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Dr.hanan.said@nursing.asu.edu.eg

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Editor in Chief, Prof. Sahar Mahmoud Elkhedr,
Faculty of Nursing, Tanta University, Tanta.
e-mail: sahar.abdelgawad@nursing.tanta.edu.eg
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Effect of Educational Program on Nursing Students' Perception Regarding Nanotechnology in Health Care

Walaa Saber Abdel gayed Younis¹, Entisar Aboelghite El-Hossiny El-kazeh², Samira El-Sayed El-Mezayen³, Nahed Karam Mahmoud Elsehry⁴

¹Demonstrator of Community Health Nursing, Faculty of Nursing, Tanta University, Egypt.

²Professor of Community Health Nursing, Faculty of Nursing, Tanta University, Egypt.

^{3,4}Assistant professor of Community Health Nursing, Faculty of Nursing, Tanta University, Egypt.

Corresponding author: Walaa Saber Abdel gayed Younis

Email: wsaber510@gmail.com

Abstract

Background: Nanotechnology has appeared a revolutionized force in nursing care field. It provides a surpassing opportunity in monitoring, prevention, and treatment of diseases to enable nurses in provision of precision-based patient care. So, nursing students must be aware about this technology. **Aim** was to evaluate the effect of educational program on nursing students' perception regarding nanotechnology in health care. **Study design:** A quasi-experimental research design was utilized. **Setting:** This study was conducted at Faculty of Nursing, Tanta University. **Subjects:** Simple random sampling of 200 nursing students from the fourth academic year, Faculty of Nursing, Tanta University. **Tools of data collection:** - One tool was used in this study. **Tool I: Nursing students' perception regarding nanotechnology in health care questionnaire:** included three parts: Part (1): Socio-demographic characteristics of the studied nursing students. Part (2): Nursing students' knowledge about nanotechnology in health care. Part (3): Nursing students' attitude toward nanotechnology in health care. **Results:** Pre-program, all the studied nursing students had low levels of knowledge and negative attitudes about nanotechnology in health care. While, immediately and one month after giving the educational program, all of them had high levels of knowledge and positive attitudes toward nanotechnology in health care. **Conclusion:** The educational program significantly brought out an improvement in the knowledge and attitude of the studied nursing students regarding nanotechnology. **Recommendations:** Continuous educational programs, workshops, and training for nursing students to gain them with the needed information, support acceptance of this technology and work effectively with it. **Keywords:** Educational program, Nursing students, Perception, Nanotechnology, Health care.

Introduction

Nanotechnology is the next uprising in our daily life. It is one of the ultimate innovatory technologies in 21st century. It is the capacity to transform Nano science theory to valuable and practical applications by monitoring, designing, controlling, and manufacturing objects at the nanometer scale (objects sized between 1: 100 nanometers). So, Nanotechnology means simply to deal with small things. Nanotechnology can make materials with certain characteristics that can provide particular functions **(Bayda, Adeel, Tuccinardi, Cordani, & Rizzolio, 2019)**.

Nanotechnology with its wonderful applications in healthcare field has a major effect on development of health care sector and make substantial progression in nursing care provided to the patients particularly in monitoring, post-operative care, infection control, wound care and chronic diseases management which enable nurses in providing precision care, promoting workflow competency, enhance clinical outcomes and find solutions to numerous problems in nursing field **(Rabaiy et al., 2025)**

Worldwide, the precedence research report illustrated that, the global market size for nanotechnology in health care was accounted for

209.43 billion USD in 2024. It may grow to 233.70 billion USD in 2025. It is predicted to surpass around 627.03 billion USD by 2034. Represents compound annual growth rate (CAGR) of 11.59% between 2025 and 2034 **(Precedence Research Report 17, 12, 2024)**.

In Egypt, according to insight research report, the market size for nanotechnology-based drugs was value as 238.5 million USD in 2022 and predicted to reach 518.7 million USD by 2030. It offers compound annual growth rate of 10.2% during the forecast period 2023-2030 **(Insight Research Report, 2024)**.

Nanotechnology has many effective applications in multiple fields that positively affect our daily life such as health care, energy, environment, defense sector, industry, and agriculture. Applications of nanotechnology in health care can enhance the development and delivery of health care. Additionally, participate in making efficient results with novel prospects through prevention, early detection, precision treatment of diseases leading to better and safer life. It creates important advantages to nursing practice due to excess utilizing in medicine **(Saxena, Nyodu, Kumar, & Maurya, 2020)**.

Nanotechnology begins to grow since several years and used within health care field. Nanotechnology education for nursing students is still restrictive and there is gap of knowledge about nanotechnology and its uses in health care field to nursing students. So, it is important to combine nanotechnology to nursing academic programs as nanotechnology significant variable influencing nursing care practice and health care field. In addition to that nursing students will be engaged in using this technology in the future **(Huertas, Fuentes, Garcia, & Bustos, 2024)**.

Community health nurse has a significant role in providing nursing students teaching program about this technology and its benefits, harms, useful applications and nurses roles to raise their awareness and improve their attitude about this technology because it is a recent and promise technology with a useful solution to health care problems and there is insufficient education for this technology **(Dikmen, Bagriacik, & van Giersbergen, 2022)**.

Significance of the study:

Nanotechnology has begun to be developed and be used within the multidisciplinary approach that has established her in the health care field. Nurses are influenced by nanotechnology evolution to

improve nursing care provided to their patients. In addition, there is no information about nanotechnology in health care in the nursing curriculums and there is lack of research studies about nanotechnology in Egypt. Furthermore, nursing students will provide nursing services after their graduation. So, nursing students should be knowledgeable about nano technological products that will be used in field of health care **(Sayılan & Mercan, 2016)**. Therefore, the aim of this study is to evaluate the effect of educational program on nursing students' perception regarding nanotechnology in health care.

Aim of the Study was to evaluate the effect of educational program on nursing students' perception regarding nanotechnology in health care.

Research Hypothesis: Nursing students' perception regarding nanotechnology in healthcare was expected to be improved after the application of educational program.

Subjects and Method

Study Design: Quasi-experimental research design was utilized.

Study Settings: The study was conducted at Faculty of Nursing, Tanta University, Tanta, Egypt.

Subjects: Simple random sampling of 20% from fourth academic year

2024-2025 of nursing students, Faculty of Nursing at Tanta University. The total number of nursing students = 1030, 20 % of them were approximately 200 nursing students.

Tool of the study: One tool was developed by the researcher as follow:

Nursing students' perception regarding nanotechnology in health care questionnaire. It divided into three parts: - **Part (I): Socio-demographic characteristics of studied nursing students:** It covered data about nursing students' age, sex, residence, marital status, monthly family income, parents' level of education and parents' occupation.

Part (2): Nursing students' knowledge about nanotechnology in health care: This part was developed by the researcher after reviewing the related and literatures (Ciftci et al., 2019; Dikmen, Bagriacik, & Giersbergen, 2022; Sayulan & Mercan, 2016) to assess nursing students' knowledge about nanotechnology in health care. It comprised of 28 questions that covered the following items: definition, history, applications of nanotechnology, uses, advantages and disadvantages of nanotechnology in health care.

The scoring system: Each correct answer was taken a score of “one”, while incorrect /don't know answers was taken a score of “zero”. Then all the correct answered were summed up and the total score was calculated and ranged from (0-57) which further categorized into three level of knowledge as follow:

- **Low level of knowledge:** < 60 % of the total score: < 34 points.

- **Moderate level of knowledge:** 60% -< 75% of the total score: 34 - 43 points.

- **High level of knowledge:** ≥ 75% of the total score: ≥ 43 points.

Part (3): Nursing students' attitude toward nanotechnology in health care: This part was developed by the researcher after reviewing the related and recent literatures (Gul, 2017; Secken, 2009; Zor & Kan, 2021). This part was included 23 structured statements included (14 positive and 9 negative statements). The part aims to assess the nursing student's attitude towards nanotechnology in health care. The responses were evaluated by using three-point Likert scale ranged from (0-2). Positive responses were evaluated by 0 (disagree), 1 (Neutral), 2 (Agree). Negative responses were reversed as evaluated by 2 (disagree), 1 (Neutral), 0 (Agree).

The scoring system: The total score was calculated and ranged from (0-46) which further categorized into two levels of attitude as follow:

- **Negative attitude** ≤ 60 of the total score: ≤ 28 points.

- **Positive attitude** > 60 of the total score: > 28 points.

Method

The study was executed as follow:

1-Obtaining approval: An official permission was taken from the Dean of the Faculty of Nursing, Tanta University before conducting the study.

2-Ethical considerations: Acceptance of the Faculty of Nursing, Tanta University Scientific Research of Ethical Committee was taken to conduct the study, code of ethics (495-7-2024).

-An informed consent was taken from all subjects of the study, each participant was reported that he/she has the right to withdraw at any time, privacy and confidentiality was put into consideration and the study nature did not cause any pain or harm for them.

3-Developing the study tools: The study tool was developed by the researcher based on review of the related literatures and translated into Arabic language to suit the Egyptian culture reviewed by the supervisors. Then, it was tested for its face and content validity by a jury of seven

professors' expertise in Community Health Nursing field. Validity of questionnaire was calculated and found to be (96%).

4-Pilot study: was conducted by the researcher on 20 nursing students which represents 10% of the sample for testing its clarity, applicability and to identify the time length needed for data collection. Those nursing students were included in the main study sample. As, there no change or modification was done on the tool.

5-Reliability: The tools of the study were tested by using Cronbach's alpha test, it was computed and it was found to be = (0.704) for all tools of the study (for knowledge items was found to be = 0.667, and for attitude items it was found to be = 0.658).

6-Developing the educational program: The subsequent phases were adopted as follow.

I) Assessment phase: The previously mentioned tools used to collect the baseline data by interviewing each nursing student in community health nursing laboratory and hall 4.

II) Planning phase: according to nursing students' needs. It was included the following steps:

A. Formulating program goal and objectives: The main goal of the program was to enhance the

perception of nursing students about nanotechnology in healthcare.

Specific objectives: were formulated for each session

B- Preparing and organizing the content of the educational program: The contents were organized in four consecutive sessions as follow: -

Session (1): Program orientation, expectations and overview about nanotechnology in health Care: - (Time 45 minutes): It aimed to initiate a relationship with the studied nursing students and to stated them about the goal of the program, sessions objectives, sessions expectations. In addition to conduct pre-test evaluation, clarify meaning and current statistics of nanotechnology in healthcare.

Session (2): History and applications of nanotechnology: (Time 30 minutes): It aimed to raise the nursing students' knowledge about history and applications of nanotechnology.

Session (3): Advantages and disadvantages of nanotechnology in healthcare: (Time 30 minutes): It aimed to clarify advantages and disadvantages of nanotechnology in healthcare to the nursing students.

Session (4) Uses of nanotechnology in healthcare: (Time 45 minutes): It aimed to increase nursing

students' awareness about uses of nanotechnology in healthcare.

c- Selecting the teaching strategies: Teaching methods: - as interactive lectures, group discussion and brain storming.

Instructional materials: - as Power point presentation and booklet.

III) Implementation phase: It was carried out at community health nursing laboratory and hall 4 in Faculty of nursing and four successive sessions were provided for them according to their actual needs using diverse methods of teaching and audiovisuals aids.

IV) Evaluation phase: It was conducted three times for nursing students. **-First time (pre-test):** pre-program implementation for nursing students using the study tool.

-Second time (immediate post-test): Immediately after educational program implementation using the study tool (part 2 and part 3).

-Third time (Follow up): one month after educational program implementation using study tool (part 2 and part 3).

(6) Statistical analysis of the data

The statistical data were organized, tabulated, and statistically analyzed using statistical package for social studies (SPSS) version 23. For comparison for more than two related means the F variance of repeated measures analysis was

used. For comparison for more than two independent means, one-way A n o v a test was used and for comparison between two independent means, t test was used. Correlation between variables was evaluated using Pearson's correlation coefficient (r).

Results

Table (1) represents distribution of the studied nursing students according to means and standard deviation of knowledge items about nanotechnology during pre, immediate and one-month post program intervention. The table reveals that, the means of knowledge items about nanotechnology was the highest immediately after program implementation than pre- program. However, there was a slight decline in means one-month post program than immediate program implementation, where the mean of their total knowledge score increased from 17.420 ± 8.59 pre-program intervention to 54.710 ± 1.029 immediately after program implementation and 50.630 ± 1.598 after one month post educational program.

Table (2) represents relation between total knowledge score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention.

This table shows that there was a statistically significant relationship between total knowledge score and age of the studied nursing students, mothers' occupation, the fathers' educational level and family monthly income during pre-program intervention at P (0.025, 0.015, 0.019, 0.001) respectively. Also, post-program implementation, there was a statistically significant relationship between total knowledge score with the fathers' educational level and fathers' occupation immediately post program at P (0.038 & 0.041) respectively. Otherwise, there was no relationship with other characteristics.

Table (3) represents distribution of the studied nursing students according to means and standard deviation of attitudes sub scales total scores toward nanotechnology in health care during pre, immediate and one-month post program intervention.

The table shows that, means and standard deviation of attitude sub scales total scores (importance of nanotechnology, research and exploration about nanotechnology in health care and concerns about using of nanotechnology in healthcare) toward nanotechnology was the highest immediately after program implementation (21.98 ± 0.211 ,

11.99 $\pm$ 0.212 & 9.36 $\pm$ 1.161) respectively than pre-program (7.195 $\pm$ 2.670, 4.920 $\pm$ 2.057 & 1.880 $\pm$ 1.694). However, there was a slight decline in means and standard deviation one-month post program than immediate program implementation (21.97 $\pm$ 0.211, 11.96 $\pm$ 0.290 & 5.865 $\pm$ 1.420) with a statistically significant difference between them at (P= 0.001).

Table (4) represents relation between total attitudes score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention.

The table shows that there was a statistically significant relationship between total attitudes score and age of the studied nursing students and residence during pre-program intervention at (p= 0.035 & 0.045) respectively. Also, there was a statistically significant relationship between total attitudes score with fathers' occupation and family monthly income immediately and one month after program implementation at (p= 0.018 & 0.034) respectively.

Furthermore, there were no statistically significant relationships with other characteristics.

Table (5) represents correlation between total knowledge score and total attitude score during pre,

immediate and one-month post-program intervention. This table reveals that there was a significant positive correlation between total knowledge score of the studied nursing students with their total attitudes score during immediate and one-month post program intervention at p (0.000 & 0.048) respectively. In addition, total knowledge score during one-month post program intervention positively correlated with total attitude score during one-month post program intervention at p (0.006).

Table (6) represents distribution of the studied nursing students according to their knowledge about uses of nanotechnology in healthcare during pre, immediate and one-month post program intervention. The table shows that, there was a statistically significant improvement among the studied nursing students' knowledge regarding uses of nanotechnology in health care during pre, immediate and one-month post program intervention at (p<0.01).

Table (7) represents distribution of the studied nursing students according to their knowledge about advantages and disadvantages of nanotechnology in health care during pre, immediate and one-month post program intervention. This table

reveals, that 41.5%, 27.5%, 31.0%, 23.5%, 18.0% of the studied nursing students knew that improve quality of life of the people, early diagnosis of diseases, increase efficacy of treatment, reduce side effects of medications, improve patient outcomes were among advantages of nanotechnology before implementation of the program respectively compared to approximately the all (100.0%, 99.0%, and 99.5%) immediately after program implementation respectively. Also, about all (100.0%, 98.5%, and 99.5%) of them one month after program implementation respectively.

Concerning knowledge related to disadvantages of nanotechnology in health care, 28.5%, 50.0%, 25.0%, 27.0%, 16.5% of them knew that toxicity effect, high cost for developing and producing of nanoparticles, regulatory challenges, requires a trained and highly skilled nursing staff and limited information on nanotechnology respectively are disadvantages of nanotechnology in health care pre-program implementation respectively compared to the majority (92.5%, 97.5%, 93.0%, 98.5%, 94%) immediately after program implementation respectively to (89.0%, 94.5%, 87.5%, 92.5%, 85.0%) of them after one month of

program implementation respectively.

Table (8) represents distribution of the studied nursing students according to their knowledge regarding role of community health nurses towards nanotechnology in health care during pre, immediate and one-month post program intervention.

It was noticed that about two thirds (60.0%) of the studied nursing students knew that educating people about uses of nanotechnology in health care. Also, about two fifths (41.0%) of them knew that raising awareness about devices and administering nanotechnology-based medications. Additionally, more than one quarter (26.5%) of them knew that observing and recording the effectiveness of nanotechnology treatment on patients and only 19.5% of them knew that a scientific research on impact of nanotechnology in health care were among role of nurse towards nanotechnology pre-program implementation compared to all of them knew the correct answers immediately and one month after program implementation with a statistically significant difference between them at ($P= 0.001$).

Figure (1) represents distribution of the studied nursing students according to their levels of

knowledge about nanotechnology in health care during pre, immediate and one-month post program intervention. It was clear that, all the studied nursing students had a low level of knowledge about nanotechnology in pre-program implementation. After implementation of educational program, the percentages of those having high level of knowledge increased from zero percentage pre-program intervention to 100% immediately and one-month post program intervention.

Figure (2) represents the distribution of the studied nursing students regarding their sources of information about nanotechnology. The figure shows that; all the studied nursing students had received information about nanotechnology from the internet.

Table (1): Distribution of the studied nursing students according to means and standard deviation of knowledge items about nanotechnology during pre, immediate and one-month post program intervention

Knowledge items total scores	The studied nursing students (n=200)			F P
	Pre- program intervention	Immediate program	One- month post- program	
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
Meaning of nanotechnology	0.86 $\pm$ 0.680	1.92 $\pm$ 0.272	1.82 $\pm$ 0.389	244.44 < 0.001**
The origin of the word Nano	0.33 $\pm$ 0.471	0.88 $\pm$ 0.332	0.80 $\pm$ 0.405	122.33 < 0.001**
Meaning of the word Nano	0.50 $\pm$ 0.501	0.98 $\pm$ 0.140	0.88 $\pm$ 0.332	92.324 < 0.001**
Meaning of nanometer	0.49 $\pm$ 0.501	0.98 $\pm$ 0.140	0.89 $\pm$ 0.320	95.593 < 0.001**
Nanoparticles as particles smaller than 100 nanometer in size	0.35 $\pm$ 0.528	0.95 $\pm$ 0.229	0.85 $\pm$ 0.358	122.06 < 0.001**
Nano scale objects can be seen with naked eye?	0.66 $\pm$ 0.485	0.98 $\pm$ 0.140	0.97 $\pm$ 0.171	39.379 < 0.001**
Objects at the Nano scale can have new properties that are different from its known properties in its normal size.	0.37 $\pm$ 0.513	1.0 $\pm$ 0.000	1.0 $\pm$ 0.000	306.53 < 0.001**
Properties of objects at the Nano scale can be exploited to develop useful technologies in health care?	0.40 $\pm$ 0.491	1.0 $\pm$ 0.000	1.0 $\pm$ 0.000	298.50 < 0.001**
Properties of objects at the Nano scale may give rise to both advantages and disadvantages of nanotechnology	0.36 $\pm$ 0.481	1.0 $\pm$ 0.000	1.0 $\pm$ 0.000	353.77 < 0.001**
The father of nanotechnology	0.16 $\pm$ 0.363	0.87 $\pm$ 0.337	0.68 $\pm$ 0.465	249.22 < 0.001**
First defined and used the term nanotechnology	0.11 $\pm$ 0.314	0.85 $\pm$ 0.358	0.72 $\pm$ 0.453	268.39 < 0.001**
The concepts of nanotechnology first discussed	0.07 $\pm$ 0.256	0.90 $\pm$ 0.307	0.79 $\pm$ 0.408	437.68 < 0.001**
Applications of nanotechnology	1.95 $\pm$ 1.385	5.63 $\pm$ 0.759	5.04 $\pm$ 1.211	554.80 < 0.001**
Uses of nanotechnology in disinfection within healthcare facilities	0.66 $\pm$ 0.661	1.91 $\pm$ 0.356	1.62 $\pm$ 0.669	334.19 < 0.001**

p< 0.01 highly significant**

Table (1): Continue, distribution of the studied nursing students according to means and standard deviation of knowledge items about nanotechnology during pre, immediate and one-month post program intervention

Knowledge items total scores	The studied nursing students (n=200)			F P
	Pre- program intervention	Immediate program	One- month post- program	
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
Uses of nanotechnology in pharmaceutical industry.	0.56 $\pm$ 0.498	1.0 $\pm$ 0.000	1.0 $\pm$ 0.000	156.35 < 0.001**
Reasons for using nanotechnology in pharmaceutical industry	0.71 $\pm$ 0.788	2.82 $\pm$ 0.499	2.56 $\pm$ 0.720	613.56 < 0.001**
Uses of nanotechnology in cancer treatment	0.78 $\pm$ 0.719	2.86 $\pm$ 0.449	2.56 $\pm$ 0.800	656.78 < 0.001**
Uses of Nano robots in healthcare	0.53 $\pm$ 0.633	1.89 $\pm$ 0.350	1.59 $\pm$ 0.620	376.78 < 0.001**
Uses of nanotechnology in medical imaging?	0.57 $\pm$ 0.662	1.96 $\pm$ 0.271	1.87 $\pm$ 0.456	409.38 < 0.001**
Uses of nanotechnology in pain management	0.70 $\pm$ 0.716	2.93 $\pm$ 0.316	2.77 $\pm$ 0.573	824.80 < 0.001**
Uses of nanotechnology in diabetes treatment	0.50 $\pm$ 0.626	1.89 $\pm$ 0.386	1.66 $\pm$ 0.647	370.67 < 0.001**
Nanotechnology can be used in sunscreens to provide greater protection from ultraviolet rays	0.39 $\pm$ 0.488	0.95 $\pm$ 0.218	0.87 $\pm$ 0.343	128.58 < 0.001**
Advantages of using nanotechnology in health care	1.42 $\pm$ 1.229	4.98 $\pm$ 0.140	4.97 $\pm$ 0.186	818.79 < 0.001**
Disadvantages of using nanotechnology in health care	1.48 $\pm$ 1.075	4.76 $\pm$ 0.661	4.49 $\pm$ 0.935	782.26 < 0.001**
Role of community health nurses towards nanotechnology in health care	1.47 $\pm$ 1.116	4.00 $\pm$ 0.000	4.00 $\pm$ 0.935	1032.3 < 0.001**

Table (2): Relation between total knowledge score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention

Socio-demographic characteristics of the studied nursing students	The studied nursing students (n=200)					
	Pre-program		Immediate program		One-month post program	
	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P
Age in years						
- 21 -	18.33 ±8.53	2.26 0.025*	54.71±0.996	0.150	50.64±1.633	0.197
23 -	15.387±8.43		54.69±1.139	0.881	50.59±1.530	0.844
Sex						
- Male	16.77±8.275	0.834	54.59±1.066	1.213	50.38±1.452	1.690
- Female	17.82±8.792	0.405	54.78±1.020	0.227	50.78±1.672	0.093
Place of residence						
- Rural	17.21±8.421	0.516	54.69±1.111	0.355	50.65±1.656	0.366
- Urban	17.90±9.030	0.606	54.75±0.856	0.723	50.56±1.465	0.715
Marital status						
- Single	17.79±8.384	1.517	54.75±1.019	1.550	50.62±1.615	0.046
- Married	15.14±9.621	0.131	54.42±1.136	0.123	50.64±1.520	0.964
Family monthly income						
- Not enough	11.50±8.945	13.623 0.001**	54.55±0.876	1.141 0.322	50.69±1.720	0.290 0.749
- Enough	19.13±8.115		54.77±1.084		50.64±1.633	
- Enough and save	15.11±5.521		54.47±0.943		50.35±0.931	
Educational level of mother						
- Illiterate	13.30±8.393	2.083 0.084	54.40±1.173	2.293 0.061	50.20±1.135	0.609 0.657
- Read & write	14.40±9.178		54.70±0.732		50.75±1.618	
- Basic education	19.57±9.342		54.25±1.109		50.35±1.947	
- Secondary education	18.26±8.224		54.77±1.075		50.63±1.560	
- University education & postgraduate	16.34±8.263		54.95±0.920		50.85±1.542	

p<0.05* significant

p<0.01** highly

Table (2): Continue, Relation between total knowledge score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention

Socio-demographic characteristics of the studied nursing students	The studied nursing students (n=200)					
	Pre-program		Immediate program		One-month post program	
	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P
Educational level of mother						
- Illiterate	13.30±8.393	2.083 0.084	54.40±1.173	2.293 0.061	50.20±1.135	0.609 0.657
- Read & write	14.40±9.178		54.70±0.732		50.75±1.618	
- Basic education	19.57±9.342		54.25±1.109		50.35±1.947	
- Secondary education	18.26±8.224		54.77±1.075		50.63±1.560	
- University education & postgraduate	16.34±8.263		54.95±0.920		50.85±1.542	
Educational level of father						
- Illiterate	9.25±7.675	3.022 0.019*	54.00±0.816	2.597 0.038*	50.00±0.816	0.443 0.778
- Read & write	8.36±1.825		55.04±0.804		50.80±1.435	
- Basic education	13.70±8.369		54.54±1.062		50.50±1.318	
- Secondary education	18.85±8.463		54.57±1.103		50.56±1.799	
- University education & postgraduate	17.48±8.425		55.00±0.908		50.80±1.377	
Mother occupation						
- Working	14.65±8.293	2.44	54.81±0.971	0.781	50.45±1.501	0.824
- House Wife	18.19±8.538	0.015*	54.67±1.059	0.436	50.67±1.626	0.411
Father occupation						
- Daily worker	14.70±9.675	1.488 0.207	54.41±0.847	2.536 0.041*	50.35±1.817	0.512 0.727
- Employee	17.60±8.297		54.95±0.923		50.77±1.446	
- Professional works	16.43±8.058		54.60±1.132		50.46±1.756	
- Craft works	18.04±8.526		54.36±1.410		50.80±1.581	
- Free business	19.36±8.444		54.79±0.954		50.61±1.602	

p<0.05* significant

p<0.01** highly significant

Table (3): Distribution of the studied nursing students according to means and standard deviation of attitude sub scales total scores toward nanotechnology in health care during pre, immediate and one-month post program intervention

Attitude toward nanotechnology in health care subscales	The studied nursing students (n=200)			F P
	Pre-program intervention	Immediate program	One-month post-program	
	Mean $\pm$ SD Range	Mean $\pm$ SD Range	Mean $\pm$ SD Range	
Importance of nanotechnology subscales total score	7.195 $\pm$ 2.670 (0-13)	21.98 $\pm$ 0.211 (20-22)	21.97 $\pm$ 0.211 (20-22)	6061.5 < 0.001**
Research and exploration about nanotechnology in health care sub scales total score	4.920 $\pm$ 2.057 (0-11)	11.99 $\pm$ 0.212 (9-12)	11.96 $\pm$ 0.290 (9-12)	1156.4 < 0.001**
Concerns about using of nanotechnology in healthcare sub scales total score	1.880 $\pm$ 1.694 (0-7)	9.36 $\pm$ 1.161 (6-12)	5.865 $\pm$ 1.420 (2-10)	1625.7 < 0.001**
Mean $\pm$ SD of total attitude score	17.420 $\pm$ 8.591	54.710 $\pm$ 1.029	50.630 $\pm$ 1.598	8306.4 < 0.001**

p< 0.01 highly significant**

Table (4): Relation between total attitude score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention

Socio-demographic characteristics of the studied nursing students	Total attitude score (n=200)					
	Pre-program		Immediate program		One month post program	
	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P
Age in years						
- 21 -	14.31±2.954	2.11	43.29±1.135	0.569	39.80±1.539	0.136
- 23 -	13.29±3.564	0.035*	43.39±1.077	0.570	39.82±1.048	0.892
Sex						
- Male	14.09±3.087	0.337	43.22±1.119	0.995	39.79±1.516	0.102
- Female	13.93±3.251	0.737	43.38±1.113	0.321	39.81±1.333	0.919
Place of residence						
- Rural	13.70±3.191	2.018	43.41±1.157	1.837	39.85±1.434	0.692
- Urban	14.68±3.078	0.045*	43.10±0.986	0.068	39.70±1.331	0.490
Marital status						
- Single	14.01±3.170	0.183	43.28±1.131	1.411	39.80±1.434	0.212
- Married	13.89±3.315	0.855	43.57±0.997	0.166	39.86±1.208	0.833
Family monthly income						
- Not enough	14.08±2.655	0.907 0.405	43.28±1.162	0.335 0.716	40.17±1.384	3.44 0.034*
- Enough	14.09±3.203		43.31±1.132		39.65±1.398	
- Enough and save	13.00±3.969		43.32±1.115		40.35±1.272	
Educational level of mother						
- Illiterate	12.60±2.319	0.745 0.563	43.80±1.135	0.726 0.575	40.30±1.160	0.587 0.673
- Read & write	13.80±3.607		43.10±1.119		39.90±1.774	
- Primary level	14.50±2.715		43.21±1.258		39.93±1.438	
- Secondary level	13.93±3.323		43.34±1.089		39.68±1.296	
- High level & postgraduate	14.24±3.105		43.34±1.087		39.85±1.509	

p<0.05* significant

p<0.01** highly significant

Table (4): Continue, Relation between total attitude score and socio-demographic characteristics of the studied nursing students during pre, immediate and one-month post program intervention

Socio-demographic characteristics of the studied nursing students	Total attitude score (n=200)					
	Pre-program		Immediate program		One month post program	
	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P	Mean ± SD	T test or F value P
Educational level of father						
- Illiterate	13.50±0.577	0.967 0.426	43.50±1.000	0.136 0.969	40.00±0.000	0.718 0.580
- Read & write	14.52±3.516		43.19±1.209		39.57±1.660	
- Primary level	13.25±3.179		43.29±1.122		40.13±1.597	
- Secondary level	14.29±3.010		43.32±1.108		39.86±1.361	
- High level & postgraduate	13.53±3.494		43.38±1.134		39.62±1.328	
Mother occupation						
- Working	14.23±3.154	0.547	43.43±1.087	0.752	39.93±1.404	0.678
- House Wife	13.93±3.197	0.585	43.29±1.125	0.453	39.77±1.404	0.498
Father occupation						
- Daily worker	13.45±3.118	1.281 0.279	42.90±0.978	3.056 0.018*	39.45±1.410	1.509 0.201
- Employee	13.60±3.478		43.61±1.081		40.00±1.494	
- Professional works	14.00±2.948		43.00±1.259		39.43±1.406	
- Craft works	14.36±2.737		43.32±1.180		39.96±1.513	
- Free business	14.80±3.070		43.36±1.014		39.91±1.117	

p<0.05* significant**p<0.01** highly significant**

Table (5): Correlation between total knowledge scores and total attitudes scores during pre, immediate and one-month post program intervention.

