10), Pp. 870-883.
- Pinar, G., & Pinar, T. (2020).** The impact of health belief model based educational intervention on women's knowledge, beliefs, preventive behaviors and clinical outcomes about osteoporosis. *SAGE Open*, Vol. 10, No. (3), Pp. 1-12.
- Sekiya, K. (2023).** Understanding Osteoporosis: Causes, Symptoms, Prevention, and Treatment. Paediatric Rheumatology Unit, Hospital Infantil Universitario Niño Jesús. *International Journal of Editorial Clinical Rheumatology*, Vol. 18, No. (12), Pp. 393-395.
- Tian, L., & Yu, X. (2022).** Bone health in children and adolescents: A review of influential factors and dietary management. *Foods*, Vol. 11, No. (18), Pp. 2856.
- Valenzuela-Martínez, S., Ramírez-Expósito, M. J., Carrera-González, M. P., & Martínez-Martos, J. M. (2023).** Physiopathology of osteoporosis: nursing involvement and anagement. *Biomedicines*, Vol. 11, No. (4), Pp. 2-20.

## Assessment of Nurses' knowledge and Practices regarding Children with Acute Pancreatitis.

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### Abstract

**Background** Acute pancreatitis is an emerging problem in pediatrics, with most cases resolving spontaneously. It is characterized by inflammation of the pancreas, the presence of interstitial edema, infiltration, necrosis and haemorrhage. **The study aim was** to assess nurses' knowledge and practice regarding children with acute pancreatitis. **Design:** A descriptive research design was utilized **Subjects:** All nurses (79) who were working in Paediatric Medical Department of Tanta Main University Hospital and (51) from Paediatric Department and Paediatric Intensive Care Unit of Kafer-Elsheikh University Hospital. **Tools:** two tools were utilized. **Tool I:** knowledge Structured questionnaire. **Tool II:** Observational Checklist about nurses' practice regarding acute pancreatitis. **Results:** nearly two thirds of the studied nurses had high level of knowledge about acute pancreatitis, while more than three quarters of them had satisfactory practice level. **Conclusion:** pediatric nurses had high level of knowledge and satisfactory level of practice regarding acute pancreatitis in children. **Recommendations:** Implementing regular and continuous educational program about children's acute pancreatitis to increase nurses' knowledge and practice for those children. **Keywords:** Acute Pancreatitis, Assessment, Children, Nurses and Practices.

### Introduction

Acute pancreatitis (AP) is one of the most common reasons for gastrointestinal hospitalization. It's Incidence is 13 per 100,000 children. It is an emerging problem in pediatrics, with most cases resolving

spontaneously. Approximately 10% to 23%, however, are believed to develop "severe acute pancreatitis.(Roark et al., 2020).

Acute pancreatitis is defined as the histological presence of inflammation of the pancreatic parenchyma. It is a



reversible process characterized by the presence of interstitial edema, infiltration by inflammatory cells and variable degrees of cellular apoptosis, necrosis and hemorrhage. The recurrent fibrotic and inflammatory processes may cause different degrees of dysfunction in the endocrine and exocrine pancreas or in both **(Thapa et al., 2022)**

The causes of AP in children include biliary disease, metabolic disease, drug-induced AP, idiopathic AP, systemic diseases and trauma, infectious diseases, pancreas divisum and hereditary. **(Iannuzzi et al., 2022)**.

The most common risk factor of AP in children include physical injury as bicycle handlebar injuries, certain medications such as antiepileptic or blunt trauma, gallstones, or problems in the anatomy of the ducts in the liver or pancreas. or blunt trauma to the mid-upper abdomen can cause AP, chemotherapy agents and certain antibiotics **(Saeed, 2020)**.

Clinical manifestations of AP include severe abdominal pain which is the major symptom of pancreatitis that causes the pediatric patient to seek medical care. Abdominal pain and tenderness and back pain result from irritation and edema of the inflamed pancreas that stimulate the nerve endings. Increased tension on the

pancreatic capsule and obstruction of the pancreatic ducts also contribute to that pain.

Typically, the pain occurs in the mid-epigastrium. Pain is frequently acute in onset, occurring 24 to 48 hours after a very heavy meal, and it may be diffuse and difficult to localize and not relieved by antacids. Pain may be accompanied by abdominal distension; a poorly defined, palpable abdominal mass; and decreased peristalsis. Pain caused by pancreatitis is accompanied frequently by nausea and vomiting that don't relieve the pain **(Huang, et al., 2025)**. Management of AP in children relies on supportive measures and volume replacement in specific cases, as well as in the early introduction of enteral nutrition, depending on the pediatric, clinical conditions, in order to reduce morbidity associated with the disease. The early diagnosis and the proper management can contribute to better outcomes of children and prevent immediate and late related complications **(Hines & Pandol, 2024)**.

The complications observed in children with AP can be immediate or late. Immediate complications include hypovolemic and septic shock associated with dysfunction of multiple organs and systems. Renal dysfunction and cavity effusions, such as ascites and pleural effusion, as well as acute

respiratory distress, may also complicate the child's condition. The most common late complications include pancreatic necrosis and formation of pseudo cysts. Early recognition and diagnosis of pancreatitis is key to prevent disease progression and associated complications **(Lal et al., 2020)**.

Nursing management of the child with AP include providing pain relief medications and emotional support. In addition to monitoring the child for signs of local or systemic complications. The child must be closely monitored for signs and symptoms of pancreatic infection, which include increased abdominal pain and tenderness, fever, and increased white blood cell count **(Mehany, Belal, Mohamed & Shaaban, Abdel Hamid, (2022)**.

Acute pancreatitis in children is a serious condition that requires prompt and effective nursing care to prevent complications. Nurses play a critical role in the management of pediatric patients with AP, necessitating a strong foundation of knowledge and practice. Management of AP in children relies on supportive measures and volume replacement in specific cases, as well as in the early introduction of enteral nutrition, depending on the pediatric clinical conditions, in order to reduce morbidity associated with the disease.

The early diagnosis and the proper management can contribute to better outcomes of children and prevent immediate and late related complications **(Hines & Pandol, 2024)**.

Pediatric nurses play an important role in the management of AP. Nurses must be able to take complete detailed history in order to correctly identify pancreatitis, and to eliminate differential diagnosis of similar presentation. Nurses must be able to identify risk factors associated with AP, have assessment skills, and know what diagnostics tests are needed. In order to prevent disease progression the cause of pancreatitis must also be identified **(Mehany et al., (2022)**.

Nursing intervention include relieving pain and discomfort, improving breathing pattern, nutritional status, skin integrity, monitoring and managing potential complication, promoting home and community-based care, continuing care and measuring blood glucose level and nursing of nasogastric tube. **(Sarin & Kaur, 2022)**.

### **Significance of the study**

Acute pancreatitis is started to be diagnosed more often in children. It affects children of all stages, but the mortality rate associated with It increases with age. The incidence of multiple organ failure increases with

age, possibly as a result of the gradual decline in the physiological function of the major organs with age. Closely monitoring the function of the main organ (i.e., lungs and kidneys) is necessary, and aggressive treatment is necessary to reduce death from AP in children. Therefore, the aim of this study was to assess nurses' knowledge and practice regarding children with AP. Therefore, the aim of this study was to assess nurses' knowledge and practice regarding children with AP (Valverde-López, Martinez-Cara, & Redondo-Cerezo, 2022).

## **Subjects and Methods**

### **Research design**

A descriptive research design was used to conduct this study.

### **Setting**

The study was conducted at the Pediatric Medical Department of Tanta Main University Hospital which includes 7 wards every ward contains 6 beds, Pediatric Medical Department of Kafer-Elsheikh University Hospital that includes 3 wards, every ward includes 3 beds and Pediatric Intensive Care Unit at Kafer-Elsheikh University Hospital that includes 8 beds.

### **Subjects**

All nurses who were working in the previously mentioned settings (79) from Pediatric Medical Department of Tanta Main University Hospital and

(51) nurse from Pediatric Department and Pediatric Intensive Care Unit at Kafer-Elsheikh University Hospital were participating in the study.

### **Tools of data collection**

#### **Tool I: knowledge structured questionnaire:**

It was developed by the researcher after reviewing recent related literature (Morton, Bowers, Wessels, Koen & Tobias, 2020) & (Hinkle, White, Weisburd & Kuen, 2023); to assess nurses' knowledge regarding acute pancreatitis in children. It consisted of two parts:

**Part (1):** Socio demographic characteristics of nurses such as age, marital status, qualifications, years of experience and previous attendance of training courses related to acute pancreatitis in children.

**Part (2):** Nurses' knowledge about acute pancreatitis. It involved 8 items as definition of acute pancreatitis, causes, pathophysiology, clinical manifestations, classification, and criteria for predicting severity of pancreatitis, complications and nursing management.

#### **Scoring system**

**Nurses' knowledge was scored as following:**

Correct and complete answer was scored (2)

Correct and incomplete answer was scored (1)

Wrong answer and don't know was scored (0)

**Total scoring system for nurses' knowledge was categorized as the following:**

- High level of knowledge from 80% and more.
- Moderate level of knowledge from 80% to 60%.
- Low level of knowledge less than 60%.

**Tool II: Observational checklist about nurses' practice regarding acute pancreatitis :** The check list was adopted and based on the identified guidelines care (Berman AT et al .,2023) &( Niciol .,2020) It was used to assess nurses' practices regarding children diagnosed with acute pancreatitis.

**It consisted of the following procedures:**

- Monitoring blood glucose level.
- Monitoring fluid intake and output.
- Care of nasogastric tube.

**The scoring system for each step of nurses' practice was scored as following:**

- Done was scored as (1)
- Not done was scored as (0)

**Total scoring system for nurses' practice was classified as follow:**

- Less than 80% was considered unsatisfactory
- From 75% and more was considered satisfactory

## Method

1. An official permission was obtained from the dean Faculty of Nursing and the responsible authorities of selected setting explaining the aim of study.

2. Ethical and legal considerations: -

- Ethical approval was obtained from Scientific Research Ethical Committee at Tanta University, Faculty of Nursing to conduct the study with code No.: (20-12-21).
- Nature of the study did not cause any harm or pain to the entire sample.
- Privacy and confidentiality were taken into consideration while data collection.
- Nurses were reassured that their participation is voluntary and that they can withdraw from study at any time and their consent to participate was obtained.

3. Content validity had been confirmed by a jury of five expertise in the field of Pediatric Nursing before conducting the study.

4. A Pilot study was carried out on 10% of nurses to test feasibility and clarity of tools, which was excluded from the study. Accordingly necessary modification was done. The pilot study was excluded from the study.

5. Cronbach's alpha for knowledge score was 0.806 (high reliability). It was 0.791 for practice score that is indicate good reliability and 0.873 for

attitude score that is indicate high reliability.

6. The aim of the study was explained to the studied nurses.

7. The researcher met studied nurses to establish their trust and cooperation by out lining the study's aim.

8. A written consent was taken from the studied nurses.

9. The researcher interviewed the studied nurses at the previously mentioned settings 3 days per week in the morning shift and every interview took about 20 minutes.

10. The knowledge questionnaire was translated into Arabic language by researchers and filled by participated nurses in the presence of researcher to clarify any point to them.

11. The researcher observed pediatric nurses while applying care to children as monitoring blood glucose level, monitoring fluid intake and output and providing care for nasogastric tube.

12. The data was collected over period of 6 months from July 2022 to December 2022.

### Results and Statistical analysis

**Table (1):** shows percentage distribution of studied nurses' socio-demographic characteristics; it was observed that more than one third of the studied nurses(36.9%) aged from 20 to less than 25 years old with a mean and standard deviation  $33.49 \pm 12.09$ . Regarding their marital status, about

two thirds of them (64.6%) were married, while more than half of them (53.8%) had less than 5 years of experience.

Regarding their educational qualifications, about half of them (50.8%) had Bachelor of Nursing. In addition, most of them (93.8%) didn't attend training courses related to acute pancreatitis in children.

**Table (2):** illustrates percentage distribution of the studied nurses' knowledge regarding acute pancreatitis; It was found that more than two thirds of studied nurses (63.1%) reported correct and complete answers related to definition of acute pancreatitis while more than half of them(56.2%) reported correct and complete answers regarding causes of acute pancreatitis.

Regarding functional changes associated with acute pancreatitis, it was observed that half of studied nurses (50.8%) had correct and complete answers. Concerning symptoms of acute pancreatitis, less than three quarters of them(70.8%) reported correct and complete answers. At the same time, nearly two thirds of them (62.5%,61.2%) reported correct and complete answers regards classification and complications of acute pancreatitis respectively.

In addition to 59.2 % and more than two thirds of them (66.2%) reported

correct and complete answers relating to characteristics of severe pancreatic inflammation and nursing care for children with acute pancreatitis respectively.

**Figure(1):** illustrates percentage distribution of studied nurses' total knowledge level regarding acute pancreatitis in children. The table clarified that less than two thirds of studied nurses (61.3%) had high level of knowledge regarding acute pancreatitis while 24.1% of them had moderate level of knowledge compared to only 14.6% of them who had low level of knowledge with mean and standard deviation of total knowledge score = **42.01 ±13.38**.

**Table (3):** illustrates percentage distribution of studied nurses' total practice level regarding acute pancreatitis in children. The table announced that 80.5% of studied nurses had satisfactory practice level regarding care of children with acute pancreatitis, while slightly less than one fifth of them (19.5%) had unsatisfactory practice level with mean and standard deviation of the total nurses' practices score **Mean ± SD28.14 ±10.47**

**Table (4):** shows the correlation between the studied nurses' total knowledge score and their total practice score regarding acute pancreatitis; it was found that there was

a positive statistically significant correlation between total knowledge score and total practice score of studied nurses regarding acute pancreatitis where as  $p=(0.026)$  and  $r=( 0.739)$

**Table (5):** determines that 35.0% of studied nurses whose age was between 25 to less than 30years old, had high level of knowledge while 41.9% of those nurses who were between 20 to less 25years had moderate level of knowledge and there was statistically significant relation between nurses' age and their knowledge where  $p= (.043)$

In the same direction, 40.0% of studied nurses who had less than 5years of experience, had high level of knowledge and nearly three quarters of them (74.2%) had moderate level of knowledge beside, there was statistically significant relation between years of experience and nurses' knowledge whereas  $p = (0.01)$ . As regards, nurses' educational qualifications; it was clear that more than two thirds of studied nurses (66.3%) who had bachelor of nursing demonstrated high level of knowledge and there was statistically significant relation between nurses' educational qualifications and their knowledge whereas  $p=.000^{**}$  Finally, all studied nurses (100.0%) who didn't attend training courses related to acute pancreatitis in children demonstrated

low level of knowledge and there was significant relation between nurses' knowledge and attendance training courses related to acute pancreatitis where as  $p = .000^{**}$

**Table (6):** clarifies that 39% of nurses who were between 25 to less than 30 years old, had satisfactory level of practice where  $p = (0.03)$ . In addition, nearly two thirds of studied nurses (64.8%) who had less than 5 years of experience had satisfactory level of practice and there was statistically significant relation between years of experience and their level of practice as  $p = (0.001)$ .

The table also clarified that majority of nurses (96.0%) who didn't attend training courses related to acute pancreatitis in children had unsatisfactory level of practice and there was statistically significant relation between attendance training courses related to acute pancreatitis in children and nurses' practice as  $p = 0.09$ .

**Table (1): Percentage distribution of studied nurses' socio-demographic characteristics (n=130)**

| Socio-demographic characteristics                            | No.          | %    |
|--------------------------------------------------------------|--------------|------|
| Age                                                          |              |      |
| 20<25                                                        | 48           | 36.9 |
| 25<30                                                        | 43           | 33.1 |
| 30<35                                                        | 12           | 9.2  |
| 35<40                                                        | 7            | 5.4  |
| 40<45                                                        | 13           | 10.0 |
| More than 45                                                 | 7            | 5.4  |
| Mean ± SD                                                    | 33.49 ±12.09 |      |
| Marital status                                               |              |      |
| Single                                                       | 35           | 26.9 |
| Married                                                      | 84           | 64.6 |
| Divorced                                                     | 2            | 1.6  |
| Widower                                                      | 9            | 6.9  |
| Years of experience                                          |              |      |
| <5 years                                                     | 70           | 53.8 |
| 5 < 10 years                                                 | 22           | 16.9 |
| 10 < 15 years                                                | 13           | 10.0 |
| > 15 years                                                   | 25           | 19.3 |
| Qualifications                                               |              |      |
| Nursing Diploma                                              | 22           | 16.9 |
| Technical Institute of Nursing                               | 42           | 32.3 |
| Bachelor of Nursing                                          | 66           | 50.8 |
| Attendance courses related to acute pancreatitis in children |              |      |
| Yes                                                          | 8            | 6.2  |
| No                                                           | 122          | 93.8 |
| Workplace                                                    |              |      |
| Tanta University Hospital                                    | 78           | 60.0 |
| Kafrelsheikh University Hospital                             | 52           | 40.0 |



**Table (2): Percentage distribution of studied nurses' knowledge regarding acute pancreatitis (n=130).**

| Item related to acute pancreatitis knowledge          | The studied nurses (n=130)   |             |                                |             |                   |             |
|-------------------------------------------------------|------------------------------|-------------|--------------------------------|-------------|-------------------|-------------|
|                                                       | Correct and complete answers |             | Correct and incomplete answers |             | Incorrect Answers |             |
|                                                       | No.                          | %           | No.                            | %           | No.               | %           |
| Definition of Acute pancreatitis                      | 82                           | <b>63.1</b> | 33                             | 25.4        | 15                | 11.5        |
| Causes of acute pancreatitis                          | 73                           | 56.2        | 46                             | <b>35.4</b> | 11                | 8.4         |
| Functional changes associated with acute pancreatitis | 66                           | 50.8        | 39                             | 30.0        | 25                | 19.2        |
| Symptoms of acute pancreatitis                        | 92                           | <b>70.8</b> | 22                             | 16.9        | 16                | 12.3        |
| Classification of acute pancreatitis                  | 81                           | 62.3        | 30                             | 23.1        | 19                | 14.6        |
| Characteristics of sever pancreatic inflammation      | 77                           | 59.2        | 25                             | 19.2        | 28                | <b>21.5</b> |
| Complications of acute pancreatitis                   | 80                           | 61.5        | 31                             | 23.8        | 19                | 14.6        |
| Nursing care for children with acute pancreatitis     | 86                           | 66.2        | 25                             | 19.2        | 19                | 14.6        |

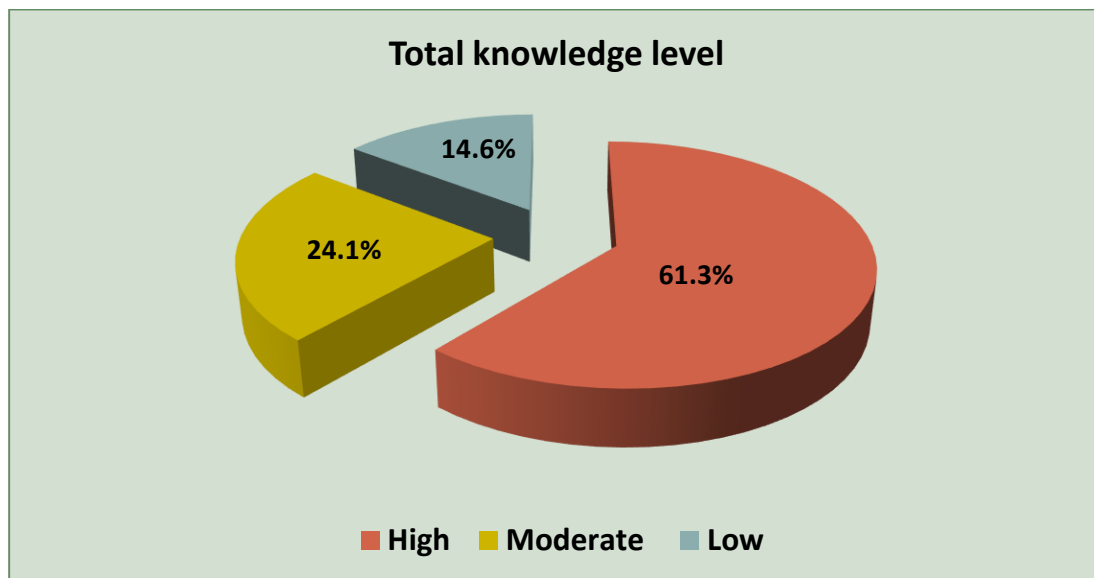


**Figure (1): Total nurses' knowledge about acute pancreatitis in children (n=130).**

**Table (3): percentage distribution of the studied nurses' total practices level regarding acute pancreatitis (n=130).**

| Total practices level | No.               | %    |
|-----------------------|-------------------|------|
| Satisfactory          | 105               | 80.5 |
| Unsatisfactory        | 25                | 19.5 |
| Total Mean $\pm$ SD   | 28.14 $\pm$ 10.47 |      |

**Table (4): Correlation between total nurses' knowledge and their total practice score related to acute pancreatitis in children.**

| Total knowledge Score | Total practices score |         |
|-----------------------|-----------------------|---------|
|                       | R                     | p-value |
|                       | 0.739                 | 0.026*  |

**P<0.05 (statistically significance)      R=0.739, P=0.026**

**Table (5): Relation between nurses' knowledge and their socio-demographic characteristics.**

| Socio demographic characteristics                                     | Total knowledge level |      |                    |      |               |       | Test of significanc<br>X <sup>2</sup> e | p-value |
|-----------------------------------------------------------------------|-----------------------|------|--------------------|------|---------------|-------|-----------------------------------------|---------|
|                                                                       | High<br>(n=80)        |      | Moderate<br>(n=31) |      | Low<br>(n=19) |       |                                         |         |
|                                                                       | No.                   | %    | No.                | %    | No.           | %     |                                         |         |
| Age/ Years                                                            |                       |      |                    |      |               |       |                                         |         |
| 20<25                                                                 | 24                    | 30.0 | 13                 | 41.9 | 11            | 57.9  | 12.549                                  | .043*   |
| 25<30                                                                 | 28                    | 35.0 | 10                 | 32.3 | 5             | 26.3  |                                         |         |
| 30<35                                                                 | 7                     | 8.8  | 4                  | 12.9 | 1             | 5.3   |                                         |         |
| 35<40                                                                 | 4                     | 5.0  | 2                  | 6.5  | 1             | 5.3   |                                         |         |
| 40<45                                                                 | 10                    | 12.5 | 2                  | 6.5  | 1             | 5.3   |                                         |         |
| More than 45                                                          | 7                     | 8.8  | 0                  | 0.0  | 0             | 0.0   |                                         |         |
| Marital status                                                        |                       |      |                    |      |               |       |                                         |         |
| Single                                                                | 17                    | 21.3 | 10                 | 32.3 | 8             | 42.1  | 10.848                                  | .093    |
| Married                                                               | 57                    | 71.3 | 17                 | 54.8 | 10            | 52.6  |                                         |         |
| Divorced                                                              | 0                     | 0.0  | 2                  | 6.5  | 0             | 0.0   |                                         |         |
| Widowed                                                               | 6                     | 7.5  | 2                  | 6.5  | 1             | 5.3   |                                         |         |
| Years of experience                                                   |                       |      |                    |      |               |       |                                         |         |
| <5 years                                                              | 32                    | 40.0 | 23                 | 74.2 | 15            | 78.9  | 19.054                                  | .001**  |
| 5 < 10 years                                                          | 17                    | 21.3 | 4                  | 12.9 | 1             | 5.3   |                                         |         |
| 10 < 15 years                                                         | 9                     | 11.3 | 2                  | 6.5  | 2             | 10.5  |                                         |         |
| > 15 years                                                            | 22                    | 27.5 | 2                  | 6.5  | 1             | 5.3   |                                         |         |
| Qualifications                                                        |                       |      |                    |      |               |       |                                         |         |
| Nursing Diploma                                                       | 11                    | 13.8 | 9                  | 29.0 | 2             | 10.5  | 24.961                                  | .000**  |
| Technical Institute of Nursing                                        | 16                    | 20.0 | 17                 | 54.8 | 9             | 47.4  |                                         |         |
| Bachelor of Nursing                                                   | 53                    | 66.3 | 5                  | 16.1 | 8             | 42.1  |                                         |         |
| Attendance Training courses related to acute pancreatitis in children |                       |      |                    |      |               |       |                                         |         |
| Yes                                                                   | 6                     | 7.5  | 2                  | 6.5  | 0             | 0.0   | 20.560                                  | .000**  |
| No                                                                    | 74                    | 92.5 | 29                 | 93.5 | 19            | 100.0 |                                         |         |

\*Statistically significant  $p < 0.05$ \*\*High statistically significant  $p < 0.001$

**Table (6): Relation between total nurses' practice and their socio-demographic characteristics.**

| Socio demographic characteristics                                     | Total practices level   |      |                          |      | X <sup>2</sup> | p-value |
|-----------------------------------------------------------------------|-------------------------|------|--------------------------|------|----------------|---------|
|                                                                       | Satisfactory<br>(n=105) |      | Unsatisfactory<br>(n=25) |      |                |         |
|                                                                       | No.                     | %    | No.                      | %    |                |         |
| Age/year                                                              |                         |      |                          |      |                |         |
| 20<25                                                                 | 31                      | 29.5 | 17                       | 68.0 | 17.836         | .003**  |
| 25<30                                                                 | 41                      | 39.0 | 2                        | 8.0  |                |         |
| 30<35                                                                 | 9                       | 8.6  | 3                        | 12.0 |                |         |
| 35<40                                                                 | 5                       | 4.8  | 2                        | 8.0  |                |         |
| 40<45                                                                 | 13                      | 12.4 | 0                        | 0.0  |                |         |
| More than 45                                                          | 6                       | 5.7  | 1                        | 4.0  |                |         |
| Marital status                                                        |                         |      |                          |      |                |         |
| Single                                                                | 26                      | 24.8 | 9                        | 36.0 | 3.338          | .342    |
| Married                                                               | 71                      | 67.6 | 13                       | 52.0 |                |         |
| Divorced                                                              | 2                       | 1.9  | 0                        | 0.0  |                |         |
| Widowed                                                               | 6                       | 5.7  | 3                        | 12.0 |                |         |
| Years of experience                                                   |                         |      |                          |      |                |         |
| <5 years                                                              | 68                      | 64.8 | 2                        | 8.0  | 19.915         | .001**  |
| 5 < 10 years                                                          | 19                      | 18.1 | 3                        | 12.0 |                |         |
| 10 < 15 years                                                         | 8                       | 7.6  | 5                        | 20.0 |                |         |
| > 15 years                                                            | 10                      | 9.5  | 15                       | 60.0 |                |         |
| Educational Qualifications                                            |                         |      |                          |      |                |         |
| Nursing Diploma                                                       | 19                      | 18.1 | 3                        | 12.0 | 18.420         | .000    |
| Technical Institute of Nursing                                        | 25                      | 23.8 | 17                       | 68.0 |                |         |
| Bachelor of Nursing                                                   | 61                      | 58.1 | 5                        | 20.0 |                |         |
| Attendance Training courses related to acute pancreatitis in children |                         |      |                          |      |                |         |
| Yes                                                                   | 7                       | 6.7  | 1                        | 4.0  | 17.561         | .009*   |
| No                                                                    | 98                      | 93.3 | 24                       | 96.0 |                |         |

\*Statistically significant  $p < 0.05$ \*\*High statistically significant  $p < 0.001$

## Discussion

Acute pancreatitis has been increasingly diagnosed in children in recent decades. A variety of etiologies can cause it in children, including structural/anatomic, obstructive/ biliary, trauma, infections, toxins, metabolic, systemic illness, inborn errors of metabolism, and genetic predispositions. Acute Pancreatitis in children is a complex and potentially severe condition that requires prompt and effective management. Despite its increasing incidence, there is a notable gap in pediatric-specific management guidelines, often relying on adult-based protocols (**Bhanot et al., 2022**).

Understanding nurses' current knowledge and practice is crucial for improving pediatric patient outcomes and ensuring that children with AP receive the best possible care (**Barros et al., 2023**). So this study aimed to assess nurses' knowledge and practice regarding children with acute pancreatitis.

Regarding the studied nurses' knowledge about acute pancreatitis, the result of the current study revealed that more than three fifths of studied nurses reported correct and complete answers related to definition of acute pancreatitis, while more than half of them reported correct and complete answers regarding causes of acute pancreatitis. This may be due to the fact that the definition and causes of acute pancreatitis are foundational aspects often covered in basic nursing education and about half of

the studied nurses had Bachelor of Nursing, making them more familiar and easier for nurses to recall.

This result was in accordance with a study carried out by **Uysal, (2024)**, who stated that more than half of nurses demonstrated good knowledge about the definition and causes of acute pancreatitis. Conversely, (**Mohammed, Mohamed, Me hany, (2019)**) whose study about effect of educational program on nurses' performance regarding patients with acute pancreatitis, reported that the majority of studied nurses had incorrect answers related to definition and causes of acute pancreatitis before implementation of an educational program.

Additionally, the present study displayed that less than three quarters of the studied nurses reported correct and complete answers regarding symptoms of acute pancreatitis. Besides, nearly two thirds of them gave correct and complete answers regarding classification and complications of acute pancreatitis, respectively. This result was in agreement with **Rijal, (2019)** who noticed that more than half of studied nurses reported correct answers about symptoms of pancreatitis. On the contrary, a study conducted by (**Maiber, Ismail, Frag Ibrahim, (2024)**) found that more than half of nurses reported low level of knowledge about classifications and complications of pancreatitis before

implementation of an educational program.

Moreover, the current study indicated that almost three fifths and about two thirds of the studied nurses reported correct and complete answers relating characteristics of sever pancreatic inflammation and nursing care for children with acute pancreatitis, respectively. In the same line, a study carried out by **Mangsbacka & Gustavell, (2022)** indicated that the highest percentage of the studied nurses reported correct and complete answers toward characteristics of severe pancreatitis. In contrast, to **Zhang & Yang, (2022)** who argued that most of the studied nurses had incorrect answers about nursing care for acute pancreatitis.

Pertaining the studied nurses' total knowledge level regarding acute pancreatitis, the present study demonstrated that about two thirds of the studied nurses had high level of knowledge regarding acute pancreatitis. From the research point of view, this may be due to higher education of those nurses where about half of them had Bachelor of Nursing and the fact that acute pancreatitis in children is a critical condition that requires nurses to have a solid knowledge base to ensure effective care, which may lead to their prioritization of acquiring and retaining such knowledge. This finding was in harmony with a study conducted by **Giamouris et al., (2024)** who found that most of the studied nurses had high level

of knowledge about pancreatitis in children. On the other hand, this result contradicted with a study carried out by, **(Mohammed et al., (2019))** who explained that more than two thirds of the studied nurses had insufficient total level of knowledge regarding acute pancreatitis. This may be due to that most of the studied nurses didn't attend training courses related to acute pancreatitis.

Regarding the studied nurses' total practices level regarding acute pancreatitis, the current study highlighted that most of the studied nurses had satisfactory level of practice regarding care of children with acute pancreatitis. This may be due to the fact that most of the studied nurses had a Bachelor of Nursing degree and about two-thirds of them had a high level of knowledge regarding pancreatitis, which typically provides a strong foundation in theoretical and practical knowledge, enabling them to deliver competent care. This finding was supported by, **Hamed, Amin&Elsayed (2021)**, who noticed that most of pediatric nurses had satisfactory level of practice about pancreatitis care. The present study result was against **Mohamed, Zaki, Mohamoud&AbdElhamed, (2023)** who indicated that majority of nurses had unsatisfactory level of practice regarding pancreatitis care.

This result was inconsistent with the findings of **Maiber et al., (2024)** who observed that more than half of the studied

nurses had an unsatisfactory level of practice about pancreatitis care. At the same time, **Eltesh et al., (2024)** reported in their study about Nurses' Perception regarding Artificial Pancreas among Type I Diabetes Mellitus at the National Diabetic Institute that more than half of studied nurses had incompetent level of practice regarding care of children with pancreatitis.

Regarding correlation between total nurses' knowledge and total practice score related to acute pancreatitis, the present study illustrated that there was statistically significant positive correlation between total knowledge and total practice score regarding acute pancreatitis. This may be due to the fact that an increase in nurses' knowledge equips them with a better understanding of the theoretical and practical aspects of managing acute pancreatitis in children, enabling them to apply evidence-based practices effectively.

Correspondingly, study carried out by **Hamed et al., (2021)**, who reported that there was a strong positive correlation between nurses' total knowledge and total actual practice regarding care of children undergoing gastrointestinal surgeries. In contrast

to **(Reyad, Mahmoud & Eldriny, (2022))** who noted that, no statistically significant differences were found between total nurses' practice mean scores and their total knowledge score. They added that, these alarming findings revealed that

nurses may not follow the best recommended practices, even if they are available.

The result of the current study displayed that there was highly statistically significant relation between nurses' knowledge and their years of experience, qualifications and attending training courses related to acute pancreatitis in children. This can be explained this can be attributed to the findings of newly graduated nurses who had bachelor degree and less than 5 years of experience are still have fresh knowledge has the desire to learn and more powerful newly graduated and about two fifth of studied nurses had less than 5 years of experience and two thirds of them had bachelor of nursing this means that combined high educational with less years of experience allow them to still having fresh up to date information which in turn results in high level of knowledge. Also, all of studied nurses who didn't attend training courses demonstrated low level of knowledge.

This may be due to the accumulation of practical experience, advanced theoretical knowledge from higher qualifications, and targeted updates gained through specialized training courses. These factors collectively enhance nurses' understanding and management of acute pancreatitis in children. This result was consistent with **Mohamed et al., (2023)** who stated that educational qualification and training courses had a high-frequency positive effect on the knowledge score.

Conversely, findings of a study conducted by **(Wangari,Omondi&Maina,(2024)** who found that level of qualification and work experience were not significantly associated with the levels of knowledge.

In addition, the current study portrayed that there was a statistically significant relation between nurses' age and their knowledge level. This can be explained as more than one third of studied nurses whose age was between 25 to less than 30 years old, had high level of knowledge. This may be attributed that those nurses with young age get more opportunities for continuous education through attending workshops besides still having fresh updated information regarding acute pancreatitis.

In addition nurses might have accumulated more professional experience, exposure to diverse clinical situations, which contribute to their higher knowledge levels. On the other hand, **(Alaa, Ahmed, Syam&Ali, (2023)** argued that, there was no statistically significant relationship between the nurses' knowledge level and their age. Also, **(Kareem, Shraida&Razzaq (2022)** whose study reported that there was a non-significant association between the overall nurses' knowledge and their age.

As regards relation between total nurses' practice and their socio-demographic characteristics, the present study showed that there was highly statistically significant relation with their age and their

years of experience. This can be interpreted as more than one third of nurses who were between 25 to less than 30 years old, had satisfactory level of practice. As well, nearly two thirds of them who had less than 5 years of experience had satisfactory level of practice.

As regards nurses with high educational level with less years of experience allow them to still having fresh up to date information they are more likely to develop advanced practical skills and a deeper understanding of their roles. In addition, as reported by study results more than one third of studied nurses had high level of knowledge which in turn increases their level of practice. This result was in accordance with **Zhaoet al., (2023)** whose study found that there was significant association between nurses' age and years of experience and their level of practice. In contrast, a study conducted by **Eltesh, (2024)** who reported that there was no statistically significant relation between nurses' total reported practices level and their age and their years of experience.

Moreover, the current study reflected that there was statistically significant relation between nurses' attendance training courses related to acute pancreatitis in children and work place and their level of practice. Where majority of nurses who didn't attend training courses had unsatisfactory level of practice. Also, nearly two thirds of nurses who were



working at Tanta university hospital demonstrated satisfactory practice level compared to only more than one third who were working at Kafr Elsheikh university hospital.

This may be attributed to the fact that attending training courses enhanced nurses' knowledge and skills, equipped them with the necessary competencies to provide optimal care. Additionally, the influence of the workplace could reflect variations in access to resources, support systems, and institutional priorities that either facilitate or hinder opportunities for professional development. This result was compatible with **Sheng et al., (2019)** who found that there was significant association between nurses' practice and attending training courses. Conversely, **Abdulsamea et al., (2023)** noticed that there was no significant relation between nurses' practice score and attending continues training and place of work.

### Conclusion

**Based on the results of the present study, it can be concluded that**

Less than two thirds of the studied nurses had high level of knowledge about acute pancreatitis, while majority of them had satisfactory level of practice regarding care of children with acute pancreatitis. In addition, there was a positive statistically significant correlation between total nurses' knowledge score and their total practice score related to acute pancreatitis.

### Recommendations

**Based on the findings of the current study, it can be recommended that**

1. Regular and continuous educational programs about acute pancreatitis in children, should be conducted for pediatric nurses to increase their knowledge while caring for those children.
2. Further research should be conducted on a large sample to achieve generalizability.
3. Including acute pancreatitis in the curriculum for undergraduate and graduate nursing education.

### References

- Abdulsamea, H., Bahafi, A., Mohammed, N. A., Mohammed, H., Allabani, D., & Bagaber, A. S. (2022).** Assessment of Nurses' Knowledge and Practice of Some Gastrointestinal Drugs. *ScientificNursingJourn*, 1(3), 90-155.  
<https://doi.org/10.21673/anadoluklin.1415506>
- Alaa, S., Ahmed, H., Syam, N., & Ali, S. (2023).** Nurses' Knowledge and practices regarding the Perioperative Care of Patients with Cholelithiasis undergoing Laparoscopic Cholecystectomy: Guidelines Proposal. *Alexandria Scientific Nursing Journal*, Egypt, 25 (1),93101 [10.21608/asalexu.2023.300014](https://doi.org/10.21608/asalexu.2023.300014)

- Barros, J., Ramdeen, M., Rivera-Sequeiros, A., Baima, J., Saad-Hossne, R., Alencar, R., & Sassaki, Y. (2023).** Profile of inflammatory bowel disease nurses in Brazil. *Arquivos de Gastroenterologia*, 60(3), 300-308.<https://doi.org/10.1590/S0004-2803.230302023-16>
- Berman, M., Soltero-Rivera, M., & Scanlan, A. (2023).** Prevalence of dental and skeletal malocclusions in mesocephalic and dolichocephalic dogs: a retrospective study
- Bhanot, M. (2022).** Proposal on to term "joint cholangiotrace" for specify joint trace that needs urgent single slide small. *World J Gastrointest Endosc.* (10<sup>th</sup> ed). Japan. NawaHospital, 451-459 [DOI] [PMC free article] [PubMed] [Google Scholar]
- Eltesh, A. (2024).** Nurses' Perception regarding Artificial Pancreas among Type I Diabetes Mellitus at the National Diabetic Institute. *Helwan International Journal for Nursing Research and Practice*, 3(7), 409-423. 10.21608/HIJNRP.2024.305796.1194
- Giamouris, V., Davenport, M., Davies, H., Geaney, G., Banerjee, T., Bakewell, C., & Grammatikopoulos, T. (2024).** Pancreatitis in children: *practical management from the BSPGHAN Pancreatitis Working Group. Frontline Gastroenterology.* <https://doi.org/10.1136/flgastro-2024-102788>
- Hinkle, C., White, C., Weisburd, D., & Kuen, K. (2023).** Disorder in the eye of the beholder: Black and White residents' perceptions of disorder on high-crime street segments. *Journal of Criminology & Public Policy*, 22(1), 35-61. <https://doi.org/10.1111/1745-9133.12602>
- Hamed, D., Amin, E., & Elsayed, S. (2021).** Assessment of Nurses' knowledge and Practices Regarding Children Undergoing Gastrointestinal Surgery. *Egyptian Journal of Health Care*, 12(4), 723-735 <https://doi.org/10.21608/asalexu.2022.248622>
- Hines, O., & Pandol, S. (2024).** Management of chronic pancreatitis. *bmj*, 384. <https://www.bmj.com/research> doi: <https://doi.org/10.1136/bmj-2023-070920>
- Huang, Y., Qiu, M., Pan, S., Zhou, Y., Huang, X., Jin, Y., & Hong, W. (2025).** Temporal trends in gender, etiology, severity and outcomes of acute pancreatitis in a third-tier Chinese city from 2013 to 2021. *Annals of Medicine*, 57(1), 2442073.

<https://doi.org/10.1080/07853890.2024.2442073>

**Iannuzzi, J., King, J., Leong, J., Quan, J., Windsor, J., Tanyingoh, D., Shaheen, A. (2022).** Global incidence of acute pancreatitis is increasing over time: a systematic review and meta-analysis. *Gastroenterology*, 162(1), 122-134.

<https://doi.org/10.1053/j.gastro.2021.09.043>

**Kareem, M., Shraida, A., & Razzaq, S. (2022).** Assessment of nurses' knowledge regarding management of patient's with cholelithiasis disease. *International Journal of Current Science Research and Review*, 1(4).

**Lal, S., Venkatesh, V., Rana, S., Anushree, N., Bhatia, A., & Saxena, A. (2020).** Paediatric acute pancreatitis: clinical profile and natural history of collections. *Pancreatology*, 20(4), 659-664. <https://doi.org/10.1016/j.pan.2020.03.007>

**Maiber, H., Ismail, A., Frag, W., & Ibrahim, R. (2024).** Effect of Educational Guidelines on Nurses' Performance for patients with Chronic Pancreatitis. *Tanta Scientific Nursing Journal*, 32(1), 94-111.

**Mangsbacka, M., & Gustavell, T. (2022).** Nurses' Experiences Using an Interactive System to Assess and

Manage Treatment-Related Symptoms of Patients With Pancreatic Cancer: *Interview Study*. *JMIR nursing*, 5(1), e36654 <https://preprints.jmir.org/preprint/36654>.

**Mehany, A., Belal, A., Mohamed, A., Shaaban, S., & Abdel Hamid, G. (2022).** Apoptotic and anti-angiogenic effects of propolis against human bladder cancer: Molecular docking, 158(11), 556-563.

<https://doi.org/10.1080/1354750X.2021.2020903>

**Mohamed, A., Hassan, R., & El-Sheikh. (2020).** Nurses' knowledge and their practice regarding post intensive care syndrome of critically ill pediatric patient. *Mansoura Nursing Journal*, 7(2), 153-161. <https://doi.org/10.21608/asalexu.2022.248622>

**Mohamed, H., Mohamed, R., & Refaat, H. (2021).** Assessment of nursing performance toward enteral feeding at pediatric critical care units. *Egyptian Journal of Health Care*, 12(4), 1159-1178. <https://doi.org/10.21608/asalexu.2022.248622>

**Mohamed, N., Zaki, N., Mohamoud, E., & Abd-Elhamed, A. (2023).** Effect of Implementing Clinical Pathway on Nursing Care for Children with type one Diabetes Mellitus Suffering from

Hyperglycemia. *Assiut Scientific Nursing Journal*,  
<https://dx.doi.org/10.21608/asnj.2023.194530.1526>

**Mohammed, S., Mohammed, M., & Mehany, M. (2019).** Effect of Educational Program on Nurses' performance Regarding Patients with Acute Pancreatitis. *Assiut Scientific Nursing Journal*, 7(17), 64-74.  
<https://dx.doi.org/10.21608/asnj.2019.56822>

**Mohamed, S., Salem, G., & Almushawah, R. (2023).** Pediatric nurses' knowledge and practices of nasogastric tube placement and verification: A cross-sectional study. *Nutrition*, 115, 112136  
<https://doi.org/10.1016/j.nut.2023.112136>.

**Morton, D., Bowers, C., Wessels, L., Koen, A., & Tobias, J. (2020).** Job satisfaction of registered nurses in a private critical care unit in the Eastern Cape: *Apilot study. Health SA Gesondheid*, 25.

<https://doi.org/10.1186/s12960-015-0093-2>

**Nabeel, F., & El-Saeed, R. (2022).** Effect of Educational Toolkit on Pediatric Nurses' Knowledge, and Practices toward Noroviruses among Children. *Egyptian Journal of Health Care*, 13(3), 859-867  
<https://doi.org/10.1007/s10806-019-09810->

<https://dx.doi.org/10.21608/ejhm.2022.258690>

**Reyad, O. R., Mahmoud, F. H., & Eldriny, S. N. M. (2022).** Assessment on attendants' knowledge in space regarding intra-abdominal pressure measurement in inside Compartment Syndrome Prevention. to *Egyptian Journal on Hospital Medicine*, 89(1), 4578-4586. DOI: 10.21608/ejhm.2022.258690

**Rijal, S. (2022).** Post-operative fair in trace: mild intervention.  
<https://doi.org/10.1002/ncp.10386>

**Roark, R., Sydor, M., Chatila, A., Umar, S., Guerra, R., Bilal, M., & Guturu, P. (2020).** *Management of gastroesophageal reflux disease.* *Disease-a-Month*, 66(1), 100849.  
<https://doi.org/10.1016/j.disamonth.2019.02.002>

**Saeed, S. A. (2020).** end trace in kids: Updates in epidemiology, shall in dealing. *Current Subjects in Pediatric in Adolescent Health Care*, 50(8), 100839.

**Sarin, J., & Kaur, P. (2022).** *Wong's Essentials of Pediatric Nursing: Third South Asian Edition-E-Book: Elsevier Health Sciences*, 220-390.  
<https://dx.doi.org/10.21608/menj.2023.307039>  
<https://doi.org/10.1016/j.cppeds.2020.100839>

**Sheng, M. (2019).** Knowledge, attitudes, in spaces (KAP) regarding intra-

abdominal pressure monitoring among pediatric intensive care attendants: A cross-sectional study. *International Journal on mild Sciences*.

<https://doi.org/10.1016/j.ijnss.2024.05.002>

**Shehab, S., & Soultan, A. (2021).** Impact of Application of Nursing Guidelines on Health Outcomes for Patients Undergoing Gastrointestinal Endoscopes. *Egyptian Journal of Health Care*, 12 (2), 195- 208

**Thapa, R., Iqbal, Z., Garikipati, A., Siefkas, A., Hoffman, J., Mao, Q., & Das, R. (2022).** Early prediction of severe acute pancreatitis using machine learning. *Pancreatology*, 22(1), 43-50. <https://doi.org/10.1016/j.pan.2021.10.003>

**UYBAL, H. (2024).** Nursing Care and Education in Pancreatic Diseases. *Turkiye Klinikleri, Internal Medicine Nursing-Special Topics*, 10(1), 65-76.

<https://doi.org/10.1016/j.nut.2023.112136>

**Valverde-López, F., Martínez-Cara, J., & Redondo-Cerezo, E. (2022).** *Pancreatitis aguda. Medicina clínica*, 158(11), 556-563. <https://doi.org/10.1080/1354750X.2021.2020903>

**Wangari, N. J., Omondi, L., & Maina, D. (2024).** Attendants' Knowledge, Attitude, in Space on Enteral Feeding on Critically ill Sick at Kenyatta National Hospital Critical Care Unit. *East African Journal on Health in Science*, 7(1), 22-33. DOI: <https://doi.org/10.37284/eajhs.7.1.1697>

**Zhang, M., & Yang, M. (2022).** Evaluation on Perioperative care for Sick for Hepatobiliary Static Hurts Combined for Diabetes Mellitus Based on Multilayer Perceptron Neural Network. *Wireless Communications in Mobile Computing*, 2022(1), 3833034. <https://doi.org/10.1155/2022/3833034>

## Effectiveness of Sodium Bicarbonate Mouth Wash on mucositis among Cancer Patients Undergoing Chemotherapy

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### Abstract

**Background:** Oral mucositis is one of the most debilitating problems of chemotherapy during the treatment period. It is important to prevent and treat mucositis because this complication is associated with pain, inability to maintain hydration and nutrition. **Aim of the study:** This study aimed to evaluate the effectiveness of sodium bicarbonate mouth wash on mucositis among cancer patients undergoing chemotherapy. **Research Design:** A quasi-experimental design was utilized in this study. **Setting:** The study was conducted at oncology medical department at Aswan University Hospital. **Sample:** A convenient sample of 100 adult patients of both sex who undergoing chemotherapy treatment and received sodium bicarbonate mouth care. **Tools:** In this study three tools were used for data collection: **I)** Interview questionnaire sheet included Patients' socio- demographic characteristics and Patients' medical history. **II)** Oral Mucositis severity Scale. **Results:** The results revealed that, more than two fifth (42%) of the studied patients have fourth degree of oral mucositis and more than one third of them (35%) have third degree pre intervention while, this percentages improved after use of sodium bicarbonate mouth wash. Furthermore, regarding oral mucositis symptoms, more than two fifth (42%) of the studied patients have severe level of oral mucositis symptoms pre intervention while, this percentages improved to less than one tenth (8%) post intervention. **Conclusion:** The study concluded that sodium bicarbonate mouthwashes are effective in treating and reducing the severity of oral mucositis and its symptoms in cancer patients undergoing chemotherapy. **Recommendations:** using sodium bicarbonate mouthwash as a therapeutic care measure in clinical settings.

**Keyword:** Cancer, Chemotherapy, Mucositis and Sodium Bicarbonate.

## Introduction

Cancer is one of the most common and problems diseases of this century. In 2022, there were an estimated 20 million new cancer cases and 9.7 million deaths. The estimated number of people who were alive within 5 years following a cancer diagnosis was 53.5 million. About 1 in 5 people develop cancer in their lifetime, approximately 1 in 9 men and 1 in 12 women die from the disease. **(Bray et al., 2024).**

The most popular way to treat different kinds of cancer with chemotherapy. But chemotherapy can cause a lot of issues and unwanted effects. Chemotherapy mucositis can also cause a super-infection, which raises the risk of bacteremia and sepsis. People with oral mucositis are more likely to have bad treatment results, a lower quality of life, and more medical costs than people who don't get this ailment **(Rambod, Pasyar & Ramzi, 2022).**

Ulcers that form when the oral mucosa is damaged are very likely to get bacteria and cause systemic illness. It makes it hard to talk, to chew, swallow and take medicine by mouth. Oral mucositis also makes the patient's hospital stay longer, raises the expense of therapy, increases the need for drugs to control pain, and requires parenteral nourishment, all of which make the patient's quality of life worse. **(Kongwattanakul et al., 2022).** Mucositis is the painful swelling and

ulceration of the mucous membranes. It happens most often as a side effect of chemotherapy and radiation therapy for cancer. Mucositis may make it harder for the patient to handle chemotherapy or radiation therapy, and it also affects their nutritional condition. It might have a big effect on the patient's quality of life and cancer therapy. **(Barasch, Epstein & Doty, 2024).**

Recent research has indicated that 40% to 75% of those who get chemotherapy still get oral mucositis. However, for patients with head and neck tumors who are getting high-dose chemotherapy or chemoradiotherapy, the risk of severe mucositis can be as high as 80%. Also, several chemotherapy drugs, including as methotrexate, 5-fluorouracil, and cisplatin, are still significantly linked to damage to the mucous membranes. **(Lee, Lee, & Kim, 2021).**

Specifically, Sodium Bicarbonate (SB), a component of basic oral care, is one the most used agents regarding the prevention and treatment of OM. It is also used as a cleansing agent due to its ability to dissolve mucus and loosen debris. The benefits of SB use is due to its alkalizing effect (thereby raising oral pH), which prevents the growth of aciduric bacteria, making saliva more fluid and preventing the accumulation of detritus. **(Hong et al., 2020).**

Nurses play a very important role in all parts of managing oral mucositis, such as



assessing the condition, educating patients how to take care of their mouths, giving them medications, and helping them deal with the pain of their symptoms. Nurses have a lot of duties when it comes to treating oral mucositis. They need to properly examine and monitor the mouth and symptoms, manage the condition by making sure that patients have access to the right treatment, and teach patients how to take care of their mouths. Nurses should also help create and carry out standardized clinical practice guidelines. (Iovoli et al, 2023).