Total attitude score of the studied nurses	Total knowledge scores of the studied nurses		
	Pre-program	immediate program	one-month post program
	r p	r p	R P
Total attitudes scores during pre-program	0.127 0.073	0.088 0.217	0.090 0.207
Total attitudes scores during immediate program	0.071 0.315	0.310 0.000**	0.140 0.048*
Total attitudes scores one-month post program	-0.041- 0.563	0.154 0.029*	0.194 0.006**

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table (6): Distribution of the studied nursing students according to their knowledge about uses of nanotechnology in health care during pre, immediate and one-month post program intervention

Uses of nanotechnology in health care		The studied nursing students (n=200)						
		Pre-program intervention		Immediate program		One-month post-program		χ^2 P
		No	%	No	%	No	%	
Uses of nanotechnology in disinfection within healthcare facilities								
-Disinfection of medical equipment and hospital surfaces	Correct	66	33.0	196	98.0	178	89.0	227.237 0.001**
-Using silver nanoparticles as effective disinfectant due to their strong antimicrobial activity to reduce the spread of infection	Correct	65	32.5	185	92.5	146	73.0	178.429 0.001**
-Nanotechnology has no role in disinfection within healthcare facilities	Incorrect	27	13.5	0	0.0	17	8.5	27.95 0.001**
-Do not know		63	31.5	3	1.5	3	1.5	120.00 0.001**
Uses of nanotechnology in medical textiles production								
-Adding nanomaterial to conventional materials during manufacturing to give them new properties	Correct	46	23.0	195	97.5	175	87.5	261.613 0.001**
-Production of medical textiles that has antimicrobial properties and water repellent	Correct	47	23.5	195	97.5	172	86.0	255.423 0.001**
-Antibacterial medical gown can be made for doctors and nurses	Correct	31	15.5	193	96.5	171	85.5	282.488 0.001**
-Nanotechnology has no role in production of medical textiles	Incorrect	38	19.0	1	0.5	19	9.5	39.500 0.001**
-Do not know		70	35.0	0	0.0	1	0.5	138.029 0.001**

Table (6): Cont. Distribution of the studied nursing students according to their knowledge about uses of nanotechnology in health care during pre, immediate and one-month post program intervention

Uses of nanotechnology in health care		The studied nursing students (n=200)						
		Pre-program intervention		Immediate program		One-month post- program		χ^2 P
		No	%	No	%	No	%	
Uses of nanotechnology in mouth care products								
-Using nanomaterial to enhance toothpaste effectiveness	Correct	63	31.5	195	97.5	168	84.0	216.133 0.001**
-Using nanomaterial to enhance mouth wash effectiveness	Correct	29	14.5	194	97.0	166	83.0	283.503 0.001**
-Nanotechnology has no role in mouth care products	Incorrect	42	21.0	1	0.5	23	11.5	44.316 0.001**
-Do not know		81	40.5	1	0.5	1	0.5	160.00 0.001**
Nanotechnology can be used in pharmaceutical industry.								
-Yes	Correct	113	56.5	200	100.0	200	100.0	174.00 0.001**
-No	Incorrect	26	13.0	0	0.0	0	0.0	
-Do not know		61	30.5	0	0.0	0	0.0	
If the answer is yes, what are the reasons for using it in pharmaceutical industry								
-Small size of nanomaterial	Correct	62	54.9	198	99.0	198	99.0	272.00 0.001**
-Less damage to healthy tissues	Correct	30	26.5	184	92.0	157	78.5	260.09 0.001**
-Affect directly the diseased cells	Correct	50	44.2	180	90.0	152	76.0	208.059 0.001**
-Don't know		98	86.7	0	0.0	0	0.0	196.00 0.001**

Table (6): Cont. Distribution of the studied nursing students according to their knowledge about uses of nanotechnology in health care during pre, immediate and one-month post program intervention

Uses of nanotechnology in health care		The studied nursing students (n=200)						
		Pre-program intervention		Immediate program		One-month post- program		χ^2 P
		No	%	No	%	No	%	
Uses of nanotechnology in cancer treatment								
-Deliver chemotherapy directly to cancer	Correct	61	30.5	192	96.5	173	86.5	227.773 0.001**
-Improve efficacy of chemotherapy	Correct	24	12.0	190	95.0	173	86.5	297.893 0.001**
-Gold nanoparticles can be used in cancer treatment	Correct	69	34.5	187	93.5	163	81.5	192.86 0.001**
-Nanotechnology has no role in cancer treatment	Incorrect	26	13.0	0	0.0	7	3.5	36.200 0.001**
-Do not know		52	26.0	0	0.0	0	0.0	104.000 0.001**
Uses of Nano robots in healthcare								
-Tiny robots from 1-100 nanometers helping in perform surgical operations	Correct	60	30.0	189	94.5	164	82.0	216.015 0.001**
-Deliver drugs directly to specific cells or tissues	Correct	45	22.5	188	94.0	154	77.0	229.356 0.001**
-Nano robots can't be used in health care	Incorrect	32	16.0	0	0.0	12	6.0	36.465 0.001**
-Do not know		78	39.0	0	0.0	0	0.0	156.00 0.001**
Uses of nanotechnology in medical imaging								
-Using nanoparticles to improve imaging quality of cells and tissues	Correct	72	36.0	195	97.5	187	93.5	229.177 0.001**
-Early diagnosis of diseases	Correct	41	20.5	196	98.0	185	92.5	285.873 0.001**
-Do not know		66	33.0	1	0.5	1	0.5	130.00 0.001**

Table (6): Cont. Distribution of the studied nursing students according to their knowledge about uses of nanotechnology in health care during pre, immediate and one-month post program intervention

Uses of nanotechnology in health care		The studied nursing students (n=200)						
		Pre-program intervention		Immediate program		One-month post- program		χ^2 P
		No	%	No	%	No	%	
Uses of nanotechnology in pain management								
-Deliver drugs to painful areas of the body	Correct	53	26.5	197	98.5	194.0	97.0	282.125 0.001**
-Reduce side effects of medications	Correct	49	24.5	191	95.5	174	87.0	250.542 0.001**
-Improve efficacy of analgesic drugs	Correct	36	18.0	197	98.5	186	93.0	299.642 0.001**
-Nanotechnology has no role in pain management	Incorrect	45	22.5	0	0.0	1	0.5	86.130 0.001**
-Do not know		42	21.0	0	0.0	0	0.0	84.00 0.001**
Uses of nanotechnology in diabetes treatment								
-Production of Nano technological devices to control blood glucose level	Correct	65	32.5	188	94.0	171	85.5	213.232 0.001**
-Improve diabetic wound healing by improve properties of medical bandage	Correct	35	17.5	190	95.0	160	80.0	256.646 0.001**
-Nanotechnology has no role in diabetes treatment	Incorrect	25	12.5	3	1.5	17	8.5	18.600 0.001**
-Do not know		90	45.0	2	1.0	2	1.0	176.00 0.001**
Nanotechnology can be used in sunscreens to provide greater protection from ultraviolet rays								
-Yes	Correct	77	38.5	190	95.0	173	86.5	216.438 0.001**
-No	Incorrect	45	22.5	10	5.0	27	13.5	
-Do not know		78	39.0	0	0.00	0	0.0	

More than one answer was allowed $p < 0.01^{**}$ highly significant

Table (7): Distribution of the studied nursing students according to their knowledge about advantages and disadvantages of nanotechnology in health care during pre, immediate and one-month post program intervention

Advantages and disadvantages of nanotechnology in health care		The studied nursing students (n=200)						
		Pre-program intervention		Immediate program		One-month post-program		χ^2 P
		No	%	No	%	No	%	
Advantages of using nanotechnology in health care								
Improve quality of life of the people.	Correct	83	41.5	200	100.0	200	100.0	234.00 0.001**
Early diagnosis of diseases	Correct	55	27.5	200	100.0	200	100.0	290.00 0.001**
Increase efficacy of treatment	Correct	62	31.0	198	99.0	197	98.5	266.101 0.001**
Reduce side effects of medications	Correct	47	23.5	199	99.5	199	99.5	304.00 0.001**
Improve patient outcomes.	Correct	36	18.0	199	99.5	199	99.5	324.012 0.001**
Do not know		65	32.5	0	0.0	0	0.00	130.00 0.001**
Disadvantages of using nanotechnology in health care								
Toxicity effect and hypersensitivity from using of some nanoparticles	Correct	57	28.5	185	92.5	178	89.0	239.031 0.001**
High cost for developing and producing of nanoparticles	Correct	100	50.0	195	97.5	189	94.5	176.896 0.001**
Regulatory challenges as it requires strict regulatory approval before using it	Correct	50	25.0	186	93.0	175	87.5	249.942 0.001**
It requires a trained and highly skilled nursing staff	Correct	54	27.0	197	98.5	185	92.5	264.014 0.001**
Limited information on nanotechnology	Correct	33	16.5	188	94.0	170	85.0	278.18 0.001**
Do not know		53	26.5	0	0.0	0	0.0	106.00 0.001**

More than one answer was allowed $p < 0.01^{**}$ highly significant

Table (8): Distribution of the studied nursing students according to their knowledge regarding role of community health nurses towards nanotechnology in health care during pre, immediate and one-month post program intervention

Role of community health nurses towards nanotechnology in health care	The studied nursing students (n=200)							
	Pre-program intervention		Immediate program		One-month post-program		χ^2 p	
	No	%	No	%	No	%		
Role of community health nurses towards nanotechnology in health care								
-Educating people about uses of nanotechnology in health care	Correct	120	60.0	200	100.0	200	100.0	160.00 0.001**
-Raising awareness about devices and administering nanotechnology-based medications prescribed by physicians to patients	Correct	82	41.0	200	100.0	200	100.0	236.00 0.001**
-Observing and recording the effectiveness of nanotechnology treatment on patients	Correct	53	26.5	200	100.0	200	100.0	294.00 0.001**
-Scientific research on impact of nanotechnology in health care	Correct	39	19.5	200	100.0	200	100.0	322.00 0.001**
-Do not know		50	25.0	0	0.0	0	0.0	100.00 0.001**

More than one answer was allowed $p < 0.01^{**}$ highly significant

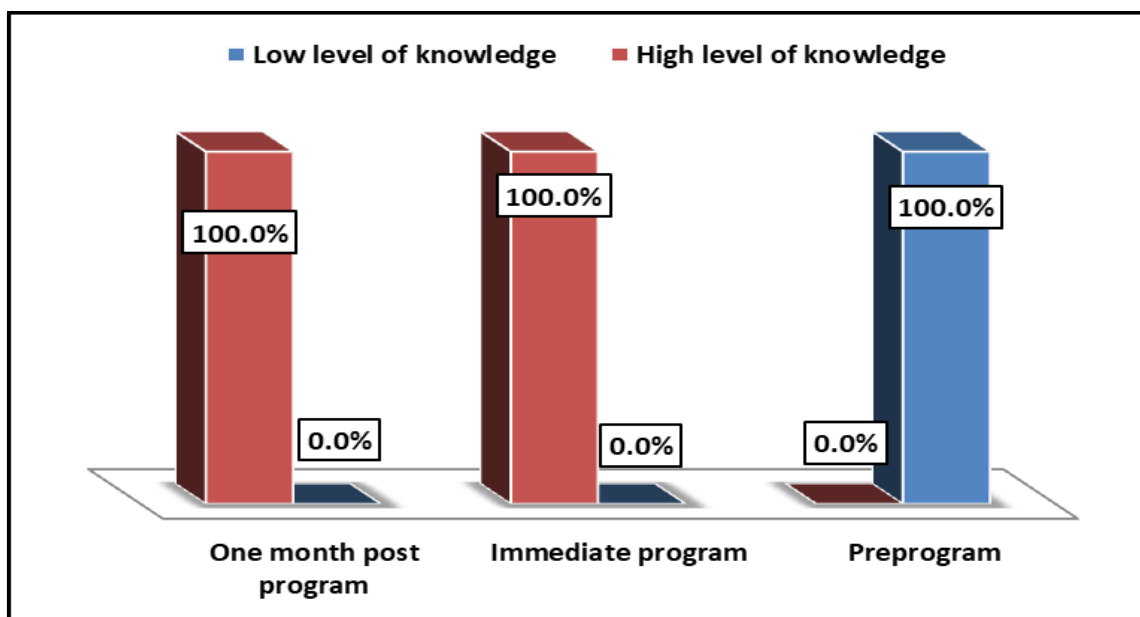


Figure (1): Distribution of the studied nurses according to their levels of knowledge in health care

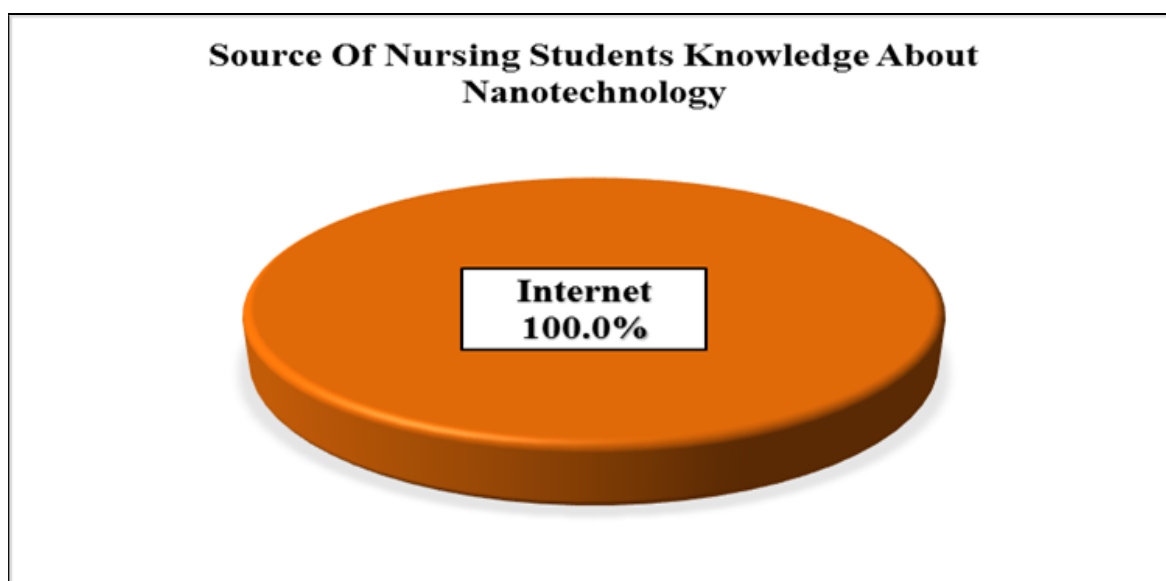


Figure (2): Sources of nursing students' knowledge about nanotechnology

Discussion

The integration of nanotechnology to healthcare is changing delivery of care to patients by providing real time, smart and high-quality interventions. In this context, it will benefit nursing practice greatly especially in monitoring the patients, wound care, infection control and chronic disease management. Nurses stand at the heart of care of patients, provide education, monitoring and management of chronic diseases, making them in a prime position to integrate intelligent nanotechnologies to every day clinical practice. (Yahia, & El Sharkawey, 2025).

Generally, the existing study results show that educational program was influential in upgrading nursing students' knowledge and attitudes towards nanotechnology. The majority of the studied nursing students before program implementation reported low knowledge and negative attitude towards nanotechnology (**Figure 1 and Table 1 & 3**). This was in same line with the findings of Cifteci et al., (2019), who studied "Evaluation of the effectiveness of the education given to nursing students about nanotechnology, in Turkey", They revealed that the application of nanotechnology education was functional in progressing the studied

nursing students' knowledge towards nanotechnology, as total knowledge scores increased from 15.45 ± 7.80 pre-program to 23.16 ± 5.12 post-program.

The studied nursing students' socio-demographic characteristics are key determinants during implementation of the program. There are considerable items of them can influence nursing students' level of knowledge and attitudes. So, the existing study shows that range age of the studied nursing students is (21-23) years with a mean age (22.20 ± 0.655) and two thirds of them were females. Also, about three quarters of their income were enough and about three quarters of them living in rural areas. Furthermore, about one quarter of mothers and fathers of the studied nursing students had university and post-graduate education.

The existing study reveals that there was a statistically significant relationship between age of the studied nursing students and their total knowledge score during pre - program intervention only as ($P=0.025$), while there isn't relation immediately and one month after program implementation (**Table 2**). This can confirm the value of the program conducted on the studied nursing students for all of them equally regardless their age

differences. These outcomes were supported with **Karim et al., (2019)**, who studied “Understanding, knowledge and perception of nanotechnology among private universities’ students, in Malaysia”, who concluded that, level of nanotechnology knowledge of the studied students was significantly affected by age.

Additionally, the existing study shows that there was a statistically significant relationship between mothers' occupation and their total knowledge score during pre-program intervention as ($P= 0.015$). This may be justified as more than three quarters of mothers of the studied nursing students were housewives. Housewives mothers especially those with higher education may increase time spent with their children with daily interaction for more educational activities and increase their confidence to explore a new technology. These findings were supported with by **Saylan & Mercan, (2016)**, who studied "The knowledge level of nursing students in nanotechnology and factors affecting, in Turkey", they concluded that not working mothers allows mothers spending further time with their children who positively participate in their academic achievement and children

development, while there is no relation immediately and one month after program implementation (**Table 2**). This proves the value of educational program on the studied nursing students for all of them equally regardless mothers' occupation.

Also, the current study reveals that there was a statistically significant relationship between family monthly income and their total knowledge score during pre-program intervention as ($P= 0.001$), this may be imputed to that about three quarters of the studied nursing students their income was enough. Also, this indicates that family monthly income is a potent determinant for nursing students' total knowledge score, as it supplies them with greater accessibility to educational resources, while there is no relation immediately and one month after program implementation (**Table 2**). This confirms the value of educational program on the studied nursing students for all of them equally regardless family monthly income. These findings were affirmed with the study performed by **Ho, Looi, Leung, Bekalu, and Viswanath (2020)**, who conduct a study under the title "Comparing the knowledge gap hypothesis in the United States and Singapore: the case of

nanotechnology", which reported that, the income were positively correlating with knowledge of nanotechnology among the participants in United States.

Furthermore, there was a statistically significant relationship between the fathers' educational level and their total knowledge score during pre - program and immediately after program intervention as ($P= 0.019, 0.038$) respectively (**Table 2**). According to research findings, these outcomes offered that nursing students' capacity to acquire and retain the knowledge is framed by socio-economic context. As, fathers with higher educational level encourage their children to explore new technology and provide them with high quality learning environment.

These outcomes were corroborative with **Dikmen et al., (2022)**, who studied "Knowledge and awareness of nursing students on the use of nanotechnology in healthcare, in Brazil", their study concluded that level of nanotechnology knowledge of nursing students was significantly affected by the level of education of their mothers, as it increases critical thinking skills, communication skills, school success for their children. Also, educated mothers are more aware about significance of new technology as nanotechnology,

which motivates their children to seek information and increase their literacy about nanotechnology.

Otherwise, these findings were conflict with **Karim et al., (2019)**, who revealed that, no significant difference were found in the level of awareness towards nanotechnology in terms of respondents' educational levels. This may be attributed to lack of awareness about nanotechnology due to novelty of this technology.

Finally, there was a statistically significant relationship between fathers' occupation and their total knowledge score immediately post program as ($P= 0.041$) (**Table 2**). This may be rationalized to the employment may offer comparatively steady economic condition, which may impact on their ability to invest educational resources and academic materials.

The current study shows that all the studied nursing students had negative attitude about nanotechnology during pre- program intervention with mean (17.420 ± 8.591). This may be attributed to that all of nursing students had low level of knowledge towards nanotechnology as nursing students' attitudes towards nanotechnology depends on their awareness to it, while there was a wonderful improvement in their attitudes immediately and one month

post program intervention as all of them had positive attitudes (**Table 3**). This improvement in their attitudes post-program in the existing study may be attributed to the impact of the program conducted in changing their negative attitudes about this technology. These findings were supported by **Diaz-Marcos & Mendoza, (2025)**, who conduct a study under the title “Shaping the future of nanotechnology: a perspective on education, dissemination and ethics, in Spain”. They found that the project was effective in boosting positive attitudes to nanotechnology among the studied students. This may be assigned to the impact of targeted educational program in improving their attitudes about this technology.

The existing study reveals that there was a statistically significant relationship between their total attitudes score and the age of the studied nursing students as well as their place of residence during pre-program as ($P= 0.035, 0.045$) respectively (**Table 4**). This may be justified to about three quarters of the studied nursing students living in rural areas where minimize their accessibility to formal resources of information to nanotechnology which affect their perception and

contributes to negative attitudes to nanotechnology.

Also, there was a statistically significant relationship between father occupation, family monthly income and their total attitudes scores immediately and one month after program implementation as ($P= 0.018, 0.034$) respectively (**Table 4**). This may be rationalized to the family with a good economic status supply their children with stable environment, better access to more resources and improves their intrinsic motivation to learn more about nanotechnology which influences on their acceptance and develop positive attitudes towards it.

These findings were in the same line **Vekli, (2020)**, who studied “Multivariate assessment of prospective science teachers’ attitudes towards Nano biotechnology, in Turkey”. These results concluded that parents' socioeconomic level is a necessary element in developing positive nanotechnology attitudes. As, individuals' viewpoint living in diverse environment with highly socioeconomic level can be more progressing with several technological devices.

The present study reveals that there was a significant positive correlation between total knowledge score of the studied nursing students with

their total attitude score during immediate and one-month post program intervention as ($p= 0.000$ & 0.048) respectively. In addition, total knowledge score during one-month post program intervention positively correlated with total attitude score during one-month post program intervention ($p= 0.006$) (**Table 5**). These findings were supported by **Diaz-Marcos & Gonzalez, (2025)**. They reported a significant positive correlation between students' knowledge of nanotechnology and their attitudes towards it, as there was a significant positive effect on nanotechnology perception among the studied students after project implementation by improving their knowledge and their attitudes towards nanotechnology.

As regards to uses of nanotechnology in health care, before program implementation, slightly less than one-third of the studied nursing students stated that deliver chemotherapy directly to cancer and reported gold nanoparticles can be used in cancer treatment (**Table 6**). These outcomes were identical with the study performed by **Arabeyyat et al., (2022)**, who studied "Public awareness of nanotechnology and its implications for health in Jordan", who found that, 43% of them aware of using nanotechnology in cancer

treatment. This may be assigned to its novelty and the media does not act their role in educating the community about new technologies as nanotechnology.

Post-intervention, the current study shows a significant improvement in most of nursing students' answers as the majority of studied nursing students identified using of nanotechnology in cancer treatment (**Table 6**). This may be due to valuable effect of educational booklets that disseminated to the studied nursing students. This was in agreement with the study conducted by **Oyono, Dakeyo, and Tatah, (2024)**, who studied "Impact of nanotechnology in cancer treatment: understanding its potential benefits and applications in improving therapeutic outcomes, in Cameroon" which illustrated that, nanotechnology have a major promise in revolutionizing cancer treatment as nanoparticles prepared to transfer therapeutic agents directly to cancer cells and promoting efficacy of drugs.

Regarding advantages and disadvantages of nanotechnology in health care, before the educational program, the majority of the studied nursing students demonstrated incomplete or did not know answer about nanotechnology advantages and disadvantages in health care

(Table 7). This may be assigned to limited inclusion of nanotechnology in the curriculum of various academic courses. The existing study results were analogous with the study performed by **Maldhure et al., (2021)**, who studied “Awareness about nanotechnology among upcoming clinicians in Vidarbha, Maharashtra”, who reported that, the majority (91.07%) of the studied students had not aware about disadvantages of nanotechnology in health care. This may be due to some students relying on informal sources of information as friends rather than formal sources of information. These informal sources often lack precision and increase knowledge gap towards nanotechnology.

Post-intervention, awareness about advantages and disadvantages of nanotechnology in health care rose as the majority of nursing students reported correct and complete answers for advantages and disadvantages of nanotechnology in health care (Table 7). This result was supported by **Goyette, (2016)**, who studied "Nanotechnology: an educational program for nurses, in United States" and explained that, 57.1% of studied nurses answered the questions correctly. From the researcher point of view, these inclusive understandings of multiple

answers clarify educational achievement. This change in perception emphasizes the value of the educational program in expanding studied nursing students' understanding of advantages and disadvantages of nanotechnology.

As regards to role of community health nurses towards nanotechnology in health care, before the program, it was noticed that the majority of them not aware about their role towards it (Table 8). These findings were affirmed with the study implemented by **Sayilan & Mercan, (2016)**, who found that, 47.7% of the studied nursing students knew that educating people about uses of nanotechnology in health care. Also, slightly more than two fifths (41.0%) of them knew raising awareness about devices and administering nanotechnology-based medications. Additionally, 35.7% of them knew observing and recording the effectiveness of nanotechnology treatment on patients. Finally, 30% of them knew that scientific research on impact of nanotechnology in health care was among role of nurse towards nanotechnology. This may be assigned to restrictive education and there is gap of knowledge to nursing students about nanotechnology. The present study reveals that all the studied nursing students had a low

level of knowledge about nanotechnology in pre-program implementation. According to research findings, this may be assigned to that about three quarters of the studied nursing students living in rural areas where minimize accessibility to formal information resources as libraries and specialized training. While, there were a wonderful improvement in their knowledge after implementation of educational program as the percentage of those having high level of knowledge increased from zero percentage pre-program intervention to 100% immediately and one-month post program intervention (**Figure 1**).

This improvement may be attributed to that about three quarters of their family income was enough which may affect on their investment to educational resources with more stable and conducive environment for learning. Furthermore, it can be justified to the impact of the educational program conducted and the capacity of the studied nursing students to easily acquire the knowledge about nanotechnology. This was supported by the findings of **Bigcas, Prudente, and Aguja, (2022)**, who studied "improving health science students' performance in nanotechnology using socio-scientific issues-based module, in

Philippines". They illustrated that; the module was effective in improving students' understanding in nanotechnology. This can be observed in the change in their pre-test and post- test mean scores from 23.14 pre-test score to 28.58 post-test score. This may be due to the value of the educational interventions in expanding the studied students' understanding of nanotechnology.

Regarding the source of knowledge of studied nursing students, the internet was the main source of information about nanotechnology among all studied nursing students (**Figure 2**). From an academic standpoint, this may be related to its availability, accessibility, provide updated large amount of information making it the most used for dissemination of information. These findings were consistent with the study performed by **Dikamen et al., (2022)**, who found that, the internet is a major source of information about nanotechnology (69.6%) among the studied nursing students.