### **Significance of the study**

Recent research has indicated that 40% to 75% of those who get chemotherapy still get oral mucositis. 20–40% of people getting chemotherapy get oral mucositis, and 76% of people getting high-dose chemotherapy before a hematopoietic stem-cell transplant do. More than 90% of those who have treatment for mouth and oropharynx cancer also get severe oral mucositis. (Nau, 2021).

As a result, oral mucositis can develop to secondary infections, intense discomfort, and trouble eating, which can cause malnutrition and dehydration. Mucositis can also lead to higher healthcare and hospitalization expenditures. (O'Neill, Scully, & Prime, 2020). So, the current study conducted to evaluate the effectiveness

of sodium bicarbonate mouth wash on mucositis in cancer patients undergoing chemotherapy.

### **Aim of the study**

This study aim to assess the efficacy of sodium bicarbonate mouthwash in alleviating mucositis among cancer patients receiving chemotherapy.

### **Research hypothesis**

Sodium bicarbonate improves cell membrane stability effective in reducing of oral mucositis and promoting oral health in patients undergoing chemotherapy compared to patients who do not receive it

### **Subjects & methods**

#### **Research design**

A quasi-experimental research design was utilized to conduct the study.

#### **Research setting**

The research was carried out at cancer department of Aswan University Hospital.

#### **Sampling**

A convenience sample of 100 adult patients of both sexes having chemotherapy treatment was screened for prospective inclusion in the trial and administered sodium bicarbonate mouth care.

#### **Tools of data collection**

To accomplish the study's objective, the following tools were utilized:

#### **Tool one: - Structured Interview Sheet**

Structured interview questionnaire was developed by investigators based on



scientific review of literature (**Carrozzo et al, 2021; Pulito et al, 2022**) which consist of three parts:

**Part I: Socio-demographic characteristics of chemotherapy-patients:** Such as age, gender, residence, marital status and occupation.

**Part II: Medical history** which include cancer type, duration of the disease, length of chemotherapy, mucositis degree, time of beginning mucositis, pain in the mouth and color of the mouth.

**Tool two: - Oral Mucositis severity assessment tool**

This tool was developed by (**Khanjani, et al., 2019**) to measure the severity of oral mucositis using the World Health Organization criteria for grading of oral mucositis. This scale included five levels (0–4) for measuring mucositis.

#### **Scoring system**

- Level zero (no ulcers).
- Level one: soreness and redness.
- Level two (ulcer and erythema).
- Level three: the patient has an ulcer and a lot of redness, and they can't take solid meals.
- Level four: Mucositis is so bad that it can't be fixed quickly, and the person can't eat through their mouth.

#### **Method of data collection**

##### **Pilot study**

A pilot study was conducted prior to the commencement of data collecting involving 10% (10) of the patients admitted to the medical oncology

department. to test the applicability, clarity and efficiency of the tools.

#### **Validity & Reliability of the instruments' content**

- All tools were reviewed for content validity by a panel of three expertise in the field of medical-surgical nursing and two in medical oncology to measure the content for accuracy and internal validity and necessary modifications were be done accordingly. The reliability for the study tools were calculated by Cronbach's alpha test; it were (.893 & .931).

#### **Ethical Consideration**

- An official letter was issued by the research ethics committee of the Faculty of Medicine, Aswan University.
- Approval to perform the study was secured from the manager of Aswan University Hospital.
- Prior to the commencement of both the pilot project and the real trial, informed permission was secured from patients interested to participate, following a thorough explanation of the study's nature and objectives. The study participant had the opportunity to decline participation or withdraw from the research at any moment without justification. Participant confidentiality was prioritized during data collection.
- Patients were told that all their data is highly private.

**Filed work**

- Assessment phase: It was included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, periodicals and magazines to develop tools for data collection.
- Patients who met the inclusion criteria were selected. After outlining the purpose of the study, the researcher obtained the patients' written informed consent agreement to participate. The patient's interview questionnaire served as the starting point for data collection.
- After getting official permission to do the study, the researcher met with the patients during the morning shift (8 a.m. to 2 p.m.) for three months to collect data. The purpose of the study was explained, the tools were given out, and the study subjects were asked to fill them out. The tools were then collected and checked for competence.
- All of the patients learned how to take care of their mouths on a regular basis (brushing their teeth, eating well, and keeping their mouths clean).
- Mouth wash done four times every day time (at 7:00 a.m., 1:00 p.m., 7:00 p.m., and 10:00 p.m). patients who answer will rinse their mouths for 30 seconds.
- Patients washed their mouths, which made sure that the mouthwash got to all the tissues in the mouth, including the tongue, palate, throat, and inside the cheeks.

- After 5 days of giving the responders mouthwash with normal saline, the researchers used the World Health Organization's standards to grade the severity of their oral mucositis.

**Statistical analysis**

After gathering the data, it was organized and put into tables. Then, it was statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 24. We used descriptive statistics to show the data as numbers and percentages, means, and standard deviations. We used the chi-square test to compare qualitative variables. We used the Wilcoxon signed rank test to compare quantitative data. Spearman correlation was used to see if there was a link between the research variables. Data was also shown as a bar chart. If the p-value was less than or equal to 0.05, the difference was judged statistically significant. If the p-value was  $< 0.001$ , the difference was thought to be very statistically significant.

**RESULTS**

Table (1): Frequency distribution of the studied patients regarding their socio-demographic characteristics demonstrates that 36% of the examined patients were aged 45 years or older, 64% were female, and 60% resided in rural areas. Regarding marital status, 64% of the patients evaluated were married, and 44% were housewives in

terms of work.

Figure (1):Percentage distribution of oral mucositis severity level among the studied patients pre & post intervention indicates that over two-fifths (42%) of the examined patients exhibit fourth-degree oral mucositis, while more than one-third (35%) present with third-degree mucositis before to intervention; these percentages subsequently improved to (8%) and (12%), respectively, following intervention.

Table (2): Comparison between total level of the studied patients regarding oral mucositis severity at pre & post intervention reveals that, there is a highly significant difference between the studied patients regarding oral mucositis severity level between pre and post intervention at ( $P=0.000$ ). Which severity of oral mucositis improved post intervention.

Table (3):Frequency distribution of the studied patients regarding their restriction of eating because of mouth sores because of mouth sores pre and post intervention indicates a highly

statistically significant difference in eating restrictions due to mouth sores among the examined patients before and after the intervention; severe eating restrictions decreased from 22% pre-intervention to 2% post-intervention.

Table (4): Frequency distribution of the studied patients regarding their restriction of drinking because of mouth sores pre and post intervention demonstrates a highly statistically significant difference in the limitation of drinking due to mouth sores among the examined patients before and after the intervention; severe restriction of drinking decreased from 16% pre-intervention to 0% post-intervention.

Figure (2):Percentage distribution of patient reported oral mucositis symptoms level among the studied patients pre & post intervention illustrates that almost two-fifths (40%) of the examined patients exhibited severe oral mucositis symptoms before to intervention, but this percentage decreased to less than one-tenth (9%) following intervention.

**Table (1) frequency distribution of the studied patients regarding their socio-demographic characteristics (n=100).**

| Item                   | No | %  |
|------------------------|----|----|
| <b>Age (years):</b>    |    |    |
| < 25years              | 12 | 12 |
| 25 to < 35 years       | 20 | 20 |
| 35 to <45 years        | 32 | 32 |
| 45 years or more       | 36 | 36 |
| <b>Gender:</b>         |    |    |
| Male                   | 36 | 36 |
| Female                 | 64 | 64 |
| <b>Residence:</b>      |    |    |
| Rural                  | 60 | 60 |
| Urban                  | 40 | 40 |
| <b>Marital status:</b> |    |    |
| Single                 | 16 | 16 |
| Married                | 64 | 64 |
| Divorced               | 12 | 12 |
| Widow                  | 8  | 8  |
| <b>Occupation:</b>     |    |    |
| Unemployed             | 16 | 16 |
| Employed               | 28 | 28 |
| House wife             | 44 | 44 |
| Educator               | 12 | 12 |

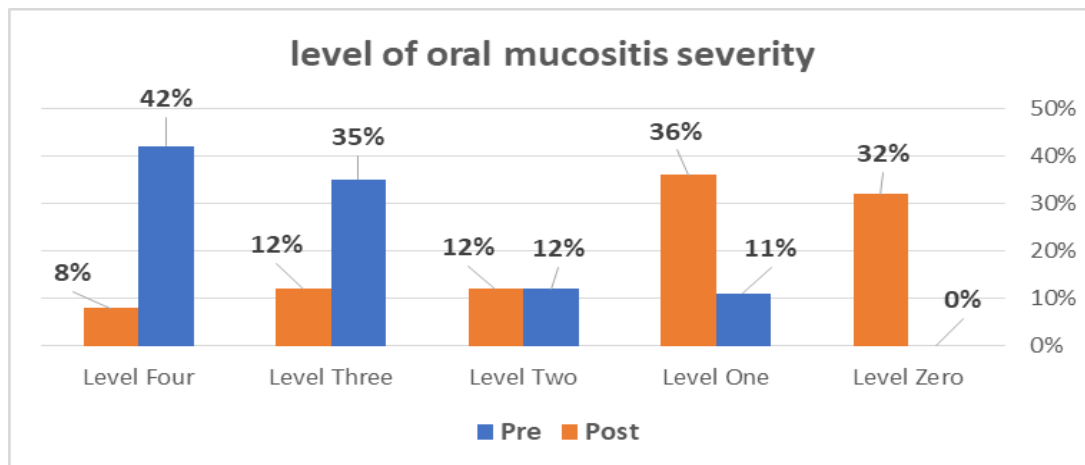


**Figure (1) Percentage distribution of oral mucositis severity level among the studied patients pre & post intervention (n=100).**

**Table (2): Comparison between total level of the studied patients regarding oral mucositis severity at pre & post intervention (n=100)**

| Oral Mucositis severity level                                                                         | Pre |    | Post |    | X <sup>2</sup> | p-value |
|-------------------------------------------------------------------------------------------------------|-----|----|------|----|----------------|---------|
|                                                                                                       | No. | %  | No.  | %  |                |         |
| Level zero (lack of ulcers)                                                                           | 0   | 0  | 32   | 32 | 75.962         | 0.000** |
| Level one (pain and erythema)                                                                         | 11  | 11 | 36   | 36 |                |         |
| Level two (erythema and ulcer)                                                                        | 12  | 12 | 12   | 12 |                |         |
| Stage three (ulceration and significant erythema, with the patient unable to consume solid meals)     | 35  | 35 | 12   | 12 |                |         |
| Level four (mucositis is so severe that it cannot be readily healed, and oral feeding is unfeasible). | 42  | 42 | 8    | 8  |                |         |

(\*\*) highly statistically significant at  $p < 0.01$ . X<sup>2</sup>= chi square test.

**Table (3): frequency distribution of the studied patients regarding their restriction of eating because of mouth sores because of mouth sores pre and post intervention (n=100).**

| Item     | Restriction of eating because of mouth sores |    |      |    |        | X <sup>2</sup> | p-value |
|----------|----------------------------------------------|----|------|----|--------|----------------|---------|
|          | Pre                                          |    | Post |    |        |                |         |
|          | No.                                          | %  | No.  | %  |        |                |         |
| No       | 20                                           | 20 | 31   | 31 | 25.052 |                | .003**  |
| Mild     | 32                                           | 32 | 40   | 40 |        |                |         |
| Moderate | 20                                           | 20 | 27   | 27 |        |                |         |
| Sever    | 28                                           | 28 | 2    | 2  |        |                |         |

(\*\*) highly statistically significant at  $p < 0.01$ . X<sup>2</sup>= chi square test.

**Table (4): frequency distribution of the studied patients regarding their restriction of drinking because of mouth sores pre and post intervention (n=100).**

| Item     | Restriction of drinking because of mouth sores |    |      |    |       | X <sup>2</sup> | p-value |
|----------|------------------------------------------------|----|------|----|-------|----------------|---------|
|          | Pre                                            |    | Post |    |       |                |         |
|          | No.                                            | %  | No.  | %  |       |                |         |
| No       | 32                                             | 32 | 29   | 29 | 16.35 |                | .005**  |
| Mild     | 32                                             | 32 | 57   | 57 |       |                |         |
| Moderate | 20                                             | 20 | 14   | 14 |       |                |         |
| Sever    | 16                                             | 16 | 0    | 0  |       |                |         |

(\*\*) highly statistically significant at  $p < 0.01$ . X<sup>2</sup>= chi square test.

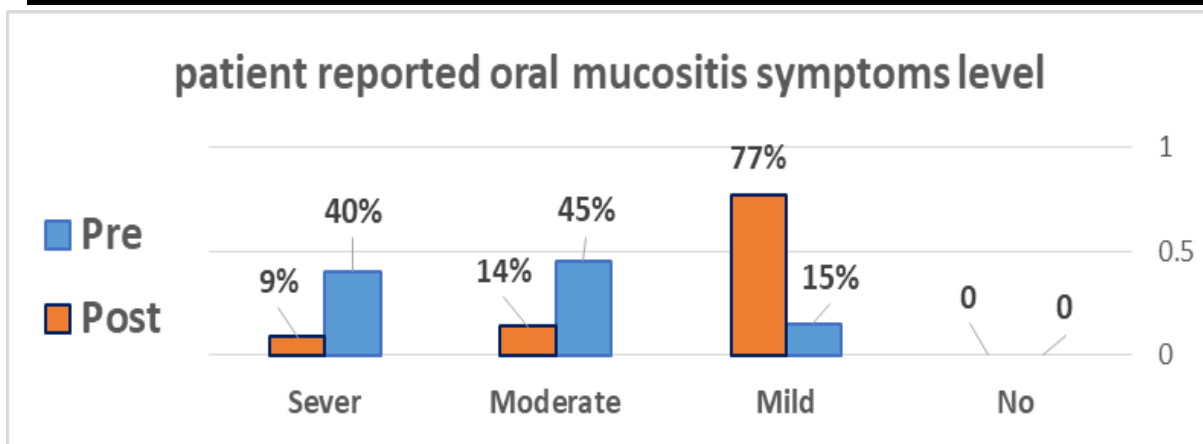


**Figure (2) Percentage distribution of patient reported oral mucositis symptoms level among the studied patients pre & post intervention (n=100).**

### Discussion

Mucositis is one of the most serious adverse effects of chemotherapy, potentially leading to treatment cessation in 11% of patients. According to previous studies, chemotherapy-induced mucosal oxidative damage generally manifests during the first and second weeks of treatment and resolves by the third or fourth week. Mucositis may lead to diminished quality of life, increased financial strain, or even hospitalization for the patient afflicted (**Roayaei, Andalib & Akhavan, (2022)**). So, the study aim to assess the efficacy of sodium bicarbonate mouthwash in alleviating mucositis among cancer patients receiving chemotherapy.

The socio-demographic features of the patients in this study indicated that almost one-third of the participants were aged 45 years or older. This outcome may be attributed to the high-

risk age group for cancer exposure, characterized by diminished immunity and inadequate nutritional state. This finding aligns with **Pulito et al. (2020)**, who did a research named "Oral Mucositis: The Hidden Side of Cancer Therapy" and discovered that over half of the cancer patients examined were aged 45 years or older. This conclusion is corroborated by **Mohamed, El-Kady, Said, Abd-Allah, & Abdelslam, (2020)**, who did a research named "Chemotherapy Induced Oral Mucositis Based on Patients Needs Assessment" and discovered that a significant proportion of the cancer patients examined were above 45 years of age. Concerning gender and domicile, almost three-fifths are female, and three-fifths dwell in rural areas. This conclusion may be attributed to the fact that some forms of cancer, such as breast cancer, are more prevalent in

females than in males. This conclusion contradicted **Mohamed et al. (2020)**, who reported that fewer than three-quarters of the investigated patients were male and over two-thirds resided in metropolitan areas.

Regarding marital status and occupation, over three-fifths of the examined patients are married, and fewer than half are housewives. This outcome may be attributable to the significant proportion of the investigated patients who are adult females residing in rural areas. This conclusion aligned with **Mohammad, Ahmed, & Magbool, (2020)**, who did a research named "Effect of Honey Mouthwash on the Health Outcomes of Patients with Stomatitis" and discovered that over half of the participants were married and housewives. In contrast, this data contradicts **Jicman et al. (2022)**, who did a research named "Oral Mucositis Induced by Chemoradiotherapy in Head and Neck Cancer," which revealed that over half of the patients examined were employed.

The current study indicated that over 40% of the patients exhibited fourth-degree oral mucositis, while more than 33% presented with third-degree mucositis prior to intervention. Post-intervention, these percentages decreased to less than 10% and slightly above 10%, respectively. This outcome may be attributed to the

detrimental impact of chemotherapy on the entire bodily system, resulting in mucositis as a prevalent side effect of the treatment.

This finding was corroborated by **Naibaho, Dharmajaya & Harahap, (2020)**, who discovered that over fifty percent of the cancer patients taking chemotherapy experienced fourth-degree oral mucositis during the assessment phase of the trial. Additionally, this assertion is corroborated by **Di Fede et al. (2023)**, who conducted a research named "Prevention and Treatment of Oral Mucositis: The Efficacy of Sodium Bicarbonate versus Other Agents," which shown an improvement in oral mucositis following the use of sodium bicarbonate intervention.

The current investigation demonstrated a highly statistically significant difference in eating restrictions due to mouth sores among the patients before and after the intervention. This outcome may be attributed to the influence of sodium bicarbonate in decreasing acidity, relieving discomfort, and enhancing flavor. This conclusion aligns with **Mohammadi et al. (2022)**, who observed a statistically significant improvement in eating among the examined group with oral mucositis following the use of sodium bicarbonate post-intervention.

The current study demonstrated a



highly statistically significant difference in the restriction of drinking due to mouth sores among the analyzed patients before and after the intervention. This outcome may be attributed to the beneficial effects of sodium bicarbonate in alleviating irritation and inflammation, as well as hydrating the throat, hence diminishing pain associated with swallowing and drinking. This outcome aligns with **Elad et al. (2020)**, who conducted a study titled "Clinical Practice Guidelines for the Management of Mucositis Secondary to Cancer Therapy" and discovered a statistically significant enhancement in fluid intake among patients with oral mucositis following the implementation of clinical practice guidelines that included sodium bicarbonate.

Regarding the severity of oral mucositis symptoms reported by patients in the study before and after the intervention, the current research indicated that two-fifths of the participants experienced severe oral mucositis symptoms prior to the intervention, whereas this percentage decreased to less than one-tenth following the intervention. A significant proportion of the patients undergoing chemotherapy exhibited severe oral mucositis, likely attributable to the adverse effects of chemotherapy, which compromise the

immune system, thereby elevating the risk of bacterial and fungal infections in the oral cavity, altering the oral environment, such as inducing xerostomia, and affecting rapidly proliferating cells, including mucosal cells in the mouth.

This outcome contradicted the findings of **Özalp Gerçeker et al. (2024)**, who conducted a study titled "The Effect of Oral Care Protocols on Mucositis in Pediatric Cancer Patients" and discovered that over half of the participants exhibited moderate oral mucositis symptoms during the assessment phase of their research.

### **Conclusion& Recommendations**

The study concluded that there exists a highly statistically significant difference among the patients about the severity of oral mucositis and the patients' reported symptoms score of oral mucositis before and after the use of sodium bicarbonate mouthwashes, indicating an improvement in mucositis.

### **.Recommendations:**

Using sodium bicarbonate mouthwash as a treatment for cancer patients at the onset of chemotherapy in a clinical setting. Nurses on the oncology unit should have regular training on the most up-to-date oral hygiene strategies that promote good oral health. More research with a bigger probability sample to make the results more generic.

## References

- Barasch, A., Epstein, J. B., & Doty, R. L. (2024).** Head and neck complications of cancer therapies: taste and smell. *Oral Diseases*.22 July 2024 <https://doi.org/10.1111/odi.15074>
- Bray, F., Laversanne, M., Sung, H., Ferlay, J., Siegel, R. L., Soerjomataram, I., & Jemal, A. (2024).** Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, 74(3), 229-263.
- Carrozzo, M., Eriksen, J. G., Bensadoun, R. J., Boers-Doets, C. B., Lalla, R. V., & Peterson, D. E. (2021).** Oral mucosal injury caused by targeted cancer therapies. *JNCI Monographs*, (53)
- Di Fede, O., Canepa, F., Maniscalco, L., Tozzo, P., Matranga, D., & Giuliana, G. (2023).** Prevention and the treatment of oral mucositis: the efficacy of sodium bicarbonate vs other agents: a systematic review. *BMC oral health*, 23(1), 4.
- Elad, S.; Rn, K.K.F.C.; Lalla, R.V.; Yarom, N.; Hong, C.; Logan, R.M.; Bowen, J.; Gibson, R.; Dds, D.P.S.; Zadik, Y. (2020):** clinical practice guidelines for the management of mucositis secondary to cancer therapy. *Cancer* 2020, 126, 4423–4431.
- Hong CHL, Gueiros LA, Fulton JS, Cheng KKF, Kandwal A& Galiti D. (2020):** Mucositis Study Group of the Multinational Association of Supportive Care in Cancer/International Society for Oral Oncology (MASCC/ISOO). Systematic review of basic oral care for the management of oral mucositis in cancer patients and clinical practice guidelines. *Support Care Cancer*. (10):3949-3967.
- Iovoli, A. J., Turecki, L., Qiu, M. L., Khan, M., Smith, K., Yu, H., ... & Singh, A. K. (2023).** Severe oral mucositis after intensity-modulated radiation therapy for head and neck cancer. *JAMA Network Open*, 6(10), e2337265-e2337265.
- Jicman, D., Sârbu, M. I., Fotea, S., Nechifor, A., Bălan, G., Anghel, M., ... & Tatu, A. L. (2022).** Oral Mucositis Induced by Chemoradiotherapy in Head and Neck Cancer—A Short Review about the Therapeutic Management and the Benefits of Bee Honey. *Medicina*, 58(6), 751.
- Khanjani Pour-Fard-Pachekenari, A., Rahmani, A., Ghahramanian, A., Jafarabadi, M. A., Onyeka, T. C., & Davoodi, A. (2019).** The effect of an oral care protocol and honey mouthwash on mucositis in acutemyeloid leukemia patients undergoing chemotherapy: A single blind clinical trial. *Clinical Oral Investigations*, 23(4), 1811–1821.
- Kongwattanakul S, Petchann N, Petroch P, Thanthong S, Tungfung S,**

- Chamchod S, Pitiporn S & Nantajit D (2022).** Prophylactic management of radiation-induced mucositis using herbal mouthwash in patients with head and neck cancer: an assessor-blinded randomized controlled trial. *J Complement Integr Med.* 19(3):771-780.
- Lee, J., Lee, H., & Kim, W. (2021).** Chemotherapy-induced oral mucositis: Pathogenesis and management strategies. *Journal of Cancer*, 12(3), 781-792.  
<https://doi.org/10.1155/2021/1857983>.
- Mohamed, Y., El-Kady, M., Said, H., Abd-Allah, D., & Abdelslam, S. (2020).** Chemotherapy Induced Oral Mucositis Based on PatientsNeeds Assessment. *Egyptian Journal of Health Care*, 11(4), 1382-1391.
- Mohammad, R., Ahmed, N. M., & Magbool, F. R. (2020).** Effect of Honey mouth wash on the health outcome of patient with stomatitis. *Int. J. Nov. Res. Healthc. Nurs*, 7, 210-219.
- Mohammadi F, Oshvandi K, Kamallan SR, Khazaei S, Ranjbar H, Ahmadi-Motamayel F. (2022):** Effectiveness of sodium bicarbonate and zinc chloride mouthwashes in the treatment of oral mucositis and quality of life in patients with cancer under chemotherapy. *Nurs Open.* 2022;9(3):1602–11.
- Naibaho, E. N., Dharmajaya, R., & Harahap, I. A. (2020).** Effectiveness of Oral Care Using Normal Saline and Baking Soda Towards Pain and Comfort in Mucositis Patients Undergoing Chemotherapy. *Indian Journal of Public Health Research & Development*, 11(10), 222-228.
- Nau, C. (2021).** Epidemiology of oral mucositis in cancer patients: Incidence, risk factors, and associated impacts. *Oral Oncology*, 115, 104761.  
<https://doi.org/10.1016/j.oraloncology.2021.104761>.
- O'Neill, D., Scully, C., & Prime, S. (2020).** Oral mucositis: Pathogenesis and management. *Oral Diseases*, 26(1), 150-157.  
<https://doi.org/10.1111/odi.13289>
- Özalp Gerçek, G. Ü. L. Ç. İ. N., Yıldırım, B., Önal, A., Bektaş, M., Leblebici, A., Ören, H. A. L. E., & Olgun, H. A. T. İ. C. E. (2024).** The Effect of Oral Care Protocols on Mucositis in Pediatric Cancer Patients: A Randomized Controlled Trial. *Journal of Contemporary Medicine*, 14(4).
- Pulito, C., Cristaudo, A., Porta, C. L., Zapperi, S., Blandino, G., Morrone, A., & Strano, S. (2020).** Oral mucositis: the hidden side of cancer therapy. *Journal of experimental & clinical cancer research*, 39, 1-15.
- Pulito, C., Cristaudo, A., Porta, C. L., Zapperi, S., Blandino, G., Morrone, A., & Strano, S. (2020).** Oral mucositis: the hidden side of cancer therapy. *Journal of experimental & clinical cancer research*, 39, 1-15.

**Rambod, M., Pasyar, N., & Ramzi, M. (2022).** The effect of zinc sulfate on prevention, incidence, and severity of mucositis in leukemia patients undergoing chemotherapy. *European Journal of Oncology Nursing*, 33, 14-21.

**Roayaei M, Andalib Z, Akhavan A. (2022):** The effect of oral zinc sulfate on prevention of chemotherapy-induced oral mucositis in breast cancer patients treated with Adriamycin and cyclophosphamide; a double-blind randomized clinical trial. *J Nephropharmacol.* 2022;12:e10533. <https://doi.org/10.34172/npj.2022.10533>.

## Effect of Implementing Respiratory Exercises on Patients' Hemodynamic Parameters Post Extubation in Cardiothoracic Intensive Care Unit

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### Abstract

**Background:** The most critical time for the patient is the postoperative phase. During this period, complications following open heart surgery result in significant consequences so using respiratory exercises have long been a standard component of post-operative care. **Aim:** Evaluate the effect of implementing respiratory exercises on patients' hemodynamic parameters post extubation in Cardiothoracic Intensive Care Unit. **Design:** A quasi-experimental study was used. **Setting:** Cardiothoracic Intensive Care Unit in Tanta International Teaching Hospital affiliated to Tanta University Hospitals. **Subjects:** Purposive sample of 60 patients divided into two groups 30 in each. **Tools:** Three tools were utilized in this research. **Tool I:** Patients' Structured Assessment. **Tool II:** Cardiothoracic Rehabilitation Exercises Tolerance Checklist. **Tool III:** Patients' Respiratory Hemodynamic Parameters. **Result:** the mean of FEV1 in the study group at first day was  $87.87 \pm 5.17$  and for the second day was  $93.63 \pm 3.43$  with highly statistically significant, p value = 0.000. Comparison with the mean control group FEV1 was  $56.30 \pm 4.21$  for day one and  $56.57 \pm 3.89$  for day two. the mean of FVC in the study group first day was  $86.27 \pm 3.06$  and for the second day was  $92.60 \pm 3.58$  with highly statistically significant p value = 0.000. A significant correlation between total exercises tolerance and heart rate and  $pao_2$  among patients in study group on 2<sup>nd</sup> day with p value 0.005 and 0.003 respectively, while there no significant correlation between total exercises tolerance and BP, RR and  $Paco_2$  with p value < 0.05. **Conclusion:** Combination of early activity and chest physiotherapy lead to better hemodynamic parameters such as oxygenation and ventilation indicators and stability of vital signs than the routine nursing care. **Recommendation:** Giving more training to nurses working in anesthesia care who deal with patients after open-heart surgery and encouraging nurses to using deep breathing exercise and incentive spirometer, shoulder mobilization and chest exercises and upper limb exercise.

**Key words:** Cardiothoracic Surgery, Hemodynamics Parameters, Respiratory Exercises

## Introduction

The most critical time for the patient is the postoperative phase spent in cardiothoracic intensive care unit. Suppose the patients are not effectively handled during this period. In that case, complications following open heart surgery result in significant consequences such as prolonged hospitalization, ICU re-admission, massive treatment expenditures, and even death. **(Saravanan, 2024)**. Cardiothoracic intensive care units include patients undergoing open-heart surgery. During this surgical procedure, an incision should be made into the heart, thus exposing one or more of the cardiac chambers. **(Hardin & Kaplow, 2025)**.

It also requires the use of a heart-lung machine, a device that allows circulation and oxygenation of the blood to be maintained outside the patient's body. The most common open heart procedures are for the repair of valvular disease and for the correction of congenital heart defects, chiefly septal and valve defects. **(Saef & Ghobrial, 2021)**.

The global average prevalence of respiratory complications post extubation following coronary artery bypass graft surgery was estimated to be 2-4% and the most common respiratory complications were reported as: atelectasis 27-95%,

pleural effusion (16.6-88%) and phrenic nerve paralysis 30-75%. **(Wiratama, Yan Efrata Sembiring & Setiawan, 2024)**.

Additionally, in Egypt a study stated that postoperative respiratory complications post extubation occurred in 7.82% of patients with coronary artery revascularization, 2.23% in patients with valvular replacement and 5.05% in patients with congenital heart diseases. **(Ahmed, Hassan, Mohamed, & Gamal, 2019)**. Acute respiratory distress syndrome occurred in 3.35% of patients with a mortality rate of about 66.6%, pneumonia in 2.79%, atelectasis in 3.35%, pleural effusion in 2.22% and pneumothorax in 0.55 %. **(Odhah, Al-Qubati, Mohammed, Abd El-Aziz, & Mahgoub, 2020)**.

Moreover, in cardiothoracic surgery department at Tanta university hospital in 2020, reported about 210 patients underwent cardiothoracic surgeries. A study conducted in the same sitting revealed that; the overall incidence of postoperative respiratory complications post extubation was 64.4% and the mortality rate was 45.8%. **(Salem, Ali, Hady, Taha, & Diab, 2020)**.

After open heart surgery using general anesthesia and cardiopulmonary bypass, the patient's respiratory function such as; vital capacity, total

lung capacity, inspiratory capacity and functional residual capacity are decreased; so, after surgery patients are taken to cardiothoracic intensive care unit (CICU) for mechanical ventilation. **(Tang, Gong, Lu, Chen, Fang, & Liu, 2021).** Controlling tachycardia and hypertension which can occur due to catecholamine release from patients with endotracheal extubation, is important to protect myocardium and prevent potential complications. **(Tarwade, & Smischney, J. 2022).**

Both intubation and extubation can increase the concentration of catecholamine in the blood by stimulating the sympathetic nervous system, and resulting in severe hemodynamic changes. However, during intubation, agents such as opioids and propofol can effectively inhibit airway stimulation by laryngoscopy and intubation. **(Qiao, Wang, Shen, Xing, & Yuan, 2024).** Although hemodynamic changes during post-operative period are normally well-tolerated by healthy individuals, such changes may be detrimental in hypertensive patients, leading to hemodynamics instability life-threatening complications such as myocardial ischemia, cardiac arrhythmias, and cerebrovascular hemorrhage. **(Hulme, & Kong, 2005).**

Respiratory exercises especially chest physiotherapy has long been a standard component of post-operative care. **(Xu Cheung, Smith, Lai, & LinL, 2022).**

Techniques used include early mobilization, positioning, exercise of shoulder and neck mobilization, incentive spirometer and deep breathing exercise with or without mechanical devices. **(Amin, Alaparthi, Samuel, Bairapareddy, Raghavan & Vaishali. 2021).**

Manual techniques such as percussion and vibration may be hazardous in cardiac surgery patient, because of the risk of sternum instability and no positive effects have been found. **(Hautalathi, 2019)**

The critical care nurse has a vital role in the postoperative care of open-heart surgery patients. They should educate the patients preoperatively about the importance of regular chest exercises and early mobilization to improve hemodynamic status instructions concerning the frequency and duration of each exercise after cardiac surgery vary notably in clinical practice. **(Köse, & Avşar, 2021).**

Moreover, critical care nurses are mostly responsible for monitoring and assessing the cardiovascular, respiratory, and renal status to create an effective care plan or guidelines. **(Sole, Klein, & Moseley, 2020).**

They provide the patients with comfort and safety, encourages mobility and prevents complications. The nursing role is crucial in reducing the incidence of morbidity and mortality and shortening the length of stay in intensive care unit. Thus, the aim of the current study is to evaluate the effect of respiratory exercises on Patients' hemodynamic parameters post extubation in cardiothoracic intensive care unit.

### **Significance of study**

During clinical observation in cardiothoracic intensive care unit, it was found that postoperative hemodynamics and functional capacity have important implications for patient recovery after cardiac surgery; respiratory related exercise may reduce postoperative complications related to hemodynamics instability such as; myocardial ischemia, cardiac arrhythmias and cerebrovascular hemorrhage and improves postoperative physiological functional capacity.(Mahmoud, Gamil, Al-mashtoly, El Khonizy & Refaie,. 2020). Early participation in prescribed postoperative exercise programs is an integral component of rapid recovery protocols leading to optimal surgical outcomes

**Aim:** Evaluate the effect of implementing respiratory exercises on

patients' hemodynamic parameters post extubation in cardiothoracic intensive care unit.

### **Research Hypothesis**

The study group who received respiratory exercises are exhibit better hemodynamic parameters such as oxygenation and ventilation indicators and stability of vital signs than the control group.

### **Subjects and methods**

#### **Research design**

A quasi-experimental research design was utilized.

#### **Setting**

The study was conducted at the Cardiothoracic Intensive Care Unit in Tanta International Teaching Hospital which is affiliated to Tanta University Hospitals. This unit was equipped with 9 bed capacity and includes advanced technology and manpower required for patients' care.

#### **Subjects**

A purposive sample of 60 patients with open heart surgery was collected from the previously mentioned setting. Based on Epidemiological Information Program (EPI info) and the total patients admitted per year according to review of Tanta University Hospital statistical records in 2020 were 210 patients this conducted form (Statical analysis of Tanta



University Hospital, 2020)., and the sample size was calculated as the following:

Z= confidence level 95%, d= Error proportion (0.05), P= population (50%). The sample was divided into two equal groups 30 patients in each group as the following:

**Study group:** consisted of 30 adult patients who received the respiratory exercise as agreed by the treating physician and implemented by the researcher.

**Control group:** consisted of 30 adult patients who received the routine nursing care as prescribed by the physician which include using of incentive spirometer and chest percussion.

**Subjects have been chosen regarding to the following criteria:**

- Adult patients aged 21-60 years old of both sex within the first two hours, post extubation, able to communicate.

**Exclusion criteria**

- Unconscious patients, Patients with history of chronic respiratory diseases, neuromuscular diseases such as Guillain-Barre syndrome, amyotrophic lateral sclerosis, muscular dystrophy, myasthenia gravis, and spinal muscular atrophy

**Tools of data collected:** - Three tools were used in this study:

**Tool I: Patients' Structured Assessment:** It was developed and structured by the researcher after reviewing of related literature, it included 3 parts as follow: - **Part(A):** - Patients' socio-demographic characteristics such as age, sex, educational level, residence, marital status, and occupation. **Part (B): Patients' health relevant data;** it included, smoking history, past medical, surgical history, and current medical history such as diagnosis, type of surgery and chief complaints. **Part (C):** Patients' extubation assessment, such as types of the tube, mode of mechanical ventilator before extubation, friction of inspired oxygen, gag, and cough reflexes. (Nadi, Azizi-Fini, & Izadi-Avanji, 2020)

**Tool II: Cardiothoracic Rehabilitation Exercises Tolerance Checklist;** This tool was developed by **García et al (2014)** to assess postoperative respiratory exercises open heart surgery patients which included two parts as follows:

**Part (A):** Respiratory physiotherapy, it consisted of 10 steps; incentive spirometer includes 6 steps, deep breathing includes 4 steps. **Part (B):** Sternal and upper limb exercises, it consisted of 22 steps; upper limb exercises include 15 steps and sternal precautions include 7 steps.

**Scoring system:** The maximum score value was composed of 32 item respiratory physiotherapy (10 item) point and sternal and upper limb exercises (22 item) each item was observed, categorized, and scored into either done =1 or not done= 0 on all items of the checklist. Then These scores were classified as unsatisfactory level (less than 60%), and satisfactory level (more than 60%).

### **Too III: - Patients' Respiratory Hemodynamic Parameters**

This tool was developed by the researcher after reviewing related literature review (**Boone, T. (2020)**). it was used to assess patient's hemodynamic parameters three times daily for two days post extubation. It is comprised from three parts as the following:

**Part (A):** Patients' vital signs, such as heart rate, respiratory rate and blood pressure. **Part (B):** Patients' oxygenation indicators, such as oxygen saturation which measured using pulse oximeter and arterial blood gases which include partial pressure of oxygen, partial pressure of carbon dioxide and oxygen saturation. **Part (C):** Patients' ventilatory indicators; such as forced expiratory volume in 1 second, forced vital capacity and maximum voluntary ventilation.

### **Scoring system**

The maximum score value was 10 which distributed as the following patients' vital signs (3 items) patients' oxygenation indicators (4 items) and patients' ventilatory indicators (3 items) each item was observed, categorized, and scored into either normal =0 or abnormal= 1 on all items of the checklist. After completing the data tabulation, the researcher gave the statistics specialist the natural numbers and results to develop a general perception of the mean and standard deviation of the results to demonstrate the effect of Implementing Respiratory Exercises on Patients' Hemodynamic Parameters Post Extubation in Cardiothoracic Intensive Care unit as protocol.

### **Method**

- 1. Official Permission** to carry out the study obtained from the responsible authorities at the study setting.
- 2. Ethical and legal consideration:**
  - a) Approval of ethical committee was obtained code 27/12/2021 and the approval code number of faculty of medicine was 22/1/2022
  - b) Informed consent was obtained from every patient after explanation of the aim of the study and assuring them confidentiality of collected data.
  - c) Patients were informed that participation is voluntary and that

they could withdraw at any time of the study.

- d) Confidentiality and Privacy of the studied patients was maintained by the use of code number instead of the patient's name.

**3. Tool development:** Tool I was developed by the researcher and Tool II was developed by (García et al 2014), and was adapted by the researcher. Tool III was developed by the researcher after reviewing related literature review.

#### **4. Tools Validity**

All tools were tested for content validity by seven jury of experts in the field of critical care nursing cardiothoracic and biostatistics Tanta University before conducting the study.

#### **5. Reliability**

The study tool (II) was tested for reliability by using Cronbach's alpha test, it was computed and found was (0.71) and tool (III) were tested for reliability were (0.74)

#### **6. A pilot study**

It was conducted before the actual study on 10% of the patients (10 patients), in order to test the clarity, feasibility and applicability of the different items of the developed tools Modifications, rephrasing and some additional terms were done by the researcher before the main study. Data obtained from those patients were

excluded and not included in the current study.

#### **7. Data collection**

Data were collected over a period of 6 months, started from March 2022 to September 2022. The present study was conducted through.

#### **8. Phases of the study**

The present study conducted through four phases as follow:

**1-Assessment phase:** The researcher used tool I to assess patients in both study and control groups immediately post extubation to collect baseline data to assess the patients who met the inclusive and exclusive criteria.

**2-Planning phase:** - This phase was formulated based on assessment phase and expected outcome criteria. The expected outcome was prescribed when planning patient care which include:

- Improve patients' oxygenation and ventilation parameters.
- improve stability of patients' vital sign.

Educational aids and strategies were used during the session which include, one to one instruction, demonstration used as teaching method. Also, teaching aids such as booklet and videos using lab tops and smart phones. A booklet and video were prepared by the researcher. The booklets and video were distributed to the patients participated in the study at the end of sessions.

#### **3- Implementation phase**

A. Control group: they received the routine nursing care as prescribed by the physician which includes using incentive spirometer and chest percussion.

B. Study group: During this phase, a respiratory related exercise implemented by the study group during sessions. During the first- and second-day post extubation, patient was started respiratory related exercises after physician permission in three sessions and the duration of each session will be 20-30 minutes during the first- and second-days post extubation as the following:

**A. The first session:** It included deep breathing exercise and incentive spirometer as follows:

**Deep breathing exercise;** assessed patient condition before exercise, place patient in semi fowler position and the researcher encouraged study group to inhale deeply through the nose and then hold the breath for 2-3 seconds then exhale through pursed lips 10 times every 2 hours for two post-operative days during daytime.

**Incentive spirometer;** place patient in semi fowler position, then hold incentive spirometer straight at eye level, put mouthpiece in patient mouth and close patient lips tightly around it to create a seal, then the patient will deeply and slowly breathe in through mouth to raise the balls and then patient hold the breath

for 5 seconds then turn the spirometer upside down and exhale in the mouthpiece to raise balls again for 4 times daily during daytime for two post-operative days.

**B. The second session:** It consisted of shoulder mobilization and chest exercises as follows:

**Shoulder shrugs;** patient will be instructed to bring shoulders up to the ears then relax shoulders down for 10 times every 4 hours for two post-operative days.

**Shoulder circles;** sitting patient upright, roll shoulder in a smooth motion up, back and down in a circle for 10 times every 4 hours for two post-operative days.

**Trunk twist;** slowly encourage patients rotate his trunk to the right, looking over his shoulder. Hold and stretch. Then rotate his trunk to the left, hold and stretch. For 10 times every 4 hours for two post-operative days.

**Chest stretch;** Place patient hands behind his head while sitting upright. Move his elbows back until he feels stretch, hold. Relax elbows forward to rest for 10 times every 4 hours for two post-operative days.

**C. The third session:** It consisted of upper limb exercise as follows:

**Forward arm raises;** the patient sitting in upright posture, straightening his arm with his thumb facing up. Raise his arm up to the front over his head. Patient

elbow should be next to his ear and will be repeated with other arm for 10 times every 4 hours for two post-operative days.

**Side arm raises;** the patient holds his arms straight out to his side with his thumb up. Patient will raise his arm up to the side over his head, hold and stretch and will be Repeated with other arm for 10 times every 4 hours for two post-operative days.

**4- Evaluation phase:** - Evaluation was done for both study and control groups using tools II and III three times daily for two consecutive days post extubation.

## Results

### **Table (1) Illustrating distribution of the studied patients according to their socio-demographic characteristics. (n=60)**

It was observed that, the majority (80 % and 93.34 %) of patients in both study and control groups were aged between 50-60 years old with Mean  $\pm$  SD of (54.73 $\pm$ 5.085 and 53.17 $\pm$ 5.045) respectively, about two-thirds (63.33% and 66.67%) of patients in both study and control groups were male, the majority (80% and 90%) of patients in both study and control groups were married.

Regarding educational level, one third (30%) of patients in the study group had university education while half (50%) of the control group patients had university education. In relation to

residence, two -thirds (66.67%) of the study patient group were rural and less than two -thirds (60%) of control group were urban. more than half (60%) of patients in control group were employee compared to less than quarter (20 %) of study patients.

### **Table (2): Shows distribution of the studied patients regarding their present medical history (n=60)**

It can be seen that, the most common diagnosis (70.00% and 73.00%) among patients in both study and control group was myocardial infarction. In addition, more than half (53.33% and 73.33%) of patients of both study and control group had CABG respectively.

Regarding patients' chief complaints, it was observed that the most common complaints (80.00%) among patients in the study group was chest pain and the least common complain (3.33%) was shortness of breath while that the most common complain (76.67 %) among patients in control group was shortness of breath and the least common complain (20.00%) was fatigue.

### **Table (3) Reveals distribution of the studied patients regarding their past medical history. (n=60)**

It was found that one third (33.33 %) of study group had history of asthma and (36.67%) of them had hypotension and ischemic heart disease while

(46.67%) of control group had diabetes mellitus and hypertension and (20%) of them had valve heart disease. Regarding previous hospitalization it was noticed that more than half (60%) of the studied patient had not admitted in hospital.

**Table (4) Reveal distribution of the studied patients regarding their past surgical history. (n=60)**

It was found that the most common (10.00%) past surgical history among patients in both study and control group was related to appendectomy while, the least common (3.33 %) past surgical was related to hysterectomy inguinal hernia and pilonidal sinus.

**Table (5) Illustrates distribution of the studied patients regarding their smoking history. (n=60)**

It was observed that less than half (46.67 %) of patients in the study group and more than half (56.67%) of patients in the control group were cigarette smoker with Mean  $\pm$  SD (26.43 $\pm$ 9.321 and 21.41 $\pm$ 3.163) respectively.

**Table (6); Reveals distribution of the studied patients regarding their mode of mechanical ventilation.**

It was noticed that all (100%) patients of the study and control group had SIMV mode

**Table (7) Shows total mean scores of cardiothoracic rehabilitation exercises tolerance domains among**

**studied patients throughout the study. (n=60)**

It was observed that there were highly statistically significant differences among study and control groups regarding physiotherapy, Sternal precautions and upper limb Exercises and Cardiothoracic Rehabilitation Exercises' tolerance throughout period of study with P = 0.000.

**Table (8): Reveals mean scores of vital signs indicators among patient of both studied groups. (n=60).**

It was observed that there were highly statistically significant differences among study and control groups related HR, BP, O<sub>2</sub>, RR, PaO<sub>2</sub> with p = 0.000, while there no significant difference was observed among control and study group related their items except respiratory rate

**Table (9): Presents mean scores of ventilator indicators among studied groups throughout the study period**

This table revealed that mean $\pm$  SD of FEV1 during the 1<sup>st</sup> postoperative day was 87.87 $\pm$ 5.17 and it was 88.71 $\pm$ 5.17 during 2<sup>nd</sup> post operative day in study group and it was 56.30 $\pm$ 4.21 and 56.57 $\pm$ 3.89 for the control group respectively. while FVC during the 1<sup>st</sup> postoperative day was 86.27 $\pm$ 3.06 and 92.60 $\pm$ 3.58 at 2<sup>nd</sup> day for study group while it was 56.57 $\pm$ 4.46 and 56.30 $\pm$ 3.72 for the control group respectively and MVV during the 1<sup>st</sup>

postoperative day was  $110.50 \pm 15.19$  and  $117.50 \pm 17.20$  at 2<sup>nd</sup> day for study group and it was  $63.40 \pm 3.82$  and  $64.77 \pm 4.84$  for the control group respectively. Statistically significant differences were found between the two groups regarding FEV1 and FVC where p value = 0.000

**Table (10): Illustrates correlation between Total exercises tolerance and their vital signs indicators.**

It was observed significant correlation between total exercises tolerance and heart rate and  $pao_2$  among patients in study group on 2<sup>nd</sup> day with p value 0.005 and 0.003 respectively while there no significant correlation between total exercises tolerance and BP, RR and  $Paco_2$  with p value > 0.05

**Table (11): Shows correlation between Total exercises tolerance and their ventilator indicators.**

It was observed that there was no significant correlation between total exercises tolerance and ventilator indicators of both groups with p > 0.05 throughout period of study

**Table (1): Distribution of the studied patients of both groups according to their socio-demographic characteristics.**

| Characteristics                 | The studied patients (n=60)       |       |                                   |       | $\chi^2$<br>P  |
|---------------------------------|-----------------------------------|-------|-----------------------------------|-------|----------------|
|                                 | Study group<br>(n=30)             |       | Control group<br>(n=30)           |       |                |
|                                 | N                                 | %     | N                                 | %     |                |
| <b>Age (in years)</b>           |                                   |       |                                   |       |                |
| - (30-<40)                      | 1                                 | 3.33  | 1                                 | 3.33  | 2.974<br>0.226 |
| - (40-<50)                      | 5                                 | 16.67 | 1                                 | 3.33  |                |
| - (50-60)                       | 24                                | 80.00 | 28                                | 93.34 |                |
| <b>Range</b>                    | <b>(38-60)</b>                    |       | <b>(33-60)</b>                    |       | F=1.435        |
| <b>Mean <math>\pm</math> SD</b> | <b>53.17<math>\pm</math>5.045</b> |       | <b>54.73<math>\pm</math>5.085</b> |       | P=0.236        |
| <b>Gender</b>                   |                                   |       |                                   |       |                |
| - Male                          | 19                                | 63.33 | 20                                | 66.67 | FE             |
| - Female                        | 11                                | 36.67 | 10                                | 33.33 | 1.00           |
| <b>Marital status</b>           |                                   |       |                                   |       |                |
| - Married                       | 24                                | 80.00 | 27                                | 90.00 | FE             |
| - Widow                         | 6                                 | 20.00 | 3                                 | 10.00 | 0.472          |
| <b>Educational level</b>        |                                   |       |                                   |       |                |
| - Illiterate                    | 3                                 | 10.00 | 6                                 | 20.00 | 1.501<br>0.059 |
| - Read & write                  | 9                                 | 30.00 | 0                                 | 0.00  |                |
| - Secondary                     | 9                                 | 30.00 | 9                                 | 30.00 |                |
| - University                    | 9                                 | 30.00 | 15                                | 50.00 |                |
| <b>Residence</b>                |                                   |       |                                   |       |                |
| - Urban                         | 10                                | 33.33 | 18                                | 60.00 | FE             |
| - Rural                         | 20                                | 66.67 | 12                                | 40.00 | 0.069          |
| <b>Occupation</b>               |                                   |       |                                   |       |                |
| - Manual Work                   | 6                                 | 20.00 | 7                                 | 23.33 | 2.188<br>0.057 |
| - Employee                      | 6                                 | 20.00 | 18                                | 60.00 |                |
| - Technical work                | 4                                 | 13.33 | 5                                 | 16.67 |                |
| - House-wife                    | 7                                 | 23.33 | 0                                 | 0.00  |                |
| - Not work                      | 7                                 | 23.33 | 0                                 | 0.00  |                |

FE:Fisher' Exact test



**Table (2): Distribution of the studied patients regarding their present medical history**

| Present medical history                | The studied patients (n=60) |       |                         |       | $\chi^2$<br>P |
|----------------------------------------|-----------------------------|-------|-------------------------|-------|---------------|
|                                        | Study group<br>(n=30)       |       | Control group<br>(n=30) |       |               |
|                                        | N                           | %     | N                       | %     |               |
| <b>Current Diagnosis</b>               |                             |       |                         |       |               |
| - Benign lung tumor                    | 1                           | 3.33  | 2                       | 6.67  | 0.642         |
| - Myocardial infarction                | 21                          | 70.00 | 22                      | 73.33 |               |
| - Mitral stenosis                      | 8                           | 26.67 | 6                       | 20.00 |               |
| <b>Type of cardio-thoracic surgery</b> |                             |       |                         |       |               |
| - CABG                                 | 16                          | 53.33 | 22                      | 73.33 | 2.614         |
| - Mitral Valve Replacement             | 10                          | 33.33 | 6                       | 20.00 |               |
| - Lobectomy                            | 4                           | 13.33 | 2                       | 6.67  |               |
| <b>Chief complains</b>                 |                             |       |                         |       |               |
| - Chest Pain                           | 24                          | 80.00 | 22                      | 73.33 | 3.665         |
| - Shortness of breath                  | 1                           | 3.33  | 23                      | 76.67 |               |
| - Fatigue                              | 23                          | 76.67 | 6                       | 20.00 |               |
| - Dyspnea on exercise                  | 13                          | 43.33 | 0                       | 0.00  | 0.288         |
| - Palpitations                         | 4                           | 13.33 | 0                       | 0.00  |               |

CABG: Coronary Artery Bypass Graft

**Table (3): Distribution of the studied patients of both groups regarding their past medical history.**

| Past medical history                      | The studied patients (n=60) |              |                         |              | $\chi^2$<br>P  |
|-------------------------------------------|-----------------------------|--------------|-------------------------|--------------|----------------|
|                                           | Study group<br>(n=30)       |              | Control group<br>(n=30) |              |                |
|                                           | N                           | %            | N                       | %            |                |
| <b>I. Respiratory diseases</b>            |                             |              |                         |              | 2.001<br>0.064 |
| - Asthma                                  | 10                          | 33.33        | 2                       | 6.67         |                |
| - Benign lung tumor                       | 3                           | 10.00        | 0                       | 0.00         |                |
| - Chronic obstructive pulmonary disease   | 1                           | 3.33         | 0                       | 0.00         |                |
|                                           | 4                           | 13.33        | 0                       | 0.00         |                |
| - Lung cancer                             | 0                           | 0.00         | 2                       | 6.67         |                |
| - Lung tumor                              | 1                           | 3.33         | 0                       | 0.00         |                |
| - Respiratory failure type 1              | 1                           | 3.33         | 0                       | 0.00         |                |
| <b>II. Liver and metabolic diseases</b>   | 3                           | <b>10.00</b> | <b>0</b>                | <b>0.000</b> | -              |
| - Cholethlasis                            | 1                           | 3.33         | 0                       | 0.00         |                |
| - Fatty liver                             | 1                           | 3.33         | 0                       | 0.00         |                |
| - Hepatitis c                             | 1                           | 3.33         | 0                       | 0.00         |                |
| <b>III. Kidney diseases</b>               | 3                           | <b>10.00</b> | <b>0</b>                | <b>0.00</b>  | -              |
| - Chronic kidney disease                  | 1                           | 3.33         | 0                       | 0.00         |                |
| - End stage renal diseases.               | 1                           | 3.33         | 0                       | 0.00         |                |
| - Kidney stones                           | 1                           | 3.33         | 0                       | 0.00         |                |
| <b>IV. Other diseases</b>                 | <b>30</b>                   | <b>100</b>   | <b>28</b>               | <b>93.33</b> | 2.216<br>0.062 |
| - Diabetic mellitus                       | 6                           | 20.00        | 3                       | 10.00        |                |
| - Hypertension                            | 11                          | 36.67        | 0                       | 0.00         |                |
| - Diabetic mellitus and Hypertension      | 2                           | 6.67         | 14                      | 46.67        |                |
| - Ischemic heart disease                  | 11                          | 36.67        | 5                       | 16.67        |                |
| - Valvular heart diseases                 | 0                           | 0.00         | 6                       | 20.00        |                |
| <b>Previous hospitalization (in days)</b> |                             |              |                         |              |                |
| <b>V. None</b>                            | 18                          | 60.00        | 0                       | 0.00         | 2.085<br>0.064 |
| - (<5)                                    | 7                           | 23.33        | 10                      | 33.33        |                |
| - (5-10)                                  | 5                           | 16.67        | 13                      | 43.33        |                |
| - (>10)                                   | 0                           | 0.00         | 7                       | 23.33        |                |
| <b>Range</b>                              | (0-8)                       |              | (2-15)                  |              | F=1.993        |
| <b>Mean ± SD</b>                          | 1.73±2.463                  |              | 7.00±4.136              |              | P=0.054        |

FE: Fisher' Exact test

\* Statistically significant at level P&lt;0.05

**Table (4): Distribution of the studied patients of both groups regarding their past surgical history.**

| Past surgical history | The studied patients (n=60) |       |                         |       | $\chi^2$<br>P  |
|-----------------------|-----------------------------|-------|-------------------------|-------|----------------|
|                       | Study group<br>(n=30)       |       | Control group<br>(n=30) |       |                |
|                       | N                           | %     | N                       | %     |                |
| - Appendectomy        | 3                           | 10.00 | 3                       | 10.00 | 3.750<br>0.586 |
| - Cholecystectomy     | 2                           | 6.67  | 2                       | 6.67  |                |
| - Hysterectomy        | 1                           | 3.33  | 0                       | 0.00  |                |
| - Inguinal hernia     | 1                           | 3.33  | 0                       | 0.00  |                |
| - Pilonidal sinus     | 1                           | 3.33  | 0                       | 0.00  |                |
| - Tonsillectomy       | 2                           | 6.67  | 0                       | 0.00  |                |

**Table (5): Distribution of the studied patients regarding their smoking history**

| Smoking history                       | The studied patients (n=60) |       |                         |       | $\chi^2$<br>P  |
|---------------------------------------|-----------------------------|-------|-------------------------|-------|----------------|
|                                       | Study group<br>(n=30)       |       | Control group<br>(n=30) |       |                |
|                                       | N                           | %     | N                       | %     |                |
| - None-smoker                         | 16                          | 53.33 | 13                      | 43.33 | FE<br>0.606    |
| - Smoker                              | 14                          | 46.67 | 17                      | 56.67 |                |
| Duration of smoke (in years)          | (10-40)                     |       | (15-27)                 |       | t=2.085        |
| Range                                 |                             |       |                         |       | P=0.056        |
| Mean $\pm$ SD                         | 26.43 $\pm$ 9.321           |       | 21.41 $\pm$ 3.163       |       |                |
| Number of tobaccos consumed (per day) |                             |       |                         |       | 3.850<br>0.050 |
| - (<10)                               | 1                           | 3.33  | 0                       | 0.00  |                |
| - (10-20)                             | 10                          | 33.33 | 5                       | 16.67 |                |
| - (>20)                               | 3                           | 10.00 | 12                      | 40.00 |                |
| Range                                 | (5-40)                      |       | (20-40)                 |       | F=2.571        |
| Mean $\pm$ SD                         | 19.29 $\pm$ 8.739           |       | 30.29 $\pm$ 8.380       |       | P=0.055        |

FE: Fisher' Exact test

**Table (6): Distribution of the studied patients of both groups regarding their mode of mechanical ventilation**

| Extubation assessment                    | The studied patients (n=60)    |       |                                |       | $\chi^2$<br>P |
|------------------------------------------|--------------------------------|-------|--------------------------------|-------|---------------|
|                                          | Study group<br>(n=30)          |       | Control group<br>(n=30)        |       |               |
|                                          | N                              | %     | N                              | %     |               |
| Mode of Mechanical ventilation<br>- SIMV | 30                             | 100.0 | 30                             | 100.0 | -             |
| Range<br>Mean $\pm$ SD                   | (100-100)<br>100.00 $\pm$ 0.00 |       | (100-100)<br>100.00 $\pm$ 0.00 |       | -             |

**Table 7: Total mean scores of cardiothoracic rehabilitation exercises tolerance domain among studied patients throughout the study**

| Cardiothoracic Rehabilitation exercises tolerance domains    | The studied patients (n=60) / Range / Mean $\pm$ SD |                             |                |                             |                             |                |
|--------------------------------------------------------------|-----------------------------------------------------|-----------------------------|----------------|-----------------------------|-----------------------------|----------------|
|                                                              | Study group (n=30)                                  |                             | t <sub>p</sub> | Control group (n=30)        |                             | t <sub>p</sub> |
|                                                              | Day1                                                | Day2                        |                | Day1                        | Day2                        |                |
|                                                              | Mean $\pm$ SD                                       | Mean $\pm$ SD               | Mean $\pm$ SD  | Mean $\pm$ SD               | Mean $\pm$ SD               |                |
| <b>A. Respiratory physiotherapy</b>                          | (5-10)<br>8.50 $\pm$ 1.6                            | (5-10)<br>8.50 $\pm$ 1.6    | 0.00<br>1.00   | (4-4)<br>4.00 $\pm$ 0.0     | (4-4)<br>4.00 $\pm$ 0.0     |                |
| Study group Vs. Control group<br>t<br>p                      | 14.703<br>0.000**                                   | 14.703<br>0.000**           |                |                             |                             |                |
| <b>B. Sternal precautions and upper limb Exercises</b>       | (12-22)<br>18.20 $\pm$ 2.69                         | (12-22)<br>18.23 $\pm$ 2.67 | 0.048<br>0.962 | (6-7)<br>6.33 $\pm$ 0.47    | (6-7)<br>6.33 $\pm$ 0.47    | 0.00<br>1.00   |
| Study group Vs. Control group<br>t<br>p                      | 23.735<br>0.000**                                   | 23.992<br>0.000**           |                |                             |                             |                |
| <b>C. Cardiothoracic Rehabilitation Exercises' tolerance</b> | (21-32)<br>26.70 $\pm$ 3.06                         | (22-32)<br>26.73 $\pm$ 3.05 | 0.043<br>0.966 | (10-11)<br>10.33 $\pm$ 0.47 | (10-11)<br>10.33 $\pm$ 0.47 | 0.00<br>1.00   |
| Study group Vs. Control group<br>t<br>p                      | 28.903<br>0.000**                                   | 29.519<br>0.000**           |                |                             |                             |                |

\*\* high significant p value = 0

**Table (8): Mean scores of vital signs indicators among patient studied group**

| Vital signs indicators          | The studied patients (n=60)<br>Range<br>Mean $\pm$ SD |                                |                 |                                 |                                |                  |
|---------------------------------|-------------------------------------------------------|--------------------------------|-----------------|---------------------------------|--------------------------------|------------------|
|                                 | control group<br>(n=30)                               |                                | t<br>P          | study group<br>(n=30)           |                                | t<br>P           |
|                                 | Day1                                                  | Day2                           |                 | Day1                            | Day2                           |                  |
|                                 | Mean $\pm$ SD                                         | Mean $\pm$ SD                  | Mean $\pm$ SD   | Mean $\pm$ SD                   | Mean $\pm$ SD                  |                  |
| <b>1. Heart Rate</b>            | (75-110)<br>90.33 $\pm$ 9.35                          | (77-107)<br>91.07 $\pm$ 7.49   | 0.335<br>0.739  | (69-87)<br>76.03 $\pm$ 4.65     | (72-96)<br>84.10 $\pm$ 6.74    | 5.411<br>0.000*  |
| <b>2. Blood Pressure</b>        |                                                       |                                |                 |                                 |                                |                  |
| - Systolic                      | (100-140)<br>124.97 $\pm$ 10.23                       | (111-140)<br>126.40 $\pm$ 7.34 | 0.623<br>0.53   | (92-126)<br>112.67 $\pm$ 9.85   | (100-125)<br>117.40 $\pm$ 6.48 | 2.198<br>0.032*  |
| - Diastolic                     | (75-98)<br>86.30 $\pm$ 6.76                           | (67-96)<br>84.90 $\pm$ 6.22    | 0.834<br>0.408  | (49-86)<br>73.47 $\pm$ 10.85    | (59-83)<br>73.47 $\pm$ 8.54    | 0.00<br>1.00     |
| <b>3. Respiratory Rate (RR)</b> | (17-31)<br>24.33 $\pm$ 3.98                           | (18-34)<br>26.80 $\pm$ 4.43    | 2.265<br>0.027* | (17-19)<br>18.00 $\pm$ 0.78     | (26-34)<br>29.30 $\pm$ 2.26    | 25.846<br>0.000* |
| <b>4. O2 saturation</b>         | (97-100)<br>98.60 $\pm$ 1.03                          | (97-100)<br>98.97 $\pm$ 0.44   | 1.798<br>0.077  | (93-98)<br>95.60 $\pm$ 1.33     | (96-99)<br>97.50 $\pm$ 0.90    | 6.573<br>0.000*  |
| <b>5. PaO2</b>                  | (83-105)<br>93.17 $\pm$ 6.49                          | (80-110)<br>94.63 $\pm$ 7.46   | 0.815<br>0.419  | (139-401)<br>284.70 $\pm$ 91.48 | (61-119)<br>91.53 $\pm$ 1.45   | 11.476<br>0.000* |
| <b>6. PaCo2</b>                 | (30-45)<br>36.97 $\pm$ 3.09                           | (33-44)<br>37.97 $\pm$ 2.85    | 1.301<br>0.198  | (30-46)<br>38.33 $\pm$ 3.80     | (33-45)<br>39.50 $\pm$ 3.68    | 1.220<br>0.228   |

**Table (9): Mean scores of ventilator indicators among studied groups throughout the study period**

| Ventilatory indicators | The studied patients (n=60) |                    |         |                      |                  |        |
|------------------------|-----------------------------|--------------------|---------|----------------------|------------------|--------|
|                        | Range                       |                    |         |                      |                  |        |
|                        | Mean $\pm$ SD               |                    |         |                      |                  |        |
|                        | Study group (n=30)          |                    | t<br>P  | Control group (n=30) |                  | t<br>P |
|                        | Day1                        | Day2               |         | Day1                 | Day2             |        |
| 1. <b>FEV1</b>         | (81-98)                     | (87-98)            | 5.086   | (51-65)              | (50-65)          | 0.254  |
|                        | 87.87 $\pm$ 5.17            | 88.71 $\pm$ 5.17   | 0.000** | 56.30 $\pm$ 4.21     | 56.57 $\pm$ 3.89 | 0.800  |
| 2. <b>FVC</b>          | (80-92)                     | (85-98)            | 7.355   | (49-65)              | (50-64)          | 0.251  |
|                        | 86.27 $\pm$ 3.06            | 92.60 $\pm$ 3.58   | 0.000** | 56.57 $\pm$ 4.46     | 56.30 $\pm$ 3.72 | 0.802  |
| 3. <b>MVV</b>          | (87-140)                    | (88-141)           | 1.671   | (56-72)              | (59-72)          | 1.222  |
|                        | 110.50 $\pm$ 15.19          | 117.50 $\pm$ 17.20 | 0.100   | 63.40 $\pm$ 3.82     | 64.77 $\pm$ 4.84 | 0.227  |

FEV1: Forced Expiratory Volume in 1 second

FVC: Forced Vital Capacity

MVV: Maximum Voluntary Ventilation

\*\*Statistically significant at level  $P < 0.05$

**Table (10): Correlation between Total exercises tolerance and their vital signs indicators.**

| Vital signs indicators              | The studied patients (n=60) |       |              |               |                         |       |       |       |
|-------------------------------------|-----------------------------|-------|--------------|---------------|-------------------------|-------|-------|-------|
|                                     | Total exercises tolerance   |       |              |               |                         |       |       |       |
|                                     | Study group<br>(n=30)       |       |              |               | Control group<br>(n=30) |       |       |       |
|                                     | Day 1                       |       | Day 2        |               | Day 1                   |       | Day 2 |       |
|                                     | r                           | P     | R            | P             | r                       | P     | r     | P     |
| <b>I. Pulse (HR)</b>                | 0.262                       | 0.161 | <b>0.495</b> | <b>0.005*</b> | 0.323                   | 0.082 | 0.171 | 0.367 |
| <b>II. Blood Pressure</b>           |                             |       |              |               |                         |       |       |       |
| <b>Systolic</b>                     | 0.111                       | 0.558 | 0.088        | 0.645         | 0.061                   | 0.750 | 0.067 | 0.727 |
| <b>Diastolic</b>                    | 0.094                       | 0.623 | 0.029        | 0.879         | 0.203                   | 0.282 | 0.003 | 0.988 |
| <b>I. Respiratory Rate (RR)</b>     | 0.006                       | 0.976 | 0.107        | 0.573         | 0.091                   | 0.631 | 0.223 | 0.237 |
| <b>II. O<sub>2</sub> saturation</b> | 0.061                       | 0.750 | 0.270        | 0.149         | 0.166                   | 0.382 | 0.320 | 0.085 |
| <b>PaO<sub>2</sub></b>              | 0.245                       | 0.192 | <b>0.522</b> | <b>0.003*</b> | 0.205                   | 0.277 | 0.067 | 0.725 |
| <b>PaCo<sub>2</sub></b>             | 0.043                       | 0.823 | 0.007        | 0.971         | 0.088                   | 0.643 | 0.080 | 0.675 |

\* Statistically significant at level P&lt;0.05

**Table (11): Correlation between Total exercises tolerance and their ventilator indicators.**

| Ventilatory indicators | The studied patients (n=60) |       |       |       |                      |       |       |       |
|------------------------|-----------------------------|-------|-------|-------|----------------------|-------|-------|-------|
|                        | Total exercises tolerance   |       |       |       |                      |       |       |       |
|                        | Study group (n=30)          |       |       |       | Control group (n=30) |       |       |       |
|                        | Day 1                       |       | Day 2 |       | Day 1                |       | Day 2 |       |
|                        | r                           | P     | R     | P     | r                    | P     | r     | P     |
| 1. FEV1                | 0.102                       | 0.592 | 0.084 | 0.660 | 0.153                | 0.418 | 0.043 | 0.821 |
| 2. FVC                 | 0.127                       | 0.503 | 0.073 | 0.702 | 0.107                | 0.572 | 0.000 | 1.000 |
| 3. MVV                 | 0.004                       | 0.983 | 0.176 | 0.352 | 0.095                | 0.619 | 0.110 | 0.564 |

### Discussion

Open heart surgery is the most operation that done in 10 past years. Patients' respiratory capacity declines, muscle oxygen transmission deteriorates, and exercise tolerance deteriorates may be as a result of this postoperative **Colquhoun., et al (2021)**.

In addition to reducing the risk of lung problems during the recovery phase, exercises involving deep breathing and coughing also prevent secretion accumulation, promote oxygen transfer to cells, balance body and brain functions, consciousness, and sympathetic-parasympathetic system functions. Additionally, preoperative rehabilitation using an Incentive Spirometer is linked to a lower incidence of post-operative

pulmonary complications. Especially after open heart surgery (**Faleh, AL-Fayyadh, 2022**)

**Discussion will be presented in 4 parts:**

#### **Part(I): Socio-demographic characteristics of studied patient**

Regarding socio-demographic characteristics of studied patients, it was revealed that the majority of studied patients were 50-60 years with the mean ages of  $53.17 \pm 5.045$ . This may be due that aging is association with many health and disease conditions, including heart disease, as a result of life stresses. This was in line with **Kinas, and Bilgic (2024)**. who revealed that average age of the studied sample who had open heart surgery was 50 to 60 with the mean age of  $63.08 \pm 8.20$ . Moreover a study



conducted by **Fahmy, Ibrahim, & Kandeel. (2021)**. revealed that the average age of the studied sample was 51 to 61 with the mean age of  $48.6 \pm 12.2$ .

In relation to gender, less than two third of studied patients were male. This may possible because men always work in professions that require alertness and under intense physiological and psychological pressure, and that men smoke more than women and are more nervous at different times of work due to the demands of life. This finding was consistent with a study done by **El-gafour., et al., (2021)** who stated that less than two third of studied patients were male.

Regarding marital status, the present study revealed that, the majority of studied patients were married. This may result in increasing pressures on financial life, which requires a lot of continuous work. This finding was supported by a study done by **Fahmy, Ibrahim, & Kandeel, (2021)**. The effect of passive range of motion exercises on hemodynamic parameters of mechanically ventilated patients. . which revealed that most of samples were married.

Concerning residence, the current study showed that less than two thirds of studied patients were urban, this may be environmental pollution, such

as smoking fumes, cars, lack of oxygen, and a stressful life, this result is not the same line with **El-gafour., et al., (2021)** who found that less than half of studied patients were from urban.

Regarding educational level, the findings of the present study revealed that half of the studied patients had university education this because university education will lead to jobs that require a lot of work and constant pressure. This was supported by **Mortensen, et al., (2024)**. Who found that patients with low education levels, earlier myocardial infarction, or have a two-fold chance of sick leave >6 months after open heart surgery. This result was not supported by **Awad., et al., (2018)**. who found that about one third of sample had secondary education.

Regarding occupational status, the finding of the present study revealed that, about less than two thirds of studied patients were employed due to exposure to psychosocial work stressors especially that are associated with poor organizational outcomes, including sickness absence and presenteeism. This was supported by **Taouk, et al., (2020)**. Who reported that Psychosocial work stressors increase risk of coronary heart disease mortality

Also, **Hany, Ali & Abdel-Azeem (2019)**. in study about “Effect of deep breathing technique on severity of pain among postoperative coronary artery bypass graft patients” reported that, higher coronary heart disease incidence rates were found among employed patients.

## **Part II: Medical and surgical history of studied patient.**

In relation to smoking history, the present study showed that half of studied patients were smokers. This may be one of the main causes of deaths and open-heart surgeries, because smoking leads to blockage of arteries and pulmonary alveoli and leads to serious heart and devastating lung diseases such as pneumonia and others. This finding was consistent with a study done by **Duncan, et al., (2019)**. Who reported in study “associations of smoking cessation with subsequent risk of cardiovascular disease”. They found that there was a significantly higher risk of coronary vascular disease CVD within 5 years in heavy smokers and also supported by **Brescia. (2019)**. Who reported in study Impact of prescribing on new persistent opioid use after cardiothoracic found that tobacco use is be a higher risk for cardiovascular diseases that lead to open heart surgery.

Concerning medical history, the results of the present study showed that, one third of studied patients had hypertension and ischemic heart disease. This finding was supported by a study done by **de la Figuera, et al., (2018)**. titled “Clinical characteristics and management of patients with atrial fibrillation treated with direct oral anticoagulants according to blood pressure control”. reported that, most of the samples was ischemic heart diseases.

In relation to current diagnosis, the present study showed that less than three quarters of studied patients had myocardial infarction that considered one of the most common reasons of open-heart surgery. This finding was consistent with a study done by **Smit, Coetzee & Lochner, (2020)**. “The pathophysiology of myocardial ischemia and perioperative myocardial infarction. “. who reported that perioperative myocardial infarction (P MI) is considered the causes of perioperative open-heart surgery

Regarding type of cardio-thoracic surgery, the present study showed that half of studied patients were CABG. This finding was consistent with a study done by **Ruel, et al., (2024)**. who found that CABG is the operation most commonly performed by adult cardiac surgeons

In relation to chief complaints after cardiac surgery, the present study showed that majority of studied patients had chest pain. This finding was consistent with a study done **Gulati, et al., (2021)**. guideline for the evaluation and diagnosis of chest pain. stated that the majority of studied patients had chest pain. especially that had no previous cardiac surgery.

### **Part III: Extubating assessment of study patient:**

Regarding mode of mechanical ventilation, the present study showed that all of studied patients were on SIMV mode with ETT. This mode is considered the most important parameters by which weaning is performed for the patient. This finding was in line with a study done by **Manjunath, et al., (2021)**. who found that less than two thirds of studied patients were on SIMV mode.

### **Part IV: Total mean scores of cardiothoracic rehabilitation exercises tolerance domains of studied patient.**

It was observed that there were highly statistically significant differences among study and control groups regarding physiotherapy, Sternal precautions and upper limb Exercises and Cardiothoracic Rehabilitation Exercises' tolerance throughout period of study

The significant improvements observed in the study group regarding adherence to physiotherapy, compliance with sternal precautions, performance of upper limb exercises, and overall cardiothoracic rehabilitation exercise tolerance are consistent with findings from recent research emphasizing the benefits of structured rehabilitation protocols.

For example, a randomized controlled trial investigated the addition of integrated core and graduated resistance upper limb exercises to inpatient cardiac rehabilitation for patients with acute sternal instability following coronary artery bypass grafting (**CABG**). The intervention group demonstrated significant reductions in sternal separation and pain, along with improved activities of daily living (**ADL**) scores compared to the control group, suggesting that incorporating targeted upper limb exercises can enhance sternal healing and functional recovery post-CABG **El-Ansary et al., (2019)**.

Despite these positive outcomes, considerable variation exists in clinical practice regarding sternal precautions and upper limb exercise prescriptions following median sternotomy. Surveys have highlighted inconsistencies in the type and timing of exercise restrictions, often guided by patient-reported pain rather than standardized

protocols. For instance, a web survey conducted among Australian physiotherapists revealed significant variability in upper limb exercise guidelines within outpatient cardiac rehabilitation programs, with only 43% reporting screening for sternal instability and management primarily based on clinical experience **Balachandran et al., (2014)**.

Similarly, a study assessing the immediate effects of upper limb exercises with and without deep breathing on lung function after cardiac surgery found that while simultaneous deep breathing induced a greater increase in tidal volume during exercises, it also triggered a transient rise in pain, exertion, and dyspnea compared to exercises performed without deep breathing **Reinhart, et al., (2024)**.

It was observed that there were highly statistically significant differences among study and control groups related to **HR, BP, O<sub>2</sub>, RR, PaO<sub>2</sub>**, while there no significant difference was observed among control and study group related their items except respiratory rate

Concerning Pulse (**HR**), the results of the present study showed that there are highly significant differences between studied group throughout period of study. This finding was consistent with a study done by (**Köse& Avşar 2021**).

In study titled by Impact of early and regular mobilization on vital signs and oxygen saturation in patients undergoing open-heart surgery. Who found that the pulse value was decreased and there was a highly significant correlation before and after mobilization after open heart surgery. Also, in another study by **Sivrikaya, (2023)**. Titled “Vital Signs, Pain and Difficulty of Patients During Mobilization found that there was a significant correlation in heart rate before and after mobilization

Regarding Blood Pressure, the present study showed that it was high in control group and normal in study group. This finding is in the same line with the study of **Amiri, et al., (2023)**. In the study titled the effect of using virtual reality technology on anxiety and vital signs before surgery in patients undergoing open heart surgery. Who found there were a significant correlation in blood pressure before and after mobilization. On the other hand, the researcher found in his present study showed that the respiratory rate was high in two days with control group and normal with study group. This finding was contraindicated with study of **Helwani, et al., (2024)**. In the study of A 3-hour fast-track extubation protocol for early extubation after cardiac surgery who found that normal

respiratory rate in two group post-operative surgery and in the same line with another study that done by **Yilmaz (2020)**. In the study of the effect of progressive breathing relaxation training on preoperative anxiety and surgical stress response.

Regarding O<sub>2</sub> saturation, the present study showed that there were normal range of O<sub>2</sub> with study group with significant correlation between studied groups in O<sub>2</sub> saturation. This finding is supported by **Esfandiari (2022)**. In study “Evaluation of the effect of white noise on anxiety level, vital signs, hemodynamic indices of patients undergoing open heart surgery who found significant correlation in O<sub>2</sub> saturation between studied groups Also **Derakhtanjani, et al., (2019)**. In the study of Comparison, the effect of active cyclic breathing technique and routine chest physiotherapy on pain and respiratory parameters after coronary artery graft surgery. stated a significant correlation in O<sub>2</sub> saturation between studied groups

Concerning Pao<sub>2</sub>, the results of the present study showed that increasing in pao<sub>2</sub> level especially with study group in first day due to using mechanical ventilation for this patient highly significant study this finding was consistent with a study done **Kinas & Bilgic (2024)**. In study “Impact of breathing exercises in

patients who had open heart operation on respiratory function and exercise tolerance. “Who found that there was significant difference between studied group in also in another study supported these results by. **Afxonidis., et al., (2021)** In study of Efficacy of early and enhanced respiratory physiotherapy and mobilization after on-pump cardiac surgery: a prospective randomized controlled trial. This result may be because breathing exercise increase blood perfusion form the heart to all the body.

Concerning PaCo<sub>2</sub>, the results of the present study showed normal range of PaCo<sub>2</sub> that there no significant between study and control group this may be due to using a mechanical ventilation as oxygenation tool that in the same line with **Afxonidis, et al., (2021)** In study of Efficacy of early and enhanced respiratory physiotherapy and mobilization after on-pump cardiac surgery: a prospective randomized controlled trial. found there were no change in PaCo<sub>2</sub>.

Regarding mean scores of ventilator indicators among studied groups throughout the study period the researcher found increased in respiratory function due to increase of anxiety, using respiratory muscles and exhaustion of patient due to bed ridden

that there was a significant correlation between FEV1 and FVC among studied groups for both parameters about, this result are in the same line with **Fayazi., et al., (2021)**. In study The Effect of Open-Heart Surgery on FVC, FEV1 and FVC/FEV1 of Patients found significant correlation between FVC, FEV1 After Surgery and also supported by another study by **Mgbemena., et al., (2022)**. In study Acute changes in handgrip strength, lung function and health-related quality of life following cardiac surgery who found significant correlation between FEV1 and FVC in Pre-operative and physiotherapy discharge patient who had open heart surgery

Regarding the correlation between total exercises tolerance and blood pressure it was found a significant correlation between two groups. this finding is supported by **Kinas& Bilgic (2024)**. In study about Impact of breathing exercises in patients who had open heart operation on respiratory function and exercise tolerance and found that there was a significant correlation with Blood pressure and exercise between experimental and control group with in preoperative ,2<sup>nd</sup> and 3<sup>rd</sup> day post open-heart surgery

**Finally.,** in another study this result in the same line with **Iriart., et al.,**

**(2020)** in study titled by heart rate response during exercise predicts exercise tolerance in adults with transposition of the great arteries and atrial switch operation found that there was a significant correlation between heart rate and  $\dot{V}O_2$  max during physical exertion.

### Conclusion

The current study showed that cough augmentation techniques have positive impact on airway clearance of mechanically ventilated patients. The intervention resulted in more hemodynamic stability, oxygen saturation, blood gases exchange and breathing stability resulting from airway clearance.

### Recommendations

- Using Cough Augmentation Techniques as a part of the daily care in managing cases complains of secretions in intensive care unit.
- Continuous training sessions and set new policies about recommendations of airway clearance for patients receiving care on a result.
- The same study could be replicated in more hospitals with a larger probability sample for further research.

## References

- Afxonidis, G., Moysidis, D. V., Papazoglou, A. S., Tsagkaris, C., Loudovikou, A., Tagarakis, G., ... & Anastasiadis, K. (2021, December).** Efficacy of early and enhanced respiratory physiotherapy and mobilization after on-pump cardiac surgery: a prospective randomized controlled trial. In *Healthcare*, 9(12), p. 1735. MDPI.
- Ahmed, A. A., Hassan, M. S., Mohamed, Y. S., & Gamal, L. M. (2019).** Applying Cardiac Rehabilitation Exercise Protocol to Reduce Post-operative Cardio-Pulmonary Complications among Open Heart Surgery Patient's. *Minia Scientific Nursing Journal*, 6(1), 45-55.
- Amin, R., Alaparathi, G. K., Samuel, S. R., Bairapareddy, K. C., Raghavan, H., & Vaishali, K. (2021).** Effects of three pulmonary ventilation regimes in patients undergoing coronary artery bypass graft surgery: a randomized clinical trial. *Scientific Reports*, 11(1), 6730.
- Amiri, A., Jalali, R., & Salari, N. (2023).** The effect of using virtual reality technology on anxiety and vital signs before surgery in patients undergoing open heart surgery. *Perioperative Medicine*, 12(1), 62.
- Awad, M. K., Taha, N. M., Debis, A. M., & Mohamed, E. H. (2018).** Effect of therapeutic exercises program on patients' outcomes undergoing open heart surgeries. *Zagazig Nursing Journal*, 14(1), 45-61.
- Balachandran, S., Lee, A., Royse, A., Denehy, L., & El-Ansary, D. (2014).** Upper limb exercise prescription following cardiac surgery via median sternotomy: a web survey. *Journal of cardiopulmonary rehabilitation and prevention*, 34(6), 390-395.
- Boone, T. (2020).** The ASEP Board Certified Exercise Physiologists Prescribe Exercise Medicine. *Journal of Professional Exercise Physiology*, 17(2).
- Brescia, A. A., Waljee, J. F., Hu, H. M., Englesbe, M. J., Brummett, C. M., Lagisetty, P. A., & Lagisetty, K. H. (2019).** Impact of prescribing on new persistent opioid use after cardiothoracic surgery. *The Annals of thoracic surgery*, 108(4), 1107-1113.
- Colquhoun, D. A., Leis, A. M., Shanks, A. M., Mathis, M. R., Naik, B. I., Durieux, M. E., ... & Blank, R. S. (2021).** A lower tidal volume regimen during one lung ventilation for lung resection surgery is not associated with reduced postoperative pulmonary complications. *Anesthesiology*, 134(4), 562.
- De la Figuera, M., Cinza, S., Egocheaga, I., Marín, N., & Prieto, M. A. (2018).** Clinical characteristics and management of patients with atrial fibrillation treated with direct oral

anticoagulants according to blood pressure control. *Hipertensión y riesgo vascular*, 35(4), e1-e9

**Derakhtanjani, A. S., Jaberi, A. A., Haydari, S., & Bonabi, T. N. (2019). Comparison the effect of active cyclic breathing technique and routine chest physiotherapy on pain and respiratory parameters after coronary artery graft surgery: A randomized clinical trial. *Anesthesiology and pain medicine*, 9(5), e94654**

**Duncan, M. S., Freiberg, M. S., Greevy, R. A., Kundu, S., Vasan, R. S., & Tindle, H. A. (2019). Association of smoking cessation with subsequent risk of cardiovascular disease. *Jama*, 322(7), 642-650.**

**El-Ansary, D., LaPier, T. K., Adams, J., Gach, R., Triano, S., Katijjahbe, M. A., ... & Cahalin, L. P. (2019). An evidence-based perspective on movement and activity following median sternotomy. *Physical therapy*, 99(12), 1587-1601**

**El-gafour, A., Mahmoud, A., Younis, G. A. E., & Gad, S. M. A. E. L. (2021). Assessment of patients' needs pre and post open heart surgery. *Tanta Scientific Nursing Journal*, 22(3), 11-32.**

**Esfandiari Bakhtiari, R. E. B. (2022). Evaluation of the effect of white noise on anxiety level, vital signs, hemodynamic indices of patients undergoing open heart surgery in**

**Ayatollah Kashani Hospital in Shahrekord. *Scientific Journal of Nursing, Midwifery and Paramedical Faculty*, 7(3), 14-23.**

**Fahmy, A. M., Ibrahim, A., & Kandeel, N. A. (2021). The effect of passive range of motion exercises on hemodynamic parameters of mechanically ventilated patients. *Mansoura Nursing Journal*, 8(3), 271-285.**

**Faleh, J. N., & AL-Fayyadh, S. (2022). Preoperative Incentive Spirometer to Prevent Postoperative Pulmonary Complications following Open Heart Surgeries: A Randomized Single Blinded Multi-Centric Clinical Trial. *Journal of Contemporary Medical Sciences*, 8(4).**

**Fayazi, N., Montazerghaem, H., & Boushehri, E. (2021). The Effect of Open Heart Surgery on FVC, FEV1 and FVC/FEV1 of Patients. *Hormozgan Medical Journal*, 25(3), 126-131.**

**Garcia-Delgado, M., Navarrete-Sanchez, I., & Colmenero, M. (2014). Preventing and managing perioperative pulmonary complications following cardiac surgery. *Current Opinion in Anesthesiology*, 27(2), 146-152.**

**Gulati, M., Levy, P. D., Mukherjee, D., Amsterdam, E., Bhatt, D. L., ... & Shaw, L. J. (2021). 2021 AHA/ACC/ASE/CHEST/SAEM/SCC**



- T/SCMR guideline for the evaluation and diagnosis of chest pain: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Journal of the American College of Cardiology*, 78(22), e187-e285.
- Hany, S. M., Ali, Z. H., & Abdel-Azeem Mostafa, H. (2019).** Effect of deep breathing technique on severity of pain among postoperative coronary artery bypass graft patients. *International Journal of Novel Research in Healthcare and Nursing*, 6(2), 32-46.
- Hardin, S. R., & Kaplow, R. (2025).** Cardiac surgery essentials for critical care nursing. Jones & Bartlett Learning.
- HAUTALAHTI, J.** Sternal Stability after Cardiac Surgery. November 2019
- Helwani, M. A., Copeland, C., Ridley, C. H., Kaiser, H. A., & De Wet, C. J. (2022).** A 3-hour fast-track extubation protocol for early extubation after cardiac surgery. *JTCVS open*, 12, 299-305.
- HULME, J., & KONG, K.** Anaesthesia and Surgery in Hypertension. 1st Edition 2005 CRC Press 16 eBook ISBN9780429116285.
- Iriart, X., Le Quellenec, S., Pillois, X., Jaussaud, J., Jalal, Z., Roubertie, F., ... & Thambo, J. B. (2020).** Heart rate response during exercise predicts exercise tolerance in adults with transposition of the great arteries and atrial switch operation. *International Journal of Cardiology*, 299, 116-122.
- Kinas, S. B., & Bilgic, S. (2024).** Impact of breathing exercises in patients who had open heart operation on respiratory function and exercise tolerance. *The Australian Journal of Advanced Nursing*, 41(1), 10-20.
- Köse, S., & Avşar, G. (2021).** Impact of early and regular mobilization on vital signs and oxygen saturation in patients undergoing open-heart surgery. *Brazilian Journal of Cardiovascular Surgery*, 36(4), 506-514.
- Mahmoud, A. S., Gamil, E. E., Al-mashtoly, Z. M., El Khonizy, B. A., & Refaie, M. A. (2020).** Short term Outcome of Coronary Artery Bypass Surgery in Patients with Impaired Left Ventricular Systolic Function. *Al-Azhar International Medical Journal*, 1(2), 188-192
- Manjunath, V., Reddy, B. G., & Prasad, S. R. (2021).** Is airway pressure release ventilation, a better primary mode of post-operative ventilation for adult patients undergoing open heart surgery? A prospective randomized study. *Annals of Cardiac Anesthesia*, 24(3), 288-293.
- Mgbemena, N., Jones, A., Saxena, P., Ang, N., Senthuran, S., & Leicht, A. (2022).** Acute changes in handgrip

- strength, lung function and health-related quality of life following cardiac surgery. *PLoS One*, 17(2), e0263683.
- Mortensen, M., Nilsen, R. M., Kvalheim, V. L., Bjørnstad, J. L., Svendsen, Ø. S., Haaverstad, R., & Moi, A. L. (2024).** The influence of socio-demographic and clinical factors on sick leave and return to work after open-heart surgery: a nationwide registry-based cohort study. *European Heart Journal-Quality of Care and Clinical Outcomes*, 10(5), 431-445.
- Nadi, F., Azizi-Fini, I., & Izadi-Avanji, F. S. (2020).** Impact of continuous positive airway pressure (cpap) masks on arterial blood gas parameters and pulmonary side effects after open-heart surgery. *Journal of Vessels and Circulation*, 1(1), 1-7.
- Odah, M. A., Al-Qubati, F. A., Mohammed, M. A., Abdel-Aziz, M. A., & Mahgoub, A. A. (2020).** Effect of an educational program about acute respiratory distress syndrome on critical care nurses' performance. *Assiut Scientific Nursing Journal*, 8(20), 1-12.
- Qiao, L., Wang, Z., Shen, J., Xing, X., & Yuan, H. (2024).** Impact of Dexmedetomidine on Hemodynamics, Plasma Catecholamine Levels, and Delirium Incidence Among Intubated Patients in the ICU--A Randomized Controlled Trial. *Therapeutics and Clinical Risk Management*, 689-700.
- Reinhart, M., Jonsson, M., Enthoven, P., & Westerdahl, E. (2024).** Immediate effects of upper limb exercises with and without deep breathing on lung function after cardiac surgery—a randomized crossover trial. *Journal of Cardiothoracic Surgery*, 19(1), 503.
- Ruel, M., Gupta, S., Ponnambalam, M., & Chong, A. Y. (2024).** Less invasive and hybrid surgical/interventional coronary disease management: the future is now. *Canadian Journal of Cardiology*, 40(2), 290-299.
- Saef, J. M., & Ghobrial, J. (2021).** Valvular heart disease in congenital heart disease: a narrative review. *Cardiovascular Diagnosis and Therapy*, 11(3), 818.
- Salem, F. A., Ali, K. A. G., Hady, A., Taha, A. H., & Diab, S. M. (2020).** Development of clinical nurses' competency in cardiothoracic intensive care unit. *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 9(2), 17-30.
- Saravanan, P. (2024).** Postoperative care of the adult cardiac patient. *Anaesthesia & Intensive Care Medicine*.
- Sivrikaya, Y. A. (2023).** Vital Signs, Pain and Difficulty of Patients During Mobilization after Open-Heart Surgery. *International Journal of Caring Sciences*, 16(2), 725-734.

- Smit, M., Coetzee, A. R., & Lochner, A. (2020).** The pathophysiology of myocardial ischemia and perioperative myocardial infarction. *Journal of cardiothoracic and vascular anesthesia*, 34(9), 2501-2512.
- Sole, M. L., Klein, D. G., & Moseley, M. J. (2020).** **Introduction to Critical Care Nursing E-Book: Introduction to Critical Care Nursing E-Book.** Elsevier Health Sciences.
- Tang, F., Yi, J. M., Gong, H. Y., Lu, Z. Y., Chen, J., Fang, B., ... & Liu, Z. Y. (2021).** Remimazolam benzenesulfonate anesthesia effectiveness in cardiac surgery patients under general anesthesia. *World Journal of Clinical Cases*, 9(34), 10595.
- Taouk, Y., Spittal, M. J., LaMontagne, A. D., & Milner, A. J. (2020).** Psychosocial work stressors and risk of all-cause and coronary heart disease mortality. *Scandinavian journal of work, environment & health*, 46(1), 19-31.
- Tarwade, P., & Smischney, N. J. (2022).** Endotracheal intubation sedation in the intensive care unit. *World Journal of Critical Care Medicine*, 11(1), 33.
- Wiratama, S., Yan Efrata Sembiring, Y., & Setiawan, P. (2024).** Perioperative factors of fast track extubation success following coronary artery bypass graft surgery: a literature review. *Bali Medical Journal*, 13(1).
- Xu, X., Cheung, D. S. T., Smith, R., Lai, A. Y. K., & Lin, C. C. (2022).** The effectiveness of pre-and post-operative rehabilitation for lung cancer: a systematic review and meta-analysis on postoperative pulmonary complications and length of hospital stay. *Clinical rehabilitation*, 36(2), 172-189.
- Yilmaz, M. E. R. Y. E. M. (2020).** The effect of progressive breathing relaxation training on preoperative anxiety and surgical stress response. *International Journal of Caring Sciences*, 13(2).

## Effect of Artificial Intelligence Using Mobile-Based Nursing Education on Sexual Health among Women Receiving Medications for Hepatitis C

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### Abstract

**Background:** Hepatitis C infection affects women's quality of life, requiring new treatments like direct-acting antiviral drugs. Promoting sexual health is an important function of nurses. **Aim:** To assess effect of artificial intelligence using mobile-based nursing education on sexual health among women receiving medications for hepatitis C. **Design:** A quasi-experimental design was used to conduct the research. **Setting:** The National Liver Institute's outpatient clinic at Menoufia University in Egypt. **Sample:** 150 women with a history of hepatitis C virus infection were chosen as a purposive sample. **Tools:** The general characteristic of the women under study and their level of sexual health knowledge were two of the instruments utilized to gather data. The female sexual function index is associated with Tool II. **Results:** The study group demonstrated a significant improvement in all dimensions of the female sexual function index and sexual health awareness ( $p \leq 0.001$ ). Conversely, there were no discernible changes in the control group's knowledge of sexual health or female sexual function index scores ( $p > 0.05$ ). **Conclusion:** After undergoing HCV medication in conjunction with artificial intelligence through mobile-based education, the women in the study group showed a notable improvement in every FSFI domain and their overall knowledge of sexual health and strategies for improving it when compared to those in the control group. **Recommendation:** Integrate mobile-based artificial intelligence into the standard care plan for women receiving HCV medications, focusing on improving sexual health awareness and addressing misconceptions.

**Keywords:** Hepatitis C Medications, Sexual Health, Artificial Intelligence, Mobile-Based Nursing Education

## Introduction

The hepatitis C virus (HCV) remains a major global public health concern, especially for susceptible groups like women **(WHO, 2022)**. The frequently silent progression of HCV, which can result in chronic liver diseases including cirrhosis and hepatocellular cancer, adds to the burden of the virus **(Smith et al., 2021)**. Since the development of direct-acting antiviral (DAA) drugs, HCV treatment has undergone significant change, and in most cases, the virus can now be cured **(Johnson & Brown, 2020)**. However, pharmacologic intervention alone is not enough to achieve the best results from DAA treatment; complete education, awareness, and behavioral change are also necessary, particularly about sexual health, which is still not sufficiently addressed in this context **(Lee, Lim, & Kim, 2021)**.

The biological, social, and cultural obstacles that women with HCV face make managing the illness and providing health education more difficult **(Ahmed et al., 2019)**. Despite its vital role in HCV transmission and general well-being, sexual health is commonly disregarded or demonized. Many women don't know enough about how HCV spreads through sexual contact, how to avoid getting infected, and how the virus impacts reproductive health **(Chen, Smith, & Zhang, 2022)**. To overcome stigma and false information, as well as to enable women to embrace safe sexual practices

both during and after DAA therapy, targeted education is crucial **(Foster et al., 2020)**.

In contexts with limited resources or among individuals with low health literacy, traditional health education approaches frequently fall short in engaging women **(Gonzalez et al., 2018)**. Because of its accessibility, adaptability, and privacy potential, mobile health (mHealth) interventions have become viable substitutes **(Jones, Green, & White, 2021)**. By providing a scalable platform to support sexual and reproductive health, mobile-based education can assist in overcoming social, temporal, and geographic barriers **(Williams & Park, 2020)**.

By making it possible to deliver individualized, interactive, and adaptable educational information, artificial intelligence (AI) further expands the potential of mHealth **(Rahman et al., 2021)**. Mobile apps with AI capabilities can improve user experience and knowledge acquisition by providing decision-support tools, tracking engagement, and customizing messages according to user profiles **(Zhang et al., 2022)**. These technologies can help women receiving DAA therapy better comprehend and remember sexual health information **(Liu et al., 2021)**.

However, there is still a dearth of empirical study on the effectiveness of AI-integrated mobile education in enhancing sexual health practices and

understanding among women with HCV, despite the technology's potential. Most current initiatives focus on generic HCV knowledge and treatment adherence, frequently ignoring gender-specific requirements and sexual health issues **(Martinez et al., 2020)**. This disparity emphasizes the need for creative teaching strategies that enable women to make knowledgeable decisions about their health in the face of chronic illness.

Enhancing quality of life, lowering transmission, and promoting the long-term effectiveness of antiviral therapy all depend on raising sexual health literacy among women with HCV **(Kumar et al., 2019)**. An AI-powered mobile education approach could dispel long-standing myths, lessen stigma, and promote candid discussions on sexual and reproductive health **(Nguyen et al., 2021)**. Women are more likely to embrace healthy habits and effectively advocate for their own well-being when they have access to reliable and easily comprehensible information **(Ali & Hassan, 2020)**.

The purpose of this study is to evaluate how well an AI-based mobile educational intervention affects the sexual health habits and knowledge of women undergoing DAA medication for HCV. The intervention aims to close knowledge gaps, encourage behavior change, and improve sexual health outcomes by combining cutting-edge technology with material that is supported by evidence. It also investigates the clinical acceptability

and viability of the intervention. By offering insights into how AI might be strategically applied to help education and self-management in the care of chronic diseases, this research advances the rapidly developing field of digital health. It draws attention to how AI-powered solutions can be used to address delicate and complicated topics, such as sexual health, among underserved female groups impacted by HCV **(Taylor et al., 2023)**.

### **Study Significance**

An estimated 71 million people worldwide are afflicted with hepatitis C virus, which is still a major cause of chronic liver disease **(European Union HCV Collaborators, 2017)**. Particularly in Egypt, the prevalence of HCV is among the highest in the world. Nearly 10% of Egyptians and 7% of those aged 15 to 19 who tested positive for HCV had active viremia, according to a 2015 demographic and health survey. This amounts to approximately 5.5 million people who have a chronic infection **(Imam et al., 2020)**.

Through the implementation of bold national programs in recent years, such as the Hepatitis C Elimination and Early Non-Communicable Disease Detection Presidential Initiative, Egypt has greatly increased access to direct-acting antiviral drugs and enhanced treatment results nationwide. However, significant psychosocial aspects of treatment, such as sexual health, particularly for women, are

still not sufficiently addressed despite these medical advancements (**Saker et al., 2019**).

In Egypt, honest communication about sexual health is frequently impeded by cultural and traditional barriers, especially for women and in clinical settings where female healthcare providers are involved (**Saker, 2019**). As a result, little is known about female sexual dysfunction, particularly in women receiving therapy for HCV. This topic is a neglected but important area of concern in Egyptian healthcare research because, so few studies have addressed it (**Saker et al., 2019**).

Enhancing long-term treatment outcomes, improving quality of life, and reducing transmission rates can all be achieved by educating women with HCV about sexual health issues. A mobile-based AI intervention can help dispel misunderstandings, reduce stigma and anxiety, and encourage open communication about sexual and reproductive health issues. Equipped with factual knowledge and practical solutions, women are more able to adopt healthy habits and advocate for their own well-being (**Saker, 2019**).