Conclusion: Based on the existing study outcome, it was inferred that, the educational program significantly made an improvement in the perception of the studied nursing students regarding nanotechnology in health care. Also, there were a significant positive

correlation between total knowledge scores and total attitudes scores during immediate and one month after program implementation.

Recommendations: The following suggestions are presented based on the present study outcomes.

- Using social media for creation of attractive, brief, and periodic content about numerous benefits of embedding of nanotechnology into nursing practice.
- Integrating the subject of nanotechnology to nursing curriculums to assure receive formal education about advantages, disadvantages and uses of it in healthcare field.
- Future researches on a big sample size for nursing students and nurses in different situations to generalize the findings.

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Influence of Head Nurses' Chameleon Leadership Style on Their Ethical Work Intentions and Nurses' Grievance

¹ **Seham Aly Mahmoud,** ² **Asmaa Hosny Belal Wanas**

¹ Assistant Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

² Lecturer of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

Corresponding Author: Asmaa Hosny Belal Wanas

Email: Asmaa_wanas@nursing.tanta.edu.eg

Abstract

Background:

With miscellaneous and complex challenges confronting contemporary nurse leaders in today's dynamic environment, it is crucial for healthcare organizations to transfer from traditional leadership practices and embrace new ones, such as chameleon leadership. **Aim of the study:** Determine the influence of head nurses' chameleon leadership style on their ethical work intentions and nurses' grievances. **Methods: Design:** A descriptive-correlational design was utilized. **Setting:** The study was conducted at Tanta University Hospitals, including Emergency Hospital, Medical Hospital, and New Surgical Hospital. **Subjects:** The study's subjects included all available head nurses (N=109) and a convenient sample of nurses (N=472). **Tools:** Chameleon Leadership Structured Questionnaire, Head Nurses' Ethical Work Intentions Questionnaire, and Nurses' Grievance Questionnaire. **Results:** 89.9% of head nurses had a high level of chameleon leadership, 100% of head nurses had a high level of overall ethical work intentions, and 96% of nurses experienced a moderate level of grievance, in which 62.3% of them reported a low level of overall grievance handling practices and 88.1% of nurses reported a low level of satisfaction with grievance handling. **Conclusion:** There was no statistically significant correlation between head nurses' chameleon leadership and their ethical work intentions, whereas a statistically insignificant negative correlation between head nurses' chameleon leadership and nurses' grievances was found. **Recommendation:** Conduct a cyclic evaluation of chameleon leadership effect on the work practice environment.

Keywords: Chameleon Leadership, Ethical Work Intentions, Nurses' Grievance.

Introduction

Nursing leadership is a process by which a nurse leader inspires nurses within a healthcare organization to achieve its goals in a cohesive way (**Mugira, 2022**). It has the power to foster a positive work atmosphere that encourages nurses to contribute and fortifies their sense of accountability for their jobs especially in a complex and high-pressure landscape. As a result, emerging, flexible leadership paradigms, particularly chameleon leadership, have gained prominence (**Abdel-Azeem, El-Ashry, Amin, & Elsayed, 2025, and Cortellazzo, Bruni, & Zampieri, 2019**).

According to chameleon theory of leadership, chameleon leaders neither seek blind affiliation nor expect others to unquestioningly follow them. They understand that despite working towards collective goals, not everyone will be on the same page. Therefore, they remain open to realities and vulnerabilities, continuously learning through exposure to different environments (**Durrah, & Kahwaji, 2023**). Chameleons do not change their core, but have the ability to modify their dimensions to survive in circumstances that are unfamiliar and adapt quickly and continuously to environmental changes. (**Gordon & Cleland, 2021**).

Two dimensions constitute chameleon leadership as follows: external control and relativistic beliefs. Because leaders believe that fate and chance have an impact on their decisions and the outcomes of those decisions, they nurse leaders who display the external control trait abandon accountability for their choices and base the optimal course of action on situational indicators rather than their values (**Massoudi, 2022**). According to cultural relativists, ethics are influenced by the context in which they are applied. Moreover, they think that moral judgments are influenced by the circumstances surrounding them (**Alabadi & Al-Khakani, 2020**).

Nurse leaders using relativistic beliefs entail assessing the local surroundings in order to determine the best course of action for each unique circumstance. While they remain to use their skills to lead their groups, chameleon nurse leaders embrace change and fit in with chaos and crisis situations (**Durrah & Kahwaji, 2023**). These nurse leaders are distinguished by their adaptability, flexibility, consciousness, fluidity, and mindfulness. It is important to channel them positively, responsibly and ethically (**Abd Alhosine & Mahmood, 2022**).

Ethics is a key element of leadership, which pertains the integrity of leaders and their underlying motives (**Northouse, 2021**). Nurse leaders' ethical work intentions refer to the expected behaviors at work that can take precedence human growth in harmony with shared moral principles. It judges the future action as good, right, fair, honest, worthy, and targeted to be morally acceptable by the greater community (**Mohammad, Faeq, Ali, & Ismael, 2023**).

The nurse leaders' ethical work intentions are shaped by various factors such as attitude, perceived behavioral control, descriptive norms, moral norms, behavioral intention, and past behavior. Attitude, in this context, represents a leader's overall feeling of favorability or unfavorability toward particular actions or behaviors, such as ethical decision-making (**Kashif, Zarkada, & Ramayah, 2016**).

Perceived behavioral control (PBC) is a key predictor of ethical intentions and influenced by personal factors such as work experience and education, while both self-regulation and organizational mechanisms are essential for maintaining ethical behavior in the workplace. Subjective norms, driven by social pressure from peers, family, and society, significantly influence ethical

decision-making in a certain way. Finally, past behavior significantly influences ethical decision-making, as ethical actions strengthen moral identity and enhance self-control, where previous ethical behavior positively impacts future ethical choices (**Kashif & Khattak, 2017**).

Ethical leaders in nursing management have a vital role in shaping an optimistic work environment, influencing nurses' behavior, and improving organizational outcomes. (**El-metwally, Anany, Elghabbour, 2025 & Liu, He, Tian, Guo, Zhang, & Zhong, 2025**).

If a nurse feels that they are being treated unfairly at work, they have a grievance. Therefore, a grievance is a statement of disapproval in the area of nurse relations and a complaint about working circumstances in the context of work relations (**Lazaro, 2022**). Grievances in the workplace are caused by a variety of factors, including a lack of qualified and experienced staff, a hazardous and unhealthy work environment, inadequate managerial knowledge, gender discrimination, poor pay, a lack of opportunities for management discussion, long work hours, harassment, etc. (**Igbino, Osibanjo, & Salau, 2022**).

Resolving nurses' grievances effectively is critical for boosting the

overall organizational performance and efficiency, fostering positive working relationships, and strengthening nurses' loyalty. (Mohammad, Faeq, Ali, & Ismael, 2023 & Obiekwe & Eke, 2019).

The nurse leaders can handle grievances effectively by maintaining an open-door policy, listening to nurses' concerns, and responding within a set timeframe. (Aktar, & Alam, 2021). If grievances are left unmanaged or addressed improperly, sever effects can result on nurses' satisfaction, which consequently affects their motivation, morals, and have adverse influence on the organization's efficiency (Gulzar, Rehman, & Radouch, 2023).

Significance of the study

Nurses' grievances primarily stem from unmanageable workplace pressures. Ineffective handling of nurses' grievances decreases the leader's ability to resolve the complaint on a common understanding and attend to other issues (Phuyal, 2024). It is critical that nurse leaders have a leadership style that positively impacts the internal environment of the organization, including the attitudes and behaviors of nurses. The capacity to alter one's behavior and adjust to novel circumstances in order to achieve one's objectives is known as chameleon leadership. Chameleon

nurse leaders can lead in a variety of ways, and easily adjust to the demands of each situation. Examining the approaches taken to processing nurse complaints is crucial in order to determine how they affect the way in which nurses' grievances are handled. Therefore, this study aimed to determine the influence of head nurses' chameleon leadership style on their ethical work intentions and nurses' grievances.

Aim of the study

This study aimed to determine influence of head nurses' chameleon leadership style on their ethical work intentions and nurses' grievances.

Research questions:

- What are the levels of head nurses' chameleon leadership style?
- What are the levels of head nurses' ethical work intentions?
- What are the levels of nurses' grievances?
- What are the relations between head nurses' chameleon leadership style, their ethical work intentions, and nurses' grievances?

Subjects and Method

Study design

A descriptive-correlational design was adopted in this study to investigate the relationship between research variables and determine the extent to which they influence one another (Creswell, & Creswell, 2018).

Setting: The study was conducted at Tanta University Hospitals including Emergency Hospital, Medical Hospital, and New Surgical Hospital which is affiliated to the Ministry of Higher Education and Scientific Research.

Subjects

The study subjects consisted of all available head nurses (N=109) and a convenient sample of staff nurses (N=472) who are working in previously mentioned settings and available at the time of data collection. As well as, at least one year of working with head nurse, and provide direct patient care, the total study sample of staff nurses was calculated using EPI. Info. Microsoft to ensure obtaining an adequate and representative size were $N = \text{population size} (1618)$, $Z = \text{confidence level at } 99\% (19.6)$, and $d = \text{margin of error proportion} (0.05)$.

Tools

Three tools were used to collect the study data:

Tool I: Head Nurses' Chameleon Leadership Structured Questionnaire.

This tool used to assess head nurses' chameleon leadership style. It included two parts:

Part 1: Head Nurses' data included age, sex, hospital name, years of experience, and level of education.

Part 2: Head Nurses' Chameleon Leadership Structured Questionnaire

This part was adapted from **Zahra, (1989)**. It categorized into the following dimensions: **External LOC (2 items)**. The statements served to assess the degree to which nurse leaders believe that external forces determine their outcomes.

Relativistic beliefs (3 items). The statements served to the extent to which each nurse leader believed that ethics depends on culture or context.

Scoring system:

Head nurses' responses were measured on a five points Likert Scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The total score (5-25) categorized according to statistically cutoff point at 60% and summing score of all categories. The total score represents varying level as the following:

-High chameleon leadership level > 75 %

-Moderate chameleon leadership level 60 - 75 %

Low chameleon leadership level <60

Tool II: Head Nurses' Ethical Work Intentions Questionnaire

This tool was developed by **Kashif, Zarkada & Ramayah, (2016)** and was adapted by the researchers to assess head nurses' ethical work intentions. It included six

dimensions: attitude (6 items), perceived behavior control (5 items), descriptive norms (3 items), moral norms (4 items), past behavior (4 items), and behavioral intentions (3 items).

Scoring system

Head Nurses' responses were measured on a five points Likert Scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The total score (25 – 125) categorized according to statistically cutoff point and summing score of all categories. The total score represents varying level as the following:

- High ethical work intention level > 75 %
- Moderate ethical work intention level 60 - 75 %
- Low ethical work intention level < 60

Tool III: Nurses' Grievance questionnaire

This tool was developed by the researchers based on **Phuyal (2024)**. It used to assess nurses' grievance experiences. This tool consisted of four parts

Part 1: Nurses' personal and work-related data: It included age, sex, hospital name, years of experience and level of education.

Part 2: Nurses' Grievance Experiences: It included 10 items.

Part 3: Grievance Handling Practices: It included 9 items.

Part 4: Satisfaction with Grievance Handling Practices: It included 4 items.

Scoring system

Nurses' responses were measured on a five points Likert Scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The total score categorized according to statistically cutoff point and summing score of all categories.

The total score represents varying levels for each of part 2, 3 & 4 as the following:

- High level >75 %
- Moderate level 60 - 75 %
- Low level <60

Method for data collection:

Ethical considerations :

The ethical approval was obtained from the Scientific Research Ethics Committee. (Code No. 593-2-2025). Then the approval of authoritative personnel of Tanta University Hospitals was obtained. After that, the study purpose was clarified to subjects and the oral consent to participate was obtained from them. The confidentiality of nurses' data was guaranteed, the freedom to withdraw was confirmed and the study wouldn't cause any harm for them.

Validity and reliability: To assess the face and content validity, the researchers created the questionnaires, translated them into Arabic presented to five nursing administration specialists from Faculty of Nursing, Tanta University. Prior to data collection, a pilot study was carried out on 10% (n= 47) nurses and (n=11) head nurses from Tanta Main Hospital to evaluate the clarity of the tools and not included in the total study subjects. Tools were modified and finalized based on the experts' responses and the pilot study. The reliability of the tools (I, II, &III) was tested using Cronbach's alpha coefficient test with values (0.803, 0.930, & 0.733), respectively. Also, the Content Validity Index was 93 %, 94%, and 97%, respectively .

Field work: During the morning shift after the nurses finished their assigned work, the researchers met the participants individually in their work units and distributed the questionnaires to obtain their responses. Data was collected at the beginning of April 2025 to the end of June 2025.

Statistical analysis:

IBM SPSS software version 20.0 (Armonk, NY: IBM Corp, released 2011) was used for data statistical analysis which summarized as numbers and percentages.

Kolmogorov-Smirnov test was used

to assess normality for continuous data. Quantitative data were explained using minimum and maximum range, mean and standard deviation. The tests used were; **Chi-square test**, to compare between different groups. **F-test (ANOVA)**, to compare between more than two groups. **Pearson coefficient**, to correlate between two normally distributed quantitative variables. Significance of the attained results was estimated at the 5% level.

Results

Table (1) Displays distribution of head nurses' and nurses' personal Data. Regarding head nurses' personal data, the table displays that more than two thirds (69.7%) of head nurses were older than 35 years, with a mean score of 37.19 ± 4.92 . Most (94.5%) of them were females. Also, nearly half (47.7%) of head nurses worked in emergency hospital, one third (33.0%) in new surgeries hospital and only 19.0% in medical hospital. 73.4% of them had more than 10 years of experience, with a mean of 8.19 ± 2.9 years. Adding to that, the majority (83.5%) of them had bachelor's degrees of nursing.

On the other side, regarding nurses' personal data, the table presents that more than half (59.3%) of nurses were less than 30 years old, with a mean score of 30.11 ± 5.27 . All of them were females. Also, more than

two thirds (69.1%) of nurses worked in emergency hospital, but 17.8% & 13.1% of them worked in medical & new surgeries hospitals, respectively. Around half (51.3%) of them had 5 or fewer years of experience with a mean score of 8.09 ± 5.53 . Adding to that, 42.2% & 41.7% of nurses had a technical diploma in nursing & a bachelor's degree in nursing, respectively.

Figure 1: Illustrates levels of overall head nurses' chameleon leadership. It shows that the majority (89.9%) of head nurses had a high level of chameleon leadership, while the minority (10.1%) showed a moderate level.

Table (2): Displays levels mean scores and ranking of head nurses' chameleon leadership dimensions. The table shows that around three quarters (76.1% & 72.5%) of head nurses had high relativistic beliefs and external LOC levels, respectively as dimensions of chameleon leadership. Also, as noticed, relativistic beliefs were ranked as the highest (92.20 ± 11.30) dimension of chameleon leadership with mean average scores of 4.69 ± 0.45 , followed by external LOC with mean average scores of 4.61 ± 0.64 .

Figure (2): Illustrates levels of head nurses' overall ethical work intentions. It showed that all (100%)

of head nurses had a high level of overall ethical work intentions.

Table (3): Displays mean scores and ranking of head nurses' ethical work intentions dimensions. As noticed, past behavior was ranked as the highest (87.16 ± 1.87) dimension of head nurses' ethical work intentions with a mean average score of 4.49 ± 0.07 , followed by perceived behavior with a mean average score of 4.24 ± 0.14 . On the other side, behavioral intentions was ranked the lowest (75.0 ± 0.0) dimension of head nurses' ethical work intentions with a mean average score of 4.0 ± 0.0 .

Figure (3): Presents levels of nurses' overall grievance experience. It shows that most (96%) of nurses experienced a moderate level of overall grievance, while a small proportion (4%) of them had a low level.

Figure (4): Shows levels of overall grievance handling practices. It reveals that more than half (62.3%) of nurses reported a low level of overall grievance handling practices, while, more than one third (37.7%) of them reported a moderate level.

Figure (5): Shows levels of nurses' overall satisfaction with grievance handling practice. It reveals that the majority (88.1%) of nurses reported a low level of satisfaction with grievance handling practices. While

only 11.9 % of them reported a moderate level of satisfaction.

Table (4): Reveals mean scores and ranking of nurses' grievance. As noticed, grievance experience was ranked as the highest (66.33 ± 4.61) of nurses' grievances, with a mean average score of 3.65 ± 0.18 , followed by grievance handling practices adopted by head nurses with a mean average score of 3.18 ± 0.60 . On the other side, nurses' satisfaction with grievance handling practices was ranked the lowest (44.21 ± 15.28) with a mean average score of 2.77 ± 0.61 .

Table (5): Presents correlation between head nurses' chameleon leadership and their ethical work intentions and nurses' grievances. As shown in the table, there was no statistically significant correlation between head nurses' chameleon leadership and their ethical work intentions at ($r=0.008$ & $P= 0.936$). Also, the table shows that, there was a statistically insignificant negative correlation between head nurses' chameleon leadership, and nurses' grievance experience, grievance handling practices and nurses' satisfaction, with handling practices at $P= 0.314$, 0.906 , and 0.436 respectively.

Table (1): Distribution of head nurses and nurses' personal Data (n = 109)

Personal data	Head nurses (n = 109)		Nurses (n = 472)	
	No.	%	No.	%
Age (years)				
<30	9	8.3	280	59.3
30 – 35	24	22.0	75	15.9
>35	76	69.7	117	24.8
Min. – Max.	27.0 – 55.0		25.0 – 40.0	
Mean $\pm$ SD.	37.19 $\pm$ 4.92		30.11 $\pm$ 5.27	
Gender				
Male	6	5.5	0	0.0
Female	103	94.5	472	100.0
Hospital name				
Medical Hospital	21	19.3	84	17.8
New Surgeries Hospital	36	33.0	62	13.1
Emergency Hospital	52	47.7	326	69.1
Years of experience				
≤ 5	16	14.7	242	51.3
>5 – 10	80	73.4	75	15.9
>10	13	11.9	155	32.8
Min. – Max.	4.0 – 13.0		1.0 – 20.0	
Mean $\pm$ SD.	8.19 $\pm$ 2.09		8.09 $\pm$ 5.53	
Educational level				
Bachelor's degree of Nursing	91	83.5	197	41.7
Technical Diploma in Nursing	0	0	199	42.2
Postgraduate Studies	18	16.5	76	16.1

SD: Standard deviation

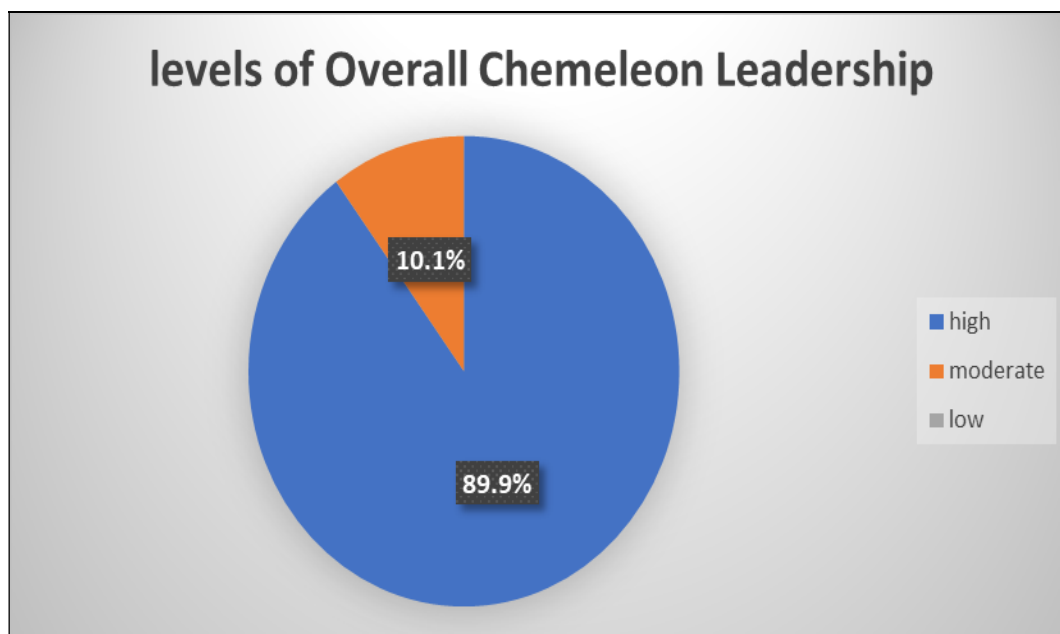


Figure (1) levels of overall head nurses' chameleon leadership (n = 109)

Table (2) Distribution of levels, mean scores and ranking of head nurses' chameleon leadership dimensions (n = 109)

Chameleon Leadership Dimensions	High (>75%)		Moderate (60% – 75%)		Low (<60%)		Score Range	Average Score (1 – 5)	Percent Score	Rank
	No.	%	No.	%	No	%		Mean ± SD	Mean ± SD	
External LOC	79	72.5	28	25.7	2	1.8	(2 – 10)	4.61 ± 0.64	90.37 ± 16.10	2
Relativistic beliefs	83	76.1	25	22.9	1	0.9	(3 – 15)	4.69 ± 0.45	92.20 ± 11.30	1
Overall	98	89.9	11	10.1	0	0.0	(5 – 25)	4.66 ± 0.38	91.47 ± 9.61	

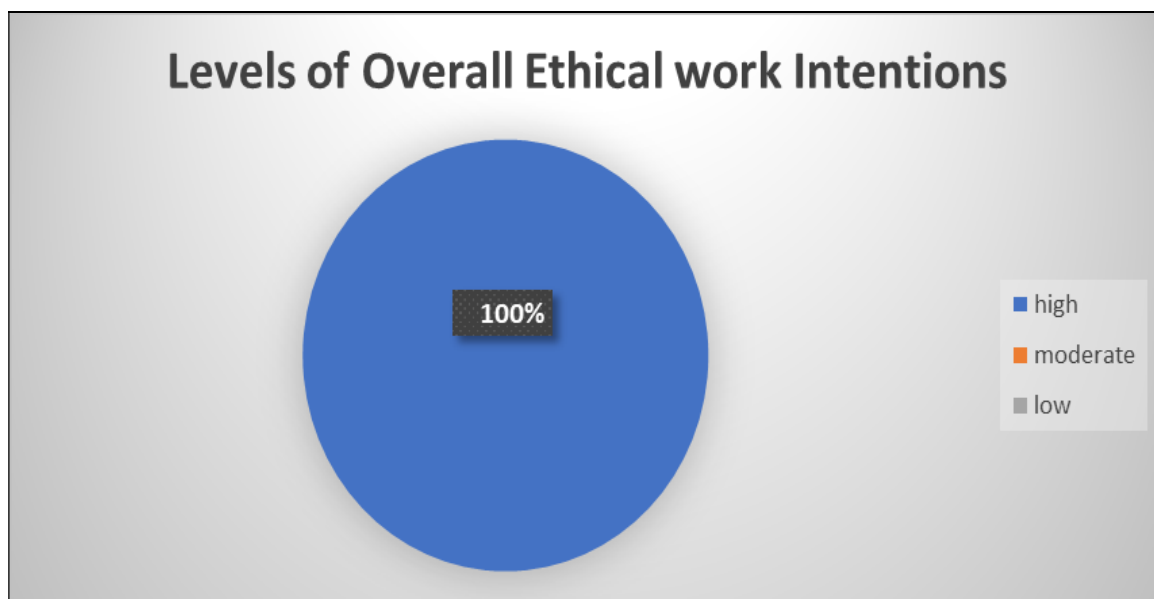


Figure (2): Levels of head nurses' overall ethical work intentions (n = 109)

Table (3) Mean scores and ranking of head nurses' ethical work intentions dimensions (n = 109)

Ethical Work Intention Dimensions	Score Range	Total Score		Average Score (1 – 5)	Percent Score	Rank
		Min. – Max.	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
Attitude	(6 – 30)	24.0 – 29.0	25.13 $\pm$ 0.72	4.19 $\pm$ 0.12	79.70 $\pm$ 3.01	3
Perceived behavior	(5 – 25)	21.0 – 25.0	21.18 $\pm$ 0.72	4.24 $\pm$ 0.14	80.92 $\pm$ 3.61	2
Descriptive norms	(3 – 15)	11.0 – 15.0	12.08 $\pm$ 0.53	4.03 $\pm$ 0.18	75.69 $\pm$ 4.41	5
Moral norms	(4 – 20)	16.0 – 20.0	16.13 $\pm$ 0.67	4.03 $\pm$ 0.17	75.80 $\pm$ 4.18	4
Past behavior	(4 – 20)	16.0 – 18.0	17.94 $\pm$ 0.30	4.49 $\pm$ 0.07	87.16 $\pm$ 1.87	1
Behavioral Intension	(3 – 15)	12.0 – 12.0	12.0 $\pm$ 0.0	4.0 $\pm$ 0.0	75.0 $\pm$ 0.0	6
Overall	(25 – 125)	103.0 – 119.0	104.5 $\pm$ 2.48	4.18 $\pm$ 0.10	79.47 $\pm$ 2.48	



Figure (3): Levels of nurses' overall grievance experience (n = 472)



Figure (4): Levels of overall grievance handling practices (n = 472)



Figure (5) levels of nurses' Overall satisfaction with grievance handling (n = 472)

Table (4): Mean scores and ranking of nurses' grievance (n = 472)

Nurses' Grievance	Score Range	Total Score		Average Score (1 – 5)	Percent Score	Rank
		Min. – Max.	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
Grievance experience	(10 – 50)	32.0 – 39.0	36.53 $\pm$ 1.84	3.65 $\pm$ 0.18	66.33 $\pm$ 4.61	1
Grievance handling practices	(9 – 45)	18.0 – 36.0	28.64 $\pm$ 5.40	3.18 $\pm$ 0.60	54.55 $\pm$ 15.01	2
Satisfaction with grievance handling	(4 – 20)	8.0 – 16.0	11.07 $\pm$ 2.44	2.77 $\pm$ 0.61	44.21 $\pm$ 15.28	3

Table (5): Correlation between head nurses' chameleon leadership and their ethical work intentions and nurses' grievance

Variables	R	p
-Chameleon Leadership vs. Ethical Work Intentions	0.008	0.936
-Chameleon Leadership vs. nurses' grievance experience	-0.881	0.314
-Chameleon Leadership vs. Grievance Handling Practices	-0.147	0.906
-Chameleon Leadership vs. nurses' satisfaction with handling practices	-0.775	0.436

r: Pearson coefficient *: Statistically significant at $p \leq 0.05$

Discussion

Currently, nursing leadership is the essence of successful organizational performance, especially in those complicated healthcare services. Brilliant nursing leadership are able to shape how work environments to successfully navigate those demands of the contemporary health systems through prioritizing adaptability, creativity, and quick responses **Abdel-Azeem et al.(2025)**. Chameleon Leadership is one of the contemporary adaptive models which characterized by leaders' ability to change their behaviors, voice tone, and emotional responses according to situations without affect their personal identity (**Fisher, 2020**).

I-Head nurses' Chameleon Leadership

The present study revealed that the majority of head nurses had a high level of chameleon leadership. This may be interpreted by chameleons, whose character can change their skin, allowing them to adapt to different environments. So, nursing leaders adopt this leadership style which enables them to modify their strategies to deal with different nurses and situations, while upholding their core values which can create a positive work atmosphere and encourage creativity.

This result was supported by **Abdel-Azeem et al. (2025)**, who found that

around two thirds of staff nurses reported a moderate level of chameleon leadership and stated that chameleon- leaders have a useful level of emotional intelligence, contextual awareness, and adaptability that enables them to function well in a variety of work settings.

According to **Durrah & Kahwaji (2023)**, various leadership styles are used in the healthcare sector to achieve the optimum goals driven by the need for competitive advantage. So, chameleon leadership has been implemented as a strategy for identifying efficient practices and applying them to immediate problems.

Regarding head nurses' chameleon leadership dimensions, more than three quarters of head nurses had a high relativistic beliefs level, which was ranked as the highest dimension of chameleon leadership. This may be interpreted by nurse leaders acting in variant environments, including those with diverse people, cultures, values, and situations. The relativistic beliefs consider that what is right or wrong can vary between individuals or societies, and the leader can act based on what is considered appropriate for different individuals or situations to achieve goals. So, chameleons have the justification to adapt their

attitudes, and behaviors to fit different cultures and subcultures, which allows them to survive psychologically and materially.

In the same line of these results, **Esen (2023)** who stated that the leaders with relativistic beliefs may change or adapt their ethics to according to the surrounding circumstances for protecting self-interest. Also, **Abd Alhosine & Mahmood (2022)** supported this result and found relativistic beliefs were at a high level of importance and ranked the first in terms of chameleon leadership dimensions.