In light of this, the study is significant because it aims to evaluate the impact of artificial intelligence through mobile-based education on female patients' sexual health when taking direct-acting antiviral medications for the hepatitis C virus. Additionally, it complements

national efforts by addressing this important but frequently disregarded component of comprehensive patient intervention (**Tunçel et al., 2019**).

**The aim of the study** The study's aim was to evaluate effect of artificial intelligence on the sexual health of women on direct-acting antiviral drugs for the hepatitis C virus through mobile-based nurse education.

### **Research Hypotheses:**

**H<sub>1</sub>:** Compared to those receiving standard care, women undergoing HCV medications in conjunction with artificial intelligence through mobile-based nursing education have noticeably higher female sexual function index scores.

**H<sub>2</sub>:** There a statistically significant improvement in FSFI scores among women in the study group after artificial intelligence through mobile-based nursing education, compared to their pre-intervention scores.

**H<sub>3</sub>:** Following artificial intelligence employing mobile-based nursing education, women in the study group noticeably more knowledge about sexual health and strategies for improving it than women in the control group.

### **Subjects and Method**

**Design:** A quasi-experimental design was used in the investigation with two groups: study and control groups.

**Setting:** The research was conducted at the National Liver Institute's outpatient clinic at Menoufia University in Egypt.

**Sample:** 150 women with a history of Hepatitis C virus infection were chosen as a purposive sample. Participants were split evenly into two groups: 75 women made up the study group and 75 women in the control group.

- The study group consisted of women who got HCV medications in addition to regular outpatient care and additional nurse interventions, such as advice on safe sexual behavior, methods to increase psychological well-being, and steps to promote sexual health.
- The control group consisted of women who did not get any additional nurse interventions, merely regular outpatient care and DAA treatment.

#### **Criteria for Inclusion**

- Women without cirrhosis who have a persistent HCV infection
- Currently married and sexually active
- Undergoing treatment with medications

#### **Criteria for Exclusion**

- Postmenopausal females
- Unmarried women
- Patients are diagnosed with diabetes, ischemic heart disease, depression, or cirrhosis, as these conditions can negatively impact sexual function

#### **Calculating Sample Size**

- The Epi Info statistics program (Open-Source Statistics for Public Health) was used to determine the sample size, which was based on a 95% confidence level, 5% margin of error, and 80% power. and a 1:1 ratio between study and control groups.

#### **Data Collection tools**

##### **Tool I: An organized questionnaire for interviews**

Researchers created this tool, which had two sections and was based on pertinent literature (Ali & Hassan, 2020):

- **Section 1: Demographic Information**– Included age, educational level, occupation, and household income.
- **Section 2: Sexual Health Knowledge Assessment** – Included 11 questions covering sexual health definitions, importance, influencing and harmful factors, and ways to promote sexual health.

**Scoring:** Total scores were categorized as:

- Poor (<60%)
- Average (60–75%)
- Good (>75%)

**Validity:** Content validity was assessed by a panel of five experts (from obstetrics, maternal health, and internal medicine), who reviewed and refined the tool for relevance and clarity.

**Reliability:** Assessed via the **test-retest method**, with a high level of internal consistency is indicated by Cronbach's alpha of 0.861.

##### **Tool II: Female Sexual Function Index (FSFI)**

A validated instrument for evaluating women's sexual function across six key categories is the Female Sexual Function Index (FSFI), which was modified from Reed et al. (2014). A 5-point Likert scale is used to grade the tool's 19 items, with



domain-specific weightings to calculate both domain and total scores.

### Scoring of FSFI Domains

| Domain       | Questions | Score Range | Factor | Minimum Score | Maximum Score |
|--------------|-----------|-------------|--------|---------------|---------------|
| Desire       | 1–2       | 1–5         | 0.6    | 1.2           | 6.0           |
| Arousal      | 3–6       | 0–5         | 0.3    | 0.0           | 6.0           |
| Lubrication  | 7–10      | 0–5         | 0.3    | 0.0           | 6.0           |
| Orgasm       | 11–13     | 0–5         | 0.4    | 0.0           | 6.0           |
| Satisfaction | 14–16     | 0 (or 1)–5  | 0.4    | 0.8           | 6.0           |
| Pain         | 17–19     | 0–5         | 0.4    | 0.0           | 6.0           |

- **Total FSFI Score Range:** 2.0 to 36.0
- Better sexual function is indicated by a higher score (Weigl et al., 2005; Anis et al., 2011).

### Tool Validity

A panel of five academic experts verified the content validity of the FSFI (Arabic version): two from the Department of Maternal & Newborn Health Nursing at Menoufia University's Faculty of Nursing, and three from the Department of Obstetrics & Gynecology, Faculty of Medicine. A number of changes were made to improve clarity, accuracy, and relevance in response to their input.

### Tool Reliability

When the reliability of the FSFI was assessed using the test-retest method, Cronbach's alpha coefficient was 0.82, which indicates strong internal consistency. The tool's consistency across many parameters of sexual function was further confirmed by domain-specific

reliability coefficients, which ranged from 0.79 to 0.86 (Saker, 2019).

### Administrative Procedures

The Dean of the Faculty of Nursing obtained formal administrative approval prior to the start of the study after obtaining permission from the National Liver Institute's management. An official letter explaining the research objectives and importance was submitted to justify access to participants and study settings.

### Ethical Considerations

The Menoufia University Faculty of Nursing's Ethical Research Committee provided ethical approval. All participants gave their informed consent after being fully informed about the study's goals, methods, and rights. Confidentiality of personal information was assured, and involvement was completely voluntary.

### Pilot Study

To assess the tools' clarity, viability, and completion time, pilot research involving 30 women, or 10% of the entire sample, was carried out. The required changes were made in light of the pilot's results to guarantee the full study's efficacy.

### Data Collection

In order to fully comprehend the findings, the researchers conducted an extensive review of both local and international literature. Relevant information was gathered from books, scientific journals, magazines, and reliable internet sources. Based on this review, study instruments were developed and validated. Fieldwork

was conducted from April to August 2023 at the National Liver Institute. The researchers attended the study setting three days per Monday through Friday, 9:00 a.m. to 12:00 p.m., where they introduced themselves to the medical team, including doctors and nurses, and explained the goal and importance of the study. Informed consent was requested from participants who satisfied the inclusion requirements before data collection began. The research was carried out in four successive stages:

### **1. Phase of Assessment**

In this stage, the investigators individually met each woman diagnosed with a persistent infection of the HCV who qualified for DAA therapy at the outpatient clinic. After explaining the study objectives and securing informed consent, participants completed an assessment of sociodemographic and the FSFI to assess baseline sexual health status prior to initiating DAAs.

### **2. Planning Phase**

A comprehensive educational booklet was developed by researchers. The booklet included:

- The definition and importance of sexual health
- Components of healthy sexual function
- Strategies to improve physical and psychological well-being
- Techniques to enhance sexual satisfaction and function

This content served as the foundation for the AI-based mobile education intervention.

### **3. Implementation Phase**

The intervention was delivered using artificial intelligence through mobile-based education. The study group received the educational content via two instructional sessions, with groups of five women participating and each lasting thirty minutes. The sessions with AI support used an educational booklet as a primary teaching tool, and content was reinforced through mobile-based interactive support.

#### **Session 1 Topics**

- Definition and importance of sexual health
- Characteristics of a sexually healthy individual
- Consequences of poor sexual health

#### **Session 2 Topics**

- Measures to improve sexual health:

**Safe Sex:** Using condoms and hygienic practices to prevent HCV transmission.

#### **Psychological Well-being**

Breathing exercises, relaxation techniques, walking, emotional expression, and specialist consultation. Physical activity (e.g., Kegel, yoga, walking) was emphasized for enhancing libido and performance, supported by Stanton et al. (2018).

#### **Sexuality-Enhancing Measures**

- Counseling sessions focusing on reducing anxiety and enhancing sexual responsiveness

- Addressing psychological barriers to sexual satisfaction
- Encouraging sensory stimulation through taste, smell, sound, touch, and visual cues as described by Binik and Hall (2014)
- Practicing pelvic exercises (e.g., Kegels), recommended at 20 repetitions per session, twice daily, three days a week, as suggested by Lolowang, Afiyanti, and Ungsianik (2019)

#### 4. Evaluation Phase

The FSFI was given again after the conclusion of the intervention to both study and control groups. The outcomes were then compared to assess effect of AI-based mobile education on sexual wellbeing of women receiving DAAs for HCV.

**Data analysis:** The data was organized, inspected, coded, tabulated, analyzed, and presented using descriptive statistics, such as frequencies and percentages for qualitative variables. A test of significance was used to compare the study and control groups. When  $P > 0.05$ , there is no statistically significant difference. A  $P$  value of 0.05 denotes a statistically significant difference, whereas a  $P$  value of 0.001 denotes an extremely significant difference.

#### Results

The personal details of the women in the study and control groups, who were all between the ages of 18 and 50, are shown in Table 1. Of the study and control groups, over half (50.7% and 53.3%, respectively) were between the ages of 28

and 39. Notably, age, educational attainment, domicile, and socioeconomic status did not differ statistically significantly between the study and control groups ( $P > 0.05$ ).

With all  $p$ -values over 0.05, Table 2 shows that the mean scores of the FSFI domains (desire, arousal, lubrication, orgasm, and pain) did not change statistically significantly between the study and control groups.

The research group's mean scores in every FSFI domain were significantly higher than those of the control group ( $P \leq 0.001$ ), according to Table 3.

Figure 1 illustrates that the total FSFI score significantly improved within the study group following nursing intervention and DAAS. Specifically, the post-intervention mean score ( $18.8 \pm 0.27$ ) was significantly higher than the pre-intervention score ( $16.77 \pm 1.6$ ).

Regarding all facets of sexual health knowledge and enhancement techniques, Table 4 reveals no discernible differences between the study and control groups ( $P > 0.05$ ).

Table 5 demonstrates a statistically significant increase in the study group's (the women with hepatitis C) sexual health knowledge as compared to the control group. Following the nurse intervention, a greater proportion of study group participants achieved good knowledge scores in key areas such as the definition (53.3%), importance (46.7%), influencing factors (46.7%), enhancers

(53.3%), impairers (46.7%), sexual cycle (46.7%), measures to improve sex (53.3%), and nutrition (53.3%). Conversely, the control group possessed significantly lower percentages in each domain.

Figure 2 demonstrates that just one-third (33.3%) of both groups knew enough about sexual health before the intervention. While the control group

mostly continued to have inadequate knowledge after the intervention, the majority of the study group gained good knowledge.

**Table 1: The study and control groups' sociodemographic attributes in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV (n=150)**

| Variables             | Study group<br>(n=75) |      | Control group (n = 75) |      | x 2   | P-value     |
|-----------------------|-----------------------|------|------------------------|------|-------|-------------|
|                       | No.                   | %    | No.                    | %    |       |             |
| Age                   |                       |      |                        |      |       |             |
| 18- 28                | 12                    | 16.0 | 15                     | 20.0 | 0.351 | > 0.05      |
| >28 – 39              | 38                    | 50.7 | 40                     | 53.3 |       |             |
| >39 – 50              | 25                    | 33.3 | 20                     | 26.7 |       |             |
| Educational Level     |                       |      |                        |      |       |             |
| Read and write        | 24                    | 31.3 | 25                     | 33.3 | 0.140 | > 0.05      |
| Secondary             | 24                    | 32.0 | 24                     | 32.0 |       |             |
| University            | 27                    | 36.7 | 26                     | 34.7 |       |             |
| Husband education.    |                       |      |                        |      |       |             |
| Read and write        | 27                    | 36.0 | 60                     | 40.0 | 0.151 | .<br>> 0.05 |
| Secondary             | 23                    | 30.7 | 40                     | 26.7 |       |             |
| University            | 25                    | 33.3 | 50                     | 33.3 |       |             |
| Occupation            |                       |      |                        |      |       |             |
| Housewife             | 12                    | 16.0 | 15                     | 20.0 | 0.351 | > 0.05      |
| Employee              | 38                    | 50.7 | 40                     | 53.3 |       |             |
| Health-related career | 25                    | 33.3 | 20                     | 26.7 |       |             |
| Husband occupation.   |                       |      |                        |      |       |             |
| Unemploye             | 27                    | 36.0 | 60                     | 40.0 | 0.151 | .<br>> 0.05 |
| Employee              | 23                    | 30.7 | 40                     | 26.7 |       |             |
| Worker                | 25                    | 33.3 | 50                     | 33.3 |       |             |
| Residence             |                       |      |                        |      |       |             |
| Rural                 | 43                    | 58.0 | 47                     | 62.7 | 1.068 | > 0.05      |
| Urban                 | 32                    | 42.0 | 28                     | 37.3 |       |             |
| Income                |                       |      |                        |      |       |             |
| Enough                | 44                    | 58.7 | 50                     | 66.0 | 1.720 | > 0.05      |
| Not enough            | 31                    | 41.3 | 25                     | 34.0 |       |             |

**Table 2: FSFI Domains in the Study and Control Groups Prior to DAAS Treatment and Nursing Intervention in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV**

| Domains      | Study Group<br>(n=75)<br>(X± SD) | Control Group<br>(n =75)<br>(X± SD) | *t test | P-value |
|--------------|----------------------------------|-------------------------------------|---------|---------|
| Desire       | 3.47±1.17                        | 3.52±0.91                           | 0.012   | >0.05ns |
| Arousal      | 3.56±0.86                        | 3.49±0.83                           | 0.213   | >0.05ns |
| Lubrication  | 4.48±0.93                        | 4.38±0.86                           | 0.243   | >0.05ns |
| Orgasm       | 4.54±0.94                        | 4.46±1.14                           | 0.412   | >0.05ns |
| Satisfaction | 3.97±0.84                        | 3.97±0.84                           | 0.512   | >0.05ns |
| Pain         | 5.21±1.06                        | 5.23±1.08                           | 0.621   | >0.05ns |
| Total        | 17.77±1.6                        | 17.75±1.5                           | 1.038   | >0.05ns |

\* Independent sample test; N.B. ns indicates that no statistically significant difference was found.

**Table 3: In the context of mobile-based AI education for women receiving DAA treatment for HCV, FSFI domains following DAAS treatment and nursing intervention in the study group and the control group**

| Domains      | Study Group (n =75)<br>(X± SD) | Control Group<br>(n =75)<br>(X± SD) | *t test | P-value  |
|--------------|--------------------------------|-------------------------------------|---------|----------|
| Desire       | 4.25±1.0                       | 3.46±1.14                           | 5.012   | ≤0.001** |
| Arousal      | 4.07±0.61                      | 3.35±0.83                           | 6.213   | ≤0.001** |
| Lubrication  | 4.26±0.6                       | 3.49±0.86                           | 6.243   | ≤0.001** |
| Orgasm       | 4.05±0.67                      | 3.52±0.91                           | 5.412   | ≤0.001** |
| Satisfaction | 3.73±1.01                      | 2.97±0.84                           | 4.512   | ≤0.001** |
| Pain         | 4.85±0.87                      | 4.23±1.08                           | 6.621   | ≤0.001** |
| Total        | 18.8±0.27                      | 16.75±1.5                           | 10.038  | ≤0.001** |

N.B. \*\* indicates that the difference was quite substantial.

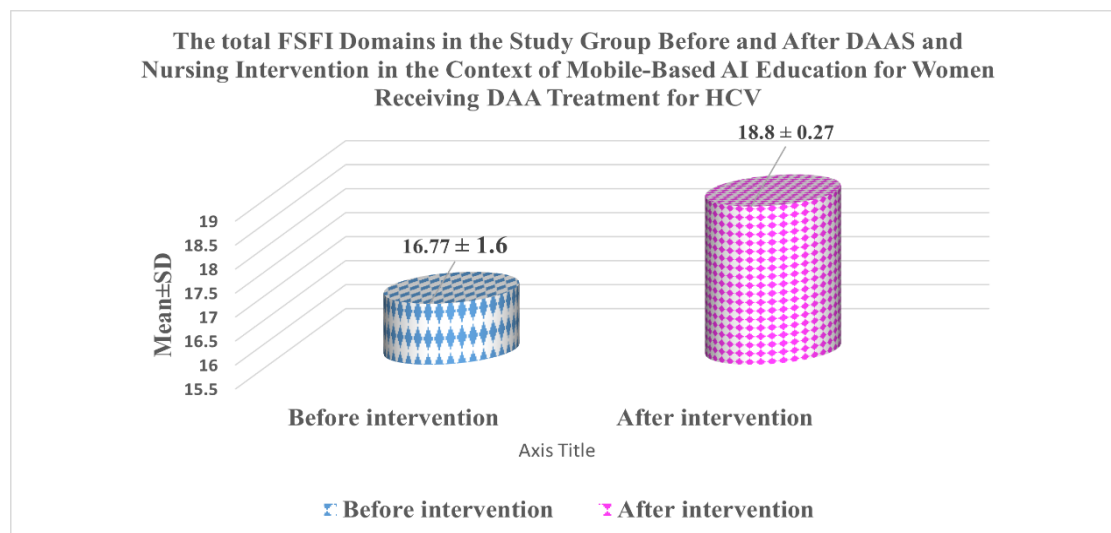


**Figure 1: Before and After DAAS and Nursing Intervention, the Study Group's Total FSFI Domains in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV**

**Table (4): The study and control groups' level of sexual health knowledge prior to the Nursing Intervention in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV**

| Items                              | Study group (n=75) |      | Control group (n =75) |      | X <sup>2</sup> | P-value  |
|------------------------------------|--------------------|------|-----------------------|------|----------------|----------|
|                                    | No.                | %    | No.                   | %    |                |          |
| Definition                         |                    |      |                       |      |                |          |
| - Good                             | 25                 | 33.3 | 20                    | 26.7 | 5.67           | > 0.05ns |
| - Average                          | 15                 | 20.0 | 30                    | 40.0 |                |          |
| - Poor                             | 35                 | 46.7 | 25                    | 33.3 |                |          |
| Importance                         |                    |      |                       |      |                |          |
| - Good                             | 25                 | 33.3 | 20                    | 26.7 | 6.02           | > 0.05ns |
| - Average                          | 30                 | 40.0 | 30                    | 40.0 |                |          |
| - Poor                             | 20                 | 26.7 | 25                    | 33.3 |                |          |
| Factors affecting sexual wellbeing |                    |      |                       |      |                |          |
| - Good                             | 30                 | 40.0 | 25                    | 33.3 | 14.91          | > 0.05ns |
| - Average                          | 15                 | 20.0 | 30                    | 40.0 |                |          |
| - Poor                             | 30                 | 40.0 | 20                    | 26.7 |                |          |
| Factors improving sexual wellbeing |                    |      |                       |      |                |          |
| - Good                             | 26                 | 34.7 | 25                    | 33.3 | 0.23           | > 0.05ns |
| - Average                          | 24                 | 32.0 | 30                    | 40.0 |                |          |
| - Poor                             | 25                 | 33.3 | 20                    | 26.7 |                |          |

|                                           |    |      |    |      |      |          |
|-------------------------------------------|----|------|----|------|------|----------|
| Factors impairing sexual wellbeing        |    |      |    |      |      |          |
| - Good                                    | 20 | 26.7 | 30 | 40.0 |      |          |
| - Average                                 | 20 | 26.7 | 20 | 26.7 | 7.33 | > 0.05ns |
| - Poor                                    | 35 | 46.6 | 25 | 33.3 |      |          |
| Cycle of sexual intercourse               |    |      |    |      |      |          |
| - Good                                    | 25 | 33.3 | 25 | 33.3 | 2.20 | > 0.05ns |
| - Average                                 | 20 | 26.7 | 15 | 20.0 |      |          |
| - Poor                                    | 30 | 40.0 | 35 | 46.7 |      |          |
| Measures used to improve sexual wellbeing |    |      |    |      |      |          |
| - Good                                    | 20 | 26.7 | 25 | 33.3 | 2.22 | > 0.05ns |
| - Average                                 | 25 | 33.3 | 20 | 26.7 |      |          |
| - Poor                                    | 30 | 40.0 | 30 | 40.0 |      |          |
| Nutrition that improves sex               |    |      |    |      |      |          |
| - Good                                    | 25 | 33.3 | 25 | 33.3 | .75  | > 0.05ns |
| - Average                                 | 10 | 13.3 | 35 | 46.7 |      |          |
| - Poor                                    | 40 | 53.4 | 15 | 20.0 |      |          |
| Exercise that improves sex                |    |      |    |      |      |          |
| - Good                                    | 30 | 40.0 | 30 | 40.0 | 6.02 | > 0.05ns |
| - Average                                 | 20 | 26.7 | 25 | 33.3 |      |          |
| - Poor                                    | 25 | 33.3 | 20 | 26.7 |      |          |

Note that ns indicates that no statistically significant difference was found.

**Table 5: Compare between the Study and Control Groups after the Nursing Intervention in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV regarding their Level of Knowledge Regarding Sexual Health**

| Items                              | Study group (n=75) |      | Control group (n=75) |      | X <sup>2</sup> | P-value  |
|------------------------------------|--------------------|------|----------------------|------|----------------|----------|
|                                    | No.                | %    | No                   | %    |                |          |
| Definition                         |                    |      |                      |      |                |          |
| -Good                              | 40                 | 53.3 | 20                   | 26.7 | 16.83          | ≤0.001** |
| -Average                           | 25                 | 33.3 | 30                   | 40.0 |                |          |
| -Poor                              | 10                 | 13.4 | 25                   | 33.3 |                |          |
| Importance                         |                    |      |                      |      |                |          |
| -Good                              | 35                 | 46.7 | 20                   | 26.7 | 6.88           | ≤0.001** |
| -Average                           | 25                 | 33.3 | 30                   | 40.0 |                |          |
| -Poor                              | 15                 | 20.0 | 25                   | 33.3 |                |          |
| Factors affecting sexual wellbeing |                    |      |                      |      |                |          |
| -Good                              | 35                 | 46.7 | 25                   | 33.3 | 10             | ≤0.001** |
| -Average                           | 30                 | 40.0 | 30                   | 40.0 |                |          |

|                                           |    |      |    |      |       |                   |
|-------------------------------------------|----|------|----|------|-------|-------------------|
| -Poor                                     | 10 | 13.3 | 20 | 26.7 |       |                   |
| Factors improving sexual wellbeing        |    |      |    |      |       |                   |
| -Good                                     | 40 | 53.3 | 25 | 33.3 | 24.92 | $\leq 0.001^{**}$ |
| -Average                                  | 30 | 40.0 | 30 | 40.0 |       |                   |
| -Poor                                     | 5  | 6.7  | 20 | 26.7 |       |                   |
| Factors impairing sexual wellbeing        |    |      |    |      |       |                   |
| -Good                                     | 35 | 46.7 | 30 | 40.0 | 17.63 | $\leq 0.001^{**}$ |
| -Average                                  | 30 | 40.0 | 20 | 26.7 |       |                   |
| -Poor                                     | 10 | 13.3 | 25 | 33.3 |       |                   |
| Cycle of sexual intercourse               |    |      |    |      |       |                   |
| -Good                                     | 35 | 46.7 | 25 | 33.3 | 24.35 | $\leq 0.001^{**}$ |
| -Average                                  | 25 | 33.3 | 15 | 20.0 |       |                   |
| -Poor                                     | 15 | 20.0 | 35 | 46.7 |       |                   |
| Measures used to improve sexual wellbeing |    |      |    |      |       |                   |
| -Good                                     | 35 | 46.7 | 25 | 33.3 | 14.44 | $\leq 0.001^{**}$ |
| -Average                                  | 25 | 33.3 | 20 | 26.7 |       |                   |
| -Poor                                     | 15 | 20.0 | 30 | 40.0 |       |                   |
| Nutrition that improves sex               |    |      |    |      |       |                   |
| -Good                                     | 40 | 53.3 | 25 | 33.3 | 15.10 | $\leq 0.001^{**}$ |
| -Average                                  | 20 | 26.7 | 35 | 46.7 |       |                   |
| -Poor                                     | 15 | 20.0 | 15 | 20.0 |       |                   |
| Exercise that improves sex                |    |      |    |      |       |                   |
| -Good                                     | 40 | 53.3 | 30 | 40.0 | 5.40  | $\leq 0.001^{**}$ |
| -Average                                  | 20 | 26.7 | 25 | 33.3 |       |                   |
| -Poor                                     | 15 | 20.0 | 20 | 26.7 |       |                   |

N.B. \*\* indicates that the difference was quite substantial.



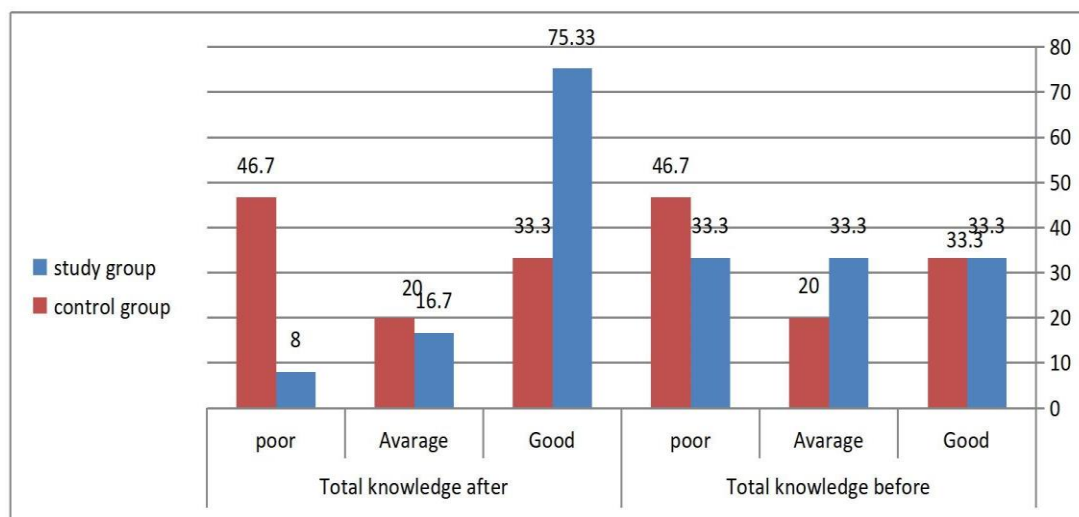


**Figure 2: Before and after the nursing intervention, the study and control groups' overall sexual health knowledge levels in the Context of Mobile-Based AI Education for Women Receiving DAA Treatment for HCV**

### Discussion

The current study investigated how women undergoing DAA therapy for hepatitis C's sexual health was affected by nursing care and artificial intelligence-driven mobile-based education. Results showed that there were no statistically significant differences between the study and control groups on any of the FSFI's pre-intervention subscales. Even though the control group reported more pain, the study group showed significantly higher FSFI mean scores across all domains (desire, arousal, lubrication, orgasm, satisfaction, and pain) after receiving DAA treatment and putting the mobile-based educational intervention into practice. These gains were statistically

significant. and highlight positive influence of technology-based education when integrated into patient care.

From the researchers' perspective, these findings can be attributed to the multifaceted nature of chronic HCV, which not only affects hepatic function but also manifests extrahepatically, contributing to psychosocial challenges such as depression, anxiety, stigma, and marital strain. These problems can significantly affect one's quality of life and sexual health. This study's use of mobile-based AI education made it possible to deliver information in a personalized, easily accessible, and stigma-free manner. This could have given participants

accurate knowledge, decreased misconceptions (such as those spread through shared meals or beverages), and promoted candid discussion about private matters.

This is consistent with **Saker's (2019)** research, which found that after being diagnosed, women with HCV in Egypt had significantly lower levels of sexual satisfaction and stable households, frequently because of stigma and misunderstandings in society. Because of the strongly ingrained cultural taboos and false information around the disease, women with chronic HCV occasionally experienced divorce or social rejection. In a similar vein, **Evangelia et al. (2016)** noted in Greece that patients receiving HCV therapy had reduced sexual functioning, most likely as a result of psychological stress and medication side effects.

In support of these findings, **(Tunçel et al. 2019)** noted that vaginal dryness, itching, and burning are common symptoms experienced by women with chronic HCV, especially during interferon and ribavirin therapy, which further exacerbates sexual dysfunction. About one-third of participants in both groups showed adequate knowledge of sexual health, according to the baseline (pre-test) assessment, which showed no appreciable difference between the control and study groups. However,

after the intervention, the majority of the women in the study group shown a marked improvement in their knowledge of sexual health, but nearly half of the control group remained at very low levels. The usefulness of AI-powered mobile-based interventions in recognizing, addressing, and educating women on sexual health issues in a non-threatening and culturally appropriate way is highlighted by this statistically significant improvement.

Given the paucity of previous research investigating the impact of nurses and digital treatments in improving sexual health among women with HCV, these findings are very significant. **Evans (2013)** pointed out that nurses frequently encounter difficulties when talking to patients about sexuality and need structured resources and training to handle these conversations tactfully and successfully. By providing consistent, private, and tailored sexual health education, mobile-based AI interventions can assist nurses and enhance the quality and results of care. According to **WHO (2022)**, providing up-to-date, accurate knowledge about the social, psychological, and physical aspects of sexual health is part of comprehensive sexuality education. Such interventions can close information gaps, debunk myths, encourage positive attitudes, and enable people to make informed

decisions about their sexual and reproductive health when they are provided via digital platforms.

The current study concludes by highlighting the potential contribution of artificial intelligence incorporated into mobile learning platforms to enhancing the sexual health function and awareness of women undergoing DAA for HCV. In Egypt and other comparable contexts, this technology-driven method offers a scalable, culturally aware, and successful way to enhance clinical treatment and address a frequently disregarded aspect of women's health.

### **Conclusion**

The results of this study demonstrate that after undergoing HCV medication in conjunction with artificial intelligence through mobile-based education, the women in the study group showed a notable improvement in every FSFI domain. This result validates the study's initial hypothesis. Additionally, a within-group comparison showed that the study group's FSFI scores significantly increased after the intervention, demonstrating the efficacy of the combined strategy. The second hypothesis is supported by this result. Furthermore, study participants showed a statistically significant improvement in their overall knowledge of sexual health and

strategies for improving it when compared to those in the control group. This supports the third study hypothesis. All the study's hypotheses are validated and approved in light of these results.

### **Recommendations**

- Integrate mobile-based artificial intelligence into the standard care plan for women receiving HCV medications, focusing on improving sexual health awareness and addressing misconceptions.
- Provide continuous nursing support and counseling for women undergoing HCV treatment to address sexual dysfunction, reduce stigma, and enhance quality of life.

### **Further Research**

- Implement nationwide awareness campaigns targeting women living with HCV to reduce stigma associated with the disease and its perceived link to sexual transmission.
- Incorporate sexual health assessment tools (e.g., FSFI) into routine clinical evaluations for women receiving HCV treatment to ensure early identification of dysfunction.

### **References**

- Ahmed, S., Khan, M., & Rahman, S.** (2019). Challenges in managing hepatitis C among women: A review of biological, social, and

- cultural barriers. *Journal of Hepatology*, 58(3), 457-467. <https://doi.org/10.1016/j.jhep.2019.02.006>
- Ali, S., & Hassan, R.** (2020). The role of mobile health interventions in empowering women with hepatitis C: A systematic review. *Mobile Health Journal*, 22(1), 34-44. <https://doi.org/10.1111/mhj.12345>
- Chen, J., Smith, L., & Zhang, Q.** (2022). Sexual health and hepatitis C: Knowledge and behavioral gaps in women. *Sexual Health Review*, 30(2), 89-97. <https://doi.org/10.1080/shr.2022.180234>
- European Union HCV Collaborators,** (2017). The global burden of hepatitis C: Epidemiology and the status of treatment access. *Lancet Infectious Diseases*, 17(8), 784-795. [https://doi.org/10.1016/S1473-3099\(17\)30346-2](https://doi.org/10.1016/S1473-3099(17)30346-2)
- Evangelia, L., Katerina, S., Dimitrios, K., & Maria, B.** (2016). Sexual dysfunction in patients receiving treatment for hepatitis C: A Greek perspective. *Journal of Sexual Medicine*, 13(4), 721–729. <https://doi.org/10.1016/j.jsxm.2016.01.015>
- Evans, D. T.** (2013). Sexual health: The role of the nurse. *Nursing Standard*, 27(51), 48–56. <https://doi.org/10.7748/ns2013.08.27.51.48.e7557>
- Foster, M., Thompson, S., & Rivera, R.** (2020). Addressing the stigma of sexual health in women with hepatitis C: A framework for targeted education. *Journal of Women's Health*, 29(5), 623-629. <https://doi.org/10.1089/jwh.2019.7756>
- Gonzalez, M., Lee, H., & Patel, S.** (2018). Addressing the barriers to effective sexual health education in women with chronic illnesses: A review. *Journal of Health Education Research*, 33(4), 354-365. <https://doi.org/10.1093/her/cyy029>
- Imam, H., Ahmed, I., & Abdelgawad, M.** (2020). Hepatitis C prevalence in Egypt: Insights from the 2015 demographic and health survey. *The Lancet Global Health*, 8(5), 587-595. [https://doi.org/10.1016/S2214-109X\(20\)30062-9](https://doi.org/10.1016/S2214-109X(20)30062-9)
- Johnson, A., & Brown, S.** (2020). The role of Direct-Acting Antiviral therapies in the treatment of

- hepatitis C: A breakthrough in antiviral medicine. *Clinical Hepatology*, 16(2), 120-127. <https://doi.org/10.1016/j.clhep.2020.01.005>
- Jones, M., Green, A., & White, L.** (2021). Mobile health interventions for hepatitis C patients: Efficacy, challenges, and future directions. *Journal of Mobile Health*, 18(1), 45-53. <https://doi.org/10.1038/jmh.2020.180>
- Kumar, A., Sharma, R., & Gupta, N.** (2019). Sexual health literacy in women with hepatitis C: Importance for improving quality of life. *Health Education Journal*, 78(4), 462-469. <https://doi.org/10.1177/0017896919837192>
- Lee, S., Lim, Y., & Kim, J.** (2021). Addressing sexual health in hepatitis C management: A gender-sensitive approach. *Journal of Hepatology and Gastroenterology*, 46(7), 1121-1127. <https://doi.org/10.1056/jhgr.2021.1121>
- Liu, M., Zhang, X., & Wu, F.** (2021). Exploring the use of AI-powered mobile applications in enhancing sexual health education among women with hepatitis C. *Journal of Medical Informatics*, 47(2), 200-211. <https://doi.org/10.1016/j.jmedinf.2020.10.005>
- Martinez, M., Patel, S., & Tran, N.** (2020). A review of current interventions in hepatitis C: Focusing on treatment adherence and knowledge gaps. *International Journal of Hepatology*, 11(4), 390-398. <https://doi.org/10.1016/j.ijh.2020.04.009>
- Nguyen, L., Tan, D., & Phan, H.** (2021). Reducing the stigma of hepatitis C among women: The role of AI in personalized mobile education. *BMC Digital Health*, 4(2), 63-71. <https://doi.org/10.1186/s41746-021-00315-7>
- Rahman, M., Singh, A., & Chowdhury, S.** (2021). Artificial intelligence in mobile health interventions for hepatitis C: A future perspective. *Journal of Health Technology*, 39(6), 509-515. <https://doi.org/10.1007/jht.2021.509>
- Saker, M.** (2019). Barriers to open discourse around sexual health in Egypt: Cultural and traditional considerations. *Sexual Health and Cultural Dynamics*, 17(1), 98-106. <https://doi.org/10.1080/shcd.2019.024556>

- Saker, N. M.** (2019). Sexual health challenges among Egyptian women diagnosed with chronic hepatitis C virus: A qualitative inquiry. *Egyptian Journal of Nursing*, 15(2), 85–92.
- Saker, M., Al-Said, N., & Hussein, E.** (2019). Sexual dysfunction in women with hepatitis C in Egypt: An under-researched issue. *Egyptian Journal of Hepatology*, 44(3), 152-160. <https://doi.org/10.1016/j.ejh.2019.03.006>
- Smith, K., Davis, M., & Clark, R.** (2021). Hepatitis C progression and liver health: The role of asymptomatic infection and early intervention. *Journal of Clinical Hepatology*, 29(5), 407-414. <https://doi.org/10.1056/jclinhep.2021.0401>
- Taylor, P., Wang, J., & Lee, M.** (2023). Artificial intelligence in digital health interventions for chronic diseases: The case of hepatitis C among women. *International Journal of Digital Health*, 7(1), 5-12. <https://doi.org/10.1016/j.ijdh.2023.01.004>
- Tunçel, A., Aydın, S., & Karataş, T.** (2019). Sexual dysfunction in women with chronic hepatitis C infection undergoing antiviral therapy. *Archives of Clinical Medicine*, 11(3), 103–110.
- Williams, P., & Park, D.** (2020). The impact of mobile health interventions on sexual health education: Review and future directions. *Journal of Mobile Health*, 19(2), 25-34. <https://doi.org/10.1038/jmh.2020.1122>
- World Health Organization.** (2022). *International technical guidance on sexuality education: An evidence-informed approach*. <https://www.who.int/publications/i/item/9789241513369>
- Zhang, Q., Liu, S., & Zhang, Y.** (2022). AI and mHealth for women's health: A systematic review of innovations in sexual health education for hepatitis C patients. *Digital Health*, 4(2), 67-75. <https://doi.org/10.1177/2055207622100667>

## Role of Family Caregivers' Expressed Emotion on Recovery of Patients with Bipolar Disorders

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### Abstract

**Background:** Bipolar disorder is a chronic condition that disturbs the patient's life and family stability, making the work of caregivers more demanding and stressful. Family caregivers are crucial to the support and rehabilitation of people with bipolar illnesses. An expanding body of evidence indicates that expressed emotion (EE) significantly influences the progression of bipolar disorder. **Aim:** assess the role of family caregivers' expressed emotion on recovery of patients with bipolar disorders. **Design:** A descriptive correlational design. **Setting:** The inpatient psychiatric department of Tanta University Hospital. **Subjects:** A Convenience sampling of 110 family caregivers and their patients diagnosed with bipolar disorder. **Tools:** **Tool I: Part 1:** Patient's and family caregivers bio-sociodemographic data, **Part 2:** Level of Expressed Emotions scale. **Tool II:** Recovery Assessment Scale Domains and Stages (RAS-DS). **Results:** The study found that there was a statistically significant negative correlation between total expressed emotion of family caregivers and total recovery of patients with bipolar disorders. **Conclusion:** Enhancing family expressed emotion by reducing criticism, hostility toward patients, over-involvement, and providing emotional support can improve communication and interrelationship within the family leading to improved overall recovery prospects. **Recommendation:** Family expressed emotion intervention emphasizing the enhancement of communication patterns and caregiver attitudes toward patients with bipolar disorder is necessary.

**Key words:** bipolar disorder, expressed emotion, family caregivers, mental health recovery.

## Introduction

Bipolar disorder (BD) is a chronic, severe, and cyclical affective illness marked by fluctuating mood disturbances. It is regarded a major public health issue that leads to dysfunction in everyday activities, elevated incidence of chronic mood disorders, psychosis, and both attempted and completed suicides. Consequently, BD incurs elevated behavioral health expenses and exhibits increased use of medical services **(Hower, Lee, Jones, et. al. 2019)**.

Bipolar illness ranks as the sixth major cause of disability globally, mostly due to its early start and chronic nature throughout life. It significantly impacts the lives of patients and their families **(Muneer, 2016)**. An expanding body of data indicates that familial stress significantly influences the development of bipolar disorder. An established measure of familial stress is expressed emotion (EE). Expressed emotions serve as an index that indicates the emotional environment of the family and the overall attitudes of family members towards patients with bipolar disorder in their everyday interactions **(Alenezi, 2020)**.

Expressed emotion (EE) quantifies the familial atmosphere, including the attitudes, feelings, and behaviors of family carers, as shown in their spontaneous communication and responses towards patients with bipolar illness. Family expressed emotion may be

categorized as high and low expressed emotion. High Expressed Emotion is the manifestation of extreme feelings, including hatred, criticism, and excessive emotional engagement directed towards individuals with bipolar disorder **(Moawad, Elmalky, & Barakat, 2023)**. Families characterized by high expressed emotion undergo fluctuating feelings, alternating between hope and disappointment. The expressed emotion level is directly related to the severity of the illness, its progression, and prognosis. Additionally, it impacts patients' self-esteem, quality of life, and adherence to medication **(Mohammed, Abd El-Latief, Zaki, & Mahmoud, 2021)**.

On the other hand, **Low expressed emotion** characterized by exhibiting reduced criticism or hostility, not overly involved, and demonstrating warmth and positive regard towards the patient. Facilitating family expression of warmth towards patients with bipolar disorder is linked to improved outcomes and enhanced recovery **(Ong, Fernandez, & Lim, 2021)**.

Recovery encompasses the progression beyond the detrimental impacts of mental illness, which includes the alleviation of symptoms and the establishment of new meaning and purpose in an individual's life. Recovery refers to the capacity to lead a fulfilling, hopeful, and productive life despite the limitations imposed by illness **(Sánchez-Guarnido, Ruiz-**



**Granados, Herruzo-Cabrera, Herruzo-Pino, 2023).**

Recovery encompasses a four-dimensional framework: symptomatic, functional, societal, and personal recovery. The dimensions of recovery are considered interrelated, yet they may also be attained independently. **Symptomatic recovery**, represents a biomedical framework for evaluating the outcomes of mental illness treatment, focusing on the objective alleviation of symptoms and the averting the relapse symptoms. **Societal recovery** aims to mitigate public stigma associated with mental illness and enhance the rights and status of clients within society (van Aken, et al., 2021).

**Functional recovery** examines an individual's ability to regain or adapt to the loss of skills. While, **Personal recovery** referred as an individual process of adaptation and growth in which one transcends the premorbid self rather than merely returning to it. Personal recovery pertains to an individual's perceived ability to manage mental illness, their sense of purpose, and their confidence in leading a fulfilling life, regardless of the severity of the disorder (Skar-Fröding et al., 2021).

#### **Significance of study:**

Bipolar disorder exhibits a high recurrence rate, with estimated over 90% experienced at least two lifetime acute affective episodes and most have multiple recurrences (Hällgren, Ösby, Westman,

& Gissler, 2019). Researchers estimate that between 25% and 60% of individuals with bipolar disorder will attempt suicide at least once in their lives and between 4% and 19% will complete suicide. The contemporary understanding of the relapse and remission trajectory of bipolar disorder highlights a biopsychosocial model, which integrates the interactive influences of genetic susceptibility, biological factors, stress from familial or life events, and psychological vulnerability (Miklowitz & Chung, 2016).

The concept of recovery in psychiatric disorders, especially bipolar disorder, has garnered increasing attention (Van Weeghel, van Zelst, Boertien, Hasson-Ohayon, 2019). Patients residing in a high-EE family environment exhibit a markedly increased risk of early relapse in comparison to those not living in such conditions. The role of psychiatric mental health nurse is essential in equipping family carers with fundamental information that enhances their ability to manage the patient and diminishes negative expressed emotions (Mohammed, et al., 2021). This research assessment aims to assist psychiatric nurses in identifying the level of expressed emotion within patients' most significant relationships. This identification is crucial for preventing relapses, reducing re-hospitalization, and enhancing the recovery process in clinical

practice for individuals with bipolar disorder.

### **Aims of the Study:**

To assess the role of family caregivers' expressed emotion on recovery of patients with bipolar disorders.

### **Research Questions**

1. What are the levels of expressed emotion among family caregivers of patients with bipolar disorders?
2. What are the levels of recovery among patients with bipolar disorders?
3. What is the relation between family expressed emotion and recovery among patients with bipolar disorders?

### **Subjects and Method**

#### **Research Design:**

The present study used a descriptive correlational research approach.

#### **Setting:**

The inpatient psychiatric unit of Tanta University Hospital was the setting of this study. This hospital is linked with the Ministry of Higher Education and Scientific Research and operates 24 hours a day, 7 days a week.

#### **Subjects:**

A convenience sample of 110 patients diagnosed with bipolar illness and their family caregivers. The sample size and analytical power were computed using the Epi-Info software statistical tool. The subjects were chosen from the prior setting based on the following criteria.

### **Inclusion criteria:**

- Adult patients & their family caregivers.
- Patients diagnosed with bipolar I and bipolar II disorders as per DSM-5 criteria.
- Patients accompanied by a family caregiver who is willing to participate in the research.

### **Exclusion criteria:**

- Acute phase of illness.
- Any evidence of organic brain disease, intellectual disability, substance use disorder and other psychiatric comorbidities.

### **Tools for data collection:**

The data was collected by using the following two tools:

**Tool I: Level of Expressed Emotions scale:** It consists of two parts:

**Part 1: Bio-sociodemographic data for patient's and family caregivers:** It was developed by the researcher based on reviewing patients' records and includes: **(Socio-demographic data of patients includes:** patient's age, sex, marital status, level of education, place of residence, occupation, religion); **(Clinical characteristics of patients includes:** age of onset of illness, duration of illness, number of previous psychiatric hospitalization, and mode of current admission) and **(Socio-demographic data of caregivers:** it includes: age, sex, level of education, working status, family size, family income).

**Part 2: Level of Expressed Emotions scale:** it was developed by (Cole & Kazarian, 1988) and then modified by (Hooly's 1998), and was adopted by the researcher. This is a self-report tool designed to evaluate the emotional context within the patient's primary relationships. It consists of (28 items), categorized into 4 subscales, namely: **Emotional support** (13 items), **Criticism** (4 items), **Irritability** (6 items), & **Intrusiveness** (5 items). Each item rated on 3-point Likert scale with responses categorized as disagree (3), neutral (2), and agree (1). The total score on this scale ranged from 28 to 84. Higher scores indicate a high level of Expressed Emotions, while lower scores indicate a low level of Expressed Emotions.

**Tool II: Recovery Assessment Scale Domains and Stages (RAS-DS):** It was developed by Corrigan & et. al., 2004) and was adopted by the researcher. It is a self-report instrument measuring recovery from severe mental illness. The scale consists of (38-items) categorized into 4 recovery domains; namely, **Functional recovery** (6 items) that assess "Doing Things I Value", **Personal recovery** that assess (18 items) "Looking Forward", **Clinical recovery** (7 items) that assess "Mastering My Illness", and **social recovery** (7 items) that assess **Connecting & Belonging**.

Each item rated on four points Likert scale that ranging from “completely true (4)”,

"mostly true (3), "a bit true (2) and “untrue (1)”. The total score of this scale ranged from (38 to 152). The higher scores indicate high level of recovery and the lower scores indicate reduced level of recovery.

### Methods

1- An official letter was sent by the dean of the nursing faculty to the director of the study settings, requesting their assistance and consent for data collection.

2- The approval of The Scientific Research Ethical Committee of Faculty of Nursing was obtained to conduct the study, code 2024 – 2 - 379.

- Informed consent was secured from participants following an explanation of the study's purpose.
- The study's nature did not inflict any harm or pain on the subjects involved.
- The participants were assured of the confidentiality and privacy of their collected information.
- Participants have the right to withdraw at any time during the data collection period.

3. The researcher translated the study tool into Arabic and assessed its internal validity with the input of five experts in the field of psychiatric nursing, making necessary modifications based on their revisions.

4. A pilot study was conducted on 10% of the sample to evaluate the feasibility and applicability of the tools. No modifications were made, and the subjects

were subsequently excluded from the actual study.

5. The reliability of the study tools was assessed using Cronbach's Alpha test. The tools demonstrated high reliability, with a correlation coefficient of 0.857 for the Level of Expressed Emotion scale and 0.834 for the (RAS-DS).

#### **6. The actual study:**

- The records of the patients were reviewed, and the subjects for the study were selected based on the established inclusion criteria.
- The study's purpose was explained to the patients and their family caregivers, who were then invited to participate.
- Data was collected through face-to-face interviews with each patient on an individual basis.
- The researcher met with the patients and their family caregivers 4 days a week. The duration of interviews with patients varied between 30 to 45 minutes, while interviews with family caregivers lasted between 15 to 30 minutes.
- The entire data collection process lasted over the initial six months of the study, commencing in April and concluding in September 2024.

#### **Statistical analysis:**

The collected data underwent systematic organization, tabulation, and statistical analysis using SPSS version 23. For quantitative data, the mean, standard deviation, and range were calculated. Categorical data were summarized using

numbers and percentages. The chi-square test ( $\chi^2$ ) was used for comparisons. Pearson's correlation coefficient (r) was employed to evaluate the relationships between variables. A significance threshold of  $P < 0.05$  was used to determine statistical significance (\*), and a further level of significance at  $P < 0.01$  was also considered (\*\*).

#### **Results:**

##### **Table (1) Show the distribution of the studied family caregivers according to their socio-demographic characteristics.**

Two third of the studied family caregivers belonged to the adult category (60%), between the age group (46 – 66) years with a mean age of  $45.66 \pm 14.016$ . An even distribution of sex was observed with an inclination towards female 64.5% and male 35.5%. The largest portion of studied caregivers (70.9%), reported being married. It was found that multiple educated levels were represent; illiterate (11.8%), read or write (12.7%), intermediate education (31.8%), university education (36.4%) and postgraduate education (7.3%). Urban living was common for family caregivers' residence (52.7%) and a large number around (67.2%) mentioned their income enough. (60.9%) of family caregivers were working. Regarding family size; more than half of family caregivers (59.1%) had 4-5 family members with mean  $4.27 \pm 1.299$ .

**Table (2) presents the distribution of the studied patients according to their socio-demographic characteristics.**

Regarding the age, around half of participants (50.9%) fall within the 19–30 years- old with a mean age of  $31.63 \pm 8.032$ . It is interesting to note that within this age group, the largest portion of studied patients (40%), reported being single and married. The studied subjects were predominantly female 62.7%. In relation to the educational level, more than half of them have university education (51.8%) and only (5.5%) were illiterate. Rural living was common for patients' residence (50.9%) and a significant portion (62.7%) mentioned that their income enough. Half of studied patients were working represent (50%). It was observed that; mother considered as a main primary family caregiver for patients with bipolar disorder (36.4%), followed by husband or wife (23.6%), the same percentage (15.5%) for both father and brothers, then daughters 6.4%, uncle and niece 1.8% and 0.9% respectively.

**Table (3) Illustrates the distribution of the studied patients according to their clinical data.** Clinically, the onset of bipolar disorders in the current sample occurred primarily before the age of 20 years old represents (40.9%), emphasizing its early onset nature. Hospital admissions for treatment were frequent, with (94.5%) have been admitting for 1- 5 times with (67.3%) had

duration of illness ranged from (1- 10) years, indicative of the disorder chronicity and recurrent course. Two third of the studied patients (65.5%) were admitted involuntarily.

**Figure (1) shows levels of expressed emotions among the studied family caregivers.** A significant portion of the studied family caregivers exhibited predominantly low level of overall expressed emotion (67.3%) as well as in specific dimensions of emotional support (86.4 %), criticism (64.5%) and irritability (53.6%). However, a distinct pattern emerged in intrusiveness, with a substantial proportion of participants (66.3%) displaying high level and only a small group 15.5% scoring low level on intrusiveness. This finding suggests that lack of emotional support and high intrusiveness may be prominent characteristics among these population.

**Table (4) Presents the mean scores and standard deviation for expressed emotion subscales among family caregivers.** The table showed that there was a statistically significant differences between the subscales of expressed emotion. The highest mean score was found in emotional support  $19.56 \pm 6.402$ , followed by intrusiveness  $13.79 \pm 3.846$ , then irritability  $11.60 \pm 2.887$  and lastly criticism  $7.53 \pm 1.952$ .

**Figure (2) Demonstrates distribution of the studied patients with bipolar disorders according to levels of**

**recovery assessment scale.** More than half of the studied patients (50.9%) had moderate overall mental health recovery. A closer examination of specific domains of recovery revealed marked discrepancy. The majority of patients had high level of personal recovery (39.1%) and moderate level of functional recovery (38.2%). Moreover, (57.3%) of patients had poor level in clinical recovery as well as in social recovery (52.7%). This finding suggests that high level of personal recovery may be prominent characteristics among these population.

**Table (5) Presents the mean scores and standard deviation for recovery subscales in the studied patients.** The table shows that there is a statistically significant differences between the subscales of recovery. The highest mean score was found in personal recovery  $51.54 \pm 11.797$ , followed by social recovery  $17.96 \pm 4.525$ , then functional recovery  $16.71 \pm 4.584$  and lastly clinical recovery  $16.43 \pm 5.696$ .

**Table (6) presents correlation coefficients and corresponding p-values, examining the interrelationships among expressed emotion and recovery in the study subjects.**

Regarding the correlation between expressed emotion and recovery, the matrix shows that a highly statistically significant negative correlation between total expressed emotion and total

recovery as well as in its all subscale functional, personal, clinical, and social recovery domains ( $r = -0.377$ ,  $p = 0.000^{**}$ ;  $r = -0.243$ ,  $p = 0.010^{*}$ ;  $r = -0.263$ ,  $p = 0.005^{**}$ ;  $r = -0.294$ ,  $p = 0.002^{**}$ ;  $r = -0.350$ ,  $p = 0.000^{**}$ ; respectively). This indicating that, the lower the levels of EE among family caregivers, the higher the recovery among patients with bipolar disorders.

In according to correlation between emotional support and total recovery and its subscale. Emotional support positively associated with total recovery ( $r = 0.425$ ,  $p < 0.000^{**}$ ) as well as functional, personal and social recovery ( $r = 0.326$ ,  $p < 0.001^{**}$ ;  $r = 0.375$ ,  $p < 0.000^{**}$  and  $r = 0.334$ ,  $p < 0.000^{**}$  respectively), but there is no significance correlation with clinical recovery. These results suggest that high levels of emotional support among family caregivers exhibit better functional, personal and social recovery. With respect to criticism and social recovery, there is a highly statistically significant negative correlation between criticism and social recovery ( $r = -0.200$ ,  $p = 0.036^{*}$ ), but there is no statistical significance correlation with functional, personal and clinical recovery. This result suggests high levels of criticism among family caregivers leads deteriorating social recovery to their patients.

Concerning the correlation between irritability and recovery subscales, the matrix shows that a highly statistically

significant negative correlation exists between irritability and total recovery ( $r = -0.278$ ,  $p = 0.003^{**}$ ), extending to negative association with clinical recovery ( $r = -0.299$ ,  $p = 0.016^{*}$ ), and social recovery ( $r = -0.470$ ,  $p = 0.000^{**}$ ); indicating that irritability among family caregivers negatively affect clinical and social recovery.

As for the correlation between intrusiveness subscale and recovery subscales, there is a highly statistically significant negative correlation between intrusiveness and clinical recovery ( $r = -0.299$ ,  $p = 0.002^{**}$ ), but there is no statistical significance correlation with functional, personal and social recovery.

**Table (1): Distribution of the studied family caregivers according to their socio-demographic characteristics**

| Socio-demographic characteristics | The studied family caregivers (n=110) |             |
|-----------------------------------|---------------------------------------|-------------|
|                                   | No                                    | %           |
| <b>Age</b>                        |                                       |             |
| 15-<30                            | 21                                    | 19.1        |
| 30-<45                            | 23                                    | 20.9        |
| 45-< 66                           | 66                                    | <b>60.0</b> |
| Range                             | 15 – 66                               |             |
| Mean ± SD                         | 45.66 ± 14.016                        |             |
| <b>Sex</b>                        |                                       |             |
| Male                              | 39                                    | 35.5        |
| Female                            | 71                                    | <b>64.5</b> |
| <b>Marital status</b>             |                                       |             |
| Single                            | 18                                    | 16.4        |
| Married                           | 78                                    | 70.9        |
| Divorced                          | 5                                     | 4.5         |
| Widowed                           | 9                                     | 8.2         |
| <b>Level of education</b>         |                                       |             |
| Illiterate                        | 13                                    | 11.8        |
| Read or write                     | 14                                    | 12.7        |
| Intermediate education            | 35                                    | 31.8        |
| University education              | 40                                    | <b>36.4</b> |
| Postgraduate education            | 8                                     | 7.3         |
| <b>Residence</b>                  |                                       |             |
| Rural                             | 52                                    | 47.3        |
| Urban                             | 58                                    | <b>52.7</b> |
| <b>Income</b>                     |                                       |             |
| Enough                            | 74                                    | <b>67.3</b> |
| Not enough                        | 36                                    | 32.7        |
| <b>Occupation</b>                 |                                       |             |
| Working                           | 67                                    | <b>60.9</b> |
| Not working                       | 43                                    | 39.1        |
| <b>Family size</b>                |                                       |             |
| 2 – 3                             | 29                                    | 26.4        |
| 4 – 5                             | 65                                    | <b>59.1</b> |
| 6 -7                              | 16                                    | 14.5        |
| Range                             | 2 – 7                                 |             |
| Mean ± SD                         | 4.27 ± 1.299                          |             |

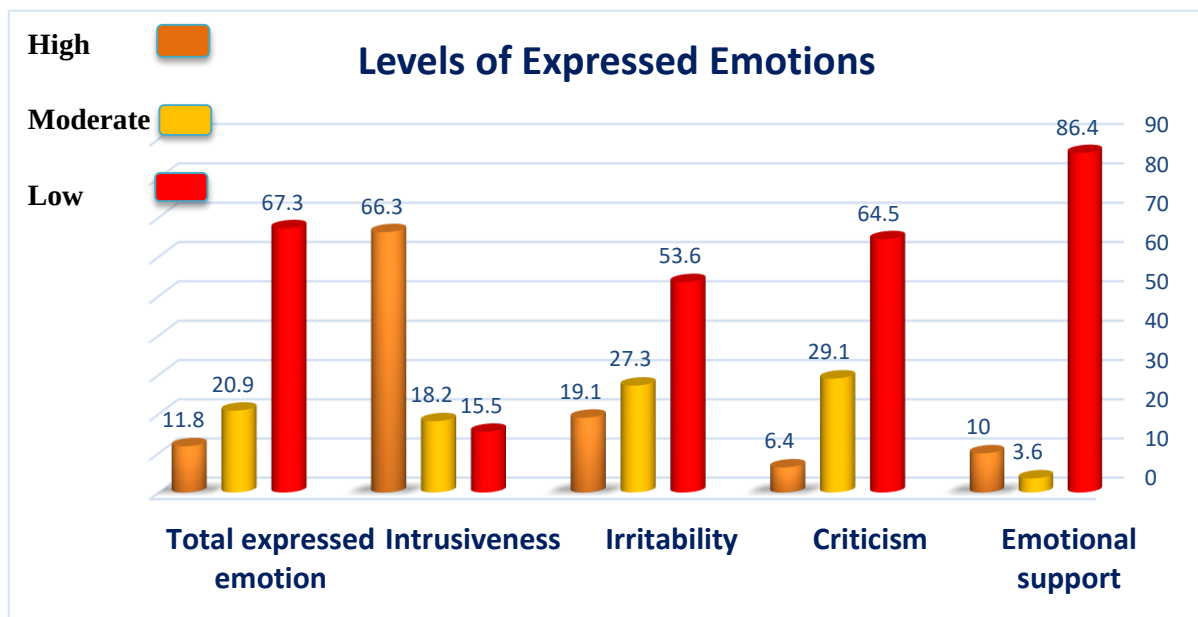


**Table (2): Distribution of the studied patients according to their socio-demographic characteristics**

| Socio-demographic characteristics         | The studied family caregivers (n=110) |      |
|-------------------------------------------|---------------------------------------|------|
|                                           | No                                    | %    |
| Age                                       |                                       |      |
| 19- < 30                                  | 56                                    | 50.9 |
| 30 – < 40                                 | 35                                    | 31.8 |
| 40 – < 50                                 | 19                                    | 17.3 |
| Range                                     | 19 – 50                               |      |
| Mean ± SD                                 | 31.63 ± 8.032                         |      |
| Sex                                       |                                       |      |
| Male                                      | 41                                    | 37.3 |
| Female                                    | 69                                    | 62.7 |
| Marital status                            |                                       |      |
| Single                                    | 44                                    | 40.0 |
| Married                                   | 44                                    | 40.0 |
| Divorced                                  | 13                                    | 11.8 |
| Separated                                 | 9                                     | 8.2  |
| Level of education                        |                                       |      |
| Illiterate                                | 6                                     | 5.5  |
| Read or write                             | 7                                     | 6.4  |
| Intermediate education                    | 34                                    | 30.9 |
| University education                      | 57                                    | 51.8 |
| Postgraduate education                    | 6                                     | 5.5  |
| Residence                                 |                                       |      |
| Rural                                     | 56                                    | 50.9 |
| Urban                                     | 54                                    | 49.1 |
| Income                                    |                                       |      |
| Enough                                    | 69                                    | 62.7 |
| Not enough                                | 41                                    | 37.3 |
| Occupation                                |                                       |      |
| Working                                   | 55                                    | 50.0 |
| Not working                               | 55                                    | 50.0 |
| Main family caregivers caring for patient |                                       |      |
| Father                                    | 17                                    | 15.5 |
| Mother                                    | 40                                    | 36.4 |
| Brothers                                  | 17                                    | 15.5 |
| Husband or wife                           | 26                                    | 23.6 |
| Daughter                                  | 7                                     | 6.4  |
| Uncle                                     | 2                                     | 1.8  |
| My niece                                  | 1                                     | 0.9  |

**Table (3): Distribution of the studied patients according to their clinical data**

| Clinical data                          | The studied patients with bipolar disorders (n=110) |      |
|----------------------------------------|-----------------------------------------------------|------|
|                                        | No                                                  | %    |
| Age of patient at the onset of illness |                                                     |      |
| 15- <20 years                          | 45                                                  | 40.9 |
| 20- <25 years                          | 28                                                  | 25.5 |
| 25- <30 years                          | 20                                                  | 18.2 |
| 30- <35 years                          | 12                                                  | 10.9 |
| 35- <41                                | 5                                                   | 4.5  |
| Range                                  | 15 – 41                                             |      |
| Mean ± SD                              | 23.25 ± 6.449                                       |      |
| Duration of illness                    |                                                     |      |
| From 1- 10 years                       | 74                                                  | 67.3 |
| From 11-20 years                       | 34                                                  | 30.9 |
| From 21- 32                            | 2                                                   | 1.8  |
| Range                                  | 1 – 32                                              |      |
| Mean ± SD                              | 8.39 ± 6.012                                        |      |
| Number of hospitalizations             |                                                     |      |
| 1 - 5 times                            | 104                                                 | 94.5 |
| 6 - 10 times                           | 4                                                   | 3.6  |
| More than 10 times                     | 2                                                   | 1.8  |
| Range                                  | 1 – 18                                              |      |
| Mean ± SD                              | 2.16 ± 2.576                                        |      |
| Patient mode of admission              |                                                     |      |
| Voluntary admission                    | 38                                                  | 34.5 |
| In voluntary admission                 | 72                                                  | 65.5 |



Figures (1): Levels of expressed emotions among the studied family caregivers'

Table (4): Mean scores and standard deviation for expressed emotion subscales among the studied family caregivers.

| Expressed emotions scale | Range   | Mean $\pm$ SD      | X <sup>2</sup><br>P |
|--------------------------|---------|--------------------|---------------------|
| Emotional support        | 13 – 39 | 19.56 $\pm$ 6.402  | 323.451<br>0.001**  |
| Criticism                | 4 – 12  | 7.53 $\pm$ 1.952   |                     |
| Irritability             | 7 – 18  | 11.60 $\pm$ 2.887  |                     |
| Intrusiveness            | 6 – 18  | 13.79 $\pm$ 3.846  |                     |
| Total scale score        | 34 – 81 | 52.48 $\pm$ 11.082 |                     |

X<sup>2</sup>= chi-square test    p<0.05\* significant p<0.01\*\* highly significant

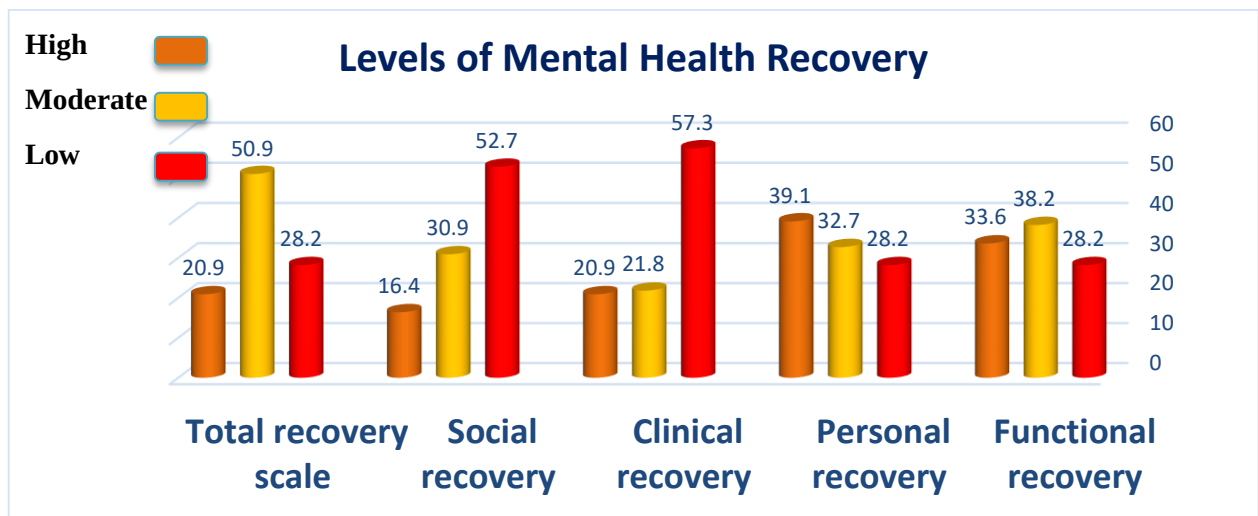


**Figure (2):** Distribution of the studied patients with bipolar disorders according to levels of recovery assessment scale

**Table (5):** Mean scores of recovery subscales among the studied patients

| Recovery assessment scale domains                  | Range    | Mean $\pm$ SD       | X <sup>2</sup><br>P |
|----------------------------------------------------|----------|---------------------|---------------------|
| Functional recovery domain (Doing things I value)  | 6 – 24   | 16.71 $\pm$ 4.584   | 202.972<br>0.001**  |
| Personal recovery domain (Looking forward)         | 19 – 70  | 51.54 $\pm$ 11.797  |                     |
| Clinical recovery domain (Mastering my illness)    | 7 – 25   | 16.43 $\pm$ 5.696   |                     |
| Social recovery domains (connecting and belonging) | 7 – 28   | 17.96 $\pm$ 4.525   |                     |
| Total recovery assessment scale score              | 54 – 140 | 102.64 $\pm$ 19.853 |                     |

X<sup>2</sup>= chi-square test    p<0.05\* significant    p<0.01\*\* highly significant

**Table (6): Correlation matrix between expressed emotion sub-scales and recovery assessment sub-scales**

| Variables                            | Functional recovery | Personal recovery | Clinical recovery | Social recovery   | Total recovery assessment sub-scales |
|--------------------------------------|---------------------|-------------------|-------------------|-------------------|--------------------------------------|
| <b>Emotional support</b>             | 0.326<br>0.001**    | 0.357<br>0.000**  | 0.176<br>0.066    | 0.334<br>0.000**  | 0.425<br>0.000**                     |
| <b>Criticism</b>                     | -0.006<br>0.948     | -0.015<br>0.875   | 0.162<br>0.090    | -0.200<br>0.036*  | -0.103<br>0.286                      |
| <b>Irritability</b>                  | -0.128<br>0.182-    | 0.127<br>0.185    | -0.229<br>0.016   | -0.470<br>0.000** | -0.278<br>0.003**                    |
| <b>Intrusiveness</b>                 | -0.059<br>0.539     | -0.030<br>0.754   | -0.299<br>0.002** | 0.002<br>0.986    | -0.117<br>0.223                      |
| <b>Total expressed emotion scale</b> | -0.243<br>0.010*    | -0.263<br>0.005*  | -0.294<br>0.002*  | -0.350<br>0.000*  | <b>-0.377<br/>0.000*</b>             |

## Discussion

The main results of this study revealed that two third of the studied caregivers showed low levels of expressed emotion. This lower level of expressed emotion is characterized by family caregivers who are less critical or hostile and not excessively involved. This is evident in the present study, as the majority of the caregivers had low levels in subscales, namely criticism and irritability. This finding may be attributed the nature of our culture which can significantly impact expressed emotion levels in these population. It's widely recognized that Egyptian families tend to exhibit greater tolerance, demonstrating acceptance and a strong sense of

commitment to unalterable situation **(Mohamed, et al, 2021)**.

Alongside this explanation, **Bishop & Greeff, (2015)** has shown that when families accept, acknowledge and comprehend the features of bipolar disorder, it can foster unity, even when the patient's illness leads to challenging behaviors. When family caregivers come to terms with the diagnosis and approach difficult situations with a positive outlook, they may discover different strategies for managing their circumstances. **(Harfush & Elsawi, 2018; Bishop & Greeff, 2015)**.

Another factor that can be attributed to this finding is family psychoeducation. Patients with bipolar disorder may

exhibit symptoms that cause discomfort to their families, resulting in crises, uncertainty, and excessive burden. This is often linked with a lack of sympathy, judgment, and seeing the patient's unusual acts as intentional as shown by caregivers. Therefore, families may exhibit elevated expressed emotion which may precede family caregivers' education regarding the illness.

**Gabra et al., (2020)** claimed that limited understanding about the disorder leads to negative attitudes and behaviors among caregivers, which has a negative influence on patients. Another investigation found that when caregivers lacked awareness about the illness, they tended to use fewer coping mechanisms and were more likely to feel defeated. Evidence indicates that more knowledge for family caregivers enhances their ability to contextualize the condition and encourages more supportive viewpoints and behaviors directed toward the individuals with bipolar disorder (**Nabi & Rizvi, 2022**). This line of reasoning aligns with a study by **Budiono et al. (2021)**, which indicated that providing education about the progression and impact of the illness, combined with behavioral therapies and communication skills training, can help families transition from high to low expressed emotion. Furthermore, **Ahmed et al. (2022)** demonstrated that the implementation

of the Psychoeducation program significantly reduced the level of expressed emotions among family caregivers.

This finding aligns with research by **Mohamed et al. (2021)**, which showed that over half of caregivers displayed a mild reaction to patient behavior. Likewise, **Kaur (2020)** discovered that most caregivers of individuals with bipolar disorder showed low expressed emotion towards them. Conversely, a study by **Hamad (2017)** reported that family caregivers of patients with bipolar disorder exhibited higher levels of expressed emotion. Additionally, **Sharma et al. (2021)** found that the majority of family caregivers were highly critical of their patients.

Concerning caregivers' emotional support subscale level, the majority of them demonstrated low levels, which is considered a prominent characteristic among the current study population. This may be due to the burden of care. Caregiver burden encompasses a range of physical, psychological, social, and financial challenges faced by family caregivers tending to relatives with chronic or mental disorders (**Liu, Heffernan, & Tan, 2020**).

Moreover, patients with bipolar disorder can be incredibly demanding. Caregivers may experience high levels of stress, anxiety, and emotional exhaustion or burnout. These

circumstances can leave them with limited emotional resources to provide support to the patient (**Girdhar & Patil, 2023**). This explanation is consistent with **Schulz et al., (2003)** who found that caregivers experiencing subjective burden often felt isolated and less likely to seek help or to provide social support to their patients.

Another contributing factor is the stigma of mental illness. Societal attitudes toward individuals with mental illness are predominantly negative, resulting in the stigmatization of caregivers who have such individuals in their families. As a result, caregivers may utilize insufficient strategies for dealing with stressors. Perceived stigma can create psychological and social challenges for family members, potentially increasing the burden of care and the level of expressed emotion (**Ghosh & Ahmed, 2019**). Stigma surrounding mental illness can impact caregivers' ability to openly discuss the patient's condition and seek support for themselves. This isolation can lead to feelings of shame and guilt, making it difficult to provide emotional support to the patient (**Prizeman, Weinstein, & McCabe, 2023**).

Along with these results, a study by **Mazumdar et al. (2024)**, showed that caregivers exhibit low levels of tolerance and emotional support,

favoring high expressed emotion toward bipolar patients. Similarly, **Kaewchum et al. (2025)** clarified that the studied family caregivers exhibit low levels of emotional warmth and positive regard. Conversely, a study by **Sharma et. al (2020)** clarified that the highest domain was warmth, suggesting that caregivers provide high levels of emotional support.

Regarding the intrusiveness subscale, the last construct of expressed emotion, the current study found a significant high level of intrusiveness. Intrusiveness is considered a component of high expressed emotion where the family caregiver becomes excessively involved in the patient's personal life and decisions (**Nayak et al. 2023**). Caregivers become overly involved in the patient's daily life, neglecting their own needs and boundaries in the process. Lack of clear boundaries between the caregiver and the patient can contribute to overinvolvement. In addition, family caregivers may experience feelings of guilt or shame related to the patient's illness. They may believe that they could have prevented the illness or are somehow responsible for the patient's struggles. These emotions can drive overinvolvement as caregivers attempt to compensate for perceived failures or alleviate their own guilt (**Ntsayagae, Poggenpoel, & Myburgh, 2019**).

This finding is consistent with research by **Yadav et al. (2018)**, which indicated that emotional over-involvement was significantly more pronounced in caregivers of patients with bipolar disorder. Similarly, **Endreddy et al. (2024)** found that the majority of family caregivers initially exhibited high levels of expressed emotion.

Speaking to the second main result, the current study represented that nearly two-thirds of the studied patients have a low level of clinical recovery. Clinical recovery denotes the alleviation of symptoms, typically achieved through the use of medications alongside behavioral therapies to diminish symptom severity (**Mezes et al. 2021**). This result may be due to the fact that inconsistent medication adherence to regimens and therapy appointments, along with a limited understanding of the illness, can significantly reduce treatment effectiveness and elevate the likelihood of relapse. Consistent with this justification, **Jawad et. al. (2018)**, stated that no adherence to medication is a prevalent issue in bipolar disorder and is significantly linked to worse clinical outcomes.

In regard to social recovery, the findings of this study indicated that approximately two-thirds of the patients examined showed a low level

of recovery. The possible explanation of low social recovery among bipolar patients is the nature of the disease. Social functioning impairment is notably common in individuals diagnosed with bipolar disorder and may endure for extended periods, despite the sustained resolution of mood symptoms. They reported that disease symptoms significantly interfered with their social and interpersonal relationships. This observation aligns with a study by **Wingo et al. (2010)**, which found that over half of the patients studied exhibited low levels of social recovery. Concerning functional recovery, this study found that most of the patients assessed demonstrated a moderate level in this domain. Functional recovery is defined as the restoration of an individual's premorbid psychosocial, residential, and occupational status. The attainment of a moderate level of functional recovery may be attributed to social integration. a component of community integration entails sustaining social relationships within the community and being aware of the support resources accessible in the local environment (**Terras, M., Hendry, G., & Jarret, D., 2019**).

Similar to this results a study by **Harfush et al., (2022)** concluded that social integration is a factor that predicts patients' recovery, surpassing



other forms of integration. This finding underscores the importance of building and maintaining social connections within the community, the need for a social network and support system for patients, and the value of promoting social interaction among individuals with psychosis. These elements can improve patients' involvement in social activities and support their recovery journey.

Concerning personal recovery, this research found that the majority of the studied patients demonstrated moderate to high levels of recovery in this domain. Personal recovery involves reclaiming autonomy over one's life while managing the challenges of mental illness; it is a distinctive and individualized journey **(Yu et al., 2020)**. This is evident in the correlation matrix in the current research, which indicates a statistically significant association between personal recovery and clinical recovery as well as personal recovery and functional recovery. Similarly, **Dubreucq et al. (2022)** conducted longitudinal research examining the relationships and distinctions between clinical and personal recovery, revealing that, although these notions are distinct, they mutually enhance one another over time. Conversely, **Van Eck et al. (2018)** clarified a positive but weak

relation between personal and functional recovery.

The correlation matrix in this study reveals a strong, statistically significant inverse relationship between overall expressed emotion and overall recovery, as well as in all specific areas of recovery: functional, personal, clinical, and social. This evidence suggests that when family caregivers exhibit lower levels of expressed emotion, patients with bipolar disorders tend to experience better recovery outcomes.

Low expressed emotion can improve the recovery process in patients with bipolar disorder by creating a more supportive and stable environment **(Sam, Nisha & Varghese, 2019)**. Additionally, a supportive environment plays a vital role in the recovery of individuals with mental health conditions. Those diagnosed with psychiatric disorders who have social support are more likely to seek help for their mental health issues during critical periods **(Harfush & Gemeay, 2018)**. This is reflected in the findings of this study, which show a statistically significant positive association between the emotional support caregivers provide and the personal, social, and functional recovery of the patients. Similarly, research conducted by **El-Azzab et al. (2021)** and **Wehba**

**et al. (2024)** also found a statistically significant relationship between social support and recovery.

This result aligns with the findings of **Mohamed et al. (2021)**, who evaluated the impact of caregivers expressed emotions on the clinical outcomes of individuals with bipolar disorder. The results indicate that more than half of family caregivers exhibited a mild reaction to patient illness, and it is confirmed that reduced expressed emotion among caregivers can improve clinical outcomes for individuals with bipolar disorder. Additionally, **Endreddy et al. (2024)** reported a significant relationship between EE and relapses. All these findings highlight that a low EE environment may promote an individual's progress in mental health recovery. Conversely, a study by **Batra et al. (2016)** reported no association between expressed emotion and relapse in bipolar disorder.

### **Conclusions:**

The present study concluded that, Low family caregivers expressed emotion can significantly foster recovery among patients with bipolar patients. Enhancing family expressed emotion by reducing criticism, hostility toward patients, over-involvement, and providing emotional support can improve communication and interrelationship within the family

leading to improved overall recovery prospects.

### **Recommendations:**

**The current study findings propose the following recommendations:**

- Implementing an effective educational program focused on bipolar disorder and the crucial role of family support could be beneficial for both family members and patients. This could improve their understanding of the condition and potentially lower levels of expressed emotion within the family.
- Family expressed emotion intervention emphasizing the enhancement of communication patterns and caregiver attitudes toward patients with bipolar disorder is necessary.
- Different types of intervention programs including supportive programs, family-centered initiatives, and psychological interventions, are essential for alleviating caregiver burden among those caring for patients with bipolar disorders, thereby reducing high levels of expressed emotion.
- Recovery from mental illness should be prioritized, necessitating the implementation of a hospital routine that incorporates diverse interventions aimed at facilitating patients' recovery.
- Implementation of a social skills training program for individuals with bipolar disorder is essential to enhance social interaction and interpersonal

relationships, thereby facilitating social recovery.

## References

- Ahmed, H., Abdel Aal, M., Shalaby, M. & Ahmed, F. (2022).** Effect of Family Caregiver Expressed Emotion Control Program on Relapse among Patients with Schizophrenia. *Journal of Nursing Science - Benha University*. 3(1)
- Alenezi A. (2020).** Health care providers expressed emotions in dealing with bipolar patients. *Archives of Psychiatric Nursing*. Shaqra University. Vol. 34(3); 169-175.
- Ali, M., Gemeay, E., Seleem M. & Tawfik, A. (2024).** Role of Self Efficacy on Recovery among Patients with Psychiatric Disorders. *Tanta Scientific Nursing Journal*. 35. (4).
- Batra, B., Ghildiyal, R., Saoji, A. (2016).** Expressed emotions among caregivers of patients with mental illness: A descriptive study. *J Dent Med Sci*. 15:59-68.
- Bishop, M. & Greeff, A. P. (2015).** Resilience in families in which a member has been diagnosed with schizophrenia. *Journal of Psychiatric and Mental Health Nursing*, 22(7), 463–471.
- Budiono W., Kantono K., Kristianto F., Avanti C. & Herawati F. (2021).** Psychoeducation Improved Illness Perception and Expressed Emotion of Family Caregivers of Patients with Schizophrenia. *Int J Environ Res Public Health*. 15;18(14):7522.
- Dubreucq, J., Gabayet, F., Godin, O., Andre, M., Aouizerate, B., Capdevielle, D., et al. (2022).** Overlap and Mutual Distinctions Between Clinical Recovery and Personal Recovery in People with Schizophrenia in a One-Year Study. *Schizophr Bull*. 48(2):382-394.
- El- Azzab S. & Ali S. (2021).** Social support, coping with stress and medication among patients with bipolar disorder. *Egyptian Journal of Nursing & Health Sciences*. 2 (2): 227-247.
- Endreddy A., Ch L., Veeramachaneni H. (2024).** Role of expressed emotions and its impact on relapse in bipolar affective disorder. *Ann Indian Psychiatry*. 8(2):110-115.
- Gabra, R., Ebrahim, O., Osman, D. & Al-Attar G. (2020).** Knowledge, attitude and health-seeking behavior among family caregivers of mentally ill patients at Assiut University Hospitals: a cross-sectional study. *Middle East Curr Psychiatry* 27, 10.
- Ghosh, R. & Ahmed N. (2019).** A study to assess the relationship between stigma and expressed emotion among the primary care givers of persons with schizophrenia attending outpatient department. *Indian J Psychiatr Nurs*. 16:2.
- Girdhar, A. & Patil, R. (2023).** Caregivers' Burden in Patients with

- Bipolar Disorder and Schizophrenia and Its Relationship with Anxiety and Depression in Caregivers: A Narrative Review. *Cureus*. 22;15(10).
- Hällgren, J., Ösby, U., Westman, J. & Gissler M. (2019).** Mortality trends in external causes of death in people with mental health disorders in Sweden, 1987-2010. *Public Health*, 47(2):121-126.
- Hamad, E. (2017).** Personal Constructs in Dementia Caregiving: The Family Caregiving Experience of People Living with Dementia in Saudi Arabia. *Electronic Thesis and Dissertation Repository*. 4472.
- Harfush, S. & Gemeay, E. (2018).** Perceived social support and medication compliance among patients with psychiatric disorders. *Internat Jour of Novel Research in Healthcare and Nursing*, 4(3); 157-169.
- Harfush, S., & Elsawi, H. (2018).** Resilience, burden, and quality of life in Egyptian family caregivers of patients with schizophrenia. (15):2, P: 196- 204.
- Harfush, S., Moussa, A., & Elnehray, S. (2022).** Association between Community Integration and Mental Health Recovery among Patients with Psychiatric Disorders. *Tanta Scientific Nursing Journal*, 24(1), 11-34.
- Hower, H., Lee, E., Jones, R., Birmaher, B., Strober, M., Goldstein, B. & et al. (2019).** Predictors of longitudinal psychosocial functioning in bipolar youth transitioning to adults. *Journal of affective disorders*, 246, 578-585.
- Jawad, I., Watson, S., Haddad, P., Talbot P., McAllister-Williams R. (2018).** Medication nonadherence in bipolar disorder: a narrative review. *Ther Adv Psychopharmacol*. 16;8(12):349-363.
- Kaewchum, T., Pitanupong, J., Tepsuan, L., Yakkaphan, P, Maneepongpermpoon, P. (2025).** Expressed emotions among caregivers of individuals with schizophrenia and associated factors: a multihospital-based survey in Southern Thailand. *BMC Psychol*. 13, 34.
- Kaur, N. (2020).** Caregiver's burden and social support among caregivers of schizophrenic patients. *Delhi Psychiatry J* 17:337–341.
- Liu, Z., Heffernan, C. & Tan, J. (2020).** Caregiver burden: A concept analysis. *Int J Nurs Sci*. 25;7(4):438-445.
- Mazumdar, M., Mazumdar, B. & Mazumdar, K. (2024).** A Study to Assess and Compare the Expressed Emotions in Caregivers of Patients of Bipolar Affective Disorder and Obsessive-Compulsive Disorder. *International Journal of Indian Psychology*, 12(1), 1245-1254.

- Mezes, B., Lobban, F., Costain, D., Longson, D., & Jones, S., (2021).** Psychological factors in personal and clinical recovery in bipolar disorder. *Journal of Affective Disorders*. Vol. 280; 326-337.
- Miklowitz, D. & Chung, B. (2020).** Family Focused Therapy for Bipolar Disorder: Reflections on 30 Years of Research. *Fam Process*. 55 (3):483-99.
- Moawad, M., Elmalky, M. & Barakat, M. (2023).** Effectiveness of Expressed Emotions Management Program on Feeling of Burden and Depressive Symptoms among Caregivers of Patients with Dementia. *Journal of Nursing Science - Benha University*. Vol. 4(2): 566 – 567.
- Mohammed, O., Abd El-Latief, S., Zaki, M. & Mahmoud, D. (2021).** Effect of Caregiver's Expressed Emotions on Clinical Outcomes of Patients with Bipolar Disorder. *Journal of Nursing Science University*, 2(2), 601-617.
- Muneer, A. (2016).** Staging models in bipolar disorder: A systematic review of the literature. *Clinical Psychopharmacology Neuroscience*. 14; 117–130.
- Nabi, M., & Rizvi, T. (2022).** Knowledge of illness among family caregivers of psychiatric patients. *International Journal of Multidisciplinary Educational Research*, 11(1), 69–75.
- Nayak, M., Pradhan S., Dash M., Satpathy, T., Das, S., Chhajed R. & Rosen, R. (2023).** Expressed Emotion, Stigma and Caregiver Burden Among Spouses Suffering from Person with Schizophrenia and Bipolar Affective Disorder. *Journal of Tianjin University Science and Technology*. 56(5).
- Ntsayagae, E., Poggenpoel, M. & Myburgh, C. (2019).** Experiences of family caregivers of persons living with mental illness: A meta-synthesis. *Curationis*. 42(1).
- Ong, S., Fernandez, P., & Lim K. (2021).** Family engagement as part of managing patients with mental illness in primary care. *Singapore Med J*. 62(5): 213–219.
- Prizeman, K., Weinstein, N., & McCabe, C. (2023).** Effects of mental health stigma on loneliness, social isolation, and relationships in young people with depression symptoms. *BMC Psychiatry*. 21;23:527.
- Sam, S., Nisha, A., Varghese, P. (2019).** Stressful Life Events and Relapse in Bipolar Affective Disorder: A Cross-Sectional Study from a Tertiary Care Center of Southern India. *Indian J Psychol Med*. 41(1):61-67.
- Sánchez-Guarnido, A., Ruiz-Granados M., Herruzo-Cabrera J., Herruzo-Pino C., (2023).** The Effectiveness of Day Hospitals in the Personal Recovery of Mental Disorder Patients during the COVID-19

- Pandemic. *Healthcare Journal*, 11(3), 413.
- Schulz, R., Burgio, L., Burns, R., Eisdorfer, C., Gallagher-Thompson, D., Gitlin, L. & Mahoney, D. (2003).** Resources for Enhancing Alzheimer's Caregiver Health Investigators. End-of-life care and the effects of bereavement on family caregivers of persons with dementia. *N Engl J Med*. 13;349(20):1936-42.
- Sharma, R., Ghai, S. & Singh, S. (2021).** Expressed Emotions and Perceived Stress among Patients and Caregivers of Patients Suffering from Bipolar Affective Disorder. *International Journal of Scientific Reports*.7 (10) 489-494.
- Skar-Fröding, R., Clausen, H., Benth, J., Ruud, T., Slade, M. & Heiervang, K. (2021).** The Importance of Personal Recovery and Perceived Recovery Support among Service Users with Psychosis. *Psychiatr. Serv.*, 72, 661–668.
- Terras, M., Hendry, G., & Jarret, D. (2019).** The Challenges of Safety and Community Integration for Vulnerable Individuals. *Safety*, 5(4), 85.
- van Aken, B., Bakia, A., Wierdsma A., Voskes Y., Van Weeghel J., van Bussel E., Hagestein C., et al. (2021).** UP'S: A Cohort Study on Recovery in Psychotic Disorder Patients: Design Protocol. *Front Psychiatry*. 12(11):609530.
- Van Eck R., Burger T., Vellinga, A., Schirmbeck F., de Haan, L. (2018).** The Relationship Between Clinical and Personal Recovery in Patients with Schizophrenia Spectrum Disorders: A Systematic Review and Meta-analysis. *Schizophr Bull*. 44(3):631-642.
- Van Weeghel, J., van Zelst, C., Boertien, D., Hasson-Ohayon, I. (2019).** Conceptualizations, assessments, and implications of personal recovery in mental illness: a scoping review of systematic reviews and meta-analyses. *Psychiatry Rehabilitation Journal*. 42:169–81.
- Wehba, N., Berma, A. & Wahba, N. (2024).** The Relationship between Social Support and Recovery Levels among Patients with Psychiatric Disorders. *PSSJN*. Vol.11(2); 18 – 28.
- Wingo, A., Baldessarini R., Holtzheimer P., Harvey P. (2010).** Factors associated with functional recovery in bipolar disorder patients. *Bipolar Disord*.12(3):319-26.
- Yadav, A., Parija, S., & Sreeraj, V. S., (2018).** Burden and Expressed Emotion in Caregivers of Schizophrenia and Bipolar Affective Disorder Patients. *MAMC journal of medical sciences*, 4(2), 68.
- Yu Y., Xiao, X., Yang, M., Ge, X., Li, T., Cao, G., Liao, Y. (2020).** Personal recovery and its determinants among people living with schizophrenia in China. *Frontiers in Psychiatry*.1436.

## Association between Milk versus Sugar-Sweetened Beverages, and Childhood Obesity in School Age Children

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### Abstract

**Background:** Childhood obesity is a worldwide phenomenon causing multiple morbidities. Globally, there will be 254 million obese children by 2030. Children are obese due to nutritional imbalances. The dietary patterns among Saudi children have shifted towards greater intake of sugary drinks and less milk intake. **Aim:** to assess the association between milk versus sugar-sweetened beverages, and childhood obesity in school age children. **Subjects and Methods:** Descriptive correlation study. **Sample:** 589 children selected by a multistage cluster sampling technique **Setting:** Eight schools in Al Ahsa Governorate. **Tools:** Children demographic information, milk and sweetened beverages consumption questionnaires developed by the researchers. Children BMI calculated by CDC BMI Calculator. **Results:** More than one third of children are overweight and obese. More than half of them consume sweetened/flavored milk, the majority drinks sweetened juices and about half of them consume soft drinks. More than one third of children drink coffee and nearly half drinks tea on daily bases. A significant relationship was found between children's BMI and high consumption of coffee and tea. **Conclusion:** Children low consumption of healthy milk and overconsumption of sweetened beverage, coffee and tea lead to obesity. **Recommendations:** Community outreach programs promoting health beverage choice, replacing sweetened beverage with adequate milk conception, can be an effective strategy for maintaining a healthy BMI in school age children.

**Keywords:** Milk, Obesity, School age children, Sweetened beverages

## Introduction

Obesity is a worldwide disorder during childhood. Increased prevalence of obesity among children from 0.7% to 5.6% in girls and from 0.9% to 7.8% in boys during the period from 1975 to 2016 was reported (**Di Cesare et al., 2019**). According to forecasts made by the Global Obesity Federation using data from the Non-Communicable Disease (NCD) Risk Factor Collaborative, there will be 254 million obese children and adolescents (aged 5 to 19) worldwide by 2030. Out of 43 million obese children worldwide, 35 million come from developing nations, with 17.5 million of these children residing in Asia (**Akter et al., 2022**). In the Kingdom of Saudi Arabia (KSA), childhood obesity prevalence in 2020 was 21.7% (**Al Shaikh et al., 2020**). A recent report from 14 districts of the Eastern Region of KSA found that about 25.7% of children were obese or overweight. Moreover, 14.6% of boys and 15.1% of girls were overweight and 11.1% of boys and 10.8% of girls were obese (**Albaker et al., 2022**). Additionally, a nationwide survey showed that obesity rate is higher in boys compared to girls (**Alhamed, et al., 2023**). Obesity reported to appear around age of 10 years, increased

significantly, and became more complex around 19 years. It results from many factors including genetic, low physical activity, nutritional imbalances and over consumption of sugar-sweetened beverages (SSBs).

Excessive consumption of SSBs causes a range of adverse health outcomes, including type 2 diabetes, cardiovascular disease, and obesity. While these chronic conditions typically present themselves in adulthood, it is vital to consider the potential impact of SSBs on the health of children during critical stages of development. Individuals who had one or more SSBs servings per day had a higher genetic risk of obesity and an elevated Body Mass Index (BMI); this risk was double that of individuals who consumed less than one serving per month (**Malik & Hu, 2022**).

Many SSBs contains caffeine, high-fructose corn syrup, and fruit juice concentrates which can lead to brain gene alterations and consequently causes many disorders such as attention deficit hyperactivity disorder (ADHD). Fructose, in particular damages brain cell communication, increases the presence of toxic molecules in the brain, and long-term



high-fructose diet can impair the brain's capacity to learn and remember information **(Kay, 2019)**. Additionally, milk consumption has decreased with the rise in sweetened juice intake and lead higher calorie intake and obesity **(Grummon, 2019)**.

Milk offers significant dietary benefit, it is rich in protein (3.6 g per 100 ml), Ca (124 mg per 100 ml), vitamin B12 (0.9 µg per 100 ml), riboflavin (0.24 mg per 100 ml) and iodine (31 µg per 100 ml). It is also a good source of potassium (160 mg per 100 ml), P (97 mg per 100 ml) and vitamin B5 (0.7 mg per 100 ml). Milk also contains calcium and insulin-like growth factor-1, which are essential for children's development and growth. Therefore, children's diets should include milk. It provides a good amount of calcium, promotes eye, nerve, and muscle health, and protects against obesity, all of which aid in physical development **(Kang, Sotunde, & Weiler, 2019)**.

In an effort from Saudi Arabia Government to promote school age children health, the Saudi Dairy and Foodstuff Corporation (SADAFCO) initiated Saudi Milk-sponsored program introduced in 2020 for schools located in 16 different cities throughout the Kingdom with an emphasis on raising awareness of the

value of a nutritious diet. Although, a million Saudi primary school students have benefited from this educational program, continuous effort is needed to ensure children compliance with the recommended milk intake of two and half to three cups per day for children 5 to 18 years old **(Statista Research Department, 2022)**.

#### **Significance of the study:**

Saudi Arabia faces a growing obesity epidemic, with a reported prevalence of 27% among children aged 10 to 19 years. The consumption of SSBs, such as sodas and sweetened juices, has been consistently linked to increased Body Mass Index (BMI), higher waist circumference, and greater body fat percentage in children. A systematic review and meta-analysis encompassing 33 studies with over 121,000 participants revealed that higher SSB consumption was associated with a 0.75 kg/m<sup>2</sup> increase in BMI, a 2.35 cm increase in waist circumference, and a 2.81% rise in body fat percentage among children and adolescents **(Al-Jawaldeh et al., 2024)**.

Conversely, replacing SSBs with milk particularly low- fat or fat-free varieties has demonstrated protective effects against weight gain. These findings underscore the importance of

beverage choices in childhood obesity prevention strategies and emphasize the need for public health initiatives promoting healthier drink options. In Saudi Arabia, where childhood obesity rates are alarmingly high, such studies are crucial for informing effective interventions and policies to combat this growing health crisis. (Collison et al., 2010). Therefore, the aim of the study is to assess the association between milk versus sugar-sweetened beverages, and childhood obesity in school age children.

### **Research question**

What is the association between milk and sugar-sweetened beverage consumption and the development of obesity among school-age children?

### **Subjects and Methods**

**Study Design:** A descriptive correlational study used to study school-age children pattern of sweetened beverages, milk Consumption and obesity. Using an effect size of 80, a confidence interval of 95%, and a significant level of .05, the calculated sample size was 589 children. The schools were selected using stratified sampling technique. A list of all governmental primary schools in the biggest two cities in Al Ahsa Governorate was obtained from the directory of education, four schools from each city were selected

randomly, then approval from the eight schools was obtained along with a list of all classes in grades 3 to 6. One class from each grade from each school was randomly selected using simple random method.

**Participants:** All children from selected classes in grades three to six were included in the study. However, children with any food allergies (lactose Intolerance, celiac disease), chronic diseases, physical or cognitive disabilities were excluded.

### **Data Collection and measurements**

After receiving IRB approval for the study (Approval no. IRB/21XX/23) dated 22 August 2023 from KAIMRC-ER along with schools' administrative approvals and children guardians' consent, data collection commenced. Children assent to participate in the study was taken orally in addition to take their parents' Approval.

Data collected from September 2023 to April 2024 using interview guided by a structured questionnaire. The questionnaire was developed by the researchers and revised by two content experts to ensure content validity Minor corrections done accordingly. The questionnaire includes three sections.

The first section included sociodemographic information for the

child and his living condition. Second section included sweetened beverage and milk consumption information such age type, amount and frequency. The last section related to measurement of child's height in cm, weight in kg using SECA 769 Digital column scale (Seca Electronic Column Scales, N.D]. These measurements along with child gender, age in months entered in the BMI Percentile Calculator for Child and Teen (CDC, 2023). The resulted BMI, BMI- for-age category entered in the data collection sheet.

Four researchers trained to conduct the interviews, while another four trained to take measurements (height, weight and calculating the BMI for age). This training carried out during a pilot study of 20 subjects prior to the official start of the research. Interrater reliability checked by percent agreement among researchers and it was 96%. Data collection carried out in the morning period before children go to their lunch break. Two researchers filled in the questionnaire and two obtained the measurement for each child.

**Statistical Analysis:** Data summarized and analyzed using the SPSS statistical package, version 29 (IBM Corp, 2020). Data checked for normality then descriptive statistics (means, SD, Frequency distribution) used to

disrobe study participants the pattern of milk and sugar-sweetened beverages consumption. Inferential statistics (T-test and ANOVA) implemented to test the relationship between participants characteristics, consumption of milk and sugar-sweetened beverages and their BMI accordingly.

## Results

Children characteristics presented in Table 1. The study included 589 children from eight governmental primary schools, 47.5% of children from Al Hofuf city and 52.5% from Al-Mubaraz city, 57.9% were boys and 42.1% were girls with a mean age of  $10.20 \pm 1.30$  years. Majority of the children live with both parents (95.1%) in medium family six family (71.6%) with most of the mothers are not employed (72.5%). Almost half of the children have unhealthy weight (43.3%). Children were either underweight (6.1%), over weight (17%), obese (12.9%), severely obese (7.3%) with a weight range from 15.4Kg to 140Kg.

Children reveal diverse preferences of milk and sugar-sweetened beverages consumption patterns (Table 2). A small percentage of children (7.8%) do not drink milk at all, while about one-third (33.6%) prefer plain milk, and more than half of them (58.6%) prefer

flavored or sweetened milk. In terms of preferred dairy products, 32.1% do not consume milk products (milk only), 14.8% prefer cheese, 39.9% prefer yogurt, 10.7% prefer ice cream, and 2.5% refrain from dairy altogether. The frequency of milk products consumption also varies, 5.6% consume milk products less than once a week, and 23.8% consume milk products once a week, 28.5% twice a week, and 42.1% consume milk products daily.

The results also indicated that of the majority of children consume artificially flavored, sweetened juices with 69.9% consuming at least one serving per day and 17.2% consuming two or more serving daily. Regarding soft drinks like soda, 44.5% of children drink a can of sweetened juices per day, and 6.9% take two or more cans per day.

In terms of other beverages, almost one third of children drink coffee on daily basis (35.7%), with 69.1% consuming

one cup, and 30.9% two cups or more. Also, almost half of the children drink tea (52.8%) out of them 68.2% drink one cup, and 31.8% drink two or more cups daily.

Table3 shows the relation between children's BMI and various characteristics, as well as their patterns of milk and sugar-sweetened beverages consumption. The data reveals that Children with higher BMIs tend to be male, older, from larger families and those living with grandparents. Additionally, children of less educated parents were having higher BMI. Higher BMI were also associated with consumption of flavored and sweetened milk, juice, and cheese. There was a statistically significant relationship between children age ( $t= 16.34$ ,  $p= .001$ ), consumption of coffee, ( $F=7.56$ ,  $P= .001$ ), and consumption of tea ( $F= 7.96$ ,  $P= .001$ ) and their BMI.