Regarding external locus of control dimension of chameleon leadership, the results revealed that more than two thirds of head nurses had a highly external LOC level. This may be explained by head nurses work in high volatile, politically charged, and changing workplace affected by external factors, including politics, administration and external markets. That's why it makes the head nurse externally oriented, ready, and reactive over time according to eternal context.

Alabadi & Al-Khakani (2020) supported these findings and showed that the study sample strongly agreed on the characteristics of organizations with chameleon leadership, which are represented in two dimensions, including; relativistic beliefs and

external LOC, which enable the organization to overcome the lack of strategic planning by adapting to surrounding circumstances and capturing external opportunities, which in turn enhances the organization's performance.

Abd Alhosine & Mahmood (2022), found that the external locus of control ranked after the relativistic beliefs at a low level of dispersion, reflecting the importance of chameleon-like leadership behaviors practiced by employees. Additionally, they reported that external LOC is the degree to which the individual believes that the outcomes they experience aren't due to their personal control and are controlled by external factors such as luck, chance, and the actions of others.

Similarly, **Massoudi (2022)** reported that chameleons are influenced by external appearances and relativistic beliefs, which can affect making their decisions, which serve their self-interest characteristics and they are more prone to be stimulated for several reasons. Adding to that, acting like chameleon needs external environment analysis for making appropriate decisions according to the cases.

II: Head Nurses' Ethical Work Intentions

The present results showed that all of head nurses had a high level of ethical

work intentions. This may be explained by head nurses' norms including surrounding cultures, workplace values and personal values, which form their attitudes and contribute in their intentions to work ethically. Adding to that, head nurses' ethical past behaviors, which formulate their self-control are better predictors of ethical actual behavior, which is a consequence of attitude, norms, and perceived behavioral control.

She et al. (2023) supported these findings and found that nurse managers had a highly ethical leadership as perceived by Chinese nurses. They stated that nurse managers' ethical work held through demonstrating normatively by open communication, ethical decision making and motivation.

In the same line, **Ayan & Baykal (2023)** reported that nurse managers are responsible for keeping ethical values in workplace and encouraging nurses to provide care in line with these values, which creates an ethical work climate. Additionally, **Sakr, Mahmoud, & EL-Shahat (2022)** found that a high proportion of the nurses perceived moderate and high ethical leadership levels and reported that ethical leadership improves nurses' attitudes and ethical conduct, and increases their perception of

hospital support, and reduces deviant workplace behaviors.

Regarding head nurses' ethical work intentions dimensions, past behavior was ranked as the highest dimension, followed by perceived behavior. Afterward, attitude, moral norms, descriptive norms & behavioral intension. This may be rationalized by organizational cultures and policies, as well as head nurses' self-regulation, education and experiences which form their perceived control to make ethical decisions and intention to do ethical work. Adding to that, past behavior of head nurses in making ethical decisions forms their moral integrity and self-control to remain ethical.

Li et al. (2023) found that attitude, subjective norms, and perceived behavioral control at high level and all had a significant effect on subjects' behavioral intention and the attitude consider the strongest factor. **Hasan and Suciarto (2020)** found that the subjects' attitudes, subjective norms and perceived behavior control had simultaneously high scores and together affect the behavioral intention. Also, found the subjective norms had the lowest score due to the attitude and perceived behavior control come from oneself which maintain behavior.

III- Nurses' grievance

Levels of overall nurses' grievance experience

The present study revealed that most of nurses experienced a moderate level of grievance. This may be interpreted by nurses exposed to excessive pressures in their workplace, including high workloads, unsatisfactory salaries, interpersonal conflicts, and unsupported management. All of these problems create a burden on nurses and a sense of discomfort and grievance.

Gulzar, Rehman, & Radouche (2023) indicated that health care workers experienced grievance in a variety of complaints including; an excessive amount of responsibility, job shifts, lack of mutual trust, lack of acknowledgment, lack of collaboration, and excessive work pressure. Adding to this, **McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, (2011)**, found a number of complaints reported by substantial proportion of direct care nurses, including being burned out, overloaded and dissatisfied with their jobs, salaries, independence, and professional status, which reflected on lowering patient care quality and satisfaction.

Levels of overall grievance handling practices

The present study results revealed that more than half of nurses reported

a low level of grievance handling practices accomplished through head nurses. This can be explained by poor communication, scarce meetings regarding grievances, unclear policies, and poor management practices.

In the same line **Mhango, Madulu, & Kyagara (2025)** indicated that managers highlighted inconsistency in handling grievances and presence of a gap in communication. Also, managers acknowledged challenges in achieving fairness, investigation neutrality and delaying resolution. Additionally, **Xie, Cooke, & Liu (2025)** found that employee grievances are usually addressed in an informal manner through managers' hierarchical order, which does not ensure fair decisions.

Levels of nurses' overall satisfaction with grievance handling practices

The present study revealed that majority of nurses reported a low level of satisfaction with grievance handling practices, this may be explained by more than half of nurses reported a low level of grievance handling practices and so on, nurses' dissatisfaction was evident.

Ramyasri (2024) indicated a significant correlation between an effective grievance handling system and increased employee satisfaction and noted a number of factors to

nourish this system, including open communication, transparency, speed of resolution and employee involvement which create a supportive workplace. Similarly, **Stotko (2021)** indicated that with the manner utilized in handling employee grievances, it is possible to be met with dissatisfaction that can result in a new complaint and initiating a new grievance procedure before resolving the original complaint.

Correlation between head nurses' chameleon leadership and ethical work intentions

The present study showed that there was no statistical significant correlation between head nurses' chameleon leadership and ethical work intentions. This may be explained by chameleon head nurses' ability to be adaptive in different situations doesn't essentially influence their ethical intentions. Also, head nurses' ethical intentions may be influenced by organizational culture and personal values rather than by adaptive leadership behaviors.

According to **fisher (2020)**, chameleon leadership is the ability of leaders to modify their behavior, tone, communication style, and emotional reactions in response to situational demands without affecting their core. On the converse, **Ruiz-Palomino & Gomis (2017)**, found a negative influence of chameleon leadership on

ethical work intention and reported chameleon approaches, including external locus of control and relativistic beliefs might have indirect effects. These chameleon-like personalities can lead to self-serving decisions and a disregard for moral standards.

Correlation between head nurses' chameleon leadership and nurses' grievance

The results revealed that, there was a statistically negative, not significant, correlation between head nurses' chameleon leadership, and nurses' grievance experience, grievance handling practices and nurses' satisfaction with handling practices. This finding mean that adapting chameleon leadership style by head nurses does not exert a meaning influence on nurses' grievance and may be affected by other factors as organizational policies, poor work environments, or communication system.

Our findings are contradicted by **Mohammad et al. (2023)**, who demonstrate a significant and robust correlation between chameleon leadership and employee grievances. They also found that the presence of chameleon leadership within the organization could be a contributing factor to organizational injustice that exacerbates employee dissatisfaction.

Conclusion

According to the study findings, the majority of head nurses had a high level of chameleon leadership, all head nurses had a high level of overall ethical work intention, most of nurses experienced a moderate level of grievance, more than two third of nurses reported a low level of overall grievance handling practices and majority of them reported a low level of satisfaction with grievance handling. There was no statistically significant correlation between head nurses' chameleon leadership and their ethical work intention and there was a statistically negative not significant correlation between head nurses' chameleon leadership, and nurses' grievance.

Recommendations

For hospital administration

- Conduct a cyclic evaluation of chameleon leadership effect on work practice environment.
- Nurture head nurses with the required knowledge and skills about chameleon leadership techniques through training programs.
- Facilitate workshops to raise nurses' understanding and encourage them to turn their unfounded grievances into solutions that can be implemented rather than voicing them.
- Foster a culture of social engagement in the workplace to

improve communication between the nurses and administration.

For head nurses

- Create a supportive ethical climate for chameleon leadership application for developing cooperation& love in decision making.
- Frequent assessment for nurses' complaints including work overload, salaries, promotions and supervisory practices.
- Adopt of open-door policy for encouraging nurses' expression of their grievances.
- Adopt of good grievance handling practices for promoting nurses' satisfaction.

Further research:

- Assess the impact of chameleon leadership on the sustainability of nursing.
- Undertaking constant, comprehensive research on the strategies and mechanisms of the chameleon approaches in organizations.

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Effect of Awakening and Breathing Coordination, Delirium Management and Early Mobility Bundle on Clinical Outcomes of Mechanically Ventilated Patients

Safaa E. Sayed Ahmed¹, Gehan Fahmy Ali^{2,3}, Salwa Atef Ganna⁴, Nadia Mostafa Eleter⁵

¹Prof. of Critical Care and Emergency Nursing, Critical Care and Emergency Nursing Department, Faculty of Nursing, Tanta University, Egypt.

²Master of Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University, Egypt.

³Responsible for infection control at outpatient clinics of the main university hospital in Mansoura

⁴Assistant Professor of Chest Diseases, Chest Diseases Department, Faculty of Medicine, Tanta University, Egypt.

⁵Lecturer of Critical Care and Emergency Nursing, Critical Care and Emergency Nursing Department, Faculty of Nursing, Tanta University, Egypt

Corresponding author: Gehan Fahmy Ali

Email: gehanfahmy2020@gmail.com

Abstract

Background: Awakening, breathing coordination, delirium management and early mobility bundle (ABCDE) is evidence constructed multicomponent strategy to optimize mechanically ventilated patients' recovery and outcomes. **Aim:** The study designed to assess the influence of awakening and breathing coordination, delirium management and early mobility bundle on clinical outcomes of mechanically ventilated patients. **Design:** A quasi-experimental research design was used. **Setting:** This study was performed at the Chest Intensive Care Units at Tanta University Hospitals. **Subjects:** A convenience sampling of 100 adult patients from the previously mentioned settings was chosen and separated to two identical groups 50 patients in each group. **Tools of the study:** Five tools were utilized: **Tool I:** Mechanically Ventilated Patients' Assessment Tool, **tool II:** Spontaneous Awakening Trial (SAT) Safety Screen Tool, **Tool III:** Spontaneous Breathing Trial (SBT) Safety Screen Tool, **Tool IV:** Intensive Care Delirium Screening Checklist (ICDSC), **Tool V:** Manual Muscle Strength Assessment Tool. **Results:** It was found differences statistically significance between the studied groups about duration of mechanical ventilation, duration of continuous sedation, incidence of delirium, number of SBT attempt with $p < 0.05$ for each. However, no differences statistically significant were found between the two studied groups regarding length of ICU stay with $p > 0.05$. **Conclusion:** Implementing ABCDE bundle is an effective nursing strategy in decreasing the incidence of delirium, severe muscle weakness, need for continuous sedation, and duration of mechanical ventilation. **Recommendations:** Awakening, breathing coordination, delirium management and early mobility bundle should be carried out routinely for mechanically ventilated patients.

Key Words: Awakening, breathing coordination, Delirium management, Early Mobility, Intensive Care Unit, Mechanical Ventilation.

Introduction

The numbers of patients requiring intensive care unit (ICU) are increasing worldwide. Regarding ICU patients, 40%–65% require mechanical ventilation (MV) during stay in ICU. Above 40% of hospitalized patients died as a result of its dangerous influence on the patients' lungs **(Mohamed et al., 2015; Kenubish, et al 2024)**.

Prolonged MV is commonly damage respiratory muscle function mainly the diaphragm. This impairment in respiratory muscle is the main cause of failure weaning from MV. Prolonged immobility, bed rest and over sedation can produce delirium and ICU acquired weakness which increases the rate of mortality and impairs quality of life **(Knight, 2019, Tobin, 2023)**.

The ratio of death increase, ICU and hospital extent of stay also increase as a result of intensive care unit-acquired weakness (ICU- AW) which impairs quality of life. It is calculated that critically ill patients experience decreases of strength from 25% to 33% after 7 days of MV **(Hung et al., 2022; Jose., et al 2025)**.

Awakening, breathing coordination, delirium management and early mobility bundle (ABCDE) is non-pharmacologic evidence constructed multifaceted approach to optimize mechanically ventilated patients'

recovery and outcomes. It is a unique team-based approach aimed to help patients to be more awake, cognitively engaged and physically active **(Garrett, 2016; Kellie et al., 2021)**.

Implementation of ABCDE bundle requires operative and appropriate interaction and collaboration among medical and nursing staff. The respiratory therapist, critical care nurse and physical therapist in the ICU evaluated patient sedation level and provided patient trials for awakening and breathing wake up and breathing program. It is linked to decrease period of MV and ICU extent of stay **(Morandi, Brummel&Ely, 2011; Kellie et al., 2021)**.

It is recommended to perform spontaneous awakening trial (SAT) by reducing the patient's sedation level, increasing their awareness when the reason of respiratory failure is being bettering and treated. The Spontaneous Breathing Trial (SBT) facilitates mechanical ventilation weaning which reduce duration of MV and decrease ventilator induce hemodynamic instability. Pressure support ventilation (PSV) or the T-piece can be utilized through SBT when preparing patients to wean from MV after meeting the criteria for weaning. **(Maria et al., 2022; Tae et al., 2024)**.

Delirium is known as an acute beginning of mental disorder plus lack of awareness and cognitive dysfunction that fluctuates over time, combined with disorientation, reduced short term memory, changed sensory perceptions (hallucinations) unusual thought operations and improper behavior. The Society of critical care medicine (SCCM) (2012) recommended that critically ill patients be regularly checked for delirium at least one every nursing shift by effective and reliable assessment tools. Patients level of awareness essential first be assessed **(Joanna, et al 2021)**

Early mobility and exercise resulted in improving the respiratory muscle strength decreasing mucus viscosity, activates the alveolar wall to releases lipoproteinase, relieves bronchial spasm, and lessen the inflammatory transudation of lung tissues which improves ventilation/perfusion ratio and the circulatory function. Also has demonstrated improvements in hemodynamic and oxygenation status. **(Matthew et al., 2021)**

Critical care Nurses (CCN) perform important function in the application of ABCDE bundle. Critical care nurse lead SAT protocol- directed sedation attempts that contain daily spontaneous awakening trials, SBT trail, assessment of delirium and agitation by confirmed tools and early

mobility and exercises. **(Michele et al., 2012; Kram et al., 2015).**

Significance of the study

From clinical practice in the specialty of critical care nursing, it was observed that prolonged MV is combined with difficult weaning. Mechanical ventilation is neither therapeutic nor curative and it must be reserved when the fundamental pathophysiologic basis for starting MV is not required any more. Additionally, continuous sedation is connected to delirium, immobility and negative clinical consequences. Mechanical ventilation is associated with series of complication that affects morbidity and mortality.

Detection of the incidence of delirium in Egypt may be severely underestimated by medical and nursing staff which there is lack of information in recording. The main challenge for critical care nurse is to avoid any type of complications associated with ventilation. Evidence sustains the superior method to decrease the problems through implementation a non-pharmacological bundle of safety steps précised in the ABCDE bundle **(Joanna et al., 2021; Yijun et al., 2022)**

Application of the ABCDE bundle contain Awakening, spontaneous breathing trial, coordination, delirium management and early mobility

which is connected with reducing period of MV, occurrence of delirium and ICU extent of stay, increasing mobility and reducing costs. So, the aim of this study was to assess the effect of applying awakening, breathing coordination, delirium management and early mobility (ABCDE) bundle on clinical outcomes of mechanically ventilated patients at intensive care.

The aim of the study was to: Assess the influence of awakening and breathing coordination, delirium management and early mobility bundle on clinical outcomes of mechanically ventilated patients.

Research hypothesis: The clinical outcomes of mechanically ventilated patients who exposed to awakening and breathing coordination, delirium management and early mobility bundle have an improvement compared to control group patients who not exposed.

Subjects and Methods

Research design: A quasi-experimental research design was used to perform this study.

Setting: The study was performed at the Chest Intensive Care Units at Tanta University Hospitals which was affiliated to Ministry of Higher Education and Scientific Research. It involved three rooms with the total capacity of 15 beds.

Subjects: From the settings stated before, 100 adult mechanically ventilated patients were selected as a convenience sampling. After that, the patients were separated into two identical groups 50 patients in both according to the subsequent inclusion criteria:

Inclusion criteria: Patients aged from 21 years and above, using invasive mechanical ventilation via endotracheal tube or tracheostomy tube, patients on synchronized intermittent mandatory ventilation (SIMV) mode of mechanical ventilation with expected to need mechanical ventilation for ≥ 48 hours.

Tools of data collection: This study used five tools to gather the essential data and included:

Tool I: Mechanically Ventilated Patients' Assessment Tool: The researcher developed the tool after extra examine of the associated literature (Avila et al., 2015, Campbell, 2014, El Mokadem., et al 2023) except part b. It was involved two parts as found below:

Part a: Patients' demographic and clinical data: It included code, age, gender, current diagnosis, past medical history and ventilator parameters.

Part b: Glasgow Coma Scale (GCS): It was developed by Teasdale and Jennett (1974) to evaluate patient's level of awareness. The GCS

included three component, eye opening, verbal reply, and motor reaction.

Scoring system:

- GCS score 13-15: patients were awaked, could presented with confusion but were able to follow directions and to communicate.
- GCS 9-12: patients were typically drowsy or obtunded; they could opened eyes and localized painful stimuli upon assessment.
- GCS 3-8: patients presented as obtunded to comatose, they were unable to follow directions; & may exhibit decorticate or decelerate posturing.

Tool II: Spontaneous Awakening Trial (SAT) Safety Screen Tool: It was developed from (Girard et al., 2008, Scott., et al 2022) and was utilized to evaluate patient's willingness and endurance for spontaneous awakening trial. It consisted of two parts as follow:

Part a: Spontaneous Awakening Trial (SAT) Safety Screen Assessment: It was used to assess patient's readiness for spontaneous awakening trial as indicated by no signs of myocardial instability in the previous 24 hours of SAT (heart rate is not more than 120 b/m, no change in systolic blood pressure by 20% from baseline and ECG free from ischemic changes), patient's continuous need for sedative infusion,

in addition to Richmond Agitation Sedation Scale (RASS) with target level less than 2.

Scoring system:

- Readiness was measured using a dichotomous scale of met and unmet.
- When the criteria of the SAT safety screen was absent, the researcher concluded that it was unsafe to shut off the patient's continuous sedative infusions.

Part b: Spontaneous Awakening Trial (SAT) Tolerance Assessment:

This part was used to assess patient's tolerance to sedation interruption for 6-12 hours without exhibiting two or more of these failure criteria: sustained agitation using RASS, pain using critical care pain observation tool (CPOT), respiratory rate of 35 b/m for ≥ 5 minutes and acute cardiac dysrhythmia. Also, it included SAT tolerance time.

Scoring system:

- Readiness was measured using a dichotomous scale of met (present) and unmet (not present).
- If two or more of the SAT tolerance assessment were absent, the researcher concluded that it was necessary to re-administer sedative infusion.

Tool III: Spontaneous Breathing Trial (SBT) Safety Screen Tool: It was developed by (Kallet et al., 2018, Christopher., et al 2024) and was utilized to evaluate patient's

willingness and endurance for SBT. It consisted of 2 parts as the following:

Part a: Spontaneous Breathing Trial (SBT) Safety Screen Assessment:

It was used to evaluate patient's willingness for weaning trial. This part consisted of: Trial number, Oxygenation parameters such as $SpO_2 \geq 88\%$, $FiO_2 \leq 50\%$, $PH > 7.34$, $PEEP < 8\text{cmH}_2\text{O}$, ventilation parameters such as inspiratory effort by patient for 5 minutes period, sufficient minute volume and neurological parameters such as GCS and agitation score and normal hemodynamic parameters as heart rate, mean arterial pressure and temperature.

Scoring system:

-Readiness was measured using a dichotomous scale of met (present) and unmet (not present).

-When the criteria of the SBT safety screen was absent, the researcher concluded that the patient was not ready for SBT.

Part b: Spontaneous Breathing Trial Tolerance Assessment:

This part was used to assess patients' tolerance to breathing trial which was monitored for 30-120 minutes. It included trial failure criteria for respiratory parameters; respiratory rate > 35 b/min or < 8 b/min, hypoxemia ($SpO_2 < 88\%$ for ≥ 5 min), neurological parameters; mental status change, cardiovascular

parameters; acute cardiac arrhythmia, or two or more indicators of respiratory distress such as heart rate > 120 b/min or heart rate change 20% from baseline, systolic blood pressure > 180 mm Hg or < 90 mm Hg or blood pressure change 20% from standard, accessory muscle used and increased anxiety/diaphoresis. Also included extent of ICU stays, period on MV, duration of continuous sedation and number of SBT attempts.

Scoring system:

- Readiness was measured using a dichotomous scale of met (present) and unmet (not present).
- If the failure criteria of the spontaneous breathing trial were present, the researcher stopped spontaneous breathing trial and returned the patient to the previous ventilator settings.

Tool IV: Intensive Care Delirium Screening Checklist (ICDSC):

It was developed by (Oliver., et al 2025, Bergeron et al., 2001) and used to assess the occurrence of delirium. It was a screening checklist of eight items based on diagnostic and statistical manual of mental disorders (DSM) characteristics and criteria and of delirium: such as altered level of consciousness, inattention, disorientation, hallucination or delusion, psychomotor agitation, or retardation, in appropriate mood or

speech, sleep and wake cycle disorder and symptom variation. The researcher rated each manifestation (1) if it is positive and (0) if manifestation is negative.

Tool V: Manual Muscle Strength Assessment Tool: This tool was measured by medical research council (MRC) sum score which developed by (Latronico& Gosselink 2015; Usker., et al 2025) it was used to assess muscle strength within the ICU. Six muscle groups (shoulder abduction, elbow flexion, wrist extension, hip flexion, knee extension, and ankle dorsiflexion) were evaluated on both sides. It evaluated the deltoid, biceps, and wrist extensor muscles of the upper limb, and the hip flexor, quadriceps, and anterior tibial muscles of the lower limbs.

Methods:

1. The study was carried out after official permission obtained from the responsible authorities at the study setting.

2. Ethical considerations:

-Scientific Research Ethical Committee Approval of the Faculty of Nursing Tanta University was obtained with the code number 328-11-2023.

-Informed consent was obtained from the patients after explanation of the aim of the study.

-Confidentiality and anonymity were maintained through the use of code numbers instead of names.

-Patient's right to withdraw from the study at any time was maintained.

3. Tools development: The researcher developed Tool I part a, tool II and tool III after extra examining the associated literature (EL Mokadem., et al 2023, Scott., et al 2022, Kallet., et al 2018, Christopher., et al 2024).

4. Content validity was checked by a jury of 9 specialists in the area of Critical Care and Emergency Nursing, chest physicians, and medical biostatistics.

5. A pilot study was performed on 10% of patients to exam the feasibility and applicability of the tools as well as to determine any obstacles that may be encountered through the period of data gathering, where required modifications were done. Those patients were excluded from the study subjects.

6. Reliability was checked on the developed tools using Cronbach's alpha test. Tool II, III were 0.791 and 0.803 respectively. Tool IV for ICDSC was 0.839, Tool V was 0.78.

7. Patients who met the inclusion criteria were evaluated and split into two equal groups, each consisting of 50 patients. The researcher began

with control group first to prevent data contamination.

8.The data was collected through the period of 10 months initiated from May 2024 and ended upon February 2025.

9.The present study was conducted through four phases as the following:

Phase (1): -Assessment phase:

Assessment was done by the researcher for all patients in both groups to collect baseline data (using tool I). This phase was started within the first 24 hours after start of mechanical ventilation and before implementing ABCDE bundle. Assessment was done by using tool (I) to collect demographic and clinical data from patients, family, health care team and patients medical records, and by the researcher's observation.

Phase (2): -Planning phase: The planning phase was formulated based on data from the assessment phase, literature review, goals and expected outcomes criteria was taken into consideration when planning patients care.

Phase (3): -Implementation phase:

- **Control group:** involved of 50 adult mechanically ventilated patients who obtained routine ICU care performed by critical care nursing staff such as frequently change patients' position, assessing level of consciousness and administering continuous sedation, analgesics according to doctor's order.

- **Study group:** consisted of 50 adult mechanically ventilated patients who received spontaneous awakening and breathing coordination, delirium management and early mobility bundle which was implemented by the researcher in addition to the usual ICU care.

Awakening and breathing coordination, delirium management and early mobility (ABCDE) Bundle consisted of the following:

I.Spontaneous Awakening Trials

(SAT) included: There are two major steps in the awakening trial which are step 1: SAT Safety Screen and step 2: Perform SAT tolerance assessment.

II.Spontaneous breathing trial (SBT) includes:

III.The researcher will perform the breathing trial after passing the awakening trial. Spontaneous breathing trial consisted of two parts SBT safety screen assessment step3 and SBT tolerance assessment step 4.

IV. Delirium management:

- Every morning, the delirium was assessed by researcher using intensive care delirium screening checklist (ICDSC).
- The researcher will perform non-pharmacological interventions for delirium prevention such as eliminating or minimizing risk factors, Use sensory aids as appropriate. Maintain early mobility.

V. Early mobility

- Based on the patients' conditions on mechanical ventilation, a 3-stage activity was adopted as the following:
- Sitting on the bed, standing by the bed or sitting in a chair, or exercising at the bedside.
- When the condition of patient allows, he/she will be mentored and motivated by the nurse to keep sitting and to do active joint movement.
- Finally, the patient will be collectively aided by nurse to do a small range of exercises, and whether the exercise will be stopped or its duration will be prolonged
- Harmful actions should be avoided throughout exercise as falling out of bed or the tube falling off.

Phase (4): Evaluation phase:

Patients of both groups was evaluated using tool II, III, IV, and V to evaluate the effect of awakening and breathing coordination, delirium management and early mobility (ABCDE) bundle on clinical consequences of mechanically ventilated patients. Evaluation was done after 48 hours from implementation of ABCDE bundle and continued day after day for the period of 3rd, 5th and 7th day.

Results:

Table 1 Illustrates the Studied Mechanically Ventilated Patients Distribution Regarding their Demographic Characteristics.

About age, around two thirds of the control and study group (68.0% & 66.0%) were in the age group of 50- < 60 years, respectively. Half of the control group in comparison with 56.0% of the study group was male.

Table 2 Clarifies the Studied Mechanically Ventilated Patients Distribution Regarding their Clinical Data

It was found no differences statistically significant among the study and control group concerning current diagnosis and past medical history which $p > 0.05$ for each.

Table 3 Illustrates the Assessment of Spontaneous A wakening Trial (SAT) Safety Screen of the Studied Mechanically Ventilated Patients.

The current study results concluded that the frequency of the absence of changes in systolic blood pressure was higher (98%) in the study group in comparison with (80%) of the control group comprising a difference that showed statistically significance with $p < 0.05$. In addition, the control group showed statistically significance higher frequency of continuous need for sedative infusion (24%) than the study group (4%).

Concerning RASS score, alert and calm patients were statistically significantly higher in the study group (76%) compared to (42%) in the control group.

Table 4 Shows the Studied Mechanically Ventilated Patients Distribution About Spontaneous Awakening Trial (SAT) Tolerance

The current findings revealed that the parameters of SAT tolerance (agitation, restlessness, respiratory rate of 35b/m for ≥ 5 minutes, use of accessory muscle, diaphoresis and decreased level of consciousness) showed statistically significant differences regarding the different hours of observation within the study and control group with $p < 0.05$ except acute cardiac dysrhythmia showed no statistical significant differences with $p > 0.05$ in all observation of both groups.

Table 5 Illustrates the Studied Mechanically Ventilated Patients Distribution regarding Assessment of Spontaneous Breathing Trail (SBT) Safety Screen.

Regarding oxygenation parameters, this table presented that the most of the study group had normal value of SpO_2 (98%), FiO_2 (96%) and pH (94%) compared to (84%, 74%, and 72%) of the control group, respectively comprising statistical significant differences with $p < 0.05$ for each. Concerning ventilation parameters, sufficient minute volume & spontaneous inspiratory exertion in a 5-minute time was statistically significantly higher in the study group (92%) in comparison

with (64%) in control group. However, PEEP showed no statistically significance differences among both groups with $p > 0.05$.

In relation to neurologic parameters, conscious patients were statistically significantly higher (80.0%) in the study group in comparison with (56.0%) control group. Concerning hemodynamic parameters, none of the study group compared to 88.0% of the control group had heart rate < 120 b/m comprising statically significant difference with $P < 0.05$.

Table 6 Shows the Studied Mechanically Ventilated Patients Distribution Regarding SBT tolerance throughout periods of implementation after SBT.

The current findings revealed that the parameters of SBT tolerance including respiratory parameters (respiratory rate > 35 b/m, $SpO_2 < 88\%$ for 5 min) showed statistically significant differences regarding the different hours of observation within the study and control group with $p < 0.05$ except respiratory rate < 8 b/m showed no statistical significant differences in both group during different hours of observation with $p > 0.05$. Concerning neurological parameters it revealed statistical significant differences during different hours of observation between study and control group. Regarding CVS parameters (acute

cardiac arrhythmia, heart rate >120b/m, accessory muscle use, diaphoresis) showed statistically significant differences during different observation within the study and control group with $p < 0.05$ except (systolic blood pressure $>180/90$ mmhg, increased anxiety, agitation) .

Table 7 Presents the Studied Mechanically Ventilated Patients Distribution regarding level of Intensive Care Delirium Screening (ICDSC) before and after intervention.

The frequency of study group patients with no delirium was statistically significantly higher in 7th day (81.08%) than pre intervention (4%). Additionally, the frequency of study group patients who were delirious was statistically reduced in the 7th day (0.0%) than pre intervention (16.0%) with $p < 0.05$ for each. Regarding control group, the frequency of patients with no delirium was increased from (8.0%) pre-intervention to (25.81%) during the 7th day of follow up and the frequency of control group patients who were delirious was reduced in the 7th day (16.13%) than pre intervention (36.0%) but reduction was not statically significant with $p > 0.05$.

Table 8 Shows the Studied Mechanically Ventilated Patients Distribution regarding Total Level

of Manual Muscle Strength before and after Intervention.

The current study concluded that normal muscle strength in the study group patients was significantly increased from (16%) during the 3rd follow up day to (43.75) % during the 5th follow up day to (54.05%) during the 7th follow up day with $p < 0.05$. While they slightly increased in control group from (8%) during 3rd follow up day to (18.4%) during 5th follow up day to (16.13) % during the 7th follow up day.

The severe muscle weakness in the study group patients was significantly decreased from (76%) during 3rd day to (10.42%) during 5th day to (8.11%) during 7th day. While there were slightly decreased in control group from (82%) during 3rd day to (47.37%) during 5th day to (38.71%) during 7th day.

It was found differences statistically significant among the control and study groups regarding total score of manual muscle strength at the end of the 7th day with $p < 0.05$.

Table 9 Shows the Studied Mechanically Ventilated Patients Distribution about Clinical Outcomes.

This table showed statistical significant differences among the control and study group concerning duration of mechanical ventilation, duration of continuous sedation, and

number of SBT attempt with $p < 0.05$ for each. But there were no statistical significant differences found among the two studied groups regarding length of ICU stay which $p > 0.05$.

Table (1): Distribution of the studied mechanically ventilated patients regarding their demographic characteristics.

Characteristics	The studied mechanically ventilated patients (n=100)				χ^2 P
	Control group (n=50)		Study group (n=50)		
	N	%	N	%	
Age (in years)					
(20-<30)	3	6.0	2	4.0	2.349 0.672
(30-<40)	3	6.0	1	2.0	
(40-<50)	3	6.0	6	12.0	
(50-<60)	34	68.0	33	66.0	
(≥60)	7	14.0	8	16.0	
Range	(22-93)		(22-84)		t=0.651
Mean ± SD	61.80±15.765		63.78±14.629		P=0.517
Gender					
Male	25	50.0	28	56.0	FE
Female	25	50.0	22	44.0	0.689

FE: Fisher' Exact test & Chi-square as appropriate

Table (2): Distribution of the studied mechanically ventilated patients about their clinical data.

Clinical data	The studied mechanically ventilated patients (n=100)				χ^2 P
	Control group (n=50)		Study group (n=50)		
	N	%	N	%	
# Diagnosis					
Lung mass	10	20.0	5	10.0	0.362
COPD	11	22.0	17	34.0	
ARF	36	72.0	36	72.0	0.548
Laryngeal mass	3	6.0	2	4.0	
# Past medical history					
Endocrine diseases	20	40.0	17	34.0	0.361
Heart diseases	24	48.0	22	44.0	
Hepatic &GIT diseases	7	14.0	14	28.0	0.548
Respiratory diseases	7	14.0	3	6.0	
Renal diseases	0	0.0	2	4.0	
Others	10	20.0	11	22.0	

Chi-square

More than one answer was chosen

COPD (chronic obstructive pulmonary diseases), ARF (Acute respiratory failure)

Table (3): Assessment of spontaneous a waking trial (SAT) safety screen of the studied mechanically ventilated patients.

Indicators	The studied mechanically ventilated patients (n=100)				χ^2 P
	Control group (n=50)		Study group (n=50)		
	N	%	N	%	
Signs of Myocardial instability					
Heart rate > 120b/m					
- Present	6	12.0	1	2.0	FE
- Absent	44	88.0	49	98.0	0.112
Change in systolic blood pressure					
- Present	10	20.0	1	2.0	FE
- Absent	40	80.0	49	98.0	0.008*
Ischemic changes in ECG					
- Present	6	12.0	1	2.0	FE
- Absent	44	88.0	49	98.0	0.112
Continuous need for sedative infusion					
- Present	12	24.0	2	4.0	FE
- Absent	38	76.0	48	96.0	0.008*
RASS score					
- Light sedation	2	4.0	0	0.0	17.836 0.001*
- Drowsy	17	34.0	10	20.0	
- Alert and calm	21	42.0	38	76.0	
- Restless	5	10.0	2	4.0	
- Agitated	5	10.0	0	0.0	

FE: Fisher' Exact test & Chi-square test

* Significant at level P<0.05

Table (4): Distribution of the Studied Mechanically Ventilated Patients Regarding Spontaneous A wakening Trial (SAT) Tolerance.

Signs of intolerance	The studied mechanically ventilated patients (n=100)													
	Control group (n=50)(%)						χ^2 P	Study group (n=50) (%)						χ^2 P
	2 hrs	4 hrs	6 hrs	8 hrs	10 hrs	12 hrs		2 hrs	4 hrs	6 hrs	8 hrs	10 hrs	12 hrs	
Agitation RASS														
- Yes	12.0	12.0	12.0	14.0	14.0	14.0	0.265	0.0	0.0	0.0	0.0	0.0	0.0	-
- No	88.0	88.0	88.0	86.0	86.0	86.0	0.998	100.0	100.0	100.0	100.0	100.0	100.0	
Control Vs Study														
χ^2	FE	FE	FE	FE	FE	FE								
P	0.027*	0.027*	0.027*	0.012*	0.012*	0.012*								
Restlessness														
- Yes	14.0	18.0	18.0	18.0	18.0	18.0	0.486	2.0	2.0	2.0	2.0	2.0	2.0	0.00
- No	86.0	82.0	82.0	82.0	82.0	82.0	0.993	98.0	98.0	98.0	98.0	98.0	98.0	1.00
Control Vs Study														
χ^2	FE	FE	FE	FE	FE	FE								
P	0.059	0.016*	0.016*	0.016*	0.016*	0.016*								
Respiratory rate of 35 b/m for $\geq$ 5 min														
- Yes	32.0	36.0	38.0	38.0	38.0	38.0	0.640	4.0	6.0	6.0	6.0	6.0	6.0	0.339
- No	68.0	64.0	62.0	62.0	62.0	62.0	0.986	96.0	94.0	94.0	94.0	94.0	94.0	0.997
Control Vs Study														
χ^2	FE	FE	FE	FE	FE	FE								
P	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*								
Acute cardiac dysrhythmia														
- Yes	14.0	14.0	14.0	14.0	14.0	14.0	0.00	4.0	4.0	4.0	4.0	4.0	4.0	0.00
- No	86.0	86.0	86.0	86.0	86.0	86.0	1.00	96.0	96.0	96.0	96.0	96.0	96.0	1.00
Control Vs Study														
χ^2	FE	FE	FE	FE	FE	FE								
P	0.160	0.160	0.160	0.160	0.160	0.160								

FE: Fisher' Exact test

* Significant at level $P < 0.05$

Table (4) Continue: Distribution of the Studied Mechanically Ventilated Patients Regarding Spontaneous A waking Trial (SAT) Tolerance.

Signs of intolerance	The studied mechanically ventilated patients (n=100)													
	Control group (n=50)(%)						χ^2 P	Study group (n=50) (%)						χ^2 P
	2 hrs	4 hrs	6 hrs	8 hrs	10 hrs	12 hrs		2 hrs	4 hrs	6 hrs	8 hrs	10 hrs	12 hrs	
- Use of accessory muscle														
- Yes	32.0	36.0	38.0	38.0	38.0	38.0	0.640	4.0	6.0	6.0	6.0	6.0	6.0	0.339
- No	68.0	64.0	62.0	62.0	62.0	62.0	0.986	96.0	94.0	94.0	94.0	94.0	94.0	0.997
Control Vs Study χ^2 P	FE 0.000*	FE 0.000*	FE 0.000*	FE 0.000*	FE 0.000*	FE 0.000*								
- Diaphoresis														
- Yes	28.0	32.0	34.0	34.0	34.0	34.0	0.679	4.0	6.0	6.0	6.0	6.0	6.0	0.339
- No	72.0	68.0	66.0	66.0	66.0	66.0	0.984	96.0	94.0	94.0	94.0	94.0	94.0	0.997
Control Vs Study χ^2 P	FE 0.002*	FE 0.002*	FE 0.001*	FE 0.001*	FE 0.001*	FE 0.001*								
- Decreased level of consciousness														
- Yes	18.0	22.0	24.0	28.0	28.0	28.0	2.362	2.0	2.0	2.0	2.0	2.0	2.0	0.00
- No	82.0	78.0	76.0	72.0	72.0	72.0	0.797	98.0	98.0	98.0	98.0	98.0	98.0	1.00
Control Vs Study χ^2 P	FE 0.016*	FE 0.004*	FE 0.002*	FE 0.000*	FE 0.000*	FE 0.000*								

FE: Fisher' Exact test

* Significant at level P<0.05

Table (5): Assessment of spontaneous breathing trial (SBT) safety screen of the studied mechanically ventilated patients.

Indicators	The studied mechanically ventilated patients (n=100)								FE P
	Control group (n=50)				Study group (n=50)				
	Present		Absent		Present		Absent		
	N	%	N	%	N	%	N	%	
Oxygenation parameters									
- SpO ₂ ≥ 88%	42	84.0	8	16.0	49	98.0	1	2.0	0.031*
- FIO ₂ ≤ 50%	37	74.0	13	26.0	48	96.0	2	4.0	0.004*
- Ph>7.34	36	72.0	14	28.0	47	94.0	3	6.0	0.006*
Ventilation parameters									
- PEEP<8cm H ₂ O	45	90.0	5	10.0	50	100.0	0	0.0	0.056
- Sufficient min volume (4-6) ml/kg	32	64.0	18	36.0	46	92.0	4	8.0	0.001*
- Spontaneous inspiratory effort in a 5 min period	32	64.0	18	36.0	46	92.0	4	8.0	0.001*
Neurological parameters									
- No agitation	45	90.0	5	10.0	50	100.0	0	0.0	0.056
- Conscious patient	28	56.0	22	44.0	40	80.0	10	20.0	0.018*
Hemodynamic parameters									
- Temperature (norm thermic)	49	98.0	1	2.0	50	100.0	0	0.0	1.00
- Heart rate <120 b/m	44	88.0	6	12.0	50	100.0	0	0.0	0.027*
- Respiratory rate<35c/m	47	94.0	3	6.0	50	100.0	0	0.0	0.242
- Mean arterial blood pressure >60mmhg	37	74.0	13	26.0	43	86.0	7	14.0	0.211

FE: Fisher' Exact test

* Significant at level P<0.0

Table (6): Distribution of the Studied Mechanically Ventilated Patients about SBT Tolerance Assessment during Periods of Implementation after SBT.

Signs of intolerance	The studied mechanically ventilated patients (n=100)									
	Control group (n=50)(%)				χ^2 P	Study group (n=50) (%)				χ^2 P
	30 min (n=39)	60 min (n=39)	90 min (n=39)	120 min (n=39)		30 min (n=49)	60 min (n=49)	90 min (n=49)	120 min (n=49)	
Respiratory parameters:										
- Respiratory rate>35b/m	28.21	66.67	69.23	69.23	19.570	16.33	28.57	38.78	38.78	8.337
- Yes	71.79	33.33	30.77	30.77	0.000*	83.67	71.43	61.22	61.22	0.040*
- No										
Control Vs Study										
χ^2	FE	FE	FE	FE						
P	0.201	0.001*	0.006*	0.006*						
- Respiratory rate<8b/m	0.00	0.00	2.56	2.56	2.799	0.00	4.08	4.08	4.08	3.515
- Yes	100.00	100.00	97.44	97.44	0.424	100.00	95.92	95.92	95.92	0.319
- No										
Control Vs Study										
χ^2	-	FE	FE	FE						
P		0.501	1.00	1.00						
- SpO ₂ <88% for 5 min	25.64	69.23	71.79	71.79	25.107	14.29	28.57	40.82	40.82	11.716
- Yes	74.36	30.77	28.21	28.21	0.000*	85.71	71.43	59.18	59.18	0.008*
- No										
Control Vs Study										
χ^2	FE	FE	FE	FE						
P	0.277	0.000*	0.005*	0.005*						
Neurological parameters: Mental status change										
- Yes	15.38	25.64	28.21	28.21	2.525	2.04	6.12	10.20	10.20	3.943
- No	84.62	74.36	71.79	71.79	0.471	97.96	93.88	89.80	89.80	0.268
Control Vs Study										
χ^2	FE	FE	FE	FE						
P	0.041*	0.015*	0.049*	0.049*						

FE: Fisher' Exact test

* Significant at level P<0.05

Table (6): Continue, Distribution of the Studied Mechanically Ventilated Patients about SBT Tolerance Assessment during Periods of Implementation after SBT.

Signs of intolerance	The studied mechanically ventilated patients (n=100)									
	Control group (n=50)(%)				χ^2 P	Study group (n=50) (%)				χ^2 P
	30 min (n=39)	60 min (n=39)	90 min (n=39)	120 min (n=39)		30 min (n=49)	60 min (n=49)	90 min (n=49)	120 min (n=49)	
CVS parameters:										
-Acute cardiac arrhythmia										
- Yes	7.69	28.21	30.77	30.77	9.374	6.12	8.16	12.24	12.24	1.627
- No	92.31	71.79	69.23	69.23	0.025*	93.88	91.84	87.76	87.76	0.653
Control Vs Study	FE	FE	FE	FE						
P	1.00	0.021*	0.038*	0.038*						
χ^2										
- Heart rate>120b/m										
- Yes	5.13	25.64	30.77	30.77	12.074	6.12	8.16	12.24	12.24	1.627
- No	94.87	74.36	69.23	69.23	0.007*	93.88	91.84	87.76	87.76	0.653
Control Vs Study	FE	FE	FE	FE						
P	1.00	0.039*	0.038*	0.038*						
χ^2										
-Systolic blood pressure>180/< 90 mmHg										
- Yes	7.69	10.26	12.82	12.82	0.754	6.12	16.33	24.49	24.49	8.643
- No	92.31	89.74	87.18	87.18	0.860	93.88	83.67	75.51	75.51	0.034*
Control Vs Study	FE	FE	FE	FE						
P	1.00	0.537	0.188	0.188						
χ^2										
-Accessory muscle use										
- Yes	28.21	66.67	69.23	69.23	19.570	18.37	24.49	36.73	36.73	6.163
- No	71.79	33.33	30.77	30.77	0.000*	81.63	75.51	63.27	63.27	0.104
Control Vs Study	FE	FE	FE	FE						
P	0.313	0.000*	0.003*	0.003*						
χ^2										
-Increased anxiety, agitation										
- Yes	5.13	12.82	15.38	20.51	4.546	4.08	8.16	20.41	22.45	10.943
- No	94.87	87.18	84.62	79.49	0.208	95.92	91.84	79.59	77.55	0.012*
Control Vs Study	FE	FE	FE	FE						
P	1.00	0.502	0.590	1.00						
χ^2										
-Diaphoresis										
- Yes	30.77	66.67	69.23	69.23	17.126	12.24	30.61	38.78	38.78	12.123
- No	69.23	33.33	30.77	30.77	0.001*	87.76	69.39	61.22	61.22	0.007*
Control Vs Study	FE	FE	FE	FE						
P	0.038*	0.001*	0.006*	0.006*						
χ^2										

Table (7): Distribution of the Studied Mechanically Ventilated Patients about Total level of Intensive Care Delirium Screening (ICDSC) before and after Intervention.

Total ICDSC Level	The studied mechanically ventilated patients (n=100)									
	Control group (n=50)(%)				χ^2 P	Study group (n=50) (%)				χ^2 P
	Before (n=50) %	After intervention				Before (n=50) %	After intervention			
		3 rd day (n=50) %	5 th day (n=38) %	7 th day (n=31) %			3 rd day (n=50) %	5 th day (n=48) %	7 th day (n=37) %	
No delirium	8.00	10.00	21.05	25.81		4.00	24.00	72.92	81.08	
Subsyndromal delirium	56.00	56.00	57.89	58.06	9.945	80.00	72.00	27.08	18.92	95.960
Delirium	36.00	34.00	21.05	16.13	0.127	16.00	4.00	0.00	0.00	0.000*
Range	(0-4)	(0-4)	(0-4)	(0-4)	F=3.080	(0-4)	(0-4)	(0-3)	(0-3)	F=32.640
Mean ± SD	2.74±1.275	2.60±1.370	2.11±1.467	1.94±1.482	P=0.029*	2.44±1.110	1.50±1.199	0.58±1.028	0.46±1.016	P=0.000*
Control Vs Study χ^2 P	6.755 0.034*	17.525 0.000*	30.558 0.000*	24.977 0.000*						

(0) Normal

(1-3) Subsyndromal delirium

(4-8) Delirium

* Significant at level P<0.05

Table (8): Distribution of the Studied Mechanically Ventilated Patients Regarding Total level of Manual Muscle Strength Throughout Period of Intervention

Total muscle strength level	The studied mechanically ventilated patients (n=100)													
	Control group (n=50)						χ^2 P	Study group (n=50)						χ^2 P
	3 rd day (n=50)		5 th day (n=38)		7 th day (n=31)			3 rd day (n=50)		5 th day (n=48)		7 th day (n=37)		
	N	%	N	%	N	%		N	%	N	%	N	%	
-Severe muscle weakness	41	82.00	18	47.37	12	38.71	23.167 0.001*	38	76.00	5	10.42	3	8.11	68.425 0.000*
-Moderate muscle weakness	5	10.00	10	26.32	10	32.26		4	8.00	18	37.50	11	29.73	
-Mild muscle weakness	0	0.00	3	7.89	4	12.90		0	0.00	4	8.33	3	8.11	
-Normal muscle strength	4	8.00	7	18.42	5	16.13		8	16.00	21	43.75	20	54.05	
Range	(12-60)		(12-60)		(12-60)		F=6.126	(12-60)		(12-60)		(12-60)		F=31.522
Mean ± SD	25.60±12.739		34.03±15.937		35.84±14.855		P=0.003*	29.98±13.989		46.23±12.555		49.46±10.548		P=0.000*
Control Vs Study t P	1.637 0.105		3.973 0.000*		4.409 0.000*									

(<36) Severe muscle weakness (36-<48) Moderate muscle weakness (48-<50) Mild muscle weakness (50-60) Normal muscle strength

* Significant at level P<0.05

Table (9): Distribution of the Studied Mechanically Ventilated Patients Regarding Clinical Outcomes

Indicators	The studied mechanically ventilated patients (n=100)		t P
	Range		
	Mean ± SD		
	Control group (n=50)	Study group (n=50)	
Length of ICU stay	(3-29)	(3-20)	0.232
	9.68±6.371	9.94±4.718	0.817
Duration on Mechanical Ventilation	(2-29)	(1-18)	2.346
	8.56±6.095	6.24±3.426	0.021*
Duration of continuous sedation	(1-10)	(1-8)	4.969
	4.66±2.200	2.80±1.471	0.000*
Number of SBT attempts	(0-3)	(0-4)	3.955
	1.14±0.904	1.84±0.866	0.000*

Data were analyzed using T- test
SBT (spontaneous breathing trail)

* Significant at level $P < 0.05$

Discussion

Awakening, breathing, coordination, delirium management and early mobility bundle (ABCDE) are used as non-pharmacologic interventions to improve outcomes of MV patients. Also, ABCDE bundle is connected with lower period of mechanical ventilation and minimizing adverse outcomes. (Garrett, 2016; Kellie et al., 2021). Regarding age, the age group of (50 - < 60) years was about two thirds of the control group and study group. Additionally, the mean age of the control group was 61.80 $\pm$ 15.765 years, while it

was 63.78 $\pm$ 14.629 years in the study group. This result may be due to aging process involves a natural decline in lung function; a deterioration of lung tissues and immune system can change which can make them susceptible to chronic inflammation. This may be attributed to increased incidence of chronic disease and ICU admission with advanced age. This study finding were supported by Elkdy et al., (2021) who showed that the age group from (50 to 59) years was about two thirds of the patients. Conversely, this study finding were opposed with Hussein et al., (2023) who found that the mean age of the studied

patients in both study and control groups was 60 or more, mean $\pm$ SD was (63.7 $\pm$ 8.94, 65.22 $\pm$ 7.61) in the control group and study group, respectively.

In relation to gender, the current study findings presented that about half of the control and study group were male. This finding may be attributed to behavioral patterns and higher rates of smoking and occupational hazards of dust exposure among men. This result was aligned with **Elkady et al., (2021)** and **El-araby et al., (2023)** who reported that two-thirds of the studied sample was male.

On the other hand, this result was opposed with **Hussein et al., (2023)** who stated that about more than half of the studied patients were females. Also, **AL-Sarahinah. (2024)** reported that the highest percent of the total sample was female in control group while in the experimental group was male.

Concerning current diagnosis, the current study results revealed that acute respiratory failure presented an equal and predominant proportion about two thirds of the sample in the control and the study group followed by COPD which presented by nearly one third in both groups. This result could be clarified by sample collection from chest intensive care units as specified before in setting selection to perform the study.

The study findings were aligned with **Hussein et al., (2023)** who stated that respiratory disorders was the most common diagnosis which forms one third of the studied patients. Also, the study by

AL-Sarahinah (2024) reported that the highest percent of primary cause of admission in control group and experimental group was respiratory followed by sepsis. Conversely, **Elkady et al., (2021)** stated that low percentage of ICU diagnosis was respiratory failure in study group but It was high in control group.

Concerning past medical history, the study results showed that heart diseases had the highest frequency comprising about nearly half of the sample in the control and study group followed by endocrine diseases. This result may be due to aging is association with many health and disease condition including heart disease as a result of life stresses.

This study finding was in difference with **Ebrahim et al., (2021)** who presented that the highest percentage of the ICU diagnosis for patients had subarachnoid hemorrhage in the study group. Also, **Elkady et al., (2021)** stated that most of the studied sample was diagnosed with renal failure

Concerning spontaneous a wakening trial (SAT) safety screen criterion, the study results reported that the frequency of the absence of changes in systolic blood pressure was higher in the study group in comparison with the control group. In addition, the control group showed statistically significance higher frequency of continuous need for sedative infusion than the study group. The study group was statistically significantly higher compared to control

group concerning RASS score, alert and calm patients. This finding could be explained by the researcher that started interruption of sedation as early as possible according to the patients condition, frequent assessment and use of sedative and early relief of pain and also early mobility help in increased level of awareness and readiness which contribute to easier stopping of sedation and successful a wakening.

Because deep level of sedation is the most important potential barriers to successful application of early rehabilitation protocol for mechanically ventilated patients (MVPs), early and safe shift to SBT do reinforce the concept of liberation of both sedation and ventilation therapies which considered an integral part of cognitive, pulmonary and physical rehabilitation program in ICUs.

The study finding was aligned with **AL-Sarahinah (2024)** which found the group of adapted ABCDE bundle experienced more time lightly sedated while other group of no ABCDE bundle was more deeply sedated.

The current study findings were agreed with **Hussein et al., (2023)** who found significant findings related to decision of SAT safety screen between the study and control groups excluding in heart rate > 120b/m and ischemic changes in ECG. Also, **Ebrahim et al., (2021)** reported that the application of ABCDE bundle had a positive influence on the amount of prescribed sedatives medications.

Conversely, this finding was contradicted by **Mehta., et al (2012)** found no difference between the two groups which both treatment, control group obtained extra sedative amounts that would results in moderate to deep level of sedation.

Concerning spontaneous awakening trial (SAT) tolerance, the current study findings revealed that parameters of SAT tolerance (agitation, restlessness, respiratory rate of 35b/m for ≥ 5 minutes, use of accessory muscle, diaphoresis and decreased level of consciousness) showed statistically significant differences regarding the different hours of observation in the study and control group except for acute cardiac dysrhythmia. The study group have success in SAT tolerance with increased awareness, open eyes in response to verbal stimuli, follow simple commands and sedative interruption for > 12 hours with lack of SAT failure criteria (signs of respiratory distress, cardiac dysrhythmia or pain, agitation, $SpO_2 < 88$ for > 5 minutes) which then the patient in study group ready to proceed to SBT screening to perform ventilator weaning.

The study findings were aligned with **Hussein et al., (2023)** who presented that there were differences statistically significant in SAT for all intolerance criteria among the study and control group after SAT. **Hooper and Girard, (2011)** verified advantages of daily SAT and expanded by combination SAT with SBT in a protocol that improved multiple consequences, less hospital days with

lesser period of sedation infusion, mechanical ventilation period, VAP occurrence, ICU days as well as death rate.

On the other hand, this finding was contradicted by **Abdelghany ., et al (2020)** found no difference statistically significant in ventilator free days between daily sedation interruption (DIS) and no-sedation, no difference statistically significant in length of ICU stay, hospital stay, incidence of VAP nor in the weaning process (simple, difficult or prolonged) among the two groups and the no-sedation group revealed a higher nurse workload in contrast with the DIS group.

In terms of SBT safety screen, it was found differences statistically significant among study and control groups regarding oxygenation parameters, ventilation parameters. In relation to neurologic parameters, conscious patients were statistically significantly higher in the study group than in the control group. Concerning hemodynamic parameters, none of the study group compared to majority of the control group had heart rate <120 b/m comprising statically significant difference.

The spontaneous breathing trails were achieved in study group safely as a result of frequent assessment by researcher and the physician to assess patients readiness to stopping MV, which found increased level consciousness in study group more than two thirds were conscious, had

normal values of oxygenation parameters, ventilation parameters and hemodynamic parameters which lead to easier following instruction during weaning and extubation and perform the trail of weaning without fear.

The current study findings were in accordance with **Hussein et al., (2023)** who reported that the study group were highly significant differences compared to control group for SBT in all safety screening criteria. **Lin and zhang (2021)** found that two thirds of patients meet the criteria of screening at first time of CPAP method.

The current study findings revealed that parameters of SBT tolerance showed statistically significant differences regarding the different hours of observation within the study group and control group except respiratory rate <8 b/m, systolic blood pressure $>180<90$ mm Hg, increased anxiety, and agitation. Moreover, these results were agreed with **Hussein et al., (2023)** who showed statistical significant differences in study and control groups regarding signs of intolerance for spontaneous breathing trial. **Shehabi et al., (2012)** revealed that early deep sedation is basic indicator of late time to extubation and elevated long-term mortality.

The study findings were in contrast with **Jing ., et al (2013)** found no significant difference which positive extubation was succeeded in 56 of 61 patients (91.8%) in the SBT group and 54 of 60 patients (90.0%) in the no SBT group so

intensive care patients can be extubated effectively without an SBT. Moreover, **Rashmi and Urmila (2021)** concluded that there were no differences in total extubation rates in the two groups however total reintubation rate was decreased in the intervention group contrasted with control group but was no statistically significant

In relation to assessment of items of intensive care delirium screening checklist (ICDSC), frequency of study group with no delirium was statistically significantly higher in 7th day than in control group during the seventh day of follow up. This result may be explained by implementation of delirium assessment and management every day by the researcher, providing early initiation of mobility and implementing of SAT and SBT as early as possible that helped in decreasing incidence of delirium and better the patients' consequences in the study group.

The current study findings were aligned with **Ebrahim et al., (2021)** who demonstrated that there was a highly statistically significant decreasing in the mean score of the delirium characteristics in the study group compared to the control group. Moreover, **Al araby et al., 2023** revealed that there were differences statistically significant among the study and control groups about occurrence and duration of delirium.

The study findings was contradictory with **Khan., et al (2014)** found that the

incidence and prevalence of delirium didn't change. And also, **Zhang., et al (2021)** found no difference statistically significant in reducing the prevalence and duration of intensive care unit delirium.

Regarding total muscle strength level, the results of the current study concluded that normal muscle strength in the study group was significantly improved during the 3rd and 5th and 7th follow up days than the control group. Improvement of manual muscle strength could be clarified by early implementation of mobilization exercises which reduced immobility-associated problems, preserved muscle function and helped counter balance the muscle loss that happens through prolonged ICU stays.