**Table 1. Distribution of the studied children Sociodemographic Characteristic**

| Characteristics (N=589) | N                    | %    |
|-------------------------|----------------------|------|
| Gender                  |                      |      |
| ▪ Male                  | 341                  | 57.9 |
| ▪ Female                | 248                  | 42.1 |
| Age (in years)          |                      |      |
| ▪ <10                   | 248                  | 42.1 |
| ▪ ≥10                   | 419                  | 71.1 |
| (Range), Mean ± SD      | (7-12). 10.22 ±1.287 |      |
| <b>Mother education</b> |                      |      |
| ▪ Primary or less       | 46                   | 7.8  |
| ▪ Elementary- Secondary | 251                  | 42.6 |
| ▪ University and up     | 292                  | 49.6 |
| Mother employment       |                      |      |
| ▪ No                    | 427                  | 72.5 |
| ▪ Yes                   | 162                  | 27.5 |
| Father education        |                      |      |
| ▪ Primary or less       | 35                   | 5.9  |
| ▪ Elementary-Secondary  | 249                  | 42.3 |
| ▪ University and up     | 305                  | 54.8 |
| Living with             |                      |      |
| ▪ Both parents          | 560                  | 95.1 |
| ▪ Either mother/father  | 24                   | 4.1  |
| ▪ Grand parents         | 5                    | 0.8  |
| Family size (members)   |                      |      |
| ▪ Small (< 5)           | 70                   | 11.9 |
| ▪ Medium (5-7)          | 422                  | 71.6 |
| ▪ Large (> 7)           | 97                   | 16.5 |
| BMI level               |                      |      |
| ▪ Under-weight          | 36                   | 6.1  |
| ▪ Healthy weight        | 334                  | 56.7 |
| ▪ Over-weight           | 100                  | 17   |
| ▪ Obesity               | 76                   | 12.9 |
| ▪ Severe Obesity        | 43                   | 7.3  |

**Table (2): Distribution of milk and sweetened beverages consumption (N=589)**

| <b>Milk and Beverages Consumption</b> | <b>N</b> | <b>%</b> |
|---------------------------------------|----------|----------|
| Preferred type of milk                |          |          |
| ▪ Plain Milk                          | 198      | 33.6     |
| ▪ Sweetened/ Flavored milk            | 345      | 58.6     |
| ▪ I do not drink milk at all          | 46       | 7.8      |
| Preferred dairy products              |          |          |
| ▪ Milk only                           | 189      | 32.1     |
| ▪ Cheese                              | 87       | 14.8     |
| ▪ Yogurt                              | 235      | 39.9     |
| ▪ Cream                               | 63       | 10.7     |
| ▪ I do not take any                   | 15       | 2.5      |
| How often child consume milk products |          |          |
| ▪ Less than once a week               | 33       | 5.6      |
| ▪ Once a week                         | 140      | 23.8     |
| ▪ Twice a week                        | 168      | 28.5     |
| ▪ Daily                               | 248      | 42.1     |
| No of sweetened drink/juices/day      |          |          |
| ▪ None                                | 76       | 12.9     |
| ▪ One                                 | 412      | 69.9     |
| ▪ Two or more                         | 101      | 17.2     |
| No of soft drink/ day                 |          |          |
| ▪ None                                | 286      | 48.6     |
| ▪ One                                 | 262      | 44.5     |
| ▪ Two and more                        | 41       | 6.9      |
| Child drink coffee                    |          |          |
| ▪ No                                  | 379      | 64.3     |
| ▪ Yes                                 | 210      | 35.7     |
| No of coffee cups child drink (n=210) |          |          |
| ▪ One                                 | 145      | 69.1     |
| ▪ Two or more                         | 65       | 30.9     |
| Child drink tea                       |          |          |
| ▪ No                                  | 278      | 47.2     |
| ▪ Yes                                 | 311      | 52.8     |
| No of tea cups child drink (311)      |          |          |
| ▪ One                                 | 212      | 68.2     |
| ▪ Two or more                         | 99       | 31.8     |

**Table (3): Relationship between Children BMI, their characteristics, milk, and beverages consumption**

| Characteristics                    | BMI Mean $\pm$ SD  | F/t<br>P |
|------------------------------------|--------------------|----------|
| Age (in years)                     |                    |          |
| ▪ <10                              | 18.19 $\pm$ 3.784  | 16.34    |
| ▪ $\geq$ 10                        | 19.91 $\pm$ 4.982  | .001*    |
| Gender                             |                    |          |
| ▪ Male                             | 19.57 $\pm$ 4.955  | 0.927    |
| ▪ Female                           | 19.19 $\pm$ 4.401  | .336     |
| ▪ Living with Both parents         | 19.37 $\pm$ 4.687  |          |
| ▪ Living with Either mother/father | 20.59 $\pm$ 5.552  | 0.98     |
| ▪ Living with Grand parents        | 21.00 $\pm$ 9.475  | .403     |
| Family size                        |                    |          |
| ▪ Small (< 5 members)              | 19.59 $\pm$ 4.500  | 0.86     |
| ▪ Medium (5-7 members)             | 19.26 $\pm$ 4.603  | .423     |
| ▪ Large (> 7 members)              | 19.94 $\pm$ 5.397  |          |
| Mother education                   |                    |          |
| ▪ Primary or less                  | 21.38 $\pm$ 5.534  | 1.58     |
| ▪ Elementary-Secondary             | 19.98 $\pm$ 4.481  | .178     |
| ▪ University and up                | 18.94 $\pm$ 4.480  |          |
| Preferred type of milk             |                    |          |
| ▪ Preferred Plain milk             | 19.156 $\pm$ 4.474 | 2.46     |
| ▪ Preferred Flavored/Sweetened     | 19.824 $\pm$ 5.269 | .117     |
| sweetened drinks/juices/ day       |                    |          |
| ▪ One                              | 19.42 $\pm$ 4.891  | 0.47     |
| ▪ Two or more                      | 19.26 $\pm$ 4.447  | .707     |
| Coffee cups child drink/day        |                    |          |
| ▪ None                             | 18.82 $\pm$ 4.391  | 7.56     |
| ▪ One                              | 20.12 $\pm$ 5.101  | .001*    |
| ▪ Two or morre                     | 22.71 $\pm$ 5.824  |          |

**Cont. table (3):**

|                          |             |       |
|--------------------------|-------------|-------|
| Tea cups child drink/day |             |       |
| ▪ None                   | 18.91±4.149 | 7.96  |
| ▪ One                    | 19.62±5.214 | .001* |
| ▪ Two or more            | 22.96±6.239 |       |

\* Statistically significant at level  $P < 0.05$

**Discussion**

The current study was the first in the region, offers valuable insights into the pattern of sugar-sweetened beverages and milk and their relationship with school age children' BMI at a randomly selected eight primary schools in Al Ahsa Governorate, Eastern Region of Saudi Arabia. Among the 589-studied children, more than third were overweight and obese. This is an alarming figure of the increasing rate of childhood obesity compared to previous reports from the different studies in the country as well as in the same region. For instance, a study conducted from 2015-2016 on school age children across different regions of KSA, estimated the prevalence of overweight and obesity of school age children at 21.5%, which increased to 25.7% in 2016-2017 (Albaker et al., 2022).

Moreover, the prevalence estimates of overweight and obesity among children in KSA continued to increase from 20% in 1990 to 60% in 2019 signifying a persistent trend of obesity among children (Almubark &

Alqahtani, 2023). Consequently, obesity-related morbidities is escalating and significantly leading to cardiovascular (Aljaadi & Alharbi, 2021) and cardio-metabolic risks (Albaker et al., 2021). During adolescents and early adulthood. In response to this growing concern, the kingdom has implemented multiple strategic objectives through the Ministry of Health to address the escalating obesity rates, aligning with the goals of Saudi vision 2030 (Ibrahim, Albwardi, Alzaher, Nahhas & Alabdulkareem, 2021). To achieve the strategic goal of the lowering obesity among Saudi children, factors causing such phenomena mandates an investigation.

The Profile of obese children among school age children in the current study indicated a varied pattern and relationship between children BMI and their demographic characteristics, and the consumption pattern of sugar-sweetened beverages and milk. Older boys tend to have higher BMI. Obesity rates increase as children get older. Kraft, 2023, explained that significant



weight gain is normal during preadolescent ages, early in girls and late in boys, between 9 -12 years old, because the body store fat preparing child for the rapid growth during puberty (Kraft, 2023). Understanding if a child's weight gain is healthy or unhealthy is about more than just numbers. However, developing healthy habits during childhood including diet and exercise can prevent continuation of weight gain and its unhealthy consequences during adulthood. This also emphasized by a recent study conducted in the Eastern Province, Saudi Arabia, evaluating the prevalence of adiposity among university students. The study indicated that male students were obese with higher adiposity compared to female students (Albaker et al., 2021).

Children who live in big families, with grandparents and less educated mothers, tend to be overweight and obese. In Saudi culture, it is common to live in big families with grandparents in same house. In addition, gathering with other family members on regular basis, which can have both positive and negative effects on children's nutritional habits. On one hand, family gatherings often involve preparation and sharing of delicious traditional foods, which can enhance

children's enjoyment of meals and promote a sense of cultural identity. On the other hand, family gatherings can also lead to unhealthy eating habits and excess as well as consuming excessive calories, unhealthy snacks, sweets and sugary drinks. This can negatively affect their nutritional well-being and lead to obesity. To ensure that family gatherings have a positive impact on children's nutritional intake, it is important for parents and caregivers to promote healthy eating habits and moderation by offering a variety of nutritious options, encouraging portion control, and providing guidance on making balanced food choices.

Moreover, the study results indicated that, children of less educated parents tend to be overweight and obese. In a longitudinal study, it explained the mediation effect of parents' education and the child's weight. The study indicated that parenteral education level was significantly associated with a higher BMI in children and 5 years later during late adolescents. The socioeconomic statues of the family, leading to behavioral and psychological risk factors for a higher BMI on the long term (Seum, Meyrose, Rabel, Schienkiewitz, & Ravens-Sieberer, 2022).

A well-balanced diet for children should include milk and its products. Milk and its products are crucial nutrients for children's healthy growth and development. Research studies reported that those children who consume milk regularly might have lower risk of obesity (Dror, 2014). This is because of the nutritional profile of milk and its role in balanced diet and its ability to promote a feeling of fullness and satiety.

More than half of the studied children do not follow the dietary recommendation of milk and its products' daily intake. Balanced Approach of dietary intake and encouraging children to consume milk as part of a balanced diet while limiting sweetened beverage intake can support healthy growth and weight management. When children do not consume the recommended amount of milk, they tend to consume other beverages with high Sugar Content including sodas and sugary juices, which are high in added sugars and calories but low in nutritional value.

The study results indicated that children who consume more sugar-sweetened beverages have higher BMI. Similarly, Gan, and associates, 2022 reported that more sugar-sweetened beverages intake is associated with higher prevalence of

overweight and obesity among children (Gan et al, 2021). High rate of SSBs are increasing worldwide. The rapid growth of beverages production and supply with the attractive marketing strategies aiming young children and youth contributed significantly to the over consumption of SSBs. High consumption of SSBs. can displace the children's healthier options like milk or water, leading to nutrient deficiencies and increased caloric intake without essential nutrients.

Moreover, the study showed a statistically significant relationship between children's BMI and the consumption of coffee and tea. Children who drink tea and coffee are more likely to be overweight and obese. In Saudi Arabia, the consumption of coffee and tea by children linked to cultural and social factors. Coffee, an integral part of Saudi heritage and culture, is often associated with hospitality and social interaction. Traditionally, Saudi families serve coffee at social gatherings and celebrations, where children observe adults drinking coffee and develop curiosity and a desire to participate in this practice. When children see family members regularly drinking coffee, they may also wish to

imitate them and feel included in these social moments.

Although, the practice of children drinking coffee and tea in Saudi Arabia is deeply rooted in the cultural norms and social practices of the community, adults should be aware of its unhealthy effects on children. Coffee and tea can affect children in several ways due to the caffeine content causing; increased alertness, difficulty concentrating, and potential sleep disturbances and poorer sleep quality, consequently, increased risk of obesity in children, as it can disrupt appetite-regulating hormones and affect metabolism (Rogers, Banks & Jenkins, 2024). As well as consuming high-calorie, caffeinated drinks regularly contribute to an overall increase in calorie intake leading to weight gain and obesity (McCormick, Reyna & Reifsnider, 2020). In addition, caffeinated beverages may replace healthier options such as water or milk with these drinks that offer little to no nutritional value. This can lead to a lack of essential nutrients and an imbalanced diet, which can contribute to weight gain.

### **Conclusion**

The current study was the first in this region to assess the association between milk versus sugar-sweetened beverages, and childhood obesity in

school age children. The low consumption of healthy milk and overconsumption of sweetened beverage, coffee and tea lead to obesity.

### **Recommendations**

Based on the study finding we recommend that further research studies; to include parents for more detailed report of the child daily dietary intake; to include other behavioral and psychological factors associated with obesity such as physical activity, screen time, family history and genetic predisposition. Additionally, develop outreach school and community programs about appropriate consumption of milk and beverages for children's health focusing on school age children with less educated parents. Promote awareness among teachers and school administrators about the importance of restricting marketing of sugar-sweetened beverages at school and improving access to water and healthier drinks such as milk.

### **References**

- Akter, R., Afrose, A., Sharmin, S., Rezwana, R., Rahman, M. R., & Neelotpol, S. (2022).** A comprehensive look into the association of vitamin D levels and vitamin D receptor gene polymorphism with obesity in

children. *Biomedicine & Pharmacotherapy*, 153, (113285): <https://doi.org/10.1016/j.biopha.2022.113285>

**Al Shaikh, A., Aseri, K., Farahat, F., Abaalkhail, B. A., Kaddam, I., Salih, Y., & Tamimi, W.** (2020). Prevalence of obesity and overweight among school-aged children in Saudi Arabia and its association with vitamin D status. *Acta Bio Medica: Atenei Parmensis*, 91(4). <https://doi.org/10.23750/abm.v91i4.10266>

**Albaker, W., El-Ashker, S., Baraka, M. A., El-Tanahi, N., Ahsan, M., & Al-Hariri, M.** (2021). Adiposity and cardiometabolic risk assessment among university students in Saudi Arabia. *Science Progress*, 104(1), 0036850421998532. <https://doi:10.1177/0036850421998532>

**Albaker, W., Saklawi, R., Bah, S., Motawei, K., Futa, B., & Al-Hariri, M.** (2022). What is the current status of childhood obesity in Saudi Arabia?: Evidence from 20,000 cases in the Eastern Province: A cross-sectional study. *Medicine*, 101(27), e29800. <https://doi.org/10.1097/MD.00000000000029800>

**Alhamed, A., Al-Zeer, A., Alsaawi, F., Alshaikh, A., Alzahr, A., Alkattan, A., Alrasheed, N., Sagor, K., Alsalem, E., Ibrahim, M., & Alfaleh, A.** (2023). The shifting patterns of childhood obesity: Insights from national school screening data. *Saudi pharmaceutical journal: SPJ: the official publication of the Saudi Pharmaceutical Society*, 31(12), 101862. <https://doi.org/10.1016/j.jsps.2023.101862>

**Aljaadi, A. M., & Alharbi, M.** (2021). Overweight and obesity among saudi children: prevalence, lifestyle factors, and health impacts. *Handbook of Healthcare in the Arab World*, 1155-1179. [http://dx.doi.org/10.1007/978-3-319-74365-3\\_187-1](http://dx.doi.org/10.1007/978-3-319-74365-3_187-1)

**Al-Jawaldeh, A., Perucic, A.-M., Hammerich, A., Abdel Moneim, A. R. I. A., Ibrahim, E. T., ALMatrooshi, F. E., Alkhalaf, M. M., Letaief, M., Alali, N. K., Alghaith, T. M., & Abbass, M. M.** (2024). A review of sugar-sweetened beverages taxation in Saudi Arabia and United Arab Emirates. *East Mediterranean Health Journal*, 30(11), 746–756.

<https://doi.org/10.26719/2024.30.11.746>

**Almubark, R. A., & Alqahtani, S. A.** (2023). Epidemiology of obesity and control interventions in Saudi Arabia. *Eastern Mediterranean Health Journal*, 29(12). <https://doi.org/10.26719/emhj.23.086>

**CDC.** (2023). BMI for Children and Teens. Centers for Disease Control and Prevention. <https://www.cdc.gov/obesity/basic/s/childhood-defining.html>

**Collison, K. S., Zaidi, M. Z., Subhani, S. N., Al-Rubeaan, K., Shoukri, M., & Al-Mohanna, F. A.** (2010). Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. *BMC Public Health*, 10, 234. <https://doi.org/10.1186/1471-2458-10-234>

**Di Cesare, M., Sorić, M., Bovet, P., Miranda, J. J., Bhutta, Z., Stevens, G. A., ... & Bentham, J.** (2019). The epidemiological burden of obesity in childhood: a worldwide epidemic requiring urgent action. *BMC medicine*, 17, 1-20. <https://doi.org/10.1186/s12916-019-1449-8>

**Dror, D. K.** (2014). Dairy consumption and pre-school, school-age and adolescent obesity in developed countries: a systematic review and meta-analysis. *Obesity reviews*, 15(6), 516-527. <https://doi.org/10.1111/obr.12158>

**Gan, Q., Xu, P., Yang, T., Cao, W., Xu, J., Li, L., & Zhang, Q.** (2021). Sugar-sweetened beverage consumption status and its association with childhood obesity among Chinese children aged 6–17 years. *Nutrients*, 13(7), 2211. <https://doi.org/10.3390/nu13072211>

**Grummon, A. H., Cabana, M. D., Hecht, A. A., Alkon, A., McCulloch, C. E., Brindis, C. D., & Patel, A. I.** (2019). Effects of a multipronged beverage intervention on young children's beverage intake and weight: a cluster-randomized pilot study. *Public health nutrition*, 22(15), 2856-2867. <https://doi.org/10.1017/S1368980019001629>

**IBM Corp.** (2020). IBM SPSS Statistics for Windows (Version 27.0) [Computer software]. IBM Corp.

**Ibrahim, M., Albwardi, S., Alzaher, A., Nahhas, M., & Alabdulkareem,**

- K. (2021).** School-Based Body Mass Index Survey: A national study of Obesity Prevalence among School Students in Saudi Arabia, 2018: Obesity Prevalence among School Students in Saudi Arabia, 2018. *Journal of Health Informatics in Developing Countries*, 15(2). Available from: <https://www.jhidc.org/index.php/jhidc/article/view/348>
- Kang, K., Sotunde, O. F., & Weiler, H. A. (2019).** Effects of milk and milk-product consumption on growth among children and adolescents aged 6–18 years: a meta-analysis of randomized controlled trials. *Advances in nutrition*, 10(2), 250-261. <https://doi.org/10.1093/advances/nmy081>.
- Kay, M. (2019),** March 13. Fructose and its Dangerous Effect On Young Brains - All My Children Daycare & Nursery School. All My Children Daycare & Nursery School. <https://allmychildrendaycare.com/fructose-and-its-dangerous-effect-on-young-brains/>
- Kraft M. (2023).** Is my child's weight gain normal? Tips to keep Kids on Track with Health Habits. Available at: <https://bestcare.org/news/my-childs-weight-gain-normal-tips-keep-kids-on-track-healthy-habits>. Accessed on 4 May, 2024.
- Malik, V. S., & Hu, F. B. (2022).** The role of sugar-sweetened beverages in the global epidemics of obesity and chronic diseases. *Nature Reviews Endocrinology*, 18(4), 205-218. <https://doi.org/10.1038/s41574-021-00627-6>
- McCormick, D. P., Reyna, L., & Reifsnider, E. (2020).** Calories, caffeine and the onset of obesity in young children. *Academic pediatrics*, 20(6), 801-808. <https://doi.org/10.1016/j.acap.2020.02.014>
- Seca, Electronic Column Scales with BMI function.** Available at: [https://www.seca.com/en\\_ke/products/all-products/product-details/seca769.html](https://www.seca.com/en_ke/products/all-products/product-details/seca769.html).
- Seum, T., Meyrose, A. K., Rabel, M., Schienkewitz, A., & Ravens-Sieberer, U. (2022).** Pathways of parental education on children's and adolescent's body mass index: the mediating roles of behavioral and psychological factors. *Frontiers in public health*, 10, 763789. <https://doi.org/10.3389/fpubh.2022.763789>

**Statista Research Department** (2022).

Saudi Arabia: milk sales volume 2021). Statista. Retrieved April 8, 2023, from: <https://www.statista.com/statistics/1316611/saudi-arabia-milk-sales-volume/>

**Rogers, E. M., Banks, N. F., & Jenkins,**

**N. D.** (2024). The effects of sleep disruption on metabolism, hunger, and satiety, and the influence of psychosocial stress and exercise: A narrativerreview. *Diabetes/metabolism research and reviews*, 40(2), e3667.

<https://doi:10.1002/dmrr.3667>

## Work Related Emergencies First Aid: Health Awareness and Practices among Sewage Workers

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### Abstract

**Background:** Sewage workers are vital to public health; they are often subject to occupational hazards and work-related emergencies, which pose risks to their safety. Effective first aid in such instances is dependent on workers' health literacy and ability to respond promptly. **Aim:** This study aimed to assess health awareness and practices of sewage workers regarding first aid in work-related emergencies. **Research design:** A cross-sectional descriptive research design was utilized. **Setting:** The study was conducted at four sewage stations, Elmadina, Qahafa, Dala, and Lotf Allah, all are affiliated to Fayoum Drinking Water and Sanitation Company. **Sample:** A stratified sample was used, and 215 workers were recruited **Tools:** Two tools were used. **Tool I:** An interviewing questionnaire consisted of four parts (socio-demographic and occupational characteristics of sewage workers, healthcare services, availability and use of personal protective equipment, the reported incidence of workplace injury and illness, and medical history) and sewage workers' knowledge about the occupational health hazards. **Tool II:** self-reported practice checklist to assess preventive measures and first aid practices in work-related medical emergencies. **Results:** The study results revealed that the majority (89.3%) of workers were exposed to workplace injuries, and nearly about two thirds (65.1%) of them had unsatisfactory level of knowledge about occupational health hazards, preventive measures, and first aid in work-related medical emergencies, only about one third (33%) of studied sewage workers had an adequate level of practice. There is a strong positive correlation with highly statistically significant between total knowledge and total reported practice scores. **Conclusion:** sewage workers had low knowledge and unsatisfactory practices regarding first aid in work-related emergencies, a high incidence of workplace injuries was observed. **Recommendation:** Targeted training programs in occupational health and first aid to protect workers from work-related medical emergencies.

**Key words:** Work-Related Medical Emergencies, First Aid, Sewage Workers



## Introduction

Occupational health and safety (OHS) is a multidisciplinary field concerned with the well-being, safety and health of individuals in their workplaces. It involves the identification, assessment and control of risks that can arise from physical, chemical, biological, or psychosocial hazards in the work environment. The ultimate goal of OHS is to promote a safe and healthy work culture that minimizes accidents, injuries and occupational diseases. Governments and organizations implement regulations and safety programs to protect workers and improve working conditions across various industries **(Saraswaty & Fadli, 2024)**.

Sewage workers operate in highly hazardous environments due to constant exposure to human waste, chemicals, toxic gases and confined spaces. Their daily tasks often involve entering sewer lines, handling contaminated materials and working in conditions that pose serious health and safety risks. These workers are vulnerable to biological hazards such as bacteria, viruses and parasites, as well as to physical injuries from slips, falls, or equipment malfunctions. The nature of their work environment makes it crucial for them to receive proper health education and safety

training **(Mokhtar, Makhtar, & Mokhtar, 2022)**.

Sewage workers face a wide range of occupational hazards that threaten their health and safety. These include exposure to toxic gases like hydrogen sulfide and methane, risk of infections from pathogens present in wastewater, skin diseases due to chemical contact and physical injuries caused by heavy machinery or slippery surfaces. Despite these dangers, many workers lack adequate training in emergency first aid procedures and are often unaware of how to respond effectively to incidents. This gap in awareness can result in delayed or improper response to injuries, worsening health outcomes and increasing the likelihood of complications or fatalities **(Muzaini, Yasin, Ismail, & Ishak, 2021)**.

To address the risks sewage workers face, it is essential to establish first aid protocols that are tailored to their specific work conditions. These protocols should include training on how to deal with chemical burns, respiratory distress, injuries caused by sharp objects and unconsciousness due to toxic gas inhalation. Accessible and well-stocked first aid kits must be available at all work sites and workers should be regularly trained through drills and refresher courses to maintain their readiness. Proper first aid

planning ensures that emergencies are managed swiftly and effectively, minimizing harm and stabilizing victims before medical professionals arrive (**Amereh et al., 2021**).

First aid in the workplace plays a critical role in managing injuries or medical emergencies before professional medical help arrives. Immediate and appropriate first aid can prevent minor injuries from becoming major complications and can even save lives in severe cases. It also contributes to reducing the recovery time of workers and lowering the costs associated with workplace accidents. Training employees in basic first aid skills fosters a safer work environment and empowers them to respond effectively during emergencies, thereby enhancing overall workplace resilience (**Noh et al., 2022**).

Beyond the availability of supplies and training, sewage workers must also be educated on how to recognize early signs of health issues and report them promptly. First aid should be part of a broader health and safety system that includes risk assessments, proper use of personal protective equipment (PPE) and clear communication channels during emergencies. Supervisors and team leaders should be trained to take charge during incidents and ensure that safety

protocols are followed. A strong first aid culture, supported by regular evaluation and improvement of emergency response strategies, is essential for safeguarding the health of sewage workers (**Philippe et al., 2022**).

Occupational health nurses play a vital role in preventing workplace hazards by promoting health education and implementing safety programs tailored to the specific needs of workers. They conduct health assessments, monitor the work environment for potential risks and provide training sessions on first aid, hygiene and disease prevention. For sewage workers, these nurses can offer invaluable support by identifying early signs of occupational illnesses and guiding workers on preventive measures. Their proactive approach helps reduce the incidence of work-related health problems and enhances overall employee well-being (**Elsayed, Elahmady, & Abd-Elrazek, 2024**).

In addition to prevention, occupational health nurses are instrumental in managing workplace emergencies and post-incident care. They assist in developing emergency response plans, ensure that first aid procedures are updated and provide follow-up care to workers recovering from injuries or

illnesses. Their expertise bridges the gap between workplace safety regulations and practical application in the field. By collaborating with management and safety officers, these nurses contribute to creating a safer and more responsive work environment, particularly in high-risk occupations like sewage maintenance (Tolera, 2023).

#### **Significance of study:**

According to International Labor Organization (ILO, 2023) 2.3 million workers die annually due to work-related injuries and diseases, nearly 6,300 workers die daily and wastewater management is among the high-risk sectors due to biological, chemical, and mechanical hazards.

Sewage workers in Egypt play a crucial role in maintaining public health and safety, despite this; they encounter numerous work-related health challenges. According to the Central Agency for Public Mobilization and Statistics (CAPMAS, 2024), there are approximately 50,000 sewage workers employed across the country, operating in around 600 sewage treatment plants and lifting stations, making them a large and significant workforce, despite their vital role, there is limited data available on their health status over the past decade.

Sewage workers have a duty to take reasonable care for their own health and safety at the workplace (WHSQ, 2021). For the purpose of taking care of themselves or helping others in the event of an accident. It is crucial for sewage workers to be aware of first aid practices. That can help in reducing mortality rates and preventing further harm or injury (Mohammed, Ahmed, Esmat, and Mona, 2022). It is also important that workers follow strict hygiene protocols and use personal protective equipment (PPE) such as gloves, boots, and masks. Regular vaccination and periodic health screenings are also recommended to reduce the likelihood of infection and to ensure early detection of occupational illnesses (Nassar, El-Masry, & El-Sayed, 2021).

Consequently, conducting this study can help the occupational health nurses develop targeted interventions to improve health awareness and first aid practices among sewage workers, which can significantly contribute to enhancing occupational health and safety practices, thereby reducing the risk of work-related injuries and illnesses.

**The aim of this study was to** -Assess the reported incidence of workplace injury and illness among sewage workers

To assess sewage workers knowledge and reported practices regarding preventive measures and first aid in work related medical emergencies.

### **Research question**

-What is the reported incidence of workplace injury and illness among sewage workers?

-What is sewage workers knowledge and reported practices regarding preventive measures and first aid in work related medical emergencies?

### **Subjects and Method**

**Study design:** - A descriptive exploratory design was used in this study.

**Setting:** - The study was conducted at four sewage stations; Elmadina, Qahafa, Dala, and Lotf Allah, all of which are affiliated to Fayoum drinking water and Sanitation **Sample size**

Workers were taken from the chosen stations Total number was 215 workers (193 study sample/22 pilot study). According to this powerful equation Company.

**Sampling technique:** A stratified random sampling technique was employed. The study population consisted of workers from four sewage stations affiliated with the Fayoum Drinking Water and Sanitation Company. The stratification was performed in two stages :First Stratum

→ Sewage Stations) : Four sewage stations were selected to represent the total population of sewage workers.

**Second Stratum (Study Subjects) :** From each of the selected stations, a proportionate number of workers were randomly chosen to make up the total of 215 participants. The distribution was as follows: Station 1: 57 workers, Station 2: 62 workers, Station 3: 50 workers, and Station 4: 46 workers

**Study tools:** Two tools were utilized for data collection the first Tool an interviewing questionnaire: developed by the researcher after reviewing the relevant and recent literature related to study topic. The tool was used to collect the data required and it was written in simple Arabic language and used for the face-to-face interview. The questionnaire was refilled by the researcher. Consisted of four parts: **Part 1** :Socio-demographic and occupational characteristics of sewage workers; including age, level of education, marital status, residence, employment years, working hours per day, and training received. It includes 12 closed ended questions from Q1-Q12.

**Part 2:** Health care services to sewage workers, availability and using of personal protective equipment. Composed of two parts (9Questions) from Q13- Q21.**Part 3:** was used to

assess the reported incidence of workplace injury; illness and medical history.composed of two parts (4Questions) from Q22-Q25.**Part 4:** Was used to assess sewage workers' knowledge about the occupational health hazards associated with sewage exposure, the preventive measures of occupational health risks, and the first aid measures in work related medical emergencies consist of three parts (29Q) fromQ26-Q54. The first part (8Q) from Q26-Q33 assess workers' knowledge about the occupational health hazards , the second part (7Q) from Q34-Q40 assess sewage workers' knowledge about the preventive measures of occupational health risks, and the third part (14Q) from Q41-Q54 to assess sewage workers' knowledge about the first aid measures in work related medical emergencies . **The second tool :** Sewage workers' self-reported practice checklist :This tool designed to assess sewage workers' self-reported occupational health risks preventive measures, and first aid practices in work-related medical emergencies.It was developed guided by: **(American Red Cross, 2021).**It classified into 2 main parts including; **The first part:** preventive measures for occupational health risks, consists of three subcategories, including basic hygienic practices (11 item), personal

habits ( 7 items), usage of Personal protective equipment ( 7 items).**The second part:** it consists of first aid practice for cardiac arrest (9items) asphyxiation (7 items), snake bite (7 items), wound (10 items), fracture (7 items), and drowning (4 items).

### **Methods**

The study was accomplished through the following steps:

#### **Administrative process**

**1- An official permission** for data collection was obtained from managers. Meetings and discussions were held between the researcher and the manager's personnel to make them aware of the aims and objectives of the research, as well as to get cooperation during the phases of the research.

#### **2-Ethical considerations**

Prior the pilot study, ethical approval obtained from Fayoum University Supreme Ethical Committee for Scientific Research Ethics. Workers' informed consent for participation was acquired after a full explanation of the aim of the study and its procedure. Workers were given the opportunity to refuse participation and were informed that they could withdraw at any time during data collection. They were also assured that any information obtained would be confidential and used for research purposes only. The investigator assured the public that all

collected data was kept anonymous and confidential.

### **3-Tools development**

The study tools were adopted by the researcher based on literatures review modified to suit the level of understanding of all subjects and was tested for translation by experts in English language.

### **4-Validity of tools.**

It was validated by a panel of five experts in community health nursing who revised the tool for clarity, relevance, comprehensiveness, understanding, and ease of implementation, and according to their opinion, minor modifications were applied.

### **5-Reliability of tools**

Cronbach Alpha Coefficient test was used to ascertain the reliability of tools after translation into Arabic language, the reliability was scaled as follows: <0-0.25 weak reliability, 0.25-0.75 moderate reliability, 0.75-<1 strong reliability and 1 is optimum. The reliability for this questionnaire was 0.851.

### **6-Pilot study**

A pilot study for tools of data collection was carried out on 10% (22 workers) to test whether they are clear, understandable, feasible, and applicable. For this study, the researcher randomly selected 22

workers to participate in the pilot testing of the questionnaire sheet and checklist. The simple modification was done based on pilot results, and the sample who shared in the pilot study was excluded from the study sample.

### **7-Data analysis**

After data were collected, they were coded and transferred into specially designed formats so as to be suitable for computer feeding. Following data entry, checking and verification processes were carried out to avoid any errors during data entry, frequency analysis, cross tabulation and manual revision were all used to detect any errors. The statistical package for social sciences (SPSS version 20) was utilized for both data presentation and statistical analysis of the results. The level of significance selected for this study was P equal to or less than 0.05.

### **Results**

**Table (1):** shows the distribution of the studied sewage workers according to their socio-demographic characteristics .it was found that 42.3% of them were from 26to less than 30 years age ranges with a mean of  $34.6 \pm 5.94$  years. 93.0% of them lived in rural areas, and 97.7% had insufficient income, respectively. it was noticed that 36.7% of them were

employed for 6-10 years and more , and 97.7 % of them were working for 8 hours and more per day, only 14% of studied participants attended training courses. While 26.6% attended training about first aid and 16.7% of the studied workers attended training about safety measures, in addition to 36.7% of them receiving training about handling hazardous materials.

**Figure (1):** Show that, (50.7%) of workers was illiterate, while minority (2.3%) of them were having higher education.

**Figure (2):** indicates that the majority (89.3%) of workers have experienced exposure to injuries in the workplace meanwhile (10.7%) haven't exposed.

**Table (2):** Indicate that 75.3% of workers recognizing occupational hazards as risks affecting their health and safety. Most of them (93.0%) acknowledge exposure to occupational hazards, including (87.4%) chemical, (80.5%) physical, (88.4%) biological and psychological hazards (79.1%). Physical hazards, such as heat (68.4%) and noise (34.4%), and mechanical hazards like slipping and falling (63.3%) are prevalent, while biological hazards include exposure to diseases from wastewater (50.2%) and viral infections (47.0%). Chemical hazards, such as lack of oxygen (40.9%) and exposure to toxic gases (32.1%), are

also recognized. as regard to psychological hazards 30.2% and 56.7% of them reported social stigma and neglect.

**Table (3):** Reveal that 65.1% of studied workers stated the signs and symptoms of emergencies that indicate the need for first aid, while 65.1% of them reported the equipment in a first aid bag and 58.6% of them reported the measures to keep the first aid box effective. However, only 9.3% of study participants reported the correct number of compressions per minute during cardiopulmonary resuscitation, and 7.0% cases where cardiopulmonary resuscitation is indicated.

**Figure (3):** Shows the total level of knowledge which indicates that 34.9% of the participants have satisfactory score level of knowledge, while 65.1% have unsatisfactory level of knowledge.

**Figure (4):** reveals the total level of practical application of the learned knowledge, with 33% of participants have implemented the acquired information into practice, while 67% have not done so.

**Table (4):** reveals significant associations between Total Knowledge level and various demographic factors. Higher age (especially 40 or more), higher

education levels (particularly university education), longer employment years (especially more than 15 years), and urban residence were correlated with a higher proportion of satisfactory knowledge ( $p < 0.001^*$  in each case). While marital status and working hours per day did not show significant associations, divorced individuals and those working fewer than 8 hours per day exhibited trends toward higher knowledge levels. Income level did not appear to significantly impact knowledge levels in this study ( $p = 0.808$ ).

**Table (5):** reveals significant associations between total practice score and various demographic characteristics. Findings include a higher proportion of individuals aged

40 or more, those with higher education levels (especially preparatory and university), and those with longer employment years (especially more than 15 years) reporting a higher rate of practice completion ( $p < 0.001^*$  in each case). Rural residence and employment years from 1-5 also showed significant associations with practice completion ( $p = 0.004^*$  and  $p < 0.001^*$ , respectively). Other factors such as marital status, level of income, and working hours per day did not demonstrate significant associations with Total Practice.

**Table (6):** shows that there is a strong positive correlation with highly statistically significant ( $r = 0.816$ ,  $p < 0.001^*$ ) between Total Knowledge and Total reported Practice score



**Table (1): Distribution of the studied workers according to their demographic characteristics (n =215)**

| Items                                   | No        | %    |
|-----------------------------------------|-----------|------|
| <b>Age by years</b>                     |           |      |
| 20- 25                                  | 20        | 9.3  |
| 26 -30                                  | 91        | 42.3 |
| 31 -40                                  | 74        | 34.4 |
| 40 or more                              | 30        | 14.0 |
| Mean±SD                                 | 34.6±5.94 |      |
| <b>Marital status</b>                   |           |      |
| Single                                  | 22        | 10.2 |
| Married                                 | 178       | 82.8 |
| Divorced                                | 10        | 4.7  |
| Widowed                                 | 5         | 2.3  |
| <b>Income per month</b>                 |           |      |
| Enough                                  | 5         | 2.3  |
| Not enough                              | 210       | 97.7 |
| <b>Residence</b>                        |           |      |
| Rural                                   | 200       | 93.0 |
| Urban                                   | 15        | 7.0  |
| <b>Employment Years</b>                 |           |      |
| From 1-5                                | 32        | 14.9 |
| from 6-10                               | 79        | 36.7 |
| from 11-15                              | 74        | 34.4 |
| more than 15                            | 30        | 14.0 |
| <b>Working hours per day</b>            |           |      |
| Less than 8 hours                       | 5         | 2.3  |
| from 8-12                               | 210       | 97.7 |
| <b>Attendance of training courses</b>   |           |      |
| Yes                                     | 30        | 14.  |
| No                                      | 185       | 86   |
| <b>Types of training courses (N=30)</b> |           |      |
| Safety measures                         | 5         | 16.7 |
| proper handling of hazardous materials  | 11        | 36.7 |
| First aid                               | 8         | 26.6 |

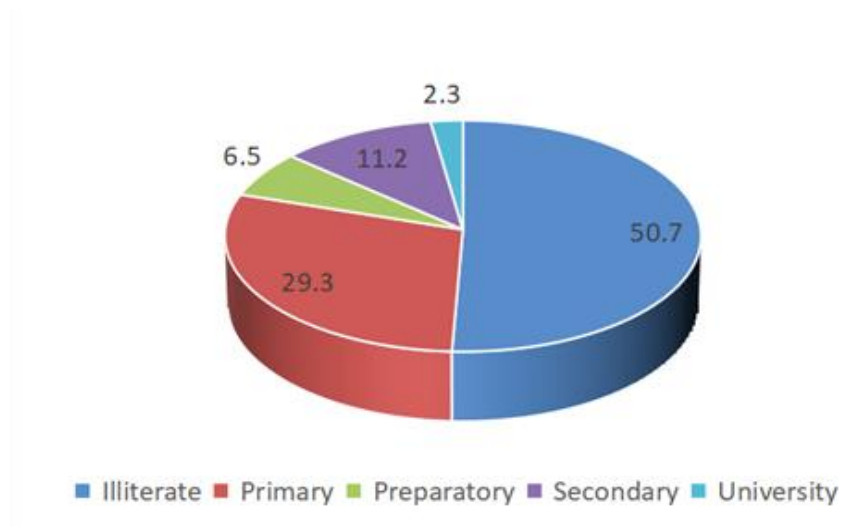


**Figure (1): Educational level among the study sample**

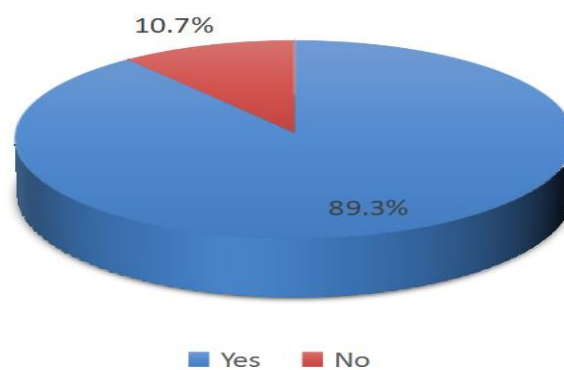


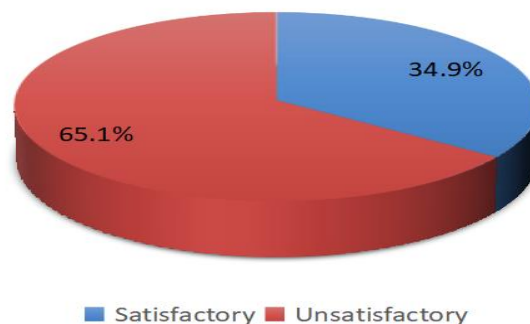
**Figure (2): Incidence of workplace injuries among studied sample**

**Table (2):** Distribution of the studied workers according to their knowledge regarding occupational health hazards (n =215).

| <b>Occupational health hazards</b>                     | <b>No</b> | <b>%</b> |
|--------------------------------------------------------|-----------|----------|
| <b>Definition</b>                                      |           |          |
| The risks that affect the health and safety of workers | 162       | 75.3     |
| When there are no risks at work environment            | 53        | 24.7     |
| <b>Exposure to occupational hazards</b>                |           |          |
| Yes                                                    | 200       | 93.0     |
| No                                                     | 15        | 7.0      |
| <b>Work-related risks.</b>                             |           |          |
| -Chemical hazards                                      | 188       | 87.4     |
| -Physical hazards                                      | 173       | 80.5     |
| -Biological hazards                                    | 190       | 88.4     |
| -Psychological hazards                                 | 170       | 79.1     |
| -Mechanical hazards                                    | 133       | 61.9     |
| <b>Physical hazards</b>                                |           |          |
| Heat                                                   | 147       | 68.4     |
| Humidity                                               | 128       | 59.5     |
| Noise                                                  | 74        | 34.4     |
| Electrocution                                          | 44        | 20.5     |
| Lack of vision                                         | 60        | 27.9     |
| Explosion                                              | 65        | 30.2     |
| <b>Mechanical hazards</b>                              |           |          |
| Slipping and fall                                      | 136       | 63.3     |
| Standing for a long period                             | 89        | 41.4     |
| Repeated bending                                       | 112       | 52.1     |
| Carrying heavy objects                                 | 113       | 52.6     |
| Falling of heavy objects on them                       | 80        | 37.2     |
| <b>Biological hazards</b>                              |           |          |
| diseases resulting from microbes in waste water        | 108       | 50.2     |
| Viral infection                                        | 101       | 47.0     |
| Eye and mouth to some droplets                         | 73        | 34.0     |
| Diseases as a result of some insects and rodents       | 68        | 31.6     |
| <b>Chemical hazards</b>                                |           |          |
| Lack of oxygen                                         | 88        | 40.9     |
| Toxic gases and asphyxiation                           | 69        | 32.1     |
| <b>Psychological hazards</b>                           |           |          |
| Social stigma                                          | 65        | 30.2     |
| Neglect                                                | 122       | 56.7     |
| not exposed to any psychological problem               | 98        | 45.6     |

**Table (3): Distribution of the studied workers according to their knowledge regarding first aid in emergency situations (n =215)**

| First aid                                                                  | Correct |      | Incorrect |      |
|----------------------------------------------------------------------------|---------|------|-----------|------|
|                                                                            | No      | %    | No        | %    |
| Definition of fist aid                                                     | 72      | 33.5 | 143       | 66.5 |
| The goals of first aid                                                     | 70      | 73.0 | 145       | 27.0 |
| Characteristics of first aid provider                                      | 65      | 30.2 | 150       | 69.8 |
| The principles of first aid                                                | 54      | 25.6 | 161       | 74.4 |
| Signs and symptoms of emergencies that require first aid                   | 92      | 65.1 | 123       | 34.9 |
| First aid kit equipment                                                    | 86      | 65.1 | 129       | 34.9 |
| Maintaining first aid box effectiveness                                    | 90      | 58.6 | 125       | 41.4 |
| Types of injuries that require first aid                                   | 71      | 65.6 | 144       | 34.4 |
| Cases in which cardiopulmonary resuscitation indicated                     | 65      | 7.0  | 150       | 93.0 |
| Correct number of compressions per minute in cardiopulmonary resuscitation | 80      | 9.3  | 135       | 90.7 |
| First aid measures in case of poisoning                                    | 100     | 4.7  | 115       | 95.3 |
| First aid measures in case of wounds and bleeding                          | 96      | 63.3 | 119       | 36.7 |
| The signs of fractures                                                     | 66      | 90.7 | 149       | 9.3  |
| First aid measures in case of fractures                                    | 79      | 18.1 | 136       | 81.9 |

**Figure (3):** Distribution of the studied workers according to their total level of knowledge regarding the occupational health hazards associated with sewage exposure, the preventive measures of occupational health risks, and the first aid measures in work related medical emergencies.

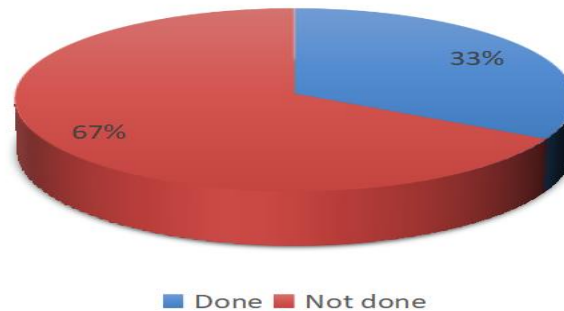


**Figure (4):** Distribution of the studied workers according to their total level of reported practice.

**Table (4): Relationships between socio demographic characteristics of the studied sewage workers and their total knowledge score about first aid in work related medical emergencies;(n=215)**

| socio demographic characteristics | Total knowledge score |       |                |      |                |         |
|-----------------------------------|-----------------------|-------|----------------|------|----------------|---------|
|                                   | Satisfactory          |       | Unsatisfactory |      | Chi-square     |         |
|                                   | N                     | %     | N              | %    | X <sup>2</sup> | P-value |
| <b>Age by years</b>               |                       |       |                |      |                |         |
| 20- 25                            | 7                     | 35.0  | 13             | 65.0 | 73.728         | <0.001* |
| 26 -30                            | 7                     | 7.7   | 84             | 92.3 |                |         |
| 31 -40                            | 34                    | 45.9  | 40             | 54.1 |                |         |
| 40 or more                        | 27                    | 90.0  | 3              | 10.0 |                |         |
| <b>Marital status</b>             |                       |       |                |      |                |         |
| Single                            | 3                     | 13.6  | 19             | 86.4 | 6.244          | 0.100   |
| Married                           | 66                    | 37.1  | 112            | 62.9 |                |         |
| Divorced                          | 5                     | 50.0  | 5              | 50.0 |                |         |
| Widowed                           | 1                     | 20.0  | 4              | 80.0 |                |         |
| <b>Level of education</b>         |                       |       |                |      |                |         |
| Illiterate                        | 8                     | 7.3   | 101            | 92.7 | 98.240         | <0.001* |
| Primary                           | 28                    | 44.4  | 35             | 55.6 |                |         |
| Preparatory                       | 13                    | 92.9  | 1              | 7.1  |                |         |
| Secondary                         | 21                    | 87.5  | 3              | 12.5 |                |         |
| University                        | 5                     | 100.0 | 0              | 0.0  |                |         |
| <b>Level of income</b>            |                       |       |                |      |                |         |
| Enough                            | 2                     | 40.0  | 3              | 60.0 | 0.059          | 0.808   |
| Not enough                        | 73                    | 34.8  | 137            | 65.2 |                |         |
| <b>Residence</b>                  |                       |       |                |      |                |         |
| Rural                             | 63                    | 31.5  | 137            | 68.5 | 14.450         | <0.001* |
| Urban                             | 12                    | 80.0  | 3              | 20.0 |                |         |

| Employment Years      |    |      |     |      |        |         |
|-----------------------|----|------|-----|------|--------|---------|
| From 1-5              | 9  | 28.1 | 23  | 71.9 | 60.999 | <0.001* |
| from 6-10             | 9  | 11.4 | 70  | 88.6 |        |         |
| from 11-15            | 30 | 40.5 | 44  | 59.5 |        |         |
| more than 15          | 27 | 90.0 | 3   | 10.0 |        |         |
| Working hours per day |    |      |     |      |        |         |
| Less than 8 hours     | 2  | 40.0 | 3   | 60.0 | 0.059  | 0.808   |
| from 8-12             | 73 | 34.8 | 137 | 65.2 |        |         |

**Table (5): Relation between socio demographic characteristics of the studied sewage workers and their total reported practice score about first aid in work related medical emergencies (n=215)**

| socio demographic characteristics | Total practice score |      |          |      |                |         |
|-----------------------------------|----------------------|------|----------|------|----------------|---------|
|                                   | Done                 |      | Not done |      | Chi-square     |         |
|                                   | N                    | %    | N        | %    | X <sup>2</sup> | P-value |
| <b>Age by years</b>               |                      |      |          |      |                |         |
| 20- 25                            | 9                    | 45.0 | 11       | 55.0 | 60.261         | <0.001* |
| 26 -30                            | 7                    | 7.7  | 84       | 92.3 |                |         |
| 31 -40                            | 31                   | 41.9 | 43       | 58.1 |                |         |
| 40 or more                        | 24                   | 80.0 | 6        | 20.0 |                |         |
| <b>Marital status</b>             |                      |      |          |      |                |         |
| Single                            | 4                    | 18.2 | 18       | 81.8 | 3.058          | 0.383   |
| Married                           | 62                   | 34.8 | 116      | 65.2 |                |         |
| Divorced                          | 4                    | 40.0 | 6        | 60.0 |                |         |
| Widowed                           | 1                    | 20.0 | 4        | 80.0 |                |         |
| <b>Level of education</b>         |                      |      |          |      |                |         |
| Illiterate                        | 7                    | 6.4  | 102      | 93.6 | 85.359         | <0.001* |
| Primary                           | 29                   | 46.0 | 34       | 54.0 |                |         |
| Preparatory                       | 12                   | 85.7 | 2        | 14.3 |                |         |
| Secondary                         | 19                   | 79.2 | 5        | 20.8 |                |         |
| University                        | 4                    | 80.0 | 1        | 20.0 |                |         |
| <b>Level of income</b>            |                      |      |          |      |                |         |
| Enough                            | 2                    | 40.0 | 3        | 60.0 | 0.113          | 0.737   |
| Not enough                        | 69                   | 32.9 | 141      | 67.1 |                |         |
| <b>Residence</b>                  |                      |      |          |      |                |         |
| Rural                             | 61                   | 30.5 | 139      | 69.5 | 8.252          | 0.004*  |
| Urban                             | 10                   | 66.7 | 5        | 33.3 |                |         |
| <b>Employment Years</b>           |                      |      |          |      |                |         |
| From 1-5                          | 11                   | 34.4 | 21       | 65.6 | 49.460         | <0.001* |
| from 6-10                         | 8                    | 10.1 | 71       | 89.9 |                |         |
| from 11-15                        | 28                   | 37.8 | 46       | 62.2 |                |         |
| more than 15                      | 24                   | 80.0 | 6        | 20.0 |                |         |
| <b>Working hours per day</b>      |                      |      |          |      |                |         |
| Less than 8 hours                 | 1                    | 20.0 | 4        | 80.0 | 0.393          | 0.531   |
| from 8-12                         | 70                   | 33.3 | 140      | 66.7 |                |         |

**Table (6):** Correlation between Total Knowledge and reported Practice scores of studied sewage workers.

| Predictor                     | Total Knowledge score |         |
|-------------------------------|-----------------------|---------|
|                               | R                     | P-value |
| Total reported practice score | 0.816                 | <0.001* |

### Discussion

The current study results revealed that, more than two fifths of the sewage workers were aged between 26 and 30 years, with an average age of  $34.6 \pm 5.94$  years (**Table 1**). This study is in disagreement with **Bassiouny and Madian (2023)**, who performed a study in El-Beheira Governorate, Egypt about “Prevalence and determinants of occupational health hazards among sewage workers in El-Beheira Governorate” and reported that the majority of the studied workers age ranged from 50 to 60 years and more than one third of them were in age group ranged from 30 to less than 40 years. From the investigator’s point of view, these results might be due to higher unemployment rates among youth in rural areas and different pattern for employment between regions.