The study findings were aligned with **Amin et al., (2023)** reported that there was significant progress in physical function regarding the study group in comparison with control group post intervention. Study by **Schallom., et al (2020)** stated that applying early mobility program in an ICU with ABCDEF bundle can increase mobility level, decrease frequency and period of delirium and extent of stay.

The study findings were contradictory with **Moss., et al (2015)** found that, the intensive program of physical therapy didn't enhance long term physical functioning in comparison with a standard of care protocol.

Concerning assessment of clinical outcomes of implementing ABCDE

bundle, it was found differences statistically significant among the control and study about duration of mechanical ventilation, duration of continuous sedation and number of SBT attempts. However, it was found no differences statistically significant between the two studied groups about length of ICU stay. This result could be explained by implementing of SAT and SBT as early as possible, early implementation of mobilization exercises, delirium assessment and management every day by the researcher.

The current study findings were supported with **Hussein et al., (2023)** who stated that highly significant differences among the study and control groups about the duration of mechanical ventilation and the duration of continuous sedation. Also, **Ebrhaim, (2021)** indicated that there was extremely significant lowering in the mean score of ventilator free days and mean ICU extent of stay in the study group in comparison with control group. **AL-Sarahinah (2024)** reported that there was no difference statistically significant regarding ICU extent of stay.

Moreover, the current study findings were compatible with **Al araby et al., (2023)** who stated that there were significant differences among the study and control about ventilator days in study group. **Frade & Mera, et al., (2022)** found that ABCDE bundle components resulted in shorter ICU stay. **Moraes et al., (2022)** showed that bundles may

decrease extent of ICU stay, mechanical ventilation period, delirium, ICU and hospital death and encouraged early movement for critically ill patients.

Conclusion: Implementing a waking and breathing coordination, delirium management and early mobility bundle (ABCDE) is an effective nursing approach in achieving positive outcomes.

Recommendations:

- ABCDE bundle intervention should be carried out routinely for managing patients on mechanical ventilation.

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Nursing Students' Satisfaction with Credit Hours System and Its Relation to Studying Workload

Zainab Ali Abd El-wahed Hemdan ^{1,2}, Reda Abd El-fatah Abo Gad³,
Seham Ali Mahmoud ⁴

¹Master Student of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

²Nursing specialist at Housh Eissa Hospital, Al Beheira, Ministry of Health, Egypt

³Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

⁴Assistant Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

Corresponding Author: Zainab Ali Hemdan

E-Mail: PG-176922@nursing.tanta.edu.eg

Abstract

Background: The credit hour system is a structured academic framework that defines workload, links learning time to outcomes, and ensures flexibility and consistency across programs. **Aim:** Identify nursing students' satisfaction with credit hours system and its relation to studying workload. **Research design:** Descriptive-correlational research design. Setting The present study was conducted at the Faculty of Nursing, Tanta University: **Subjects:** The study included stratified sample n=809 undergraduate nursing students of the BSc program (2024–2025), total number (2850) of students excluding those not enrolled in the credit hours system. **Tools:** Tool I nursing students' satisfaction with credit hours system and tool II studying workload. **Results:** Majority (88.4%) of nursing students had a satisfactory level regarding to overall credit hours system and more than half (50.9%) of nursing students had a moderate level of overall studying workload. **Conclusion:** A statistically significant negative correlation was found between nursing students' overall satisfaction of credit hours system and studying workload. ($r=-0.114$, $p=0.001$). **Recommendations:** Establish a regular review of the credit hours system, balanced course distribution, workload monitoring, active student engagement and clear faculty guidance.

Key words: Credit hours system, nursing student, Studying workload.

Introduction

Nursing education is designed to prepare healthcare professionals in providing safe and effective care to patients. It teaches nurses how to monitor patient conditions, administer treatments and medications accurately, and apply evidence-based practices to improve patient outcomes. The purpose of nursing education is to enhance the skills, knowledge, and professionalism of nurses, ultimately contributing to the overall advancement of the nursing field **(Shahi& Bist, 2021)**.

Many educational institutions have shifted toward the credit-module system due to its effectiveness and flexibility. This system is based on modular learning and credit measurement, allowing students to design individualized learning plans and evaluate their academic effort. It also adopts a modern approach that aligns theoretical knowledge with societal needs. Consequently, the credit-module system promotes independent learning, teamwork, and professional growth among nursing students **(Han et al., 2023)**.

Nursing students' satisfaction with credit hour system encompasses six domains, the students' satisfaction with the implementation process of credit hour system, academic advisors, education and students'

affairs department, faculty resources under credit hour system, members of teaching staff, assistants of teaching staff members in the light of credit hours system.

Students' satisfaction with the implementation process of credit hour system is students' perception that the program and services meet their academic expectations and support positive learning. **(Zinhom,2017& Nguyen, 2022)**.

The students' satisfaction with academic advisors that guides and supports them in planning their courses, managing their credit load, and achieving academic goals **(Mohammed, 2021)**. The education and student's affairs support students academically, socially, and personally **(McClellan& Kiyama,2023)**.

Students' satisfaction with faculty resources depends on proper facilities, teaching staff, digital resources, and administrative support to facilitate learning and track academic progress **(Jadrić et al., 2025)**. Students' satisfaction with teaching staff members plays a key role in guiding students, managing workload, and applying pedagogical strategies to ensure effective learning **(Lachance et al., 2025)**.

Students' satisfaction with assistants of teaching staff members who assist teaching staff, guiding students,

managing workload, and providing feedback (**McLeod, *et al.*, 2025**). Credits hours express the volume of learning based on the defined learning outcomes and their associated workload (**Rivadeneyra, 2022**).

Credit hours provide only a general estimation of academic demands rather than an accurate representation of students' real workload. Consequently, credit hours should be interpreted as a partial indicator that does not comprehensively capture the workload students experience in practice (**Impola, 2025**). Workload is understood as the estimated total time a student needs to complete all learning activities required to achieve the intended learning outcomes. This includes both contact hours (lectures, seminars) and non-presential activities such as projects, assignments, practical exercises, reading, and preparation for assessments (**Sirvent-Pérez et al., 2025**).

High students' workload can lead to surface learning, cognitive overload, and increased stress, negatively affecting both academic performance and well-being. Consequently, excessive workload often reduces students' satisfaction and engagement with their programs (**Thornby et al., 2023**). Students

who perceive a high workload often resort to procrastination as a way to avoid stress, which subsequently leads to task accumulation and increased psychological pressure (**Osei, 2025**).

Nursing student's workload includes three dimensions, task demand as mental, physical, temporal demand and feeling or behavior toward the task as performance, effort, and frustration level. Mental demand is the cognitive effort required to perform a task such as thinking, understanding, and processing information. Physical demand reflects the amount of physical effort or strain such as sitting for long periods or looking at screens. Temporal demand measures the time pressure students felt including the sense of being rushed, having tight deadlines, or not having enough time to perform tasks. (**Beena& Sony 2022&Prasetyo et al., 2025**).

Performance level is the extent to which students perceive that they have met the intended goals of the activity. Effort refers to how hard students felt they had to work (mentally and physically) to achieve their level of performance. Frustration level is the negative emotions experienced by students such as feeling insecure, discouraged, irritated, stressed, or annoyed (**Widyanti& Park, 2020**).

Significance of study:

The Credit hour system in Faculty of Nursing, Tanta University is a valuable system. The credit hours system is significant as it links academic credits to students' study time and workload, supporting student-centered learning and effective workload management. It also enhances the quality and comparability of higher education through standardized curriculum planning and evaluation (impola, 2025), But in some instances credit hours can become overburden for nursing students. Student workload hinders an adequate assimilation of concepts, and can lead to superficial learning, its consequences can be really harmful for students' health, affecting their self-esteem and self-confidence, anxiety (Rivadeneyra, 2022).

Relying solely on credit hours can misrepresent the actual students' workload, potentially leading to poor course selection decisions and increased academic stress (Borchers & Pardos, 2025). From research as post graduate student and had studying by credit hours system observed that although credit hours provide a structured framework for organizing courses, they do not always accurately reflect the real academic and clinical demands placed on students, which may

influence their perceived workload and overall academic experience. So, study aimed to assess nursing students' satisfaction with credit hours system and its relation to academic workload.

Aim of the study

Identify nursing students' satisfaction with credit hours' system and its relation to studying workload.

Research questions:

- 1-What are the nursing students' satisfaction levels with credit hours system?
- 2-What are the nursing students' study workload levels?
- 3-What is the relation between nursing students' satisfaction with credit hours system and studying workload?

Subjects and Method**Research design:**

Descriptive correlational research design was applied to achieve the aim of this study.

Study setting:

The present study was conducted at the Faculty of Nursing, Tanta University.

The faculty had a certificate of accreditation from the National Authority for Education Quality Assurance and Accreditation in 2019 and reaccredited for the second time in 2025. The faculty employed credit hours system at 2022.

Subjects:

The subjects of this study included a stratified proportional randomized sampling of undergraduate nursing students who are enrolled in different years of Bachelor of Science in nursing during the academic year 2024-2025 at the Faculty of Nursing fourth year was excluded as not study in credit hours system at the time of data collection.

Tools of data collection:

To achieve the aim of the present study the data was collected using the following two tools:

Tool I: Nursing Students' Satisfaction with Credit Hours System Structured Questionnaire

This tool included the following parts:

Part 1: Personal and studying related characteristics data of nursing students included age, gender, academic level, place of residence, previous academic achievement, participation in any university activities, working during studying years.

Part 2: Students' satisfaction about Credit hours system Structured Questionnaire. This tool was developed by researcher based on Zinhom, (2017), Hai, (2022) and Mohammed, (2021). It was used to assess nursing students' satisfaction with credit hours system. This part included 40 items divided

into the following six dimensions:

-Nursing students' satisfaction with implementation process of credit hours system, academic advisors, education and students' affairs department, faculty resources in the light of credit hours system, members of teaching staff in the light of credit hours system, assistant staff members in the light of credit hours system

Nursing students' responses were measured on a five points Likert Scale ranging from 1-5 where strongly disagree=1, disagree=2, neutral=3, agree=4, and strongly agree=5

Scoring system:

The total score calculated by cut off points and summing scores of all categories. The total scores represent varying levels as follows:

- Satisfactory level $\geq 80\%$.
- Unsatisfactory level $< 80\%$.

Tool II: studying Workload Structured Questionnaire

This tool was developed by researcher guided by Widianti *et al.*, (2020) and D'Eon&, Yasinian (2022). It was used to measure academic workload experienced by nursing students. It included 37 items divided into three dimensions: **Task demands** divided into two categories: mental demand and physical demand

Temporal demands, Feeling or behavior toward the task

divided into three categories: Performance, effort, and frustration.

Nursing students' responses were measured on a five points Likert Scale ranging from 1-5 where strongly disagree=1, disagree=2, neutral=3, agree=4, and strongly agree=5

Scoring system

The total score calculated by cut off points and summing scores of all categories. The total scores represent varying levels as follows:

- High academic workload level $\geq 75\%$
- Moderate academic workload level 60 - 75 %
- Low academic workload level $< 60\%$

Methods

1. Official permission was obtained from the Dean of / and authoritative personnel of Faculty of Nursing. Tanta University to the head of the departments.

2. Ethical considerations:

- a) Approval of the Scientific Committee Ethical Committee of the Faculty of Nursing was obtained with code 388-2-2024.
- b) Nature of the study was not causing any harm or pain to the nursing students.
- c) The researcher introduced herself to the participant, a full

explanation of the aim and method of the study was done to obtain the acceptance and cooperation as well as their informed consent.

d) The right to terminate participation at any time was accepted.

e) Confidentiality and privacy were taken into consideration regarding data collection. A code number was used instead of names.

3. Tool I and tool II was translated into Arabic and presented to a jury of five experts in the area of specialty to check their content validity. Necessary modifications were made including clarification, omission of certain items and adding others and simplifying work related words.

-The face validity value of Students' satisfaction about Credit Hours System

Structured Questionnaire was 94%, and Academic Workload Structured Questionnaire was 96.2%. -A pilot study was carried out on a sample (10%) of the subject (n=82), they were included in the study subject. A pilot study was carried out after the experts' opinion and before starting the actual data collection.

-The pilot study was done to test clarity, sequence of items, applicability, relevance of the

questions and to determine the needed time to complete the questionnaire. According to feedback from a jury and pilot study, minor modification was done.

4. Reliability of tools was tested using Cronbach's Alpha Coefficient test. Reliability of credit hours system Questionnaire was= 0.947 and reliability of studying workload Questionnaire was 0.906
5. Data collection phase: Data collected by the researcher. The researcher met nursing students in small groups after their class to distribute the tool I and tool II. The questionnaires were completed at the presence of the researcher to ascertain all questions were answered.
6. The data was collected over a period of three months during the academic year 2025 started from the beginning of March 2025 until the end of May 2025.
7. The estimated time needed to complete the questionnaire items from subjects for both tools was 20 up to 30 minutes.

Statistical analysis:

The statistical analysis of the data was performed using IBM SPSS software version 20.0 (Armonk, NY: IBM Corp, released 2011). Categorical data were summarized as numbers and percentages. For continuous data, normality was assessed using the Kolmogorov-

Smirnov test. Quantitative data were described using range (minimum and maximum), mean and standard deviation. Significance of the obtained results was judged at the 5% level. The correlation between two normally distributed quantitative variables was calculated using Pearson's correlation coefficient.

Results

Table (1) shows distribution of nursing students according their personal characteristics and studying related characteristics data. It was observed that, nursing students' age ranged between 18 – 25 years with mean age 21.16 ± 2.19 . As well as, nearly three quarters (72.3%) of them fall in the age group from 20 to <22 years and nearly two-thirds (63.8%) of them were female. Added to that, more than one third (36.1%) of nursing students were at second academic level and nearly half (48.8 %) of them were lived at home. While, nearly two-thirds (62.7%) of them didn't work during study. Regarding previous academic achievement, more than two-fifth (44.6%) of nursing students had A+. Also, majority (83.4%) of them didn't participate in any university activities

Figure (1) shows that majority (88.4%) of nursing students had a satisfactory level regarding to overall credit hours system. While,

only 11.6% of them had unsatisfactory level regarding to overall credit hours system.

Table (2) shows that assistants of teaching staff members in the light of satisfaction with credit hours system was ranked as the highest. While, faculty resources in the light of credit hours system was ranked as the lowest

Figure (2) denotes that more than half (50.9%) of nursing students had a moderate level of overall studying workload. Additionally, nearly half (46.7%) of nursing students had a low level of studying workload. While, only 2.3% of nursing students had a high level of studying workload.

Table (3): illustrates overall task demand was ranked as the highest. While, feeling or behavior toward the task was ranked as the lowest.

Figure (3): shows that there was a statistically significant negative correlation was found between nursing students' overall satisfaction of credit hours system and studying workload ($r = -0.114$) at ($p = 0.001$) university activities as art, fitness and gender where $p \leq 0.05$. While, there was no difference between nursing student's studying workload and their age, academic level and working while studying.

Table (1): Distribution of nursing students according to their personal and studying related characteristics (n = 809)

Personal data	No.	%
Age (years)		
<20	224	27.7
20 – 22	342	42.3
>22	243	30.0
Min. – Max.	18.0 – 25.0	
Mean $\pm$ SD.	21.16 $\pm$ 2.19	
Sex		
Male	293	36.2
Female	516	63.8
Academic level		
First	235	
Second	292	
Third	282	
Residence		
University housing	115	14.2
External housing	299	37.0
At home	395	48.8
Previous academic achievement		
A+	361	44.6
A–	293	36.2
B+	93	11.5
B–	35	4.3
C+	23	2.8
D	4	.6
Participation in any university		
Yes	134	16.6
No	675	83.4
If yes the activities is		
Sports	60	7.4
Art	32	4.0
Fitness	22	2.7
Culture	20	2.5
Working while studying		
Yes	302	37.3
No	507	62.7

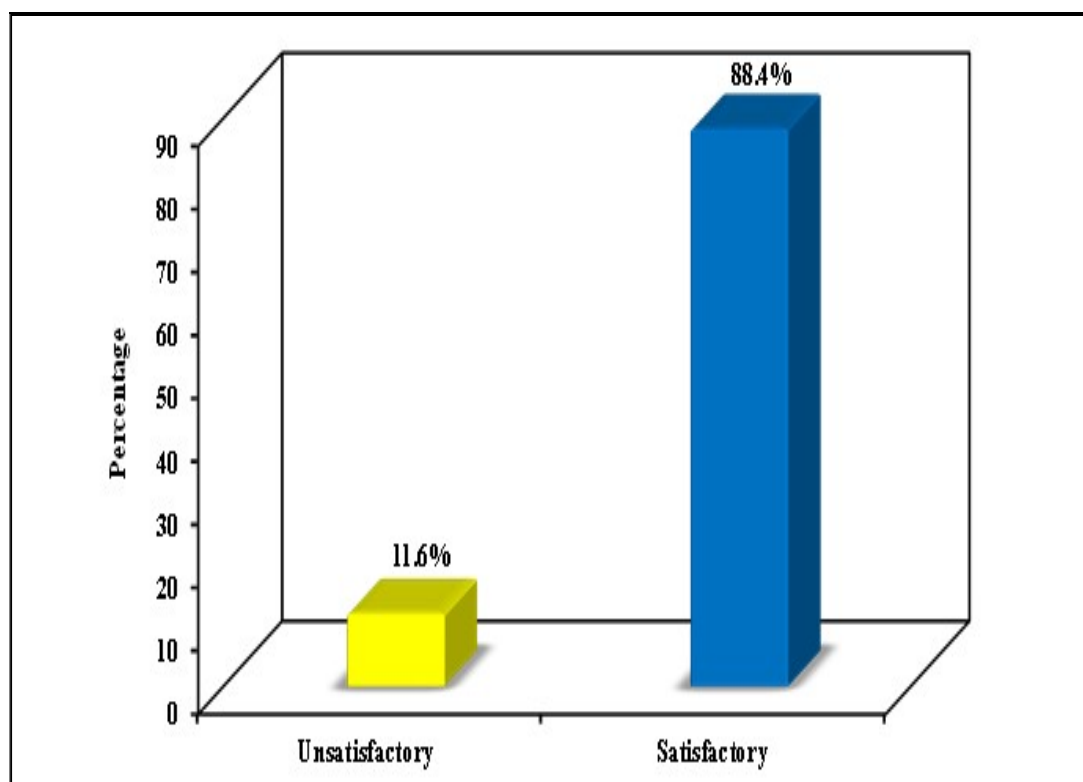


Figure (1) Levels of nursing students' overall satisfaction about credit hours system

Table (2): Mean scores, standard deviation, and ranking of nursing students' satisfaction with credit hours system dimensions (n = 809)

Nursing students' satisfaction with credit hours system dimensions	No of items	Score Range	Total Score		Mean Percent Score	Rank
			Min. – Max.	Mean ± SD		
Implementation process of credit hours system	14	(14 – 70)	33.0 – 70.0	65.38 ± 7.85	93.3%	5
Academic advisors	11	(11 – 55)	22.0 – 55.0	51.39 ± 6.48	93.4%	4
Education and student's affairs department	5	(5 – 25)	10.0 – 25.0	23.47 ± 3.28	93.9%	3
Faculty resources in the light of credit hours system	6	(6 – 30)	14.0 – 30.0	27.11 ± 4.30	90.4%	6
Members of teaching staff in the light of credit hours system	7	(7 – 35)	17.0 – 35.0	32.99 ± 4.06	94.3%	2
Assistants of teaching staff members in the light of credit hours system	2	(2 – 10)	4.0 – 10.0	9.46 ± 1.36	94.6%	1
Overall	45	(45 – 225)	126.0 – 225.0	209.80 ± 23.19	93.2%	

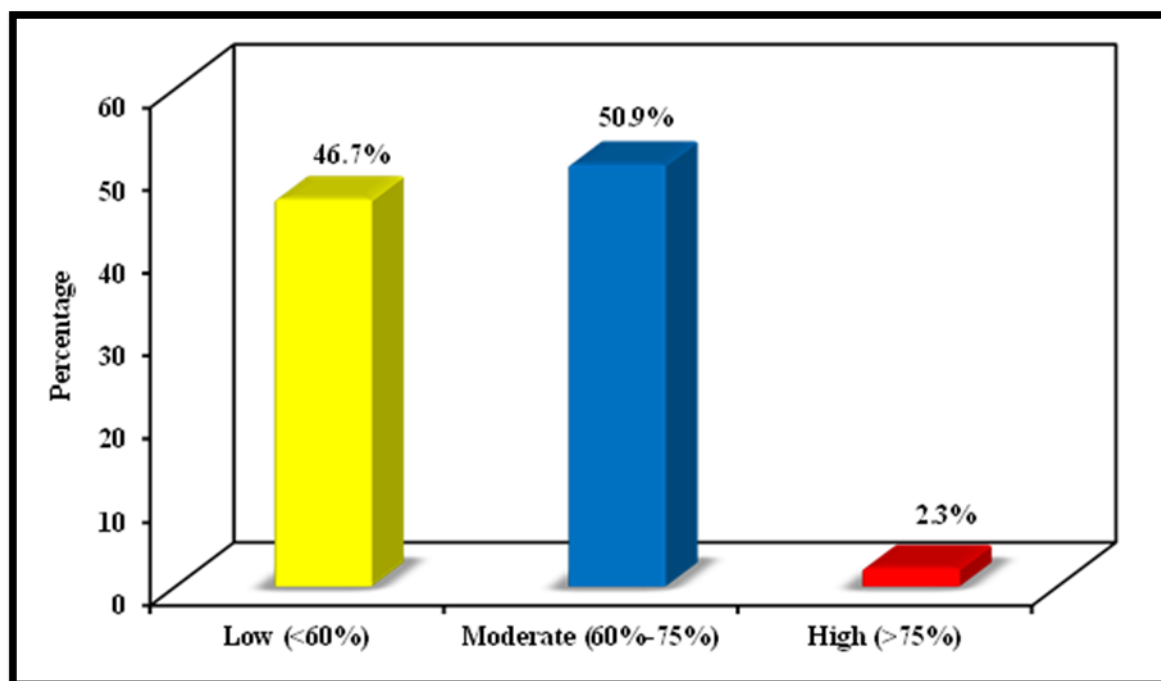


Figure (2) Levels of overall studying workload as perceived by nursing students

Table (3): Mean scores, standard deviation, and ranking of studying workload dimensions (n=809)

Studying workload	No of items	Score Range	Total Score		Percent Score	Rank
			Min. – Max.	Mean $\pm$ SD		
Task demand	10	(10 – 50)	20.0 – 50.0	40.33 $\pm$ 5.59	80.7%	1
Mental demands	6	(6 – 30)	6.0 – 20.0	11.26 $\pm$ 2.56	37.5%	-
Physical demand	4	(4 – 20)	4.0 – 12.0	7.15 $\pm$ 1.87	35.8%	
Temporal demand	7	(7 – 35)	14.0 – 35.0	27.19 $\pm$ 3.73	77.7%	2
Feeling or behavior toward the task	20	(20 – 100)	37.0 – 80.0	58.24 $\pm$ 6.10	72.8%	3
-Performance	7	(7 – 35)	10.0 – 33.0	19.01 $\pm$ 3.71	35.3%	-
-Effort	7	(7 – 35)	9.0 – 27.0	17.22 $\pm$ 2.76	49.2%	-
-Frustration level	6	(6 – 30)	6.0 – 21.0	12.40 $\pm$ 2.50	41.3%	-
Overall	37	(37 – 185)	73.0 – 138.0	98.91 $\pm$ 7.35	71.7%	

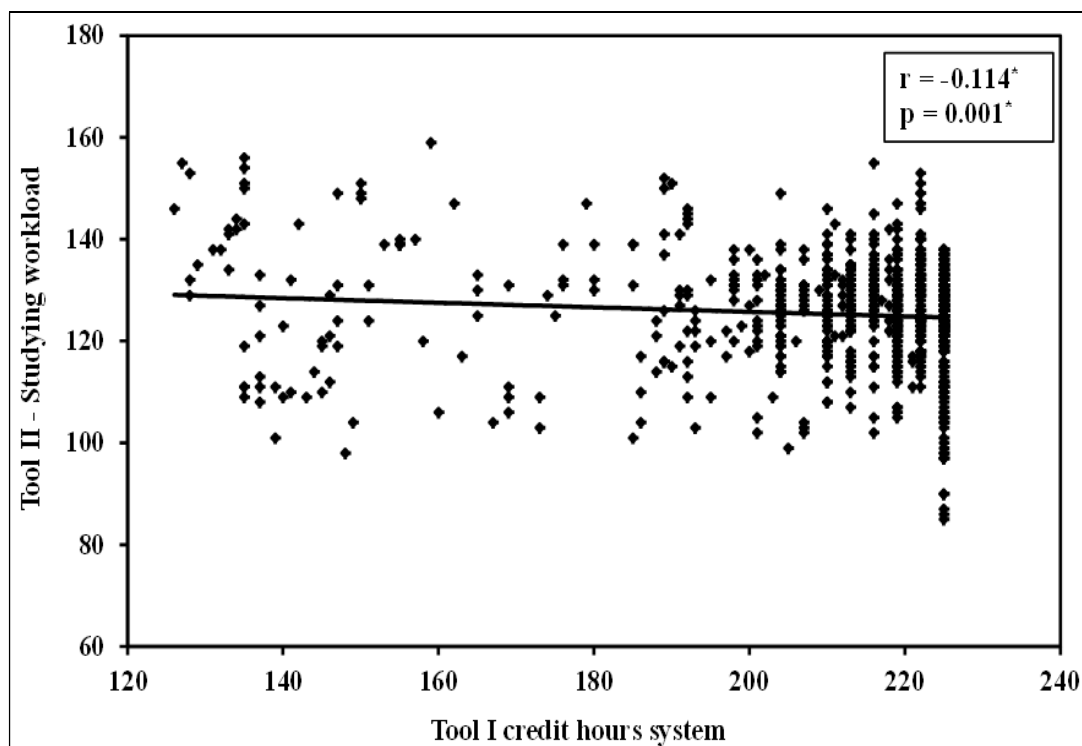


Figure (3): Correlation between nursing students' satisfaction of credit hours system and studying workload (n=809)

Discussion

The credit hour system is an academic framework that organizes courses by assigning each one a specific number of hours that reflect the amount of learning required from the student. This system helps structure curricula, clarify student workload, and link learning time with learning outcomes. It also provides a flexible framework that allows students to plan their academic pathways according to their abilities and facilitates comparability and consistency across programs in different institutions. Overall, the credit system as an organized and transparent method for managing learning and defining academic expectations (Zaripovna, 2021, June).

Regarding the current study, the majority of nursing students had high satisfactory level of overall credit hours system. This finding reflects positive attitude of nursing students for the importance of credit hours system in their education and its effectiveness in organizing the educational process and ensuring clarity of course requirements. This high level of satisfaction may be attributed to the flexibility of the system in distributing academic workload, its alignment between theoretical and clinical components, and its support for students' ability to plan and monitor their academic progress.

In line with this result Sirvent-Pérez et al., (2025), reported that effective organization and monitoring of learning

activities conducted outside scheduled classroom hours, including self-study, assignments, and project work—within a credit-based system are associated with higher student satisfaction and improved engagement in the learning process.

Additionally, **Zaripovna, (2021)** mentioned that credit hours system offers several advantages to students. It increases flexibility in course selection, allows students to progress at their own pace, promotes interdisciplinary learning, facilitates academic mobility and credit transfer, and enhances student-centered learning by linking credits to workload and learning outcomes. In contrast to the present result, **Pardos et al., (2023)** revealed that students perceived that credit hours alone do not accurately reflect the true workload of courses, as other factors such as assignment intensity and scheduling contribute more significantly to their perceived effort. This suggested that reliance solely on credit hours may lead to mismatches between student expectations and actual course demands, which can negatively affect students' satisfaction with credit-based systems.

The current study revealed that nearly three-quarters of nursing students had a satisfactory level. This finding attributed to the faculty's readiness for implementing the credit hours system. The availability of online learning compensated for limited physical spaces, while adequate technical, administrative, and clinical support facilitated effective

system implementation. From the researcher's viewpoint, this result may be explained by the adequacy and effective utilization of faculty resources, which likely support smooth implementation of the credit hours system, create a conducive learning environment, and enhance nursing students' satisfaction and positive perceptions.