The present study showed that, most of the workers were lived in rural areas, and nearly all of them reported that they

having insufficient income (**Table 1**). This finding is supported by **Sullivan and O'Neill (2019)**, in his study titled “Occupational health and safety in the wastewater industry: A review of first aid awareness and training” and found that the majority of sewage workers in rural areas, with a high proportion reporting insufficient income to meet their basic needs. From the researcher point of view, this may lead to limited access to health care services and educational opportunities in rural area, which can further exacerbate by poverty.

Conversely, a study conducted in Sweden by **Bergström, Bodin, Hagberg, Aronsson, & Josephson, (2017)** titled “Work-related symptoms among sewage workers: A nationwide survey in Sweden”, Found that sewage workers in urban areas were more likely to report better economic conditions compared to their rural counterparts. The study indicated that urban sewage workers had higher

salaries and better access to health care and social benefits. Additionally, the proportion of workers in rural areas was lower nearly half compared to the higher proportion (most of workers) observed in the present study.

In terms of working hours the present study revealed that, most of the workers' reported working eight or more hours a day (**Table 1**).these findings are consistent with findings from **Degavi et al. (2021)**, who reported prolonged work shifts as a common challenge faced by sanitation workers in Ethiopia, contrary to these findings, **Amarille and Balomaga (2021)** reported that sanitation workers in the Philippines had more balanced working conditions.

The finding of the present study revealed that half of the studied workers are illiterate (**Figure 1**). This finding is supported by a study conducted in Egypt by **Mokhtar et al. (2022)**, who stated that a significant portion of sewage workers had minimal formal education, with nearly half reporting illiteracy or only a basic level of schooling. From the researcher point of view Inadequate literacy skills can make it difficult for workers to follow written instructions, participate in training programs effectively, and understand the risks associated with handling hazardous materials.

The findings of the present study indicate that training opportunities are limited, with the majority of workers had not attended any training courses (**Table 1**). This aligns with the study conducted by **Addo and Agba (2024)**, and highlighted a critical lack of training in occupational health and safety among sewage workers, also a significant proportion of workers in hazardous occupations, including sewage management, had minimal exposure to relevant safety and emergency response training, such as first aid, safety measures, and hazardous materials handling. These results contrasted with a study conducted in South Korea by, **Lee, Kim, and Park (2018)** ,titled “Training and safety awareness among sewage workers in South Korea” and observed that training opportunities for sewage workers were more widely available, with the majority of workers receiving at least some form of safety training. According to their findings, more than two fifth of workers received first aid training, safety measures, and half of them trained on hazardous materials handling. This can be explained by the researcher as in such regions; health and safety training are often mandated by law or provided through workplace safety programs.



Regarding the reported incidence of workplace injuries, the present study indicated that the majority of workers have experienced exposure to injuries in the workplace (**Figure 2**); these findings disagreed with those of **Tolera, Tadesse, Abebe, and Gebrehiwot, (2024)** who reported that more than one third of sanitation workers had prevalence of occupational injuries.

The current study showed that, three quarters of studied workers recognize occupational hazards as risks affecting their health and safety (**Table 3**). this study was disagreed with a study carried out by **Hassan and Abad-Elzahr, (2018)**, titled “Workers' knowledge and practice about occupational hazards and safety measures in bakeries at Assuit city, Egypt” and discovered that majority of workers had incorrect answers regarding definition of occupational health, personal protective equipment for prevention of occupational hazards. Most of the workers acknowledge exposure to various hazards, including more than three quarters exposed to chemical, physical, biological, and psychological hazards (**Table 3**). These findings are in agreement with **Abdelhameed and Abdelaty (2023)**, who carried out a study about “Occupational hazards among sewage

workers in El-Beheira Governorate”, and stated that more than half of workers in waste water environments were exposed to hazards, including chemical, biological, physical, and psychological risks. From the researcher point of view the high level of exposure to occupational health hazards due to non-adherence to the use of personal protective equipment.

The current study revealed that two thirds of workers understand the signs and symptoms of emergencies needing first aid, familiar with first aid kit equipment, and more than half familiar with its maintenance, However, less than tenth of study participants reported the correct number of compressions per minute during cardiopulmonary resuscitation (**Table 4**). These results of the current study agreed with a study conducted by **Alharthy, Alhossan, and Alghamdi (2020)** in Saudi Arabia about” First aid knowledge and preparedness among workers in high-risk industries in Saudi Arabia” and found a similar gap in first aid knowledge and preparedness among workers, observed that the majority of workers were aware of the importance of first aid and had access to first aid kits, and a significant portion lacked sufficient training in how to effectively use the equipment or handle medical emergencies.

The current study results revealed that more than one third of workers had good total knowledge level and nearly two thirds had poor knowledge (**Figure 3**). These findings in some extent in the same line with a study conducted by **Hossain et al. (2023)** among sewage and sanitation workers in urban Bangladesh found that two fifths of participants had adequate knowledge. Also the study showed that the majority of workers lacked awareness of basic hygiene practices, such as proper hand washing duration and the need for protective gear when handling wastewater. These findings disagreed with **Sharma, Gupta, and Verma, (2022)** her study titled “Knowledge, attitudes, and practices regarding occupational health risks among sewage workers” revealed that over two thirds of sewage workers demonstrated satisfactory knowledge about personal protective equipment (PPE), hygiene practices.

The current study findings revealed that one-third of sewage workers had adequate level of total practice, while two-thirds had inadequate practice (**Figure 4**). This aligns with previous research by **Ahmed, Elahmady, and Abd-Elrazek, (2024)**, who found that nearly two-thirds of workers had unsatisfactory total practices, while over one-third achieved satisfactory

levels of practice regarding first aid and protective measures.

the current study revealed significant association between Total Knowledge level and various demographic factors, higher age (especially 40 or more), higher education levels (particularly university education), longer employment years (especially more than 15 years), and urban residence were correlated with a higher proportion of satisfactory knowledge (**Table 4**). These findings are similar to those of **Thompson, Johnson, and Williams, (2017)**, who found that workers with more years of experience (particularly those employed for over 15 years) demonstrated better first aid knowledge. Additionally, individuals with higher education levels, especially those with university degrees, were found to have better understanding and adherence to first aid practices. Similarly, urban residents might have more access to training programs and resources compared to those in rural areas, confirming the findings from the current study, similarly findings of **Mokhtar et al. (2022)**, who found that the higher age (especially 40 or more), higher education levels (particularly university education), longer employment years (especially more than 15 years), and urban residence are

significantly associated with higher knowledge levels.

The present study reveals significant associations between total practice score and various demographic characteristics. including a higher proportion of individuals aged 40 or more, those with higher education levels (especially preparatory and university), and those with longer employment years (especially more than 15 years) reporting a higher rate of practice completion (**Table 5**). This is consistent with research by **Hall, Smith, and Brown (2017)**, who found that older workers, who have been exposed to workplace safety protocols for a longer period, have better confidence and experience in implementing first aid, and possess better critical thinking and problem-solving skills. Contrariwise a study by **Garcia, Lopez, and Torres (2018)** and **Mitchell, Lee, and Carter (2020)** argues that although older workers (40 or more) and those with higher education levels might possess more theoretical knowledge, this does not necessarily correlate with effective first aid application in emergency situations. For instance, older workers may be less likely to perform physically demanding tasks or act quickly, while urban residents may have greater access to training resources.

Concerning correlation between Total Knowledge and reported Practice scores of studied sewage workers. This study shows that there is a strong positive correlation with highly statistically significant ( $r = 0.816$ ,  $p < 0.001^*$ ) between Total knowledge and Total reported Practice scores (**Table 6**). Which go in the same line with a study by **Al-Rashidi (2025)** who assessed the effectiveness of a training program on first aid knowledge and practices among students of physical education and sports in Kuwait. Their study found a moderate positive correlation ( $r = 0.543$ ,  $p < 0.01$ ) between posttest levels of knowledge and practice regarding selected first aid measures.

**Conclusion:** The study concluded that sewage workers had low overall knowledge and unsatisfactory practices regarding first aid in work-related emergencies. Furthermore, a high incidence of workplace injuries was observed among sewage workers.

**Recommendation:** Targeted training programs in occupational health and first aid to boost sewage workers' ability to respond effectively to work-related medical emergencies.

### References

- Abdelhameed, D. A. A., & Abdelaty, M. M. (2023).** *Occupational hazards among sewage workers in El-Beheira*

- Governorate. *Delta Scientific Nursing Journal*, 6(2), 227–244. <https://doi.org/10.21608/dsnj.2023.337872>
- Addo, D. E., & Agba, P. U. (2024).** Awareness strategies and attitude towards sewage disposal among the inhabitants of calabar education zone in cross rive state, nigeria.
- Ahmed, E., S., Elahmady, S., A., & Abd-Elrazek, M., A. (2024).** Occupational Health Hazards among Workers in Sewage Treatment Plants. *Journal of Nursing Science Benha University*, 5(1), 719-735.
- Alharthy, S., Alhossan, A., & Alghamdi, S. (2020).** First aid knowledge and preparedness among workers in high-risk industries in Saudi Arabia. *Journal of Occupational Safety and Health*, 18(1), 74-81.
- Al-Rashidi, M. S. N. (2025).** Effectiveness of a training program on knowledge acquisition and practicing some first aid skills for students of physical education and sports in Kuwait. *International Science Journal of Physical Education and Sports*, 13(1), 25–37. <https://doi.org/10.21608/isjpes.2024.269984.1097>
- Amarille, M., & Balomaga, C. (2021).** Awareness and Practices on Domestic Wastewater Sanitation of Select Coastal Barangay in Surigao City, Philippines. *Journal of Ecosystem Science and Eco-Governance*, 3(1), 14-24.
- Amereh, F., Negahban-Azar, M., Isazadeh, S., Dabiri, H., Masihi, N., Jahangiri-Rad, M., & Rafiee, M. (2021).** Sewage systems surveillance for SARS-CoV-2: identification of knowledge gaps, emerging threats and future research needs. *Pathogens*, 10(8), 946.
- Bassiouny, R., & Madian, A. A. (2023).** Prevalence and determinants of occupational health hazards among sewage workers in El-Beheira Governorate. *Journal of Nursing Science and Health*, 1(2), 66–84. <https://doi.org/10.21608/dsnj.2023.337872>
- Bergström, G., Bodin, L., Hagberg, J., Aronsson, G., & Josephson, M. (2017).** Work-related symptoms among sewage workers: A nationwide survey in Sweden. *Occupational and Environmental Medicine*, 74(6), 436–443. <https://doi.org/10.1136/oemed-2016-104075>
- Central Agency for Public Mobilization and Statistics. (2024).** Annual bulletin for water purification and sanitation statistics year 2022/2023. <https://www.censusinfo.capmas.gov.eg/Metadata-en-v4.2/index.php/catalog/675>

- Degavi, G., Debbarma, S., Adola, S. G., Safayi, B. L., Gameda, U., & Utura, T. (2021).** Occupational hazards and its relation with health-seeking and practicing behaviors among sanitary workers in Southern, Ethiopia. *International Journal of Africa Nursing Sciences*, 15, 100339.
- Elsayed, S., Elahmady, A., & Abdelrazek, A. (2024).** Occupational Health Hazards among Workers in Sewage Treatment Plants. *Journal of Nursing Science Benha University*, 5(1), 719-735.
- Garcia, R., Lopez, M., & Torres, J. (2018).** Age, education, and first aid performance: Disparities between theoretical knowledge and practical application in emergency response. *Journal of Safety Research*, 66, 112–125. <https://doi.org/10.1016/j.jsr.2018.05.003>
- Hall, E., Smith, A., & Brown, L. (2017).** The relationship between age, work experience, and first aid proficiency among industrial workers. *Safety Science*, 95, 188–197. <https://doi.org/10.1016/j.ssci.2017.02.009>
- Hassan, A. M., & Abad-Elzaher, M. M. (2018).** Workers' knowledge and practice about occupational hazards and safety measures in bakeries at Assiut city, Egypt. *Egyptian Journal of Occupational Medicine*, 42(2), 181–196.
- Hossain, M. A., Sharior, F., Shoaib, D. M., Hasan, M., Tabassum, K. F., Ferdous, S., ... & Ahmed, T. (2023).** Hygiene knowledge and practices and determinants of occupational safety among waste and sanitation workers in Bangladesh during the COVID-19 pandemic. *Hygiene and Environmental Health Advances*, 4, 100022. <https://doi.org/10.1016/j.heha.2022.10.002>
- International Labour Organization. (2023).** nearly 3 million people die of work-related accidents and diseases. Retrieved from <https://www.ilo.org/resource/news/nearly-3-million-people-die-work-related-accidents-and-diseases>
- Lee, J., Kim, H., & Park, S. (2018).** Training and safety awareness among sewage workers in South Korea. *Safety and Health at Work*, 9(3), 312–318. <https://doi.org/10.1016/j.shaw.2017.11.002>
- Mitchell, K., Lee, S., & Carter, D. (2020).** Barriers to effective first aid response: Age, physical ability, and urban-rural disparities in emergency preparedness. *International Journal of Occupational Safety and Ergonomics*, 26(3), 456–

470. <https://doi.org/10.1080/10803548.2018.1498971>
- Mohammed, E., Ahmed, H., Esmat, O., & Mona ., A. E. (2022):** Health Awareness Regarding Occupational Hazards among Workers in Sewage Treatment Plant. *Egyptian Journal of Health Care*, 2022 EJHC Vol 13. No.2
- Mokhtar, A. M. B. A., Makhtar, M. M. Z., & Mokhtar, A. M. A. (2022).** Waste and health: sewage sludge and its hazard to human. *Waste Management, Processing and Valorisation*, 135-158.
- Muzaini, K., Yasin, S. M., Ismail, Z., & Ishak, A. R. (2021).** Systematic review of potential occupational respiratory hazards exposure among sewage workers. *Frontiers in Public Health*, 9, 646790.
- Nassar, M. S., El-Masry, S. A., & El-Sayed, M. A. (2021).** Health disorders among Egyptian municipal solid waste workers and assessment of their knowledge, attitude, and practice towards the hazardous exposure. *Environmental Science and Pollution Research*, 28(30), 30993–31002. <https://doi.org/10.1007/s11356-021-12856-3>
- Noh, Y., Boor, B. E., Shannahan, J. H., Troy, C. D., Jafvert, C. T., & Whelton, A. J. (2022).** Emergency responder and public health considerations for plastic sewer lining chemical waste exposures in indoor environments. *Journal of hazardous materials*, 422, 126832.
- Philippe, S., Hueso, A., Kafuria, G., Sow, J., Kambou, H. B., Akosu, W., & Beensi, L. (2022).** Challenges facing sanitation workers in Africa: a four-country study. *Water*, 14(22), 3733.
- Saraswaty, A., & Fadli, Z. (2024).** The Impact of Occupational Health and Safety (Ohs) Policies On Employees' psychological Well-Being In Soppeng City. *Publicus: Jurnal Administrasi Publik*, 2(2), 315-325.
- Sharma, A., Gupta, A. K., & Verma, R. K. (2022).** Knowledge, attitudes, and practices regarding occupational health risks among sewage workers: A cross-sectional study. *Journal of Environmental and Public Health*, 2022, Article 1234567
- Sullivan, K., & O'Neill, P. (2019).** Occupational health and safety in the wastewater industry: A review of first aid awareness and training. *Safety and Health at Work*, 10(2), 234-241. <https://doi.org/10.1016/j.shaw.2018.11.004>
- Thompson, S., Johnson, M., & Williams, R. (2017).** The impact of work experience and education on first aid knowledge and safety compliance among industrial workers. *Journal of Occupational Health and Safety*, 35(4), 521–536.

**Tolera, G., Tadesse, T., Abebe, W., & Gebrehiwot, M. (2024).** Global prevalence of occupational injuries among sanitation workers: A systematic review and meta-analysis. *Frontiers in Public Health*, 12, 1425904.

<https://doi.org/10.3389/fpubh.2024.1425904>

**Tolera, S. T. (2023).** Occupational Diseases among Sanitary Workers in Worldwide: Systematic Review and meta-analysis. *Frontiers in Public Health*, 12, 1425904.

<https://doi.org/10.3389/fpubh.2024.1425904>.

**Workplace health and safety queensland (2021)** .First aid in the workplace Code of Practice .Available at

<https://www.worksafe.qld.gov.au>. Accessed on 25-3-2023. <https://www.worksafe.qld.gov.au>

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## Awareness of Homeless Youth regarding Personal Hygiene in Fayoum Governorate

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### Abstract

**Background:** Homeless youth suffer from a strangely great number of stressful life events in their lives, greatly during their conversion to homelessness. The homeless youth have enormous health inequities causing a higher incidence of several medical health diseases and risks. **The aim of this study:** Awareness of homeless youth regarding personal hygiene in Fayoum Governorate. **Study Design:** A cross-sectional informative research strategy was used to achieve the goal of this study. **Setting:** The study was performed at a social care shelter in fayoum governorate. **Subjects:** A Convenience sample consisted of 60 homeless youth. **Tool:** Organized Interviewing Questionnaire: Advanced by the researcher after revising the relevant research works Survey to collect the data and consists of 4<sup>th</sup> part, **Part I:** Demographic characteristics of street youth, **part II:** Homeless youth knowledge regarding personal and menstrual hygiene, **part III:** Homeless youth attitude regarding personal hygiene. **Part IV:** Homeless youth self-reported practice regarding personal and menstrual hygiene. **Results:** Revealed that, 50% aged between 12 and 15 years. 76.9% of female participants had poor knowledge regarding menstrual hygiene. 66.7% of participants had a negative attitude. 80.0% of participants reported unsatisfactory practices. **Conclusion:** The present study proved that, there were statistically important positive correlations between the overall knowledge, overall attitude and whole reported practice scores toward personal hygiene. **Recommendation:** Applying health education programs regarding personal hygiene among homeless youth in Fayoum Governorate. **Keywords:** Awareness, Homelessness, Personal Hygiene, Youth.



**Introduction:**

There is no universally limited acceptable definition of homelessness through the world, vary between agencies. Homelessness means lacking housing, comprising an individual whose main habitation during the night is a communal or remote institution such as a shelter that offers short-term living housings and an individual live in a temporary home or being incapable to sustain their housing condition and compulsory to remain with a group of peers (**Colburn & Aldern, 2022**).

**Homelessness** means to live in environments that fall below society standards and values. This meaning differentiates among major homelessness (inhospitable factual homelessness), lesser homelessness (inhabiting in numerous shapes of short-lived housing including peers, relatives, alternative lodging and communal homes) and tertiary homelessness (livelihood in a hotel or lodging house on a long term basis) (**Johnson et al., 2020**).

**Youth** is the period of lifespan between childhood and youth or maturity. Its meanings of a certain age range are diverse, as youth is not definite chronologically as a phase that can be connected to exact age varieties. The English terms of youth, teenage, and young people are exchanged through worldwide, often meaning the same thing. Youth involves early years and the period of life, which is neither childhood nor adulthood, but slightly anywhere in between. The span also occasionally

runs from the ages of 14 to 21 (**Gunter & Holford, 2023**).

**Personal hygiene** means the exercises and measures that avoid the spread of contagious illnesses and preserve the bodily, intellectual and emotional health of people. It consists of a variety of regular practices, containing hand wash, showering, dental care, and hair hygiene, nail brushing and wearing sanitary dresses. By following to correct personal hygiene habits, we can keep others and ourselves from infections, confirming harmless and well surroundings for everybody (**Sims et al., 2022**).

Community health nurses go in to the profession to improve the health of homeless youth. This is fundamental to the core of nursing. “Nursing includes the advertising of health, inhibition of infection, and maintenance of physically diseased persons, psychologically ill, and incapacitated persons of all ages, in all health caution and other public institutions (**Demarco & Healey, 2023**). Through assessment of homeless youth awareness regarding personal hygiene, designing a health teaching program to recover their information, attitude and practice, implementing teaching programs and evaluating its effectiveness to induce the change can prevent many actual or potential health problems among this vulnerable group (**Arabbadvi, Khoshnood, Foroughameri, & Mazallahi, 2023**).

**Significance of the study:**

Homelessness is related with negative outcomes among adolescents comprising deprived poor emotional and

bodily wellbeing, huge risky health actions, poor intellectual and educational capacities, alternative occasion stays and hospitalizations .Also, associated with discrimination, stigma, substance abuse, drug use disorders, mental health issues, early pregnancy, early deaths and violence **(Grattan et al., 2022)**.

Homeless youth experience significant difficulties in achieving and continuing a well regime. Homeless youth experience negative health impacts with the incidence of intellectual health problems, alcohol and drug abuse, addiction, and infectious illnesses greater than in the overall people. Opioid poisoning, heart dysfunction, contagious illnesses and outward sources of health problems, such as crashes, often lead to the greater degree of death among

#### **Aim of study:**

The aim of this study was to evaluate alertness of homeless youth regarding personal hygiene through the following objectives:

- 1- Assessing knowledge of homeless youth regarding personal and menstrual hygiene.
- 2- Appraising attitude of homeless youth regarding personal and menstrual hygiene.
- 3- Assessing practices of homeless youth regarding personal and menstrual hygiene.

#### **Subjects and Methods:**

##### **I. Technical Item:**

##### **Research design:**

A cross-sectional expressive study plan was consumed.

##### **Setting:**

homeless residents **(South, Rodgers, Wright, Whitehead, & Sowden, 2022)**. Destabilized immune systems occurred among all persons suffering street livelihood, especially amongst homeless youth **(Anthonj, Poague, Fleming, & Stanglow, 2024)**.

Community health nurses have a unique role in providing care and supporting homeless youth. All-inclusive nursing valuations must join the full series of health and societal maintenance necessities, and devices of care should imitate involvements and cares needed. Also Nurses must provide the essential psychological cares through therapy and emotionally based therapy approaches particularly for this cluster **(Kopanitsa et al., 2019)**.

The study work was carried out at Social care shelter in Fayoum Governorate that provide educational, social, promotion, recreational, living and health services for both sex of homeless children up to 21 years old. The government and donation fund the shelter. Its building consists of two floors: The upper floor includes two sections boys and girls sections, which consist of 8 rooms (isolation room, study room, bed room, dressing room, restaurant, TV room, WC room and library). The lower section includes kitchen, laundry room, social specialist office, health care room, accounts and manager room.

**Type of Sample:** Convenience sample used in the study.

##### **Tool for data collection:**

**Structured Questionnaire advanced by the researcher contained four parts:**

**Part I - Demographic characteristics of homeless youth:** this part composed of (9) closed – end questions such as gender, age, newest level of schooling, periods staying at the streets, residence, communication with relatives or families, number of family members, causes of destitution and person is being responsible for providing care for homeless youth.

**Part II – Homeless youth knowledge regarding personal hygiene: this part divided into two categories as the following:**

- This part constructed to (8) closed – end questions involved street adolescents information concerning personal hygiene like personal hygiene worth, importance, kinds, Components, Basic equipment, factors negatively impact personal hygiene, negative effects of poor personal hygiene and correct methods of personal hygiene.

**Scoring system for homeless youth knowledge regarding personal hygiene**

Related to homeless youth knowledge regarding personal hygiene Its questions were noted into Yes with 2 score and No with 0 score `The total grades were ranged from 0 – 16 and categorized as the next recording: poor grade = less than 50% (less than 8 score), fair grade= 50-70 % (8 -11 score) and good grade = more than 70% (> 11 score).

**B-** This part included (14) closed – end questions involved with street youth

knowledge concerning menstrual hygiene like: definition of Menstruation, The normal age for menarche, Duration of regular menses, premenstrual syndrome, ways of relieving pain, Physiology of menstruation, sources of information, menstrual product, frequency of changing pad, ways of disinfecting and disposing the soiled pads, dangers of poor menstrual hygiene, importance and correct ways of caring the sensitive area.

**Scoring system for homeless youth knowledge regarding menstrual hygiene**

It included questions connected to Menstrual sanitation information of homeless female adolescents: its queries were verified into Yes, correct answer with grade 2, incorrect answer and do not distinguish with grade 0 and the total grade was accumulated and categorized as the subsequent: lowly = fewer than 50%, average = 50-70 % and well = greater than 70%.

**Part III - Homeless youth attitude regarding personal hygiene:** this part composed of (13) closed – end questions such as: if There is difference between personal and general hygiene requirement, importance of washing hands with soap, using of tooth, importance of brushing teeth correctly and genital care, if towel is a personal hygiene instruments, harm effect of nail biting and poor personal hygiene, proper cough technique, changing clothes periodically, hygiene tools are not appropriate to share, following up the dentist and ophthalmologist.

**Scoring system for attitude**

A three – point likert scale was allocated to all questions (agree, neutral, disagree) hinted from one to three, as: (agree = 3, Neutral = 2, disagree = 1) with 39 total score that summed up and divided into two categories as the following:

- **Negative attitude < 60%**
- **Positive attitude ≥ 60%**

**Part IV: Homeless youth personal hygienic self-reported practices:** this part divided into two categories as the following:

**A-** This part consisted of (18) closed – end questions concerned with homeless youth personal hygienic practice (self – reported) such as: washing hands regularly, timing, materials, washing face regularly, performing correct technique, washing face regularly, having special towel, teeth brushing timing and correctly, doing gurgling, visiting dentist, showering number and its location, genital care, menstrual hygiene, care of foot, nail, ear, eye and hair, changing underwear, laundry frequency and methods, wound cleaning and avoiding sharing personal tools.

**Scoring system for homeless youth self-reported practices**

Related to homeless youth Self-Reported Practices regarding Personal hygiene: its questions were logged into Yes or right response with 2 score and No or improper response with 0 score and the total scores were collected and categorized as the next: Unsatisfactory = lower than 50% (17 or less) and satisfactory= equal or greater than 50% (≥ 17).

**B:** - This portion constructed of (10) closed – end questions concerned with homeless girls' self-reported practices regarding menstrual hygiene such as: type of absorbents used, Pad\ cloth changing timings, reusing the cloth, methods of disposal of soiled pads, performing menstrual hygiene, frequency of perineal care, shaving pubic hair, changing under wear periodically and practices for relieving pain and menstrual cramps.

**Scoring system for Menstrual Hygienic Self-Reported Practices:**

It included questions related to Menstrual hygienic Practices (self-reported practices) of homeless female adolescents: its inquiries were coded into Yes, right reply with score 2, No and wrong reply with score 0 and the full grades was extended from 0 – 20 and organized as the following: unsatisfactory= less than 50% and satisfactory= equal or more than 50%.

**Validity:**

The data collection tools were reviewed by a panel of three experts community health nursing field to test the face and content validity. Each of the experts was asked to examine tools for content coverage, relevance, understanding, comprehensiveness, wording, length, format and overall appearance. Modification was done based on the comments.

**Reliability:**

| Tool                             | Number of items | Cronbach's $\alpha$ | 95 % CI |       |
|----------------------------------|-----------------|---------------------|---------|-------|
|                                  |                 |                     | Upper   | Lower |
| Knowledge about Personal Hygiene | 8               | 0.822               | 0.755   | 0.892 |
| Menstrual-hygiene knowledge      | 14              | 0.806               | 0.725   | 0.879 |
| Attitude toward Personal Hygiene | 13              | 0.797               | 0.713   | 0.873 |
| Personal-hygiene practices       | 18              | 0.889               | 0.848   | 0.923 |
| Menstrual-hygiene practices      | 10              | 0.852               | 0.772   | 0.923 |
| All items                        | 63              | 0.923               | 0.898   | 0.956 |

**Ethical consideration:**

An official permission to conduct the proposed study was obtained from the Systematic Investigation Ethics Board Nursing Faculty, Helwan University before starting the study. The researcher clarified the objective of the study to the nurses included in the study to gain their confidence and trust. As well, the study environment motivates productive learning and the nurses announced their approval to participate.

**II. Operational Item:****Pilot Study:**

Trial study work was carried out on 10% from the research sample (6 homeless youth) and was excluded from the total sample to test the applicability, precision and the effectiveness of the instruments. There were no great modifications created after the trial study. The pilot displayed very elevated levels of consistency.

**Field work:**

- Before conducting the study, authorization was gotten from managers of the health care shelter.
- At the start, the researcher announced her- self and describes the goal of study to homeless youth to increase their sureness and confidence to prove them to contribute in the research then the oral agreement was gotten from them.
- Real study effort was passed out in the time from December 2023 years up to June 2024 years.
- The investigator gathered information throughout the two day per week (Sunday and Wednesday), visiting from 3 pm-6 pm. The questionnaires were disseminated on homeless youth and finished by the investigator calculation.
- All research sample complete questionnaire page by themselves excluding illiterate homeless youth by researcher The researcher assess about (2-3) homeless youth in a day to fulfill survey form, spent 30 minutes with each one to fulfill the survey form.

**Administrative item:**

After description of the study goal and purposes, an informed consent was gained from the Dean of college of Nursing, Helwan University of higher education and manager of social care shelter in Fayoum Governorate ordering for collaboration and agreement to

perform the research work.

#### IV. Statistical analysis:

Upon conclusion of data gathering, data was calculated and evaluated using statistical Bundle for the Societal Discipline (SPSS), version 24 for examination. The P value was set at 0.05. Descriptive statistics analyses as numbers, ratio, mean  $\pm$  standard deviation ( $\pm$  SD), were used to illustrate the grades. Suitable inferential statistics such as —F|| test or —t|| test was used as well. Chai-square test ( $\chi^2$ ) was taken for appraisal between qualitative variables. Spear mean association measures the strong point and the track of association between two graded variables. Regression analysis was hand-me-down after measuring for normal distribution, familiarity, and homoscedasticity and examination of variance for the complete regression models were finished.

#### Significance of results:

- When  $P > 0.05$ , it is statistically insignificant difference.
- When  $P < 0.05$ , it is statistically significant difference.

#### Results:

**Table (1):** shows that, the demographic data of the study group (n=60) revealed a predominantly young population, with 50% aged between 12 and 15 years. The group consisted of 56.7% males and 43.3% females. Educationally, 48.3% could not read and write, while 10% had secondary education. 38.3% have lived at the shelter for 3-5 years, and 68.3%

came from urban areas. Family presence was almost evenly split, with 53.3% having a present relationship with family. A significant 81.7% came from families with five or more members. Common reasons for homelessness included family poverty (76.7%), death of a parent (38.3%), and divorce (26.7%). Maltreatment and drug abuse are less reported but still notable. 75% take personal responsibility for their care  
**Table (2):** illustrates that, 80.0% of participants scored poorly. while those with good knowledge scores were 6.7% . The fair score category was 13.3%.

**Table (3):** shows that, 76.9% of female participants had poor knowledge regarding menstrual hygiene, while 7.7% of those participants had good knowledge.

**Table (4):** clarifies that, 66.7% of participants had a negative attitude, while those with an indifferent attitude were 25.0% and participants with a positive attitude surged were 8.3%. The  
**Table (5):** illustrates that, 80.0% of participants reported unsatisfactory practices and those with satisfactory practices was 20.0%.

**Table (6):** displays that, 84.6% of participants had unsatisfactory Menstrual Hygienic Self-Reported Practices scores. Conversely, satisfactory knowledge scores were 15.4%.

**Table 1: Frequency Distribution of Homeless Youth Demographic Data (n=60)**

| Items                                 |                                                | Study Group<br>(n=60) |      |
|---------------------------------------|------------------------------------------------|-----------------------|------|
|                                       |                                                | N                     | %    |
| Age                                   | Mean $\pm$ SD                                  | 15.21 $\pm$ 3.68      |      |
|                                       | Range                                          | 12 – 20               |      |
|                                       | 12 : < 15                                      | 30                    | 50.0 |
|                                       | $\geq 15$ : < 17                               | 19                    | 31.7 |
|                                       | $\geq 17$                                      | 11                    | 18.3 |
| sex                                   | Male                                           | 34                    | 56.7 |
|                                       | Female                                         | 26                    | 43.3 |
| Level of Education                    | Not read and write                             | 29                    | 48.3 |
|                                       | Read and write                                 | 14                    | 23.3 |
|                                       | Basic Education                                | 11                    | 18.3 |
|                                       | Secondary education                            | 6                     | 10.0 |
| Years living at the shelter           | < 1 year                                       | 8                     | 13.3 |
|                                       | 1-2 years                                      | 20                    | 33.3 |
|                                       | 3-5 years                                      | 23                    | 38.3 |
|                                       | + 5 years                                      | 9                     | 15.0 |
| Residence                             | Rural                                          | 19                    | 31.7 |
|                                       | Urban                                          | 41                    | 68.3 |
| Relation with family                  | Present                                        | 32                    | 53.3 |
|                                       | Not Present                                    | 28                    | 46.7 |
| No. Family members                    | 3 members                                      | 4                     | 6.7  |
|                                       | 4-5 members                                    | 7                     | 11.7 |
|                                       | $\geq 5$ member                                | 49                    | 81.7 |
| Reasons of homelessness               | Death of parent                                | 23                    | 38.3 |
|                                       | Divorce                                        | 16                    | 26.7 |
|                                       | Family poverty                                 | 46                    | 76.7 |
|                                       | Peer pressure                                  | 15                    | 25.0 |
|                                       | Maltreatment (physical abuse)                  | 14                    | 23.3 |
|                                       | Maltreatment (sexual abuse)                    | 2                     | 3.3  |
| Who is being responsible of your care | Drug abuse                                     | 4                     | 6.7  |
|                                       | I                                              | 45                    | 75.0 |
|                                       | person responsible for taking care of the home | 12                    | 20.0 |
|                                       | family member                                  | 3                     | 5.0  |

**Table 2: Frequency Distribution of homeless youth Personal hygiene knowledge score (n=60)**

| Total knowledge | Study Group (Pre)<br>(n=60) |      | Test value | P-value  |
|-----------------|-----------------------------|------|------------|----------|
|                 | N                           | %    |            |          |
| Poor Score      | 48                          | 80.0 | 64.861     | <0.001** |
| Fair Score      | 8                           | 13.3 |            |          |
| Good Score      | 4                           | 6.7  |            |          |

**Table 3: Frequency Distribution of homeless youth Menstrual hygiene knowledge Score (n=26)**

| Total knowledge | Female (Pre)<br>(n=26) |      | X <sup>2</sup> | P-value  |
|-----------------|------------------------|------|----------------|----------|
|                 | N                      | %    |                |          |
| Poor Score      | 20                     | 76.9 | 27.938         | <0.001** |
| Fair Score      | 4                      | 15.4 |                |          |
| Good Score      | 2                      | 7.7  |                |          |

**Table 4: Frequency Distribution of homeless youth Attitude toward Personal Hygiene Score (n=60)**

| Total attitude | Study Group<br>(n=60) |      | X <sup>2</sup> | P-value  |
|----------------|-----------------------|------|----------------|----------|
|                | N                     | %    |                |          |
| Negative       | 40                    | 66.7 | 60.222         | <0.001** |
| Indifference   | 15                    | 25.0 |                |          |
| Positive       | 5                     | 8.3  |                |          |

**Table 5: Frequency Distribution of Personal hygiene self-reported practices Score of Homeless Youth (n=60)**

| Total practice | Study Group (Pre)<br>(n=60) |      | X <sup>2</sup> | P-value  |
|----------------|-----------------------------|------|----------------|----------|
|                | N                           | %    |                |          |
| Unsatisfactory | 48                          | 80.0 | 56.601         | <0.001** |
| Satisfactory   | 12                          | 20.0 |                |          |



**Table 6: Frequency Distribution of Menstrual Hygienic Self-Reported Practices Score of the Homeless Female participants (n=26)**

| Total practice | Female (Pre)<br>(n=26) |      | X <sup>2</sup> | P-value  |
|----------------|------------------------|------|----------------|----------|
|                | N                      | %    |                |          |
| Unsatisfactory | 22                     | 84.6 | 24.968         | <0.001** |
| Satisfactory   | 4                      | 15.4 |                |          |

**Discussion:**

Homelessness refers to the condition of lacking stable, safe, and adequate housing. It encompasses individuals who live on the streets, in shelters, in temporary accommodations, or in places not intended for human habitation. Youth is a transitional stage of life between childhood and adulthood, typically characterized by ages ranging from 15 to 24 years, as defined by the United Nations. This period marked by physical, emotional, and psychological development, as well as increasing independence and responsibility (Sleet & Francescutti, 2021).

As regarding the homeless youth knowledge about personal hygiene, the present study indicated that, personal hygiene knowledge scores showed an improvement following the program as, the majority of the homeless youth had a poor knowledge about personal hygiene pre the program, while, more than two third of them had a

good knowledge about personal hygiene post the program.

The present study findings were in the similar track with the research study by **Folayan, Obiyan, & Olaleye, (2020)** who accompanied the study in India and studied "Association between water, sanitation, general hygiene and oral hygiene practices of street-involved young people in Southwest Nigeria". Further, who illustrated that, greater than half of the considered young people had poor knowledge about personal hygiene, but, lower than one third of them had a good information about personal hygiene.

From the researcher point of view, this result might due to that near to half of the studied homeless youth are illiterate, while minorities of them have secondary education. In addition, the initial poor knowledge may stem from lack of prioritization of personal hygiene due to their challenging living conditions. The significant increase in post-program knowledge reflects the

value of providing structured, accessible, and context-specific educational content.

Regarding homeless youth information concerning menstrual hygiene, the present research study results were displayed that, the female participants' awareness regarding menstrual hygiene showed more than three quarter of participants had poor knowledge regarding menstrual hygiene.

The present study findings were in the similar alignment with the research work by **Taylor-Jennifer, (2024)** who directed the study in United States entitled "Homeless Individuals' Understandings of requirements to Personal care and Hygienic Produces and Practices During menstrual period", also, who illustrated that, the majority of homeless individuals' had low knowledge level regarding menstrual hygiene and sanitary products and processes during menstruation. Moreover, the present scientific results were in deal with the research work by **DeMaria, Martinez, & Otten, (2024)** that directed the study in USA and studied "Menstruating while street livelihood: directing entrance to creations, places, and services", also, who mentioned that, the mostly of participants had poor information about menstrual hygiene.

From the researcher point of view, while more than half of participants maintained some relationship with their family, the improvement in knowledge might be related to the reduced familial guidance prior to the program. In addition, the urban background of more than two third of participants could have facilitated access to program materials and resources post-intervention.

Regarding homeless youth attitude toward personal hygiene, the present study findings were reported that, attitudes toward personal hygiene showed significant improvement following the program as, two third of homeless youth had a negative attitude toward personal hygiene pre the program, while, larger than three quartile of them had a confirmed attitude toward personal hygiene post the program.

The present study results were in the similar link with the study by **Mosites, Morris, Self, & Butler, (2021)** who performed the study in United States and studied "Data Sources That Enumerate People Experiencing Homelessness in the United States: Opportunities and Challenges for Epidemiologic Research", and who showed that, most of the homelessness participants had a negative attitude toward personal hygiene

and poor health outcomes. Furthermore, the present study findings were in a harmony with the analysis by **Leibler, Nguyen, León, Gaeta, & Perez, (2019)** who entitled "Homelessness, Personal Hygiene, and MRSA Nasal Colonization among Persons Who Inject Drugs", and who noted that, the majority of the studied participant had a negative attitude toward personal hygiene. According to homeless youth personal hygienic self-reported practices, the present study outcomes were showed that, self-reported practices in personal hygiene were more than three quarter of homeless youth had reported unsatisfactory practices in personal hygiene. The current research results were in similar contract with the investigation by **Anthonj et al., (2024)** who directed the research work in Netherlands entitled "Invisible struggles: WASH insecurity and implications of extreme weather among urban homeless in high-income countries - A systematic scoping review", also, who illustrated that, the mostly of the studied participants had a poor practices in healthy hygiene behaviors due to posture security and sanitation matters, and retrieve to communal services may be high-priced for homeless people.

From the academic investigator judgment, these results might be interrelated to inadequate awareness of proper hygiene routines. By addressing these barriers through education and practical solutions, the program likely fostered a sense of responsibility and capability among participants, enabling them to implement the learned practices in their daily lives.

As regarding homeless youth menstrual hygienic self-reported practices, the current study results were confirmed that, the program had a significant impact on the menstrual hygienic self-reported practices of the female participants as, mostly of female had unsatisfactory self-reported practices regarding menstrual hygienic.

The current study outcomes were in agreement with the study by **Taylor-Jennifer, (2024)** who conducted the study in United States and entitled "Homeless Individuals' Experiences of Access to Personal Hygiene and Sanitary Products and Processes During Menstruation", and who stated that, the majority of homeless individuals' had a negative thoughts and experiences regarding menstruation and menstruation problem solving. Also, suggested

that training program will improve their partial level.

### **Conclusion**

**Based on the consequences and outcomes of the current study and research hypothesis, the current research work settled that,** there were statistically significant positive correlations among the total knowledge, total attitude and total reported practice scores. The major sector of the homeless youth had a poor knowledge about personal hygiene.

The current study shown that, two thirds of homeless youth had a negative attitude toward personal hygiene. In addition, more than three quarter of homeless youth had reported unsatisfactory practices in personal hygiene.

### **Recommendations:**

**Constructed on the results of this research study the next advices are derived and suggested:**

1. Applying continuous health education program.in large sample and other setting for generalization.
2. Studding opportunities and challenges facing homeless youth living in shelters.
3. Researches needed for studying shelters efforts regarding infectious diseases control among that vulnerable group.

### **References:**

- Anthonj, C., Poague, K. I. H. M., Fleming, L., & Stanglow, S. (2024):** Invisible struggles: WASH insecurity and implications of extreme weather among urban homeless in high-income countries-A systematic scoping review. *International Journal of Hygiene and Environmental Health*, 255, 114285.
- Arabbadvi, Z., Khoshnood, Z., Foroughameri, G., & Mazallahi, M. (2023):** Education as an effective strategy to promote nutritional knowledge, attitudes, and behaviors in street children. *BMC Public Health*, 23(1), 989.
- Colburn, G., & Aldern, C. P. (2022):** Homelessness is a housing problem: How structural factors explain US patterns. *Univ of California Press*.
- DeMarco, R., & Healey-Walsh, J. (2023):** Community and public health nursing: evidence for practice. . *BMC oral health*.
- DeMaria, A.L., Martinez, R., Otten, E. (2024).** Menstruating while homeless: navigating access to products, spaces, and services. *BMC Public Health* 24, 909  
<https://doi.org/10.1186/s12889-024-18379-z>

- Folayan, M. O., Obiyan, M. O., & Olaleye, A. O. (2020).** Association between water, sanitation, general hygiene and oral hygiene practices of street-involved young people in Southwest Nigeria. *BMC oral health*, 20(1), 32. <https://doi.org/10.1186/s12903-020-1022-z>
- Grattan, R. E., Tryon, V. L., Lara, N., Gabrielian, S. E., Melnikow, J., & Niendam, T. A. (2022):** Risk and resilience factors for youth homelessness in western countries: A systematic review. *Psychiatric Services*, 73(4), 425-438.
- Gunter, A., & Holford, N. (2023):** Transitions to adulthood. In *An introduction to childhood and youth studies and psychology* (pp. 218-232). Routledge.
- Johnson, N. J., Roman, C. G., Mendlein, A. K., Harding, C., Francis, M., & Hendrick, L. (2020):** Exploring the influence of drug trafficking gangs on overdose deaths in the largest narcotics market in the eastern United States. *Social Sciences*, 9(11), 202. Available at <https://www.mdpi.com/2076-0760/9/11/202>
- Kopanitsa, V., McWilliams, S., Leung, R., Schischa, B., Sarela, S., Perelmuter, S., ... & Rosenthal, D. M. (2023):** A systematic scoping review of primary health care service outreach for homeless populations. *Family Practice*, 40(1), 138-151.
- Leibler, J. H., Nguyen, D. D., León, C., Gaeta, J. M., & Perez, D. (2019).** Personal Hygiene Practices among Urban Homeless Persons in Boston, MA. *International journal of environmental research and public health*, 14(8), 928. <https://doi.org/10.3390/ijerph14080928>
- Mosites, E., Morris, S. B., Self, J., & Butler, J. C. (2021):** Data Sources That Enumerate People Experiencing Homelessness in the United States: Opportunities and Challenges for Epidemiological Research. *American Journal of Epidemiology*. available at <https://doi.org/10.1093/aje/kwab051>
- Sims, S., Harris, R., Hussein, S., Rafferty, A. M., Desai, A., Palmer, S., ... & Fitzpatrick, J. M. (2022):** Social distancing and isolation strategies to prevent and control the transmission of COVID-19 and other infectious diseases in care homes for older people: an international review. *International journal of environmental research and public health*, 19(6), 3450.
- Sleet, D. A., & Francescutti, L. H. (2021).** Homelessness and Public Health: A Focus on Strategies and Solutions. *International journal of environmental research and public health*

*health*, 18(21), 11660.  
<https://doi.org/10.3390/ijerph182111660>

**South, E., Rodgers, M., Wright, K., Whitehead, M., & Sowden, A. (2022):** Reducing lifestyle risk behaviours in disadvantaged groups in high-income countries: a scoping review of systematic reviews. *Preventive medicine*, 154, 106916.

**Taylor-Jennifer, C. (2024):** Homeless Individuals' Experiences of Access to Personal Hygiene and Sanitary Products and Processes During Menstruation. *Walden Dissertations and Doctoral Studies*. 16318.  
<https://scholarworks.waldenu.edu/dissertations/16318>

## Effect of Modified Buerger-Allen Exercises on Physiological Leg Edema during the Third Trimester of Pregnancy

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### Abstract

**Background:** The third trimester of pregnancy often leads to leg edema that can cause discomfort, reduce mobility, and affect a woman's quality of life. The Modified Buerger-Allen Exercise is a series of movements designed to improve circulation and venous return, helping to reduce fluid retention in the lower extremities. **Aim:** To assess effect of Modified Buerger-Allen Exercises on physiological leg edema during the 3<sup>rd</sup> trimester of pregnancy. **Design:** A quasi-experimental design as employed. **Subjects and Methods:** **Setting:** The antenatal clinic of the National Medical Institute at Damanhour, El-Beheira Governorate Egypt. **Subjects:** A purposive sample of 90 pregnant women who met the inclusion criteria. **Tools:** Four Instruments were employed. These included a structured interview schedule for demographic and obstetric information, a chart to assess the presence and severity of pitting edema, the non-elastic tap measure and figure of eight measurement of ankle swelling. **Results:** At 10 days post-intervention, experimental group 1 showed a significant reduction in edema severity and circumferences, with 26.7% of participants improving to grade +1 edema and significant decreases in ankle and instep circumferences. By 20 days, experimental group 2 demonstrated even greater improvements, with 63.3% showing grade +1 edema and significant reductions in ankle, instep, and metatarsal-phalanges joint circumferences compared to the control group. **Conclusion:** Modified Buerger-Allen exercises method is an effective, non-invasive method for managing edema and enhancing maternal comfort. **Recommendations:** Modified Buerger-Allen Exercises should be incorporated into prenatal care routines for pregnant women particularly during the third trimester to manage leg edema.

**Keywords:** Buerger-Allen, Leg Edema, pregnancy.

**Introduction:**

The third (3<sup>rd</sup>) trimester of pregnancy is the final phase of pregnancy, from 28 to 40 weeks of gestation. It could be marked by significant physiological changes and increased fluid retention **Nissen, Johnson & Lavoie, 2023;Bhat &Kushtagi, 2024**). Edema is one of the most common issues experienced during pregnancy. Swelling in the legs and ankles can affect up to 80% of pregnant women to varying extents and is not necessarily a sign of preeclampsia or pregnancy-induced hypertension. It can be a physiological leg edema **(Mollaelah&Shahali, 2022)**.

Physiological leg edema means swelling in the lower extremities, including ankles, feet, and legs. It occurs due to fluid retention, commonly occurring during pregnancy's third trimester. This condition is primarily caused by an increase in blood volume and hormonal changes that enhance vascular permeability, leading to fluid leakage into the surrounding tissues. Additionally, the expanding uterus exerts pressure on the inferior vena cava and pelvic veins—major vessels responsible for returning blood from the lower body thereby, restricting blood flow from the

legs **(Dalio, Rahimi & Jafari, 2022; Mollaelah& Shahali, 2022)**.

The lymphatic vessels in the leg tissues attempt to drain the excess fluid, but the volume often exceeds their capacity, making this process ineffective. As the uterus enlarges during pregnancy, it also compresses the lymphatic vessels in the pelvic and abdominal regions, further hindering lymph drainage from the legs. This impaired flow leads to an accumulation of lymph, known as lymphoedema, which commonly contributes to swelling in the legs and ankles during pregnancy **(Knight,Johnson, Liu, 2023)**.

Significant pain is the most typical edema symptom, along with tingling, numbness, and cramping at night. Furthermore, legs could be unattractive and feel heavy and achy. After standing for extended periods of time and with each subsequent pregnancy, symptoms usually get worse. Physiological edema of the foot may be the cause of sleep disorders. Consequently, sleep durations of six hours or less per night can lead to longer labor periods and a higher rate of instrumental births **(Saliba Júnior,de Lima & Fernandes,2020;Navaee&Rakhshkhorshid, 2020)**.



Evaluation of patients with lower-extremity edema during late pregnancy aims to exclude deep venous thrombosis (DVT), preeclampsia, peripartum cardiomyopathy, and other pathologic causes of edema. Physiological edema is a diagnosis of exclusion. The nurse midwife needs to rule out other causes through history taking, and specific measures including the pitting edema severity scale (graded from 0 to +4), and changes in circumferential measurements of the ankle, instep, and metatarsal–phalanges joint (the MP joint, where toe joins the foot) **(Raetz, Garzon & Dillingham, 2023; Araby, Hassan & Fawzy, 2025)**

Although physiological leg edema during pregnancy is normal, management is needed to reduce discomfort. In managing edema in healthy, pregnant women, treatment focuses on improving circulation, reducing fluid retention, and alleviating symptoms **(Mollaelahi & Shahali, 2022)**. The use of complementary therapies alongside modern medical care has become increasingly accepted recently, particularly among midwives and nurses. A wide range of non-pharmacological techniques, including massage therapy,

essential oils, herbal application, water soaking, and exercises **(Ahmed, Ismail & Hassan, 2021)**.