Along with the present study findings, is **El Seesy et al .,(2021)** nursing students' satisfaction is closely related to the availability of adequate academic resources and supportive learning environments. It emphasizes the importance of well-equipped laboratories, sufficient classrooms, and effective academic and administrative support. Access to learning technologies was also found to enhance students' learning experiences. However, opposing findings are presented by **Yangdon et al., (2021)** who revealed dissatisfaction with academic workload, tutor support, and institutional facilities, showing that credit hours and related resources do not always ensure high student satisfaction across different disciplines and contexts. the current study revealed that majority nursing students had a high satisfactory level. These findings indicated that assistants of teaching staff members are experienced and knowledgeable about the credit hours system and are sufficient in number to meet increased demands, enhancing their satisfaction.

From the researcher's viewpoint, this finding may be due to a vital supportive role of assistants of teaching staff members in the credit hours system. Students perceive them as knowledgeable about system requirements and capable of handling academic demands.

This finding is consistent with **McLeod et al., (2025)** who revealed that teaching assistants not only fulfill instructional responsibilities but also serve as peer mentors, role models, and academic advisors, providing essential guidance that helps students navigate coursework and remain engaged in their studies. Their supportive role, especially for students from underrepresented groups, enhances participation in discussions and office hours, further enhancing academic persistence and student satisfaction.

On the other side, **Pashaeypoor et al., (2024)** not support the present finding and highlighted that students often face barriers such as insufficient preparation, unclear roles, and lack of acceptance, which limit the assistants' effectiveness. They reported that not all nursing students perceive teaching assistants as competent or adequately available. Consequently, student satisfaction with assistants can vary significantly across contexts

Regarding the current study, denotes that more than half of nursing students had a moderate level of overall studying workload. Additionally, nearly half of nursing students had a low level of

overall studying workload. These finding highlight that, while some students experience high workload, the majority maintain a balanced perception of their responsibilities, reflecting the effectiveness of structured curricula and workload distribution in nursing education **Gan et al., (2025)**. This finding is supported by **Mohamed et al., (2024)** who found that nursing students generally experience moderate academic stress, and emphasizes that structured curricula and balanced workload distribution help students manage academic demands effectively and reduce excessive stress. On contrary to these findings are presented by **Ullah et al., (2025)** who revealed that academic workload and related assignments were significant contributors to stress among medical and nursing students, with stress from workload being significantly associated with fear of poor grades. This highlights that academic demands can be a major stressor for nursing students and suggests the need for balanced curriculum design and supportive institutional policies to mitigate these effects.

the current study revealed that nearly half of nursing students had a moderate level of task demands of studying workload. In the study of **Baba et al., (2024)** demonstrated that students experiencing a moderate level of academic workload showed better academic performance and lower levels of stress compared to those exposed to

excessive workload demands. In contrast to the present result, **Jalil et al.,(2025)** found that nursing students experiencing high academic stress reported poor sleep quality and sleep deprivation. they highlighted that academic demands negatively affect students' physical well-being, including fatigue and difficulty concentrating

The present study results revealed that most of nursing students had a low level of feeling or behavior toward the task. This result specifically explained by performance level, nearly three-quarters of students disagreeing with seeking help from instructors or peers, completing assignments on time, feeling confident, or preparing for exams in advance suggest a tendency toward self-reliance and perhaps underutilization of available academic support resources. From the researcher's viewpoint, students may be employ alternative strategies or intrinsic motivation to meet their objectives, even when they do not actively seek guidance. In the same context, **Alghamdi et al., (2020)** who found that academic workload is a major source of stress for nursing students, reflecting their awareness of task demands. Active engagement with this workload is associated with better academic performance. In contrast to the present study results, **Baba et al., (2024)** found that students with imbalanced workload distribution struggled with time management and stress, which correlated with declining academic performance.

In the present study, a statistically negative significant correlation was found between nursing students' satisfaction of credit hours system and studying workload. It was evident that there was a significant correlation between all dimensions of nursing students' satisfaction with credit hours system and their studying workload, except between education and students' affairs department and overall studying workload, indicating that as nursing students' satisfaction with the credit hours system increases, their perception of studying workload decreases, due to better organization and clarity of academic requirements. However, the education and students' affairs department has no direct impact on academic workload, explaining the lack of a significant correlation with overall studying workload. In the same line with the current result is **Yangdon et al., (2021)** who found that student satisfaction was negatively affected by increased academic workload. While, **Marques et al., (2025)** indicated that academic workload alone does not have a significant or statistically meaningful impact on student satisfaction, especially when compared to other factors such as the quality of teaching methods and instructional practices.

Conclusion

Based on the findings of the present study, it was concluded that there was a negative statistically significant correlation was found between nursing

students' overall satisfaction of credit hours system and studying workload. specifically, majority of nursing students had a satisfactory level regarding credit hours system. As well as, more than

For Faculty Management:

-Conduct regular reviews of the credit hours system to ensure alignment between assigned credit hours and the actual studying workload experienced by nursing students.

-Ensure an equitable distribution of theoretical and clinical courses across academic semesters to prevent excessive workload accumulation.

-Develop institutional policies for systematic monitoring of students' academic workload and satisfaction levels.

-Ensure students' feedback as a core component in curriculum evaluation and continuous quality improvement processes.

For Faculty Members:

-Coordinate course content, assignments, and assessment schedules across nursing courses to minimize workload duplication and overlapping deadlines.

-Implement evidence-based teaching and assessment strategies that support effective workload management.

-Clearly communicate course objectives, learning outcomes, and assessment requirements at the beginning of each academic term.

-Provide timely academic guidance and constructive feedback to support

students' learning and satisfaction with the credit hours system.

For Nursing Students:

-Engage in academic advising services to plan course loads in accordance with the credit hours system and individual learning capacity.

-Develop effective time management and self-regulated learning skills to manage studying workload efficiently.

-Participate actively in evaluation processes related to the credit hours system and academic workload.

For Further Research:

-Investigate the role of academic advising and workload management programs in improving students' satisfaction with the credit hours system.

-Examine additional factors that may influence nursing students' satisfaction with the credit hours system, such as teaching strategies, clinical training demands, and assessment methods.

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Effect of Educational Intervention about Green Hospitals on Nurses' Perception of Safety Climate

Rasha Mohammed M Almahdy^{1,2}, Seham I Hamouda³, Heba K Obied⁴

¹Master student of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

²Supervisor in Fever Hospitals Administration, Al Gharbia Health Affairs Directorate, Egypt

³Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

⁴Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt.

Corresponding author: Rasha Mohammed M Almahdy1

Email: ms. rashamohaaed2019@ gmail.com.

Abstract

Background: Green hospitals are eco-friendly using natural resources to reduce their impacts on the environment and enhancing healing process and welling of nurses and patients. Safety climate is essential in achieving staff, patients satisfaction and organizational outcomes. **Aim:** To determine the effect of educational intervention about green hospitals on nurses' perception of safety climate. **Method: Design:** Quasi-experimental design was utilized. **Setting:** The study was conducted at El-Mahalla Fever Hospital affiliated to The Ministry of Health and Population. **Subjects:** All 151 nurses were working in the previously mentioned settings. **Tools:** Two tools were used to collect data; Nurses' knowledge about Green Hospital and Safety Climate Questionnaire and Nurses' Perception of Green Hospital and Safety Climate Questionnaire. **Results:** A zero percentage of fever hospital nurses had high level of knowledge regarding green hospitals and safety climate at pre-intervention. However, 71.5% and 55.6% of them had high knowledge level at immediate post and after three months of the intervention. Also, a zero percentage of fever hospital nurses had high perception level regarding green hospitals and safety climate at pre-intervention. While, 94.7% and 84.1% of them had high perception levels at immediate post and after three months of the intervention. **Conclusion:** There were statistically significant improvement of Fever Hospital nurses' knowledge and perception regarding green hospitals and safety climate after implementation of the intervention. **Recommendations:** Hospitals need to implement and carry out pre-occupational orientation and periodical educational intervention about green hospital and safety climate.

Keywords: Educational intervention, green hospital, knowledge, Perception, Safety climate.

Introduction

Fever hospitals are one of healthcare facilities, providing care for infectious diseases such as tuberculosis, meningitis and encephalitis. Patients treated from contagious diseases and being isolated to prevent spread of infection. In addition, they play important role in screening of contagious diseases in community **(Hussein et al., 2021)** So, Fever Hospital nurses' face many problems and stressful events daily. They experience moral distress, exposed to serious risks of injuries and death during patients care. Despite all these problems, they continue to provide services to patients. **(Hurst & Ramsey, 2025).**

The moving towards green sustainability and Egypt's vision of 2030, healthcare sectors are expected to not only create better life but also contribute actively to the achievement of equity, quality and accessibility of care while minimizing environmental impacts and efficient resources use. Thus, Fever Hospital nurses need to address novice managerial concepts such as green hospitals and safety climate **(Taie et al., 2025).**

Green hospitals designed, constructed and operated to become an eco-friendly by using many natural resources in an efficient manner to reduce the hospital impacts on the environment **(AlKaabi & Al Jaradin, 2023).**

Green hospitals aim to enhance the health and wellbeing of patients, nurses and make efficient use of resources without harming the environment **(Saad**

et al., 2024). Green hospitals focus on seven dimensions including energy efficiency and renewable energy, water efficiency, environmentally preferable building materials and specifications, waste reduction, toxics reduction, indoor air quality, smart growth and sustainable development **(Khairunnisa et al., 2022).** Energy efficiency and renewable energy can decrease greenhouse gases besides operating costs through implementing strategies and safe alternatives to monitor and control energy consumption **(Psillaki et al., 2023).** Water efficiency means practices of reducing usage of potable water and minimizing waste water through using water efficient systems **(Elariane & Salem, 2023).**

Environmentally preferable building materials and specifications include green location, using environmentally friendly materials and encourage using green resources **(Ahmed et al., 2024).**

Waste reduction reduces waste effects on damaging human health and degrading the surrounding environment through proper waste disposal or management program **(Mohammed et al., 2024).**

Toxics reduction focuses on reduce using harmful chemicals, using safe environmentally friendly alternatives and using digital devices free from mercury **(Oduncu, 2023).** Indoor air quality promotes health and wellbeing of patients, nurses and visitors, through

open green space and filtration and air cleaners (**Vallee, 2024**).

Smart growth and sustainable development of green hospitals strategies and technologies promote sustainability; through utilizing digital methods such as electronic health records to achieve desired goals (**Doulabi et al., 2024**). The core of any hospital is to minimize accidents and medical errors to promote health, safety and welling of patients and nurses. Safety climate means the shared thoughts and perceptions of nurses regarding safety in Fever Hospital (**Anandh et al., 2024**).

Safety climate centered around personal protective and medical equipment availability, absence of job hindrances to safety, management support for safety, cleanliness/orderliness of the workplace, training /feedback of safety and regular communication /minimal conflict in workplace (**Chandra et al., 2024**).

Personal protective equipment prevents risks that face nurses during caregiving. Medical equipment protects nurses from injuries and provides convenience environment (**Kabeta et al., 2023**).

Job hindrances absence provides a good, healthy work environment that help nurses to achieve desired goals and enhance job satisfaction (**Sabra et al., 2022**). Cleanliness/orderliness at workplace improve health and wellbeing of nurses; through reducing trash, infection transmission and injuries (**Akbari et al., 2023**). Management support for safety is about developing

safety policies and procedures to ensure that nurses receive appropriate safety training and reporting incidents (**Faqir, 2024**).

Training/feedback are important causes of preventing errors in fever hospital and improve nurses' performance, confidence and teamwork (**Yudiani et al., 2023**).

Regular communication is about safety and minimal conflict in workplace building trust, moral, and relationship (**Abdullah & Ruslan., 2024**).

Significance of study

Currently, the increasing burden of infectious diseases, climate change and increasing sustainability concept are putting considerable pressure on healthcare sectors. Healthcare sector is one of the major consumers of natural resources and producers of both hazardous and non-hazardous waste that may negatively affect the health of patients and nurses and environment. Therefore, some Fever Hospitals such as El-Mahalla Fever Hospital are being developed to adopt green practices and improve the safety climate in line with Egypt's Vision 2030 (**Badanta et al., 2025**).

El-Mahalla Fever Hospital nurses are a major force in enhancing medical reform and improving services to benefit patients. So, this study aims to apply an educational intervention about green hospital on fever hospital nurses' perception of safety climate for helping fever hospital nurses acquire green practices and skills. Also, help them

adapt to the rapidly changing world around them.

The aim of study is to determine the effect of educational intervention about green hospitals on nurses' perception of safety climate.

Research hypothesis

After implementation of the educational intervention the nurses' knowledge and perception regarding green hospitals and safety climate were expected to be improved.

Subjects and Method

Study design:

The present study used a quasi-experimental research approach to accomplish its goal.

Setting:

The study was carried out at El-Mahalla Fever Hospital different units. El-Mahalla Fever Hospital affiliated to the Ministry of Health and Population at El-Mahalla El-Kobra City in Al-Gharbia Governorate. Its capacity is 106 beds. It consists of: Outpatient Department, Dental Care Unit, Emergency Reception Department, Dialysis Unit, Intensive Care Unit, Inpatient Departments, Administrative Department and additional services such as Radiology unit (X ray and Computed Tomography Unit), Laboratory, Pharmacies, Central Sterilization Department, Laundry room and Kitchen.

Subjects:

- The research participants consisted of: A stratified random sample of nurse

(n=151) was selected from total number (N=250).

- The sample size and power analysis were determined using the statistical program Epi-info. The sample size was determined using the following criteria d = error proportion (0.05) & Z = 95% confidence level (1.96).

Tools for data collection:

The data of the study was collected using the following tools:

Tool I: Nurses' Knowledge Questionnaire: It included two parts as follows:

Part 1: Nursing characteristic data included age, sex, marital status, educational qualification, years of experience, current position, unit or department name, attended course about green hospital and safety climate and number of attendances in the last year.

Part 2: Nurses' knowledge about Green Hospitals and Safety Climate Questionnaire: This part was developed by the researcher, guided by **Elariane & Salem, (2023); Glarcher et al., (2022)** to assess nurses' knowledge. It included 59 true-false and multiple-choice questions.

Scoring system: Every question has a score of (1) for correct answer and (0) for wrong answer. The total score was summed and represented varying levels of nurses' knowledge. according to statistically cutoff point into

- > 75 % indicated high knowledge level
- 60- 75% indicated moderate knowledge level

- < 60 % indicated low knowledge level

Tool II: Nurses' Perception of Green Hospitals and Safety Climate Questionnaire: This tool was divided into two parts:

Part 1: Nurses' Perception of Green hospitals; It was developed by the researcher, guided by **Clark, (2019); Kaney, (2022); Lattanzio et al., (2023)** to assess nurses' perception of green hospital dimensions, It included 25 items and it was classified into 7 dimensions as follows: energy efficiency dimension included 4 items, water efficiency included 3 items, environmentally preferable building materials included 3 items, waste reduction included 5 items, Toxics reduction included 3 items, indoor air quality included 5 items. And sustainable development included 2 items.

Part 2: Nurses' perception of Safety Climate: It was developed by researcher guided by **Alrasheadi, et al., (2022); Ferreira, et al., (2022)** to assess nurses' perception of safety climate dimensions, It included 23 items and it was classified into 6 dimensions as follows: there were 3 items under personal protective equipment and medical equipment availability dimension, absence of job hindrances included 4 items, cleanliness/orderliness of workplace included 3 items, management support for safety included 4 items, training/feedback dimension included 4 items. and regular

communication/minimal conflict in workplace included 5 items.

Scoring system:

Nurses' responses were measured on a five points Likert Scale ranging from strongly agree= (5), agree = (4), Neutral= (3), disagree = (2) to strongly disagree = (1). The total scores were classified into levels according to the cutoff point as follows:

- >75% indicated high perception level.
- 60-75% indicated moderate perception level.
- <60% indicated low perception level.

Method

- Official permission to conduct the study was obtained from the dean of Faculty of Nursing, Tanta University and was submitted to the responsible authorities in El-Mahalla Fever Hospitals.

Ethical consideration:

- The Scientific Research Ethics Committee of the Faculty of Nursing granted its approval with code No. (412-3 -2024).
- After introducing herself, the researcher thoroughly explained the purpose and methodology of the study to the participants in order to gain their cooperation and approval as well as their informed permission.
- The researcher developed tools after reviewing relevant literature.
- The developed tools were presented to a jury of 5 experts. The experts were two professors of nursing administration, one professor of psychiatric nursing, one professor of critical care and emergency

nursing and one assistant professor of nursing administration, Faculty of Nursing, Tanta University to check the content validity.

- Each expert's responses were given a four-point rating score (4-1), with 4 denoting "strongly relevant," 3 denoting "relevant," and 2 denoting little relevant, 1=not relevant.

- Necessary modifications were done including; clarification, omission of certain questions and adding others and simplifying terms connected to work.

- The total face validity of tool I part 2 and tool II was calculated based on experts' opinion was 90.3% for tool I and 94.3% for tool II.

- A pilot study was conducted on a sample of 10% participants to verify and guarantee the tools' clarity and to pinpoint any issues that arose during data collecting. This sample was taken not included in the overall sample.

- Reliability of the tools tested using, the Cronbach Alpha Coefficient test the results were 0.743% for knowledge questionnaire and 0.842% for perception questionnaire.

- Tools I and II were utilized before to, immediately, and 3 months following the intervention's implementation.

- The researcher's educational intervention was created after reviewing pertinent literature.

- Data was gathered over the course from October 2024 and extended for six months till March 2025 as well as three months were following the intervention.

- Construction of educational intervention

The intervention assessment, development, implementation, and evaluation were 4 stages in which it was carried out.

Assessment phase:

- Fever hospital nurses who worked morning and afternoon shifts were encountered by the researcher. Following an explanation of the study's purpose, nurses were invited to participate.

- Before the session started, a pre-test was given to nurses using Tool I & II to assess their knowledge about green hospitals and safety climate while the researcher was present to provide any clarification that was required.

- Tool I & II evaluated nurses' knowledge and perception prior to, immediately following, and 3 months post the start of the intervention.

Development of the educational

intervention phase: The first step in the development phase was the statement of instructional objectives based on the sample's assessed needs and literature review.

Aim of the educational intervention was to determine the effect of educational intervention about green hospitals on nurses' perception of safety climate.

Objectives of the intervention

- After implementation of the educational intervention fever hospital nurses were able to:

- Identify aspects, importance and objectives of green hospitals and safety climate.
- Discuss dimensions of green hospital and safety climate.
- Recognize and apply dimensions of safety climate.

Selection and organization of content:

- After deciding on the intervention's goals, the next stage was to specifically define the teaching methodology and material
- Simple scientific language was used. The content designed after reviewing textbooks and other references about green hospital and safety climate.
- The intervention contents include:
- **Session 1:** Green hospitals, energy and water efficiency.
- **Session 2:** Environmental preferable building materials and waste reduction.
- **Session 3:** Toxics reduction, indoor air quality and sustainable development.
- **Session4:** Safety climate and its dimensions.

Learning strategies Teaching:

The educational intervention's teaching strategies include role-playing, group discussions, simulation, real-world scenarios, brainstorming, and group discussions

Teaching aids:

The teaching aids that were used in the intervention power point (PPT) with data show, handout, paper and pen.

Implementation of the educational intervention Phase:

- The 151 Fever Hospital nurses were divided into 15 groups. Each group consisted of 10 nurses. Each group received the presentation 3 days a week.
- Each session was 45 minutes. Time for answering approximately 20 minutes
- The theoretical sessions of the intervention were conducted in their workplace (head nurses' room).

Results

Table (1): represents Fever Hospital nurses' characteristic data, less than half (48.4%) of nurses were in the age group between twenty-five up to thirty-five years with mean (37.14 ± 7.04). Vast majority (98.0% and 94.0%) of them were female and married respectively. vast majority (92.7%) of them were nurses. Less than half (49.7%) of them had diploma/technical nursing. More than half (52.3%) of them had between five to fifteen years of experience with mean (16.58 ± 2.15). Less than half (44.4%) of them worked in Inpatient departments and more than one fifth (22.5%) of them worked in intensive care unit. Almost all (100%) of them didn't attend courses about green hospitals and safety climate before.

Figure (1): Reveals Fever Hospital nurses' total knowledge levels regarding green hospitals and safety climate throughout the intervention. There were statistical significant differences between nurses' total knowledge levels at $P=0.0001$. Pre-intervention, none (0.0%) of nurses had high total knowledge level about green hospitals and safety climate

this result change immediately post intervention to become around three quarters (71.5%) and more than half (55.1%) after three months of the educational intervention.

Figure (2): Shows Fever Hospital nurses' knowledge level about green hospital and safety climate throughout the intervention. About green hospital, pre-intervention none (0.0%) of nurses had high knowledge level about green hospital that change to be more than half (59.6% and 50.3%) at immediate post and after three months of the intervention respectively. About safety climate, pre-intervention nearly none (5.3%) of them had high knowledge level regarding safety climate this result change to become less than two thirds (66.2%) at immediate post and slightly decreased to more than half (57.0%) after three months of the intervention.

Figure (3): Illustrate fever hospital nurses' total perception level about green hospitals and safety climate that none (0.0%) of nurses had high total perception level about green hospitals and safety climate at pre-intervention, that change to be vast majority (94.7%) at immediate post and majority (84.1%) after three months of the intervention.

Table (2): Shows Fever Hospital nurses' total perception levels regarding green hospitals, none (0.0%) of nurses had high total perception level regarding all green hospitals dimensions except, more than three quarters (75.5%) had high perception level regarding environmental

preferable building materials dimension at pre-intervention. And majority (94.7%, 90.7%, 96.7%, 82.8%, 98%, 95.4% and 96.7%) of them had high total perception level regarding energy efficiency, water efficiency, environmental preferable building materials, waste reduction, toxics reduction, IAQ and sustainable development dimensions at immediate post respectively. While majority (94.0%, 84.8%, 94.0%, 86.2%, 91.4% and 82.8%) of them had high level of perception regarding energy, water efficiency, environmental preferable building materials, toxics reduction and IAQ dimensions and more than three quarters (78.8%) of them had high perception level regarding sustainable development dimension after three months of the educational intervention respectively.

Table (3): Demonstrates total levels of fever hospital nurses' perception regarding safety climate dimensions throughout the intervention. That none (0.0%) of nurses had high total perception levels regarding all safety climate dimensions at pre-intervention. While majority (98%, 87.4%, 91.4%, 96.0%, 92.7% and 83.4%) of them had high total perception levels at immediate post respectively and majority (97.4%, 89.4%, 90%, 94.0%, 92.0% and 84.7%) of them had high total perception levels after three months of the intervention respectively.

Figure (4): Clarifies correlation between total knowledge and total perception

scores about green hospitals and safety climate among Fever Hospital nurse. It revealed that there was a statistically significant positive correlation at $p=0.0001$ between nurses' total knowledge, and nurses' total perception at immediate post and after three months of the educational intervention.

Table (1): Fever hospital nurses' characteristic data (n=151)

Personal characteristics	The studied nursing staff (n=151)	
	No	%
Age years		
<25	10	6.6
25-35	73	48.4
>35	68	45.0
Mean±SD	37.14±7.04	
Sex		
Female	148	98.0
Male	3	2.0
Marital status		
Not married	9	6.0
Married	142	94.0
Current position		
nurse	140	92.7
Nurse Supervisor	2	1.3
Head nurse	9	6.0
Educational qualification		
Diploma/technical nursing	75	49.7
Bachelor of nursing science	68	45.0
Post graduate	8	5.3
Experience years		
<5	15	9.9
5-15	79	52.3
>15	57	37.8
Mean±SD	16.58±2.15	
Department name		
Sterilization unit	5	3.3
Inpatient departments	67	44.4
Dialysis unit	9	6.0
Intensive Care Unit	34	22.5
Emergency department	13	8.6
Outpatient department	23	15.2
Attend training about green Hospitals and safety climate		
No	151	100

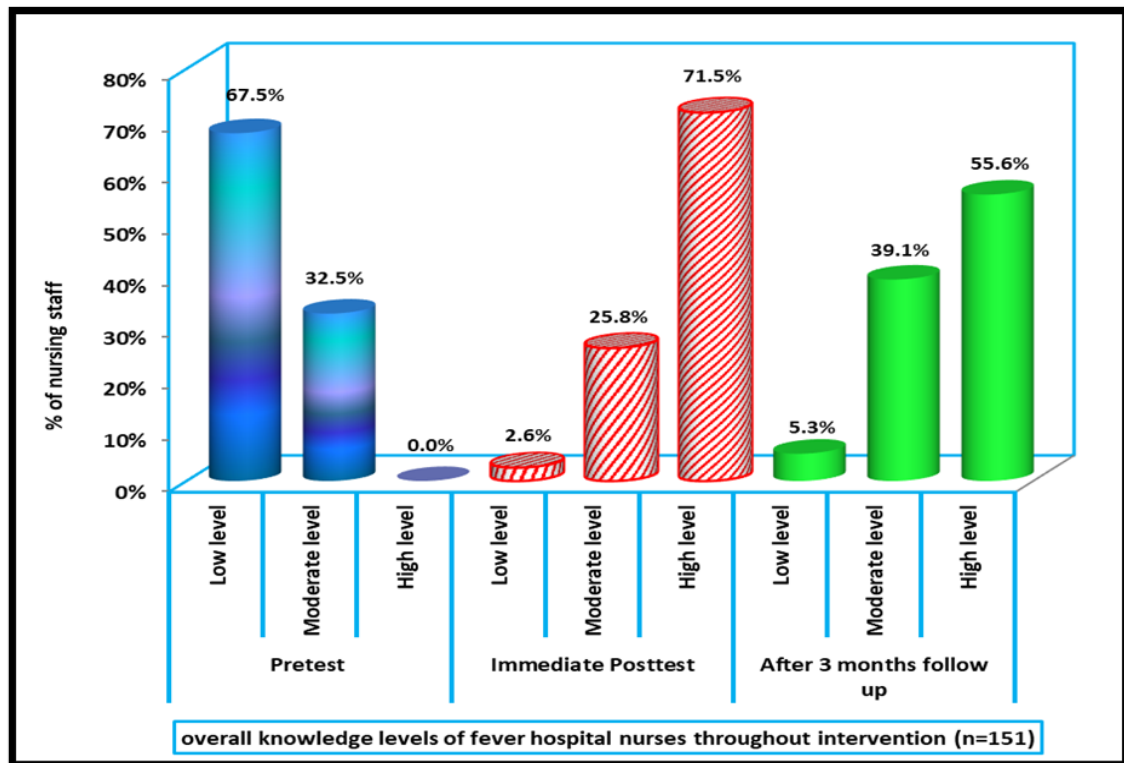
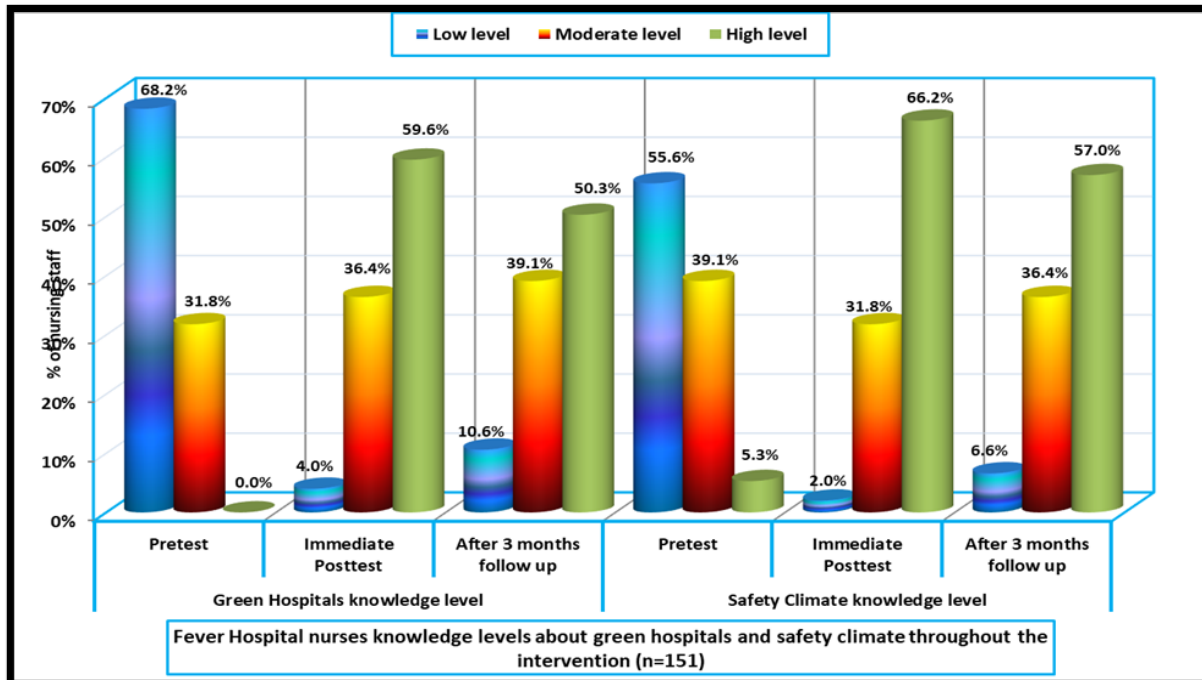
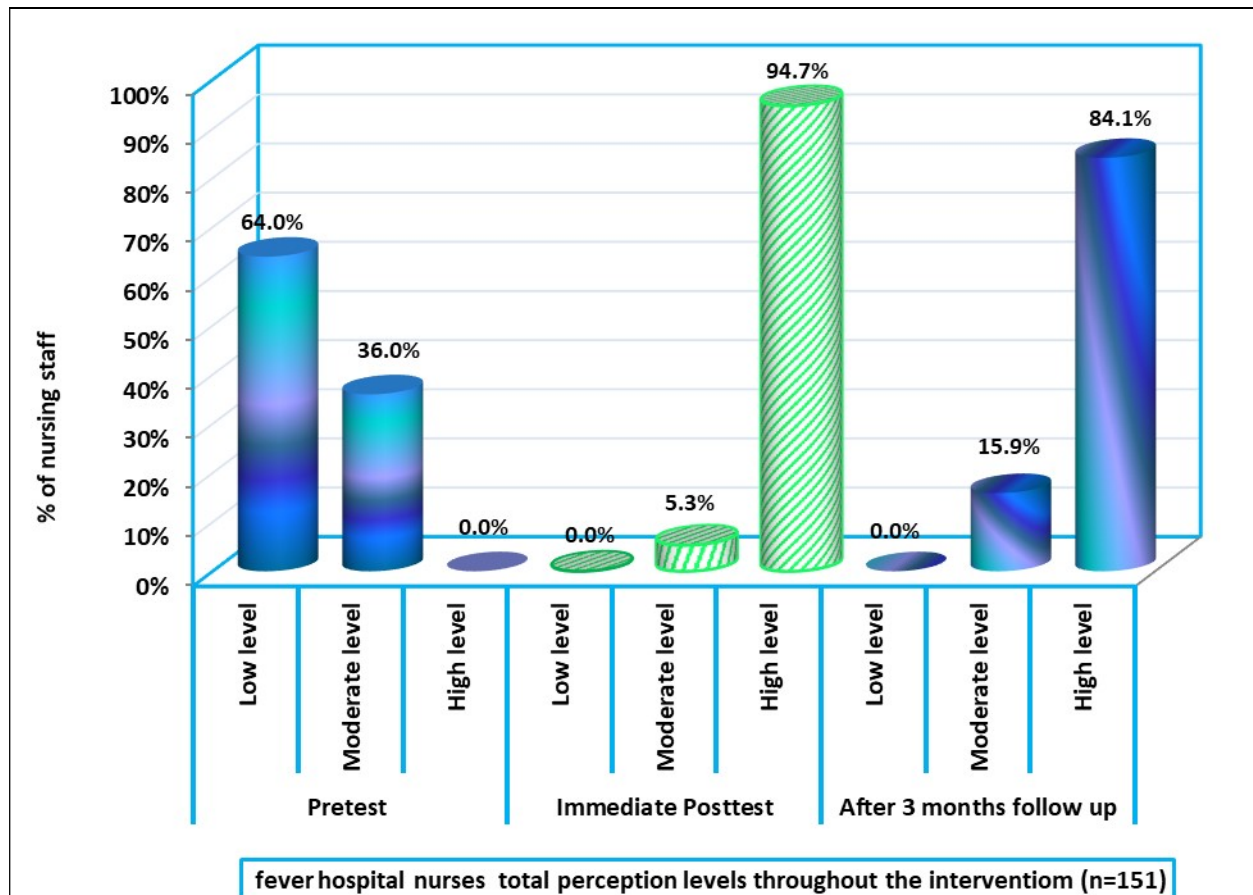


Figure (1): Fever Hospital nurses' total knowledge levels about green hospitals and safety climate throughout the educational intervention.