The nurse-midwife can recommend position, behavioral changes, elevating legs, lying on the left side, wearing compression stockings, avoiding prolonged standing or sitting, staying hydrated, support hose, appropriate clothing, as well as exercises such as the Buerger-Allen Exercises that are encouraged by the exercise board. The Buerger-Allen Exercises were originally developed for vascular patients to increase lower extremity perfusion **(Hassan, El-Naggar, Abdelrahman & Soliman, 2020; Zaki, Ragheb, Taha & Omran, 2023; Saleh, El-Tantawy, & Ahmed, 2024)**. Buerger-Allen exercises stimulate the interstitial fluids in the extravascular spaces, as well as improve venous blood circulation by combining two mechanisms, namely: 1. fluid migration from the extravascular space to the venous system and 2. fluid flow inside the extravascular space. It has no negative effects on health **(Navaee & Rakhshkhorshid, 2020; Mollaelahi & Shahali, 2023)**.

The Modified Buerger-Allen Exercises (MBAEs) have been adapted for pregnant women to stimulate peripheral circulation, drain engorged vessels, and alleviate leg edema. The MBAEs were designed to improve circulation and venous return, helping to reduce fluid retention in the lower extremities. They include a series of movements of leg elevation, flexion, and extension, which promote fluid movement toward the heart. The exercises utilize gravity to alternately empty and fill the blood vessels, stimulating collateral circulation.

The MBAEs also integrated a left lateral tilt (LLT) position to replace the supine posture to shift the fetal pressure away from the compressed inferior vena cava to enhance blood circulation (Mollaelahi & Shahali, 2023; VEDIAPPAN, LAKSHMI & RAJENDRAN, 2024). The nurses can educate pregnant women about the modified Buerger-Allen exercises and incorporate such exercises in their care to decrease discomfort of physiological leg edema during the third trimester of pregnancy and improve mobility and quality of life (Radhika, Sangeetha & Menon, 2024).

### **Significance of the study**

Few studies have examined the use of alternative therapies among pregnant women in Egypt. Additionally, despite being a low-risk, affordable, and easy physical exercise, there has been no research investigating the effect of Buerger-Allen exercises on physiological foot edema caused by pregnancy (Saleh, et al., 2024). The findings of this study could provide evidence to support the enhancement of nursing practices and contribute to the advancement and expansion of nursing knowledge, ultimately leading to better health outcomes for women.

### **Aim of the study:**

The study aimed to assess the effect of Modified Buerger-Allen Exercises (MBAEs) on physiological leg edema during 3<sup>rd</sup> trimester of pregnancy.

### **Research hypothesis:**

The pregnant women who will perform the Modified Buerger-Allen exercises will exhibit improvement in the physiological leg edema than those who don't.

### **Operational definition**

**Buerger-Allen exercises:** In this study, the specific exercises involved elevating the leg between 35 and 90 degrees, then lowering it to a dependent position, and finally resting the leg in a horizontal position.

## **Subjects and Method**

### **Research design**

A quasi-experimental (non-randomized control group) design was utilized.

### **Setting**

The study was carried out at the antenatal clinic of Damanhour National Medical Institute, a hospital under the Ministry of Health in El-Beheira Governorate, Egypt. This facility was specifically selected because it is a primary healthcare center serving Damanhour city and its neighboring regions, with enough pregnant women to meet the study's requirements.

### **Subjects**

A purposive sample of 90 antenatal women in their third trimester was selected from the previously mentioned study setting. They were randomly assigned into three groups: a control group (n=30) that received routine care for physiological leg edema; experimental group 1 (n=30), which performed Modified Buerger-Allen Exercises for lower limb edema over 10 days; and experimental group 2 (n=30), which performed the same exercises for 20 days.

### **Inclusion criteria**

- Pregnant women in their third trimester (28 to 40 weeks of gestation).

- Diagnosed with physiological leg edema (non-pathological swelling).
- Age ranged between 20 and 40 years.
- Have normal blood pressure.
- Have a singleton pregnancy with no complications.
- Able to perform physical exercises without medical restrictions.
- Attending regular antenatal check-ups at the selected clinic.

### **Sample size**

The sample size was calculated using the Epi Info program, considering a 5% margin of error, a 95% confidence level, a 10% expected frequency, and a population size of 180 over three months. The calculation indicated a minimum required sample size of 79, so a total of 90 participants were included in the study.

### **Tools**

Four tools were utilized as follows:

#### **Tool I: Structured interview schedule**

This tool was developed by researchers after reviewing literature. It was used to assess basic data of the studied pregnant women. It is composed of two parts as follows:

Part (I): Socio-demographic characteristics such as the women's age, level of education,

occupation, marital status, current residence and family type.

Part (II):Obstetrics and reproductive history asgravidity, parity, number of abortions, still birth,livingchildren,and sex of living children.

Part (III):History of current pregnancy including weeks of gestation,antenatal visit, number of antenatalvisits,timing of edema, change of edema with position, and site of edema.

#### **Tool II: Chartforpitting edema**

This tool was adopted by researchers from **Brodovicz, McNaughton, Uemura, Mehta, Skare, & Perez (2009)**. It was used to assess the degree of physiological foot edema. Edema is evaluated on its ability to pit. The researcher's thumb or forefinger is pressed into a dependent area of the mother's foot against a bony prominence for five seconds. If pitting edema is present the finger will sink into the tissue and leave a depression after removing the finger. **Brodovicz et al., (2009) estimated that** edemaisgraded on a scale of 1+ to 4 +. Edema of grade 1+: The indentation depth (less than 6 mm) quickly goes away. Edema of grade 2+: The indentation depth (6–12 mm) goes away in 10–15 seconds. Edema of grade 3+: The

indentation depth (1 to 2.5 cm) goes away in 1 to 2 minutes. Edema of grade 4+: Pitting depth >2.5 cm subsides in 2–5 minutes.

#### **Tool III: Non-elastic tape**

The tape was constructed from non-stretched fiberglass material, ensuring measurement consistency by preventing elongation during use. It was 150 cm (60 inches) in length, with clear, high-contrast markings in both metric (centimeters and millimeters).It was used to have standardized measurements during the study. The participants' ankle, instep, and foot/toe junction circumferences were measured using this instrument.

#### **Tool IV: Figure of eight measurements of the ankle swelling**

The figure of eight measurement technique was originally developed by **Esterson in 1979** to assess ankle swelling. This method was later adapted to specifically evaluate swelling across several common sites of ankle sprains, including the anterior talofibular ligament, calcaneofibular ligament, and anterior tibiofibular ligament. The technique relies on the use of a non-elastic tape measure and a marking pen, with anatomical landmarks carefully identified around the ankle to ensure

consistency and reproducibility. During the procedure, the participant's ankle was positioned by the researchers in neutral dorsiflexion at 90 degrees. The tape measure was anchored midway between the tibialis anterior tendon and the lateral malleolus, passed medially across the navicular tuberosity, under the sole at the level of the fifth metatarsal base, then wrapped around the ankle crossing the medial and lateral malleoli to form a “figure-of-eight” pattern (**Figure 1**). This approach allowed for a reliable and sensitive assessment of swelling over the talar and subtalar joints.



Figure-of-eight method. Flexible tape runs through from the tip of lateral malleolus, tuberosity of navicular, base of fifth metatarsal bone, tip of medial malleolus, and then returns to tip of lateral malleolus. (A) Medial side; (B) lateral side.

**Figure (1): Figure of eight method**(Petersen, W., Rembitzki, I. V., &Koppenburg, A. G. 2013).

### Method

#### Administrative approval

An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing, Damanhour University and was submitted to the responsible authorities of the selected study

settings to obtain their approval and cooperation for carrying out the study. Additionally, an official permission to conduct the study was obtained from the medical director of Damanhour National Medical Institute after the study's purpose was clearly explained.

#### **Ethical and legal considerations were contemplated all over the study as follows**

The study was approved by the Scientific Research Ethics Committee of the Faculty of Nursing, Damanhour University (Approval No. 96-b) before it began. Pregnant women's informed consent to participate in the study was obtained after explanation of the purpose of the study. The right to abstain or terminate participation at any time was respected. The nature of the study didn't cause any harm or pain for the entire sample. The women were assured about the privacy and confidentiality of the collected data, and that the data will be used only for the study purpose.

#### Tools development

Tool (I)was developed by researchersafter extensive review of literature.Tool (II) was adopted by the researchers from **Brodoviczetal., (2009)**.Tool (III)was clearly examinedby the researchers for its fidelity and

numbers. Tool (IV) was adapted by the researchers from originally developed by **Esterson (1979)**

### **Validity of the tools**

The content and face validity of the instruments were evaluated by five experts from obstetrics and gynecology, and community nursing departments to ensure that the instruments are relevant and appropriate for the study.

### **Pilot study**

A pilot study was carried out on 10% (9) of the antenatal women who were excluded from the main study sample. This phase helped to evaluate the clarity and relevance of the instruments. Following the feedback, appropriate adjustments were made to the instruments.

### **Reliability of the tools**

Instruments II, III, and IV underwent reliability testing utilizing Cronbach's alpha. The results indicated high reliability for all three Instruments, with scores of **(0.87)** for instrument II (the Chart for pitting edema), **(0.86)** for instrument III (the non -Elastic tap measure), and **(0.85)** for instrument IV (the figure of eight measurements of ankle swelling).

### **Data collection**

Tool (I) was used one time before the intervention, tools II, III, and IV were used three times pre, after

10 days, and after 20 days of the intervention. The study data were collected over a period of four months from the first of November 2024 to the end of February 2025.

**The study was implemented into three phases (assessment, implementation, and devaluation) as follows**

### **Phase (1): Assessment**

-The researchers explored both local and international literature pertinent to various aspects of the research problem through books, articles, internet sources, periodicals, and magazines. Then, they developed and determined the necessary data collection instruments and the study booklet using clear and concise Arabic language.

-All participants were invited to participate after an explanation of the purpose of the study to obtain their informed consent. Then, they were screened by the researchers based on the inclusion criteria. The first 30 women who met these criteria were assigned to the control group. The next 30 eligible participants were allocated to experimental group (1). Consecutively, the next 30 eligible participants were allocated to experimental group (2).

-Recruitment started with the control group to ensure the target

sample size was achieved before enrolling participants into the experimental groups, thus reducing the possibility of sample contamination.

-All three groups underwent a pre-test assessment, during which participants were individually interviewed to collect the baseline data using tool(I).

- Next, the extent of foot edema was determined for all groups by pressing index and middle fingers on foot for 5 to 10 seconds and estimating the depth created using tool (II)the chart for pitting edema.

- Then, circumferences of three parts of each foot including the ankle, instep, and foot/toe junction were measured by tool (III)the non-elastic tape for each group when the women were in sitting position. Ankle circumference was measured medially and laterally above the malleoli, where the diameter was the smallest. The instep circumference was measured over the cuneiform and cuboid bones distal to the heel, and the third circumference was measured on the distal end of the foot, at the metatarsal–phalanges joint (the MP joint, where toe joins the foot).

- Subsequently, instrument (IV) the Figure of-eight measurements for ankle swelling were conducted

for each group. During this procedure, the studied pregnant women were positioned according to their ability to be in either in a supine position or seated with the ankle maintained at approximately 20° of plantarflexion position. The researchers began with placing the tape measure midway between the tibialis anterior tendon and the lateral malleolus. The tape was then guided medially and positioned just distal to the navicular tuberosity. The tape is then pulled across the arch and just proximal to the fifth metatarsal. Then, the tape is pulled across the tibialis anterior tendon and around the ankle to a point just distal to the medial malleolus, before being finally pulled across the Achilles tendon and placed just distal to the lateral malleolus and across the start of the tape. Finally, the researchers pulled the tape snugly and read the circumference in centimeters, took three measurements and recorded the average.

### **Phase (2): Implementation**

-The experimental groups (1 and 2) each consisted of 30 pregnant women performed the modified Buerger–Allen exercises at separate rooms of the prenatal clinic to ensure their privacy. During the initial interview, the

researchers taught the women how to perform the exercises using various visual aids such as videos, pictures, and a brochure.

-Additionally, the researcher demonstrated each step, encouraged the women to re-demonstrate the exercises, and emphasized the importance of regularly performing them.

-Participants in the experimental group (1) performed the modified Buerger–Allen exercises at home once daily for 30 minutes over 10 days, while those in the experimental group (2) followed the same routine once daily for 30 minutes over 20 days.

-All women, including those in the experimental and control groups, received the standard prenatal care, which included walking and massage.

-Measurements were repeated after 10 days for experimental group (1) and after 20 days for experimental group (2). During the intervention, the researchers maintained daily contact with the participants in the experimental groups through phone calls to encourage adherence to the exercise protocol.

The modified Buerger- Allen Exercises were performed by the pregnant woman as follows:

First, the pregnant woman was lain down on the left hand with an

angle of 30° toward the supine left lateral tilt (LLT), and at the same time, the lower limb was raised up to an angle of 45°–90° and was kept until the skin turns white (appears dead white) (**Figure 2**).



**Figure (2): Lower Limb was raised up to an angle of 45°- 90°.** Then, she was sitting on a chair, lowered her legs below the surface of the rest of the body until redness appears (note that there is no pressure on the back of the knees) and the toes are bent and stretched (**Figure 3**).



**Figure (3): Legs lowered below the surface of the rest of the body.**

Finally, the pregnant woman was straightening her legs; she lay on the bed on her left side for a few minutes (**Figure 4**). The duration of each position depends on the woman's tolerance and the



amount of skin color change. Typically, exercises were prescribed in such a way that the legs were raised for 2–3 minutes and lowered for 4–6 minutes. Then, the participant was straightened on the bed for 10 minutes.



**Figure (4): Legs straighten and lay on the left side for a few minutes.**

-The standard care of the health facility was provided for the control group in the presence of the researchers. This care included massage, walking, and health education about leg edema, along with history taking, physical examination, routine investigations, and measurement of limb circumferences.

### **Phase (3): Evaluation**

-On the 10<sup>th</sup> and 20<sup>th</sup> days after the intervention, foot circumferences, degrees of pitting edema, and figure-of-eight ankle swelling measurements were assessed for all three groups.

### **Statistical data analysis**

Data were entered into the computer and analyzed using IBM SPSS software version 26.0. Qualitative data were presented as numbers and percentages, while

quantitative data were summarized using means and standard deviations. Chi-square test was used for the categorical variables to compare between different groups, Monte Carlo correction was used to find correction for chi-square when more than 20% of the cells were less than 5 to analyze the significance between the different stages, the student t-test was used for the normally distributed quantitative variables to compare between two studied groups, and the analysis of variance (ANOVA) was used for the normally distributed quantitative variables to compare between more than two groups.

### **Results**

**Table (1):** Shows socio-demographic characteristics of the studied pregnant women. It reveals that the study subjects were homogenous as there were no statistically significant differences in sociodemographic characteristics between the control group and the two experimental groups. Slightly more than two thirds of the (66.7%) of the control group their age ranged between 26–30 years, (50.0%) of the experimental group (1), and (63.3%) of the experimental group (2). Regarding education,

experimental group (2) had the highest percentage (60.0%) of illiteracy compared to (40.0%) among the control group and the experimental group (1). Most of the of the control group and the experimental group (1) (96.7%, and 93.3% respectively) were housewives, and almost as (100%) of the experimental group (2). Additionally, rural residence was more common among (66.7%) of the control group and (60.0%) of the experimental group (2), while (56.7%) of the experimental group (1) were urban participants. Regarding the family type, extended families were more frequent (70.0%) among each of the control group and experimental group (1), compared to (50.0%) of the experimental group (2).

**Table (2):** Demonstrates obstetric and reproductive history of the studied pregnant women. It proves that that the study subjects were homogenous as there were no statistically significant differences between the control and experimental groups (1 and 2). The control group had a slightly higher percentage of participants with more than five pregnancies (20.0%), compared to (13.3%) of the experimental group (1), while none of the experimental group (2) reported more than five

pregnancies. Nulliparity was common across all groups, with (46.7%) of the control group and (50.0%) among each of the experimental groups. Most (73.3%, 80.0%, and 90.0% respectively) of the participants of all groups had no history of abortion. The participants in each group reported no history of stillbirth, ranging from (50.0% to 56.7%). The proportion of participants with living children was (36.7%, 30.0%, and 30.0% respectively) among the experimental group (2), the control group and experimental group (1).

**Table (3):** Displays current pregnancy history of the studied pregnant women. It establishes that there were no statistically significant differences in the history of current pregnancy between control and experimental groups (1 and 2). Gestational age  $\geq 30$  weeks was noted in (43.3%) of the control group, (53.3%) of the experimental group (1), and (56.7%) of the experimental group (2). Regular antenatal visits were reported by (36.7%) of the control group, (30.0%) of the experimental group (1), and (46.7%) of the experimental group (2). Most of the participants in all groups had four or more antenatal visits, (90.0%) of each of the

control group and experimental group (1), and (100.0%) of the experimental group (2). Regarding edema, its onset within less than two weeks was observed in (46.7%) of each of the control group and the experimental group (1), and in (40.0%) of the experimental group (2). Additionally, edema developing between (2–4) weeks was more common in (36.7%) of the experimental group (2), compared to (26.7%, and 16.7% respectively) of the control group and the experimental group (1). It is also noticed that nearly three quarters (73.3%, and 70.0% respectively) of the experimental group (2) and of the control group had no change of edema with position, as well as had bilateral edema; compared to nearly two thirds of the experimental group (1).

**Table (4):** Explains grades of pitting edema of the studied pregnant women before, after 10 days and after 20 days of the intervention. It identifies that before the intervention, there were no statistically significant differences between the control group and experimental groups 1 and 2 in the severity of pitting edema ( $p = 0.409$ ). Most of the participants across all groups had grade +4 edema, with

(46.7%) among each of the control and experimental group (1), and (36.7%) in the experimental group (2). Ten days after the intervention, the experimental group (1) showed significant improvement compared to the control group ( $p = 0.002$ ), with (26.7%) of the participants presenting with grade +1 edema versus none in the control group, and a decrease in grade +4 edema to (10.0%) compared to (36.7%) in the control group. After 20 days, the experimental group (2) demonstrated even greater progress, with (63.3%) of the participants showing grade +1 edema and no cases of grade +4 edema, while (46.7%) of the control group still had persistent grade +4 edema.

**Table (5):** Illustrates mean difference in the foot circumference of the studied pregnant women before, after 10 days and after 20 days of the intervention. It shows that before the intervention, there were no significant differences in ankle, instep, and MP joint circumferences among the control and experimental groups (1 and 2). After 10 days, the experimental group (1) showed a significant reduction in ankle and instep circumferences ( $p < 0.05$  and  $p < 0.002$ , respectively), but no significant change in MP joint

circumference ( $p = 0.352$ ). After 20 days, the experimental group (2) demonstrated highly significant reductions in all three measurements—ankle, instep, and MP joint ( $p < 0.001$ ,  $p < 0.001$ , and  $p = 0.001$ , respectively), compared to the control group.

**Table (6):** Describes mean difference in the ankle swelling among the studied pregnant women before, after 10 days and after 20 days of the intervention. It portrays that before the intervention, there were no statistically significant differences in the ankle circumference among the control and experimental groups (1) and

(2) ( $p = 0.814$ ). However, significant improvements were observed following the intervention. After 10 days of the intervention, the experimental group (1) showed a significant reduction in the mean of the ankle circumference ( $56.92 \pm 2.58$  cm), compared to the control group ( $59.39 \pm 2.04$  cm), with a statistically significant difference ( $p < 0.001$ ). This improvement was even more evident in the experimental group (2) after 20 days, where the mean ankle circumference further decreased to ( $56.81 \pm 2.14$  cm), compared to ( $59.39 \pm 2.04$ ) cm in the control group ( $p < 0.001$ ).

**Table (1): Socio-demographic characteristics of the studied pregnant women (n= 90).**

| Socio-demographic characteristics | Control group (n=30) |       | Experimental (1) after 10 days (n=30) |       | Experimental (2) after 20 days (n=30) |        | $\chi^2$    | MC <sub>p</sub> |
|-----------------------------------|----------------------|-------|---------------------------------------|-------|---------------------------------------|--------|-------------|-----------------|
|                                   | No.                  | %     | No.                                   | %     | No.                                   | %      |             |                 |
| <b>Age (years)</b>                |                      |       |                                       |       |                                       |        |             |                 |
| less of 25                        | 7                    | 23.3% | 13                                    | 43.3% | 8                                     | 26.7%  | 3.232       | 0.537           |
| 26-30                             | 20                   | 66.7% | 15                                    | 50.0% | 19                                    | 63.3%  |             |                 |
| 35 and more                       | 3                    | 10.0% | 2                                     | 6.7%  | 3                                     | 10.0%  |             |                 |
| Mean $\pm$ SD                     | 27.3 $\pm$ 5.8       |       | 26.5 $\pm$ 4.2                        |       | 27.8 $\pm$ 4.4                        |        | F<br>=0.611 | 0.545           |
| <b>Level of education</b>         |                      |       |                                       |       |                                       |        |             |                 |
| Illiterate                        | 12                   | 40.0% | 12                                    | 40.0% | 18                                    | 60.0%  | 6.714       | 0.330           |
| Primary                           | 7                    | 23.3% | 7                                     | 23.3% | 3                                     | 10.0%  |             |                 |
| Secondary                         | 10                   | 33.3% | 8                                     | 26.7% | 9                                     | 30.0%  |             |                 |
| University                        | 1                    | 3.3%  | 3                                     | 10.0% | 0                                     | 0.0%   |             |                 |
| <b>Occupation</b>                 |                      |       |                                       |       |                                       |        |             |                 |
| House working                     | 29                   | 96.7% | 28                                    | 93.3% | 30                                    | 100.0% | 3.128       | 0.775           |
| Employer                          | 1                    | 3.3%  | 1                                     | 3.3%  | 0                                     | 0.0%   |             |                 |
| Other                             | 0                    | 0.0%  | 1                                     | 3.3%  | 0                                     | 0.0%   |             |                 |
| <b>Original residence</b>         |                      |       |                                       |       |                                       |        |             |                 |
| Rural                             | 20                   | 66.7% | 13                                    | 43.3% | 18                                    | 60.0%  | 3.529       | 0.171           |
| Urban                             | 10                   | 33.3% | 17                                    | 56.7% | 12                                    | 40.0%  |             |                 |
| <b>Type of family</b>             |                      |       |                                       |       |                                       |        |             |                 |
| Nuclear                           | 9                    | 30.0% | 9                                     | 30.0% | 15                                    | 50.0%  | 3.445       | 0.179           |
| Extended                          | 21                   | 70.0% | 21                                    | 70.0% | 15                                    | 50.0%  |             |                 |

 $\chi^2$ : Chi square test

MC: Monte Carlo

F: F for ANOVA test

**Table (2): Obstetrics and reproductive history of the studied pregnant women (n= 90).**

| Reproductive history             | Control group (n=30) |       | Experimental (1) after 10 days (n=30) |       | Experimental (2) after 20 days (n=30) |       | $\chi^2$ | MC <sub>p</sub> |
|----------------------------------|----------------------|-------|---------------------------------------|-------|---------------------------------------|-------|----------|-----------------|
|                                  | No.                  | %     | No.                                   | %     | No.                                   | %     |          |                 |
| <b>Gravidity</b>                 |                      |       |                                       |       |                                       |       |          |                 |
| Primigravida                     | 11                   | 36.7% | 12                                    | 40.0% | 15                                    | 50.0% | 7.128    | 0.123           |
| 2-4                              | 13                   | 43.3% | 14                                    | 46.7% | 15                                    | 50.0% |          |                 |
| More than 5                      | 6                    | 20.0% | 4                                     | 13.3% | 0                                     | 0.0%  |          |                 |
| <b>Parity</b>                    |                      |       |                                       |       |                                       |       |          |                 |
| Nulipara                         | 14                   | 46.7% | 15                                    | 50.0% | 15                                    | 50.0% | 1.943    | 0.746           |
| Primi                            | 6                    | 20.0% | 6                                     | 20.0% | 9                                     | 30.0% |          |                 |
| Multi                            | 10                   | 33.3% | 9                                     | 30.0% | 6                                     | 20.0% |          |                 |
| <b>Number of abortions</b>       |                      |       |                                       |       |                                       |       |          |                 |
| No abortion                      | 22                   | 73.3% | 24                                    | 80.0% | 27                                    | 90.0% | 4.938    | 0.572           |
| Once                             | 6                    | 20.0% | 3                                     | 10.0% | 3                                     | 10.0% |          |                 |
| Twice                            | 1                    | 3.3%  | 2                                     | 6.7%  | 0                                     | 0.0%  |          |                 |
| Three or more                    | 1                    | 3.3%  | 1                                     | 3.3%  | 0                                     | 0.0%  |          |                 |
| <b>Number of stillbirths</b>     |                      |       |                                       |       |                                       |       |          |                 |
| No                               | 17                   | 56.7% | 15                                    | 50.0% | 15                                    | 50.0% | 3.639    | 0.454           |
| One                              | 2                    | 6.7%  | 3                                     | 10.0% | 0                                     | 0.0%  |          |                 |
| Not applicable                   | 11                   | 36.7% | 12                                    | 40.0% | 15                                    | 50.0% |          |                 |
| <b>Number of living children</b> |                      |       |                                       |       |                                       |       |          |                 |
| Non                              | 9                    | 30.0% | 9                                     | 30.0% | 11                                    | 36.7% | 8.923    | 0.326           |
| One                              | 3                    | 10.0% | 5                                     | 16.7% | 4                                     | 13.3% |          |                 |
| Two                              | 3                    | 10.0% | 3                                     | 10.0% | 0                                     | 0.0%  |          |                 |
| Three children or more           | 4                    | 13.3% | 1                                     | 3.3%  | 0                                     | 0.0%  |          |                 |
| Not applicable                   | 11                   | 36.7% | 12                                    | 40.0% | 15                                    | 50.0% |          |                 |
| <b>Sex of Living children</b>    |                      |       |                                       |       |                                       |       |          |                 |
| Non                              | 4                    | 13.3% | 3                                     | 10.0% | 2                                     | 6.7%  | 6.116    | 0.653           |
| Only male                        | 9                    | 30.0% | 7                                     | 23.3% | 8                                     | 26.7% |          |                 |
| Only female                      | 3                    | 10.0% | 7                                     | 23.3% | 5                                     | 16.7% |          |                 |
| Male and female                  | 3                    | 10.0% | 1                                     | 3.3%  | 0                                     | 0.0%  |          |                 |
| Not applicable                   | 11                   | 36.7% | 12                                    | 40.0% | 15                                    | 50.0% |          |                 |

 $\chi^2$ : Chi square test

MC: Monte Carlo

**Table (3): Current pregnancy history of the studied pregnant women (n= 90).**

| Current pregnancy history            | Control group (n=30) |       | Experimental (1) after 10 days (n=30) |       | Experimental (2) after 20 days (n=30) |        | $\chi^2$ | MC <sub>p</sub> |
|--------------------------------------|----------------------|-------|---------------------------------------|-------|---------------------------------------|--------|----------|-----------------|
|                                      | No.                  | %     | No.                                   | %     | No.                                   | %      |          |                 |
| <b>Gestational age (weeks)</b>       |                      |       |                                       |       |                                       |        |          |                 |
| <30                                  | 17                   | 56.7% | 14                                    | 46.7% | 13                                    | 43.3%  | 1.156    | 0.561           |
| ≥30                                  | 13                   | 43.3% | 16                                    | 53.3% | 17                                    | 56.7%  |          |                 |
| Mean ± SD                            | 29.4±1.5             |       | 29.8±1.5                              |       | 29.8±1.4                              |        | F=0.554  | 0.576           |
| <b>Antenatal visits</b>              |                      |       |                                       |       |                                       |        |          |                 |
| Regular                              | 11                   | 36.7% | 9                                     | 30.0% | 14                                    | 46.7%  | 1.796    | 0.407           |
| Irregular                            | 19                   | 63.3% | 21                                    | 70.0% | 16                                    | 53.3%  |          |                 |
| <b>Number of antenatal visits</b>    |                      |       |                                       |       |                                       |        |          |                 |
| less than 4                          | 2                    | 6.7%  | 1                                     | 3.3%  | 0                                     | 0.0%   | 3.844    | 0.413           |
| 4 visits                             | 1                    | 3.3%  | 2                                     | 6.7%  | 0                                     | 0.0%   |          |                 |
| 4 and more                           | 27                   | 90.0% | 27                                    | 90.0% | 30                                    | 100.0% |          |                 |
| <b>Timing of edema</b>               |                      |       |                                       |       |                                       |        |          |                 |
| less than 2 weeks                    | 14                   | 46.7% | 14                                    | 46.7% | 12                                    | 40.0%  | 3.450    | 0.486           |
| from 2 to 4 weeks                    | 8                    | 26.7% | 5                                     | 16.7% | 11                                    | 36.7%  |          |                 |
| more than 4 weeks                    | 8                    | 26.7% | 11                                    | 36.7% | 7                                     | 23.3%  |          |                 |
| <b>Change of edema with position</b> |                      |       |                                       |       |                                       |        |          |                 |
| Yes                                  | 9                    | 30.0% | 11                                    | 36.7% | 8                                     | 26.7%  | 0.726    | 0.696           |
| No                                   | 21                   | 70.0% | 19                                    | 63.3% | 22                                    | 73.3%  |          |                 |
| <b>Site of edema</b>                 |                      |       |                                       |       |                                       |        |          |                 |
| Unilateral                           | 9                    | 30.0% | 11                                    | 36.7% | 8                                     | 26.7%  | 0.726    | 0.696           |
| Bilateral                            | 21                   | 70.0% | 19                                    | 63.3% | 22                                    | 73.3%  |          |                 |

 $\chi^2$ : Chi square test

MC: Monte Carlo

F: F for ANOVA test

**Table (4):Grades of pitting edema of the studied pregnant women before, after 10 days and after 20 days of the intervention (n=90).**

| Grades of pitting edema                       | Control group (n=30) |       | Experimental (1) after 10 days (n=30) |       | Experimental (2) after 20 days (n=30) |       | $\chi^2$ | MC <sub>p</sub> |
|-----------------------------------------------|----------------------|-------|---------------------------------------|-------|---------------------------------------|-------|----------|-----------------|
|                                               | No.                  | %     | No.                                   | %     | No.                                   | %     |          |                 |
| <b>Before intervention</b>                    |                      |       |                                       |       |                                       |       |          |                 |
| □ <b>Grade 1+:</b> Mild (1–2 mm)              | 0                    | 0.0%  | 0                                     | 0.0%  | 0                                     | 0.0%  | 3.974    | 0.409           |
| □ <b>Grade 2+:</b> Moderate (2–4 mm)          | 7                    | 23.3% | 12                                    | 40.0% | 12                                    | 40.0% |          |                 |
| □ <b>Grade 3+:</b> Moderately severe (4–6 mm) | 9                    | 30.0% | 4                                     | 13.3% | 7                                     | 23.3% |          |                 |
| □ <b>Grade 4+:</b> Severe (6–8 mm)            | 14                   | 46.7% | 14                                    | 46.7% | 11                                    | 36.7% |          |                 |
| <b>10 days After intervention</b>             |                      |       |                                       |       |                                       |       |          |                 |
| □ <b>Grade 1+:</b> Mild (1–2 mm)              | 0                    | 0.0%  | 8                                     | 26.7% | -                                     | -     | 14.039*  | 0.002*          |
| □ <b>Grade 2+:</b> Moderate (2–4 mm)          | 7                    | 23.3% | 10                                    | 33.3% | -                                     | -     |          |                 |
| □ <b>Grade 3+:</b> Moderately severe (4–6 mm) | 12                   | 40.0% | 9                                     | 30.0% | -                                     | -     |          |                 |
| □ <b>Grade 4+:</b> Severe (6–8 mm)            | 11                   | 36.7% | 3                                     | 10.0% | -                                     | -     |          |                 |
| <b>20 days After intervention</b>             |                      |       |                                       |       |                                       |       |          |                 |
| □ <b>Grade 1+:</b> Mild (1–2 mm)              | 0                    | 0.0%  | -                                     | -     | 19                                    | 63.3% | 58.781*  | <0.001*         |
| □ <b>Grade 2+:</b> Moderate (2–4 mm)          | 3                    | 10.0% | -                                     | -     | 11                                    | 36.7% |          |                 |
| □ <b>Grade 3+:</b> Moderately severe (4–6 mm) | 13                   | 43.3% | -                                     | -     | 0                                     | 0.0%  |          |                 |
| □ <b>Grade 4+:</b> Severe (6–8 mm)            | 14                   | 46.7% | -                                     | -     | 0                                     | 0.0%  |          |                 |

$\chi^2$ : Chi square test MC: Monte Carlo \*: Statistically significant at  $p \leq 0.05$



**Table (5): Mean difference in the foot circumference of the studied pregnant women before, after 10 days and after 20 days of the intervention (n=90).**

| Foot circumference         | Control group (n=30) | Experimental (1) after 10 days (n=30) | Experimental (2) after 20 days (n=30) | F         | p       |
|----------------------------|----------------------|---------------------------------------|---------------------------------------|-----------|---------|
| <b>Ankle</b>               |                      |                                       |                                       |           |         |
| Before intervention        | 25.26±0.38           | 25.29±0.57                            | 25.23±0.60                            | 0.121     | 0.886   |
| 10 days After intervention | 25.40±0.39           | 24.33±0.88                            | -                                     | t=5.098*  | <0.050  |
| 20 days After intervention | 25.45±0.41           | -                                     | 22.91±0.81                            | t=15.306* | <0.001* |
| <b>Instep</b>              |                      |                                       |                                       |           |         |
| Before intervention        | 25.26±0.38           | 25.31±0.37                            | 25.22±0.49                            | 0.380     | 0.685   |
| 10 days After intervention | 25.45±0.42           | 24.88±0.55                            | -                                     | t=4.490*  | <0.002* |
| 20 days After intervention | 25.53±0.42           | -                                     | 23.17±1.16                            | t=10.498* | <0.001* |
| <b>MP joint</b>            |                      |                                       |                                       |           |         |
| Before intervention        | 23.16±0.83           | 23.22±0.76                            | 23.18±0.75                            | 0.042     | 0.959   |
| 10 days After intervention | 23.28±0.79           | 23.10±0.69                            | -                                     | t=0.938   | 0.352   |
| 20 days After intervention | 23.28±0.70           | -                                     | 22.68±0.68                            | t=3.351*  | 0.001*  |

F: F for ANOVA test

t: Student t-test

\*: Statistically significant at  $p \leq 0.05$

**Table (6): Mean difference in the ankle swelling among the studied pregnant women before, after 10 days and after 20 days of the intervention (n=90).**

| Measurements of ankle swelling | Control group (n=30) | Experimental (1) after 10 days (n=30) | Experimental (2) after 20 days (n=30) | F        | P       |
|--------------------------------|----------------------|---------------------------------------|---------------------------------------|----------|---------|
| Measure ankle circumference    |                      |                                       |                                       |          |         |
| Before intervention            | 58.75±2.45           | 58.74±2.30                            | 59.09±2.36                            | 0.206    | 0.814   |
| 10 days After intervention     | 59.39±2.04           | 56.92±2.58                            | -                                     | t=4.099* | <0.001* |
| 20 days After intervention     | 59.39±2.04           | -                                     | 56.81±2.14                            | t=4.770* | <0.001* |

F: F for ANOVA test      t: Student t-test      \*: Statistically significant at  $p \leq 0.05$

### Discussion

Physiological leg edema during the third trimester of pregnancy is a frequent issue often resulting in discomfort and decreased mobility. This condition arises mainly due to the increased pressure exerted by the growing uterus on the pelvic veins and the inferior vena cava, which hinders the return of blood from the lower extremities. Hormonal changes and fluid retention also play a role in causing swelling, particularly in the feet, ankles, and legs. Proper management of the physiological leg edema (lower limb edema) is important to enhance maternal comfort, support healthy circulation, and prevent potential

complications **Shrestha ,Adhikari ,Tamrakar , Shrestha & Shrestha (2020)** So, this study aimed to investigate the effect of modified Buerger-Allen exercises (MBAEs) on physiological leg edema during the third trimester of pregnancy. The results of the current study revealed to no statistically significant differences in socio-demographic characteristics such as age, education, occupation, residence, and family type across control and experimental groups. These results agree with **Mollaehi and Shahali (2023)**, who stated that Modified Buerger-Allen Exercises effectively reduced lower limb edema and related pain in late pregnancy, regardless of

participants' socio-demographic profiles. This evidence reinforces the effectiveness of the intervention across diverse populations .On the other hand, **Jahan, et al., (2023)** contradicts with this study results they revealed that the factors like age, education level, and prior exercise significantly influence pregnant women's engagement in antenatal exercises. Their findings indicate that younger, more educated women with previous exercise experience are more likely to participate in such interventions. Similarly, a study conducted in **Alnaeem, Almalik, Alghamdi & Alotaibi (2024)**, found that socio-demographic factors, including age and occupation, affected pregnant women's knowledge, attitudes, and practices regarding antenatal exercise. These contrasting findings attributed to variations in sample characteristics, differences in the timing and frequency of implementing the intervention. Regarding obstetrics and reproductive history of the studied pregnant women, this study revealed that **no statistically significant differences** between the control and experimental groups regarding various reproductive history variables, including gravidity, parity, number of abortions, stillbirths, living children, and sex of living children. These results agree with

**Ali, Zafar & Khan (2023)** .They demonstrated that the venous return enhancement due to lower limb elevation and graded movement in Buerger-Allen Exercises is a mechanical effect, not significantly modulated by a woman's obstetric history. On the other hand, **Elgzar, Ibrahim, Salem &Elhassaneen (2023)** disagree with this study results. They revealed that **multiparity** might increase the likelihood of developing leg edema due to chronic vascular changes and reduced venous tone in repeated pregnancies. They suggested that interventions may require longer durations or more intensive sessions in multiparous women for optimal results.

Concerning the current pregnancy history of the studied pregnant women, this study discovered that **no statistically significant differences** in gestational age, antenatal visit frequency, edema duration, positional changes, or site of edema. These results corresponded to **Saliba-Júnior, Rollo, Saliba & Sobreira (2022)**.. They showed no baseline group differences in gestational age or edema characteristics; participants wearing stockings experienced significantly less swelling and reported positive perceptions On the other hand, **Mahmoud, El-Nemer & El Sayed (2022)** opposes this study results.

They revealed that interventions requiring postural accuracy and daily repetition (like Buerger-Allen) may be less effective in populations with poor antenatal follow-up, where reinforcement and supervision are limited. This discrepancy may be attributed to variations in sample characteristics, differences in the timing and frequency of implementing the Modified Buerger-Allen Exercises, as well as inconsistencies in participants' compliance.

Regarding grades of pitting edema of the studied pregnant women before, after 10 days and after 20 days of the intervention, the results of the current study specified that after performing the modified Buerger-Allen exercises for 10 days, the experimental group (1) showed significant improvement of the physiological leg edema, compared to the control group, with a higher number of participants exhibiting mild edema and fewer experiencing severe edema. After 20 days, the experimental group (2) demonstrated even greater improvement, with most participants showing mild edema and none having severe edema. In contrast, a considerable number of participants in the control group continued to experience persistent severe edema.

This finding aligns with the results of **Mollaelahi&Shahali (2023)**. They

reported significant improvements in all foot measurements, foot volume, and the severity of pitting edema compared to pre-intervention values. Thus, the hypothesis was confirmed, demonstrating that modified Buerger-Allen exercises can effectively reduce the physiological leg edema during the third trimester of pregnancy. Following the 10-day intervention and subsequent evaluation. There was a marked and clinically meaningful reduction in the average foot circumference, foot volume. These improvements are likely due to enhanced blood circulation in the lower limbs resulting from consistent performance of the modified Buerger-Allen exercises over the 10-day period.

As regard to foot circumference of the studied pregnant women before, after 10 days and after 20 days of the intervention, the results of the recent study showed that after 10 days, the experimental group (1) experienced a notable reduction in ankle and instep circumferences, while the MP joint remained unchanged. By 20 days, experimental group (2) showed significant reductions in all measured areas ankle, instep, and MP joint when compared to the control group. This suggests that performing modified Buerger-Allen exercises for ten days effectively

improve peripheral blood flow in the lower limbs.

These results are consistent with those reported by **Hassan, et al. (2020)**, who found a significant increase in the average ankle–brachial index (ABI) after 15 days of practicing the same exercises. However, no significant change in ABI was noted after just five days of intervention, which is also consistent with their results.

This improvement may be attributed to enhanced collateral circulation, better peripheral blood flow, and increased blood perfusion in the lower limbs. As with many exercise routines, extending the duration of the intervention may contribute to more pronounced and beneficial outcomes. The reduction in the leg's circumference may be related to the modified left lateral tilt (LLT) position, which is believed to improve venous return by easing pressure on the inferior vena cava, thereby enhancing fluid drainage from the lower extremities.

Regarding ankle swelling of the studied pregnant women before, after 10 days and after 20 days of the intervention using figure of eight measurements, the present study showed that the intervention led to significant improvements in reducing ankle swelling. Ten days after the intervention, the first experimental group showed a

noticeable decrease in ankle circumference compared to the control group. This reduction became even more pronounced in the second experimental group after 20 days, with both comparisons showing statistically significant differences.

These results align with **Mollaelahi&Shahali (2023.)** who showed that performing the modified Buerger–Allen exercises for 10 days can effectively reduce swelling in the lower limbs of pregnant women. These improvements were observed in the circumferences of both ankles, both heels, both feet compared to the pre-intervention measurements.

The findings of this study highlight the potential of modified Buerger–Allen exercises as an effective method for reducing or preventing physiological leg edema during pregnancy. This is likely attributed to these exercises promoting enhanced blood circulation and improved peripheral blood flow. Therefore, prolonging the duration of the modified Buerger–Allen exercise can optimize effectiveness in alleviating physiological leg edema during the third trimester of pregnancy (**El Sayed, Abd El-Fattah, & Abdelrahman , 2021**).

Considering that pregnant women have unique physiological characteristics, it can be useful to examine findings from similar

populations, such as individuals with diabetes. In this regard, a systematic review by **Chang Lai, Chen & Hsu (2015)** investigated the effectiveness of Buerger–Allen exercises in improving peripheral blood circulation. The review indicated that these exercises may have beneficial effects, low cost and convenience of performing them safely at home. Furthermore, Buerger–Allen exercises can enhance local blood flow. Conversely a study by **Brodovicz et al. (2009)** reported no significant changes in peripheral edema measurements following similar exercise interventions. The inconsistency may be due to differences in study design, intervention duration, or measurement techniques.

### Conclusion

The modified Buerger-Allen exercises method is an effective, non-invasive complementary approach for the managing the physiological leg edema during the third trimester of pregnancy.

### Recommendations

Based on the findings of this study, it is recommended that nurses, midwives, and other prenatal care providers should be trained for the proper technique and benefits of MBAEs. Considering the prevalence of physiological challenges during pregnancy and their effect on quality

of life, it is advisable for healthcare providers to familiarize themselves with these exercises and include them in standard prenatal care routines to ensure consistent and accurate instructions to pregnant women. Additionally, educational materials and sessions should be developed to each pregnant women on how to safely perform MBAEs at home, empowering them to take an active role in managing edema. Healthcare institutions and policymakers should consider including MBAEs as part of the standard antenatal care protocols, especially in settings where access to advanced medical treatments is limited. Additionally, further research studies with larger sample sizes and diverse populations are recommended to explore long-term benefits of the MBAEs on maternal comfort, mobility, and quality of life.

### References

- Ahmed, A. H., Ismail, N. I. A. A., & Hassan, N. M. M.** (2021). Effect of effleurage massage versus water immersion with exercise on physiological foot edema among primigravidae. *Egyptian Journal of Health Care*, 12(2), 345–356. <https://doi.org/10.21608/ejhc.2021.159852>
- Ali H., Zafar, S. N., & Khan, G. N.** (2023). Therapeutic massage to treat normal physiological ankle

- and foot edema in late pregnancy. SHED Institute of Nursing and Allied Health Sciences & Iqra University, Karachi, Pakistan.
- Alnaeem, L., Almalik, M., Alghamdi, F., & Alotaibi, R.** (2024). Socio-demographic factors influencing pregnant women's awareness and practice of antenatal exercises. *BMC Pregnancy and Childbirth*, 24(1), 112.
- Araby, R., Hassan, N., & Fawzy, M.** (2025). Evaluation of lower extremity edema during pregnancy: Diagnostic tools and clinical implications. *Egyptian Journal of Nursing Studies*, 31(1), 42–51.
- Bhat, R., & Kushtagi, P.** (2024). Physiological changes in pregnancy and their implications. *International Journal of Obstetrics and Gynecology*, 132(2), 110–118.
- Brodovicz, K. G., McNaughton, K., Uemura, N., Mehta, S., Skare, S., & Perez, A.** (2009). Reliability and feasibility of methods to quantitatively assess peripheral edema. *Clinical Medicine & Research*, 7(1–2), 21. <https://doi.org/10.3121/cmr.2009.825>
- Chang, C. F., Lai, H. L., Chen, P. W., & Hsu, H. T.** (2015). Effects of Buerger-Allen exercises on peripheral circulation in individuals with chronic conditions: A systematic review. *Journal of Clinical Nursing*, 24(17–18), 2521–2530. <https://doi.org/10.1111/jocn.12876>
- Dalio, M., Rahimi, A., & Jafari, S.** (2022). Lymphatic changes and their impact on edema in late pregnancy. *Journal of Vascular Health*, 14(2), 91–99. [https://doi.org/10.1007/978-981-16-6206-5\\_19](https://doi.org/10.1007/978-981-16-6206-5_19)
- Elgzar, W. T., Ibrahim, H. A., Salem, O. A., & Elhassaneen, N. A.** (2023). Impact of parity on vascular changes and lower limb swelling in pregnancy: A comparative study. *Journal of Obstetric and Gynecologic Research*, 49(3), 732–739.
- El Sayed, R. M., Abd El-Fattah, D. M., & Abdelrahman, S. A.** (2021). Effect of lateral tilt positions and lower limb elevation on venous return in pregnant women. *Egyptian Journal of Nursing*, 16(2), 88–98.
- Esterson, P. S.** (1979). Ankle measurements in assessing edema. *Journal of Orthopaedic and Sports Physical Therapy*, 1(1), 51–53.
- Hassan, M. A., El-Naggar, N. M., Abdelrahman, H. M., & Soliman, A. E.** (2020). Evaluation of Buerger-Allen exercise on lower extremity perfusion among pregnant women with physiological

- edema. *Journal of Advanced Nursing Research*, 35(3), 113–120.
- Hassan, R., Mostafa, D., & Ahmed, L.** (2020). The effectiveness of exercise-based interventions for managing edema in pregnancy. *Alexandria Scientific Nursing Journal*, 36(2), 77–85.
- Jahan, A., Smith, L., Brown, T., Davis, R., Lee, W. Y., & Patel, S.** (2023). Factors affecting antenatal exercise adherence: A systematic review. *Midwifery*, 122, 103617. <https://doi.org/10.1016/j.midw.2023.103617>
- Knight, R., Johnson, M., Liu, Y.** (2023). Understanding lymphatic drainage and pregnancy edema. *Midwifery Today*, 17(4), 30–34.
- Mahmoud, S. A., El-Nemer, A. M., & El Sayed, H. E.** (2022). Barriers to adherence to antenatal exercise among pregnant women: A cross-sectional study. *BMC Pregnancy and Childbirth*, 22(1), 546. <https://doi.org/10.1186/s12884-022-04845-3>.
- Mollaelahi, M., & Shahali, S.** (2022). Physiological leg edema in pregnancy: A review of causes, consequences, and conservative care. *Iranian Journal of Obstetrics, Gynecology and Infertility*, 25(7), 55–63.
- Mollaelahi, M., & Shahali, S.** (2023). Modified Buerger-Allen exercises in pregnancy: A safe non-pharmacologic method for edema relief. *Journal of Nursing Practice*, 29(1), 12–19.
- Navaee, M., & Rakhshkhorshid, M.** (2020). The impact of leg exercises on sleep quality and leg edema in pregnant women. *Iranian Red Crescent Medical Journal*, 22(3), e102394.
- Nissen, M., Johnson, S., & Lavoie, J.** (2023). Third trimester physiology and symptom management. *American Journal of Perinatal Medicine*, 40(1), 23–30.
- Petersen, W., Rembitzki, I. V., & Koppenburg, A. G.** (2013). Ankle swelling measurement: Accuracy of the figure-of-eight method. *Journal of Sports Science and Medicine*, 12(1), 123–127.
- Raetz, J., Garzon, M., & Dillingham, C.** (2023). Evaluation and management of lower extremity edema in pregnancy. *American Family Physician*, 107(1), 24–31.
- Radhika, S., Sangeetha, V., & Menon, R.** (2024). Effectiveness of modified Buerger-Allen exercises on leg edema and mobility in pregnant women.



*Journal of Clinical Nursing and Midwifery*, 10(1), 45–52.

**Saleh, S., El-Tantawy, H., & Ahmed, F.** (2024). Alternative therapies for managing pregnancy-related discomforts: An Egyptian perspective. *Egyptian Journal of Maternity and Child Health*, 22(2), 101–109.

**Saliba Júnior, C. M., de Lima, A. M., & Fernandes, A. S.** (2020). Sleep disturbances and labor outcomes in pregnant women with leg edema. *Sleep and Pregnancy Journal*, 15(3), 205–212.

**Saliba-Júnior, O. A., Rollo, H. A., Saliba, O., & Sobreira, M. L.** (2022). Positive perception and efficacy of compression stockings for prevention of lower limb edema in pregnant women. *Journal of Vascular Brasileira*, 21, e20210101. <https://doi.org/10.1590/1677-5449.210101>

**Shrestha, S. S., Adhikari, R., Tamrakar, S., Shrestha, R., & Shrestha, A.** (2020). Adherence to iron, folic acid, and calcium supplements and factors affecting it among antenatal care attending women in a tertiary care hospital: A cross-sectional study. *Kathmandu University Medical Journal*, 18(2), 83–90.

<https://doi.org/10.3126/kumj.v18i2.33265>

**Vediappan, V., Lakshmi, A., & Rajendran, S.** (2024). Impact of maternal posture and exercise on lower limb circulation during pregnancy. *Journal of Physiological Nursing*, 14(1), 66–74.

**Zaki, W. E., Ragheb, M. M., Taha, A. S., & Omran, E. S.** (2023). Effect of Buerger Allen exercise on lower extremity perfusion among patients with type 2 diabetes mellitus. *Journal of Nursing Science Benha University*, 4(1), 1166–1182. <https://doi.org/10.21608/jnsbu.2023.280725>.