N.B. Knowledge level was classified into; Low level (<60% of total scores), Moderate level (60-75% of total scores) and high level (>75% of total scores).

Figure (2): Fever Hospital nurses' knowledge levels regarding green hospitals and safety climate throughout the educational intervention.



N.B. Perception scores; low level (<60%), moderate level (60-75%) and high level (>75%)

Figure (3): Fever Hospital nurses' total perception levels about green hospitals and safety climate throughout the educational intervention.

Table (2): Fever Hospital nurses' total perception levels about green hospitals dimensions throughout the educational intervention.

Green Hospital dimensions	Pre		Immediate Post		After3 months	
	No.	%	No.	%	No	%
Energy efficiency						
Low (<60%)	151	100	8	5.3	9	6.0
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	143	94.7	142	94.0
Water Efficiency						
Low (<60%)	151	100	14	9.3	23	15.2
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	137	90.7	128	84.8
Environmental preferable building materials						
Low (<60%)	37	24.5	5	3.3	9	6
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	114	75.5	146	96.7	142	94
Waste reduction						
Low (<60%)	47	31.1	26	17.2	21	13.8
Moderate (60 – 75%)	104	68.9	0	0	0	0
High (>75%)	0	0	125	82.8	130	86.2
Toxics reduction						
Low (<60%)	151	100	3	2.0	13	8.6
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	148	98	138	91.4
Indoor air quality						
Low (<60%)	60	39.7	7	4.6	26	17.2
Moderate (60 – 75%)	91	60.3	0	0	0	0
High (>75%)	0	0	144	95.4	125	82.8
Sustainable Development						
Low (<60%)	151	100	5	3.3	32	21.2
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	146	96.7	119	78.8

N.B. Perception scores were classified into; low level (<60%), moderate level (60-75%) and high level (>75%)

Table (3): Fever Hospital nurses' total perception levels regarding safety climate dimensions throughout the educational intervention.

Safety climate dimensions	Pre		Immediate Post		After3 months	
	No.	%	No.	%	No	%
PPE & medical equipment availability						
Low (<60%)	151	100	3	2.0	4	2.6
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	148	98.0	147	97.4
Absence of job hindrances						
Low (<60%)	151	100	19	12.6	16	10.6
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	132	87.4	135	89.4
Cleanliness/orderliness of workplace						
Low (<60%)	55	36.4	13	8.6	15	10.0
Moderate (60 – 75%)	96	63.6	0	0	0	0
High (>75%)	0	0	138	91.4	136	90.0
Management support						
Low (<60%)	151	100	6	4.0	9	6.0
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	145	96.0	142	94.0
Training/feedback						
Low (<60%)	151	100	11	7.3	12	8.0
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	140	92.7	139	92.0
Regular communication/minimal conflict						
Low (<60%)	151	100	25	16.6	23	15.3
Moderate (60 – 75%)	0	0	0	0	0	0
High (>75%)	0	0	126	83.4	128	84.7

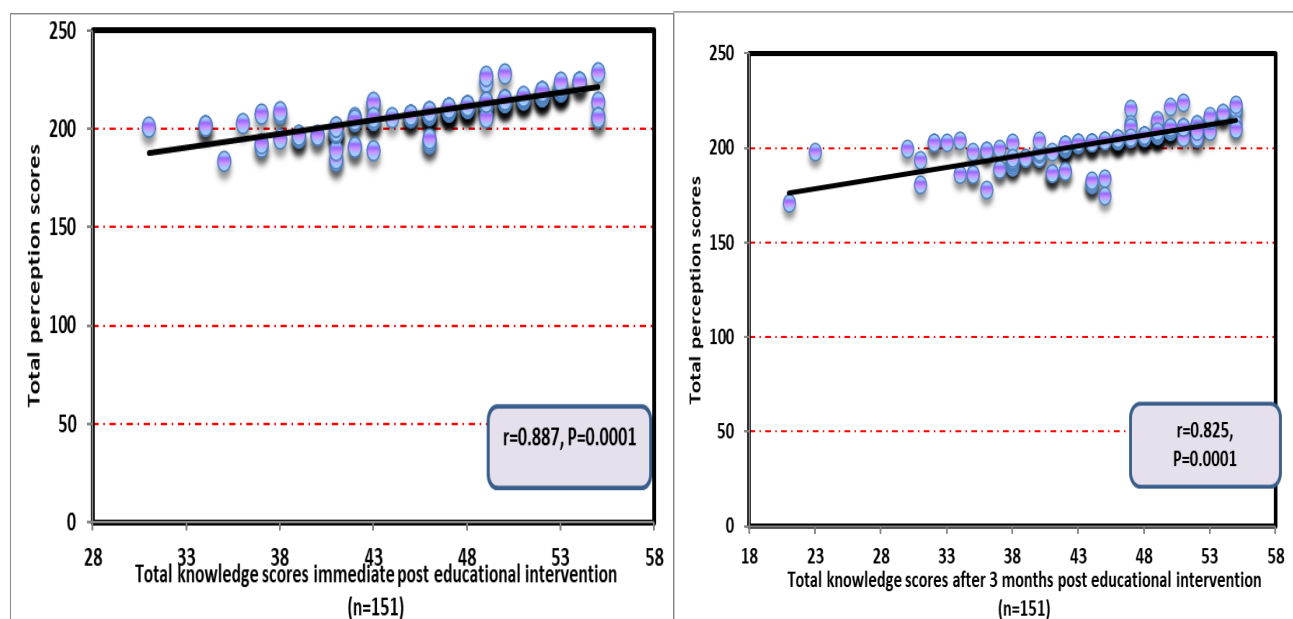


Figure (4): Correlation between total knowledge and perception scores regarding green hospitals and safety climate among Fever Hospital nurses throughout the intervention.

Discussion

Green hospitals prioritized the optimal use of natural resources in an efficient and environmentally friendly manner while promote public health by continuously maintaining high quality services (Taie et al., 2025).

Safety climate is steps taken to prevent workplace errors and illness through sharing nurses' thoughts and perception regarding the priority of safety in their workplace (Alkaffas et al., 2024).

The results of present study revealed that pre-intervention; none of nurses had a high level of allover knowledge regarding green hospitals and safety climate. This result may be due to lack of awareness about green hospital and safety climate dimensions and green hospital and safety climate at the workplace are new concepts. Also, this

result is due to all nurses didn't attend any educational program about green hospital and safety climate. This result go in the same line with Elkasas., et al., (2024); Saleh et al., (2023) founded nurses or nurses' managers had unsatisfactory total knowledge levels regarding green management and occupational safety at pre-program, these results changed to become satisfactory knowledge levels at immediately post and even three months later.

Adding to that, the current study results revealed that there was a marked highly statistically significant difference of total knowledge levels between nurses regarding green hospitals and safety climate at immediate post and after three months. From the researcher' point of view, this improvement may be because of the passion of nurses to know up to

date about administrative new trends. The study findings were supported with study conducted by **Faltas et al., (2022)** clarified that there was statistically significant difference between nurses' total knowledge levels regarding green practice and waste reduction at immediate post and after three months compared to pre-intervention according to their total mean scores of knowledge. Similarity the study of **Rayan et al., (2021)** reported that, there were highly statistical significant difference of total occupational health hazards total knowledge levels between nurse at post and follow up.

In addition, the findings of the current study were highlighted that none of nurses had high knowledge level regarding green hospital, that changed to be more than half of them had high knowledge level at immediate post and after three months of the intervention. Most probably nurses lack of knowledge may be due to they may not receive a clear guideline related to green hospital dimensions. The current study findings were in line with **Taie et al. (2025)** conducted that majority of nurses had low knowledge level regarding green hospital before awareness phase. And with the study by **Mohamed et al., (2025)** demonstrated that the educational intervention effectively improved nurses' knowledge levels and practice toward sustainability and green practices in ICU than preprogram. Furthermore, the current study findings were incongruent

with **Pakpour et al., (2021)** illustrated that the students and managers' involvement in continuous green initiatives had a satisfactory impact. Therefore, by implementing green programs, continuous improvement activities can be developed effectively and efficiently through green healthcare preparation, education and supervision. The current study results clarified that nearly none of nurses had high safety climate knowledge levels, that changed to become less than two thirds and more than half of them had high knowledge level at immediate post and after three months. This is may be related to none of them had theoretical knowledge about safety climate and its dimensions. Additionally, and they did not attend pre-orientation or training program about safety climate before. In harmony with the present results **Mohammedi et al., (2022)** who mentioned that the intervention could change staff awareness, beliefs and attitudes regarding the promotion of safe behavior and improved their safety performance. And with the result by **Nouri et al., (2024)** showed positively effect of the educational training program about handling of chemotherapy drugs in improving nurses' knowledge and behaviors regarding occupational hazards. Also, these findings of the current study supported by **Abd El-Wahed et al., (2025)** found that the educational program was enhanced occupational safety awareness among

hospital laundry staff and promoted a safer working environment. In contrary, **Moda et al., (2021)** study outcome showed that knowledge level wasn't enough to promote a positive safety climate in healthcare facilities.

Adding to that, the results of the present study reveal that nearly none of nurses had high perception levels regarding green hospitals at pre-intervention that change immediately post to become vast majority and more than three quarters after three months. Also, pre-intervention none of them had high perception levels about safety climate this result changed to be vast majority had high perception levels at immediate post and majority after three months of the intervention. This can be justified that the educational intervention providing nurses with a clear understanding of green hospital and safety concepts. In the same line the result of In the same line the result of **Mohamed, (2025)** observed that both nurse managers and staff nurses under the study attained good levels of perception regarding green hospitals after the education program. Similarly, in agreement with **Saad et al., (2024)** reported that nurses had high significant level post-intervention increases in their perception across key domains.

In contrary, the study result of **Doin & Evans, (2023)**; **Ali et al., (2025)** clarified that the majority of nurses had high perception level regarding green hospital. Also, the study conducted by **Luque-Alcaraz et al., (2024)** described that

most of nurses had high perception level, knowledge, attitude and behavior regarding environmental sustainability. The present study illustrated that there were statistically significant differences between nurses' total perception levels regarding green hospital's dimensions including energy efficiency and renewable energy, water efficiency, environmentally preferable building materials, waste reduction, toxics reduction, indoor air quality and sustainable development. These differences indicated that the intervention was effective in enhancing nurses' knowledge about green hospital dimensions, leading to sustained improvements in their perception and practices. Also, the use of different teaching methods as discussion helped reinforce knowledge and nurses' attitude. In this regard, the present study findings were in the same line with **Saad et al., (2024)** illustrated significant increases in nurses' perception regarding green hospital dimensions including water management, energy efficiency, and materials and renewable resources post the intervention. Similarly, **Bonsu et al., (2025)** showed that education training increase healthcare professionals' awareness and perception of green hospital concept.

In contrast with **Mohamed, (2025)** observed that only about half of nursing staff demonstrated good perceived practices related to green hospitals, and **Leppänen et al., (2022)** reported poor

sustainable development practices among nurse managers, highlighting that awareness and engagement remain limited without structured education.

Results of the present study showed that none of nurses had high total perception levels regarding safety climate. While almost all of them had high perception levels at immediate post and slightly decreased perception level after three months. This result may be due to the differences in fever hospital characteristics which the most of nurses were female and working in inpatient departments, ICU and emergency department. This result can be due to they usually have excessive workload and workplace violence so, lack of regular refreshers on safety issues such as emergency procedures by hospital management. Also, this may be due to underreporting which nurses' belief that nothing will change or if nurses had reported about adverse event, it would be a shame.

The present study agreed with **Elgarf et al., (2023)**; **wahl et al., (2022)** found that more than one third of patients have low safety perception level at pre-program that changed to two thirds of them have high perception level immediately post and more than one third of them have moderate perception level after 4 months. Furthermore, **Mohammadi et al., (2022)** illustrated that positive effect of the educational program on improving the level of hospital staff knowledge, attitudes and

beliefs toward safety of hospital staff. Also, with the result finding by **Ahmed & Awad., (2020)** reported that there was unsatisfactory level of nurses' performance regarding the implementation of surgical safety before implementing the intervention. And there was improving nurses' knowledge and attitude at immediate post the educational intervention.

The present study revealed that there is a statistically significant positive correlation of total knowledge, perception scores between fever hospital nurses' immediately post and after three months of the educational intervention. This may be attributed to the fact that knowledge is the foundation for knowledge and skills. Really the improvement in fever hospital nurses' perception was related to their increased knowledge and their awareness after the intervention implementation. Additionally, the intervention may have fostered a sense of passion among the staff. These findings agreed with multiple studies demonstrating similar outcomes such as **Taie et al., (2025)**; **Mohamed, (2025)** reported a significant positive correlation between total knowledge and perceived green hospital practices. Also, **(Saad et al., 2024)** found that enhanced perception of green practices was positively associated with attitudes toward patient safety. Likewise, **Elksas et al., (2024)**; **Elgarf et al., (2023)** noted consistently strong correlations between nurses' knowledge,

attitudes, and practices before and after implementing green management programs, which were maintained at follow-up. Similarly, Saleh et al., (2023) confirmed that green management training had a sustained positive impact on occupational safety. Collectively, these studies support the current findings by emphasizing that educational interventions play a vital role in strengthening the knowledge, perception and practice connection within green and safety initiatives.

Conclusion

Based on the findings of the present study, it can be concluded that:

Educational intervention provided to Fever Hospital nurses and improved their level of knowledge regarding green hospitals which reflect positive effect on nurses'safety climate perception.

Recommendations

The present study's findings lead to the following recommendations:

Hospital administrators:

Carry out periodical educational intervention for nursing staff about green hospital and safety climate.

Head nurses:

Take active responsibility for providing a sense of safety and green within the workplace to reduce nurses' stress.

Nurses:

Sustain high level of knowledge gained regarding green hospital concepts and safety climate to ensure long-term implementation.

For educational institutes:

Integrate green hospital and safety climate in the curriculum for undergraduate students' nurses as new trend.

Further research:

conduct similar studies in different types of hospitals to compare the results and generalizability of the findings.

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Iron Deficiency Anemia Prevalence and Its Relation with Knowledge, Practices and Body Composition among Nursing Intern Students

Gehan Ahmed Gamal El-Deen ¹, Ola Mosa², Eman Fadl³

¹Assistant Professor of Medical Surgical Nursing, Faculty of Nursing-Minia University, Lotus University.

²Assistant Professor, Obstetrics & Gynecological Health Nursing, Faculty of Nursing- Minia University.

³Assistant Professor of Medical Surgical Nursing, Faculty of Nursing – Minia University.

Corresponding author: Gehan Ahmed

Email: jehanahmed@mu.edu.eg.

Abstract

Background; Iron deficiency anemia is the most common kind of anemia. There are several factors causing iron deficiency anemia among intern nursing student, such as increased time spent for training in hospital which affect of food choice, consuming fast food and decrease intake of rich iron. **Aim:** This study was conducted to assess Iron Deficiency Anemia Prevalence and Its Relation with Knowledge, Practice and Body Composition among Nursing Intern Students. **Design;** descriptive cross-sectional research design was used. **Subjects and setting;** total of 662 nursing intern students were selected using purposive sampling method, ensuring broad representation across different clinical training departments in Minia University Hospitals. **Tools;** Three tools were used to collect data; Tool (1) is a structured self-administered questionnaire cover participants' demographic characteristics, knowledge and practices about IDA. Tool (II) includes selected body composition measurements, and Tool (III) is haemoglobin level assessed. **Results;** most study participants aged 23-27 years (54.8%), males (51.5%), rural residents (54.2%), had normal weight (49.5%), overweight / obese (43.4%) and have above average fat mass (61.8%). Anemic prevalence was found among on third of study participants (28.9%) with poor knowledge level (26.2%) and bad practice (86.4%) regarding IDA among anemic study participants. **Conclusion;** prevalence of IDA among some nursing intern students documented with decreased Hgb. was associated with increase BMI and fat mass related to poor knowledge and practice regarding IDA prevention. **Recommendations;** there is a pressing need for providing continuous updated for healthy lifestyle interventions among nursing intern students.

Key words: IDA Prevalence, Intern Students, Knowledge, Practices.

Introduction;

Anemia affects a large number of the global personnel, leading to serious detrimental effects on individual health as well as on social and economic progress in both developed and developing countries. It ranks as the 2nd leading cause of disability globally among all diseases (**Salim, Ahmed, and Al-Mamari, 2021**). Low red blood cell counts are a hallmark of anemia, which can negatively affect a person's quality of life (QOL) and, if ignored, cause serious clinical symptoms (**Mok et. al., 2024**).

A lack of iron is the most important cause of anemia (**Sari et. al., 2022**). It is a serious wellbeing concern and large prevalent dietary deficiency-regard the illness that impacts a large number of teenagers globally (**Abu-Baker, et. Al., 2021**). The capacity of red blood cells to transport oxygen to the body's tissues is diminished by iron deficiency anemia (IDA), which manifests clinically as conjunctival pallor, dyspnea, lightheadedness, and weakness (**Khani Jeihooni et. al., 2021**). Adolescents' ability to concentrate is disturbed, and their productivity, learning success, and mental agility are all negatively impacted by the lack of oxygen in their muscles and brains. Additionally, their physical strength

and learning performance are reduced, and their risk of infection is increased (**Utami et.al. 2022**).

Bede et al., (2020) reported that students at universities are prone to have unhealthy dietary habits, such as skipping meals, snacking, and frequenting fast food, due to their academic workload. During the hectic academic year, poor food choices made by Undergraduates could make this public health issues worse (**Amoaning et al., 2022**).

Hamali et.al., (2020) documented that iron deficiency (ID) and iron-deficiency anemia (IDA) are caused by number of circumstances; any blood loss results in the body losing iron, which can cause ID; another condition that puts a person at risk for ID is poor intestinal absorption of iron. There are several causes of anemia, but the primary one is a 50% iron intake deficit (**Utami et. al., 2022**).

In Egypt, adolescents face significant nutritional challenges. A recent UNICEF report indicates that 25% of Egyptian adolescents are anemic and 8% are obese, reflecting the dual burden of under nutrition and over nutrition (**Kamel et.al., 2025**). Their dietary patterns are often characterized by high consumption of energy-dense, nutrient-poor foods, accompanied by inadequate intake of fruits and

vegetables. Additionally, physical inactivity is widespread and contributes to the increasing prevalence of obesity among youth (Ahmed et.al., 2024).

El-Koofy et.al., (2025) agreed and added that during adolescence, significant developmental processes necessitate additional nutritional requirements, resulting in an elevated risk of nutrient deficiencies and waste. In addition, an unhealthy diet leads to obesity. Moreover, Edison et al, (2023) mentioned that, one of the main causes of nutritional problems is a lack of nutritional knowledge about iron-rich food and avoidance of iron supplements.

Consequently, improper practices can have long-term consequences. Knowledge, attitude and practice have been utilized to gather important data during situation analysis, which is input into the design of nutrition intervention and have also been used to evaluate nutrition education intervention (Okolosi et al., 2024). Therefore, adolescents must make healthy dietary choices and maintain good eating patterns to support proper development.

Research Significance

One of the Sustainable Development Goals (SDGs) and the World Health Assembly's 2025 Global Nutrition Goals are to eliminate anemia, along

with stunting, wasting, and obesity (Sari et. al., 2022). Since they promote unhealthy dietary habits and disregard preventative efforts, inadequate knowledge, attitudes, and behaviors regarding the controlling of IDA might be classified as risk factors (Amoaning et al., 2022).

There are limited evidences evaluating the risk factors that induce IDA among nursing student's male as well as female in Egypt. So, the study aims to assess the incidences of undiagnosed IDA among nursing intern students as well as the relationship between Hgb. level and their body composition, knowledge level, and practice regarding IDA.

Aim; assess prevalence of iron deficiency anemia and its relation with knowledge, practice and body composition among nursing intern students.

Design: descriptive cross sectional research design

Research questions;

1-What is the prevalence of iron deficiency anemia among nurse intern students?

2-What is the level of knowledge and practices related to IDA prevention among nurse intern students?

3-Is there relation between body composition indicators (e.g., BMI, hemoglobin levels, and body fat

percentage) and IDA-related knowledge and practices?

Subjects and method

Setting

This cross-sectional research was applied at Minia University, Egypt, targeting nursing intern students enrolled during the academic year [2024/2025] across different clinical training departments in Minia University Hospitals.

Sample

A total of 662 nursing intern students (Faculty of Nursing and Technical Institute of Nursing) participated in the study according inclusion and exclusion criteria. Participants were selected using a purposive sampling method, ensuring broad representation across different clinical training departments and willing of interns to participate in the study.

Inclusion criteria:

- Nursing interns students
- Enrolled in the internship year at Minia University for both Faculty of Nursing and Technical Institute of Nursing (write academic year)

Exclusion criteria:

- Pregnant or lactating students.
- Those currently receiving treatment for anemia.
- Presence of comorbidity (as inflammation or diseases of the colon),

-Presence of specific dietary restrictions or eating patterns (e.g., vegetarian, keto, intermittent fasting).

Tools;

Three tools were used to gather data. Tools were developed by researchers after extensive review literatures (Najm et. al., 2024, Edison et. Al., 2023, Utami et. al., 2022). The 1st tool is a structured self-administered questionnaire, which included three sections;

Part (A) Demographic characteristics of students included; name age, sex, residence, and if is smoker.

Part (B) Assessment of interns knowledge level about IDA including its definition, causes, manifestation and prevention; in addition to knowledge their about foods /drinks high in iron, foods /drinks assist body to absorb iron, and also foods/drinks reduce iron absorption.

Moreover, assessment of personal eating habit including frequency of meals taken per day; consuming meat, fish, or beans; fruits and vegetables in daily meals; eating quick food or takeout meals; commitment to eating breakfast daily and finally How would interns' rank his/her general eating habits for healthful foods; How would intern' rate his/her health.

Scoring system; close ended questions were divided; the first seven questions were answered with knew (1) or don't know (0). The remaining seven questions were scored as always, sometimes or never, with considering to the right answer (1) and the wrong answer (0).

c) Practices about IDA include questions about regularity of consuming fresh citrus fruits/vegetables, or its drink juice; sugary beverages (as soda, energy drinks); packaged snacks or fast food that is high in fat, salt, or sugar; servings of fresh, canned, frozen, or dried fruit; servings of fresh, canned, frozen, or dried vegetables; consumption of dairy products (unprocessed yogurt, low-fat dairy cheese); take iron supplements. In addition to, questions about times of taking snack (chips or crackers) between meals; desserts as chocolate, ice cream, or other sweets; amount of consuming margarine, lard, butter, or fatty meat; number of eating meals with others and degree of influencing by peers in eating habits.

Based on Bloom's cut-off, the overall knowledge and practice scores were computed as a percentage and divided into three awareness levels: high level (80–100%), moderate level (60–79.9%),

and poor level (<60%) (Mok et. al, 2024).

Second tool; utilizing standardized equipment, such as the OMRON BF511, a comprehensive body composition monitor that offers detailed information on skeletal muscle level, body and visceral fat, BMI, and resting metabolism. It is categorized as a medical device and has been clinically validated¹. The BF511 uses the Bioelectrical Impedance (BI) technique to calculate the percentage of body fat. Body tissues with a high-water content that readily carry electricity include muscles, blood vessels, and bones. Tissue with low electrical conductivity is body fat. To measure the quantity of fat tissue in the body, the BF511 applies a very mild electrical current of 50 kHz and less than 500 μ A. When using the BF511, this faint electrical current is not sensed.

The electrical impedance, height, weight, age, and gender data, as well as OMRON's body composition data, are used by the scale to calculate body composition.

Third tool; The HemoCue haemoglobin-meter (HemoCue® Hgb. 201 + System, Angelholm, Sweden) was used for point-of-care testing on capillary blood samples in order to determine the IDA status of the study participants. The

HemoCue microcuvette was filled with a drop of blood, and the results were displayed in ten minutes. The age and gender-specific hemoglobin cut-off points were used to identify the intern students' IDA status and severity level; study participants were categorized as anemic if they had Hgb. less than 12.0 g/dL (Bah et.al, 2020).

Ethical considerations

The Minia University Faculty of Nursing Research Ethics Committee granted ethical approval, and the study was carried out in compliance with the Declaration of Helsinki's tenets. The subjects gave their informed oral consent. The study was approved by the Faculty of Nursing's ethics committee (REC2024103), and participants were guaranteed anonymity, privacy, confidentiality, and the ability to decline participation.

Data collection

A self-administered questionnaire (Google form) covering demographic traits, knowledge, and practices on IDA were used to gather data. The questionnaire took about from the study participants 15 to 20 minutes to complete. Following completion of the questionnaire, the study participants' hemoglobin levels were measured to determine their IDA status. Before the blood sample was taken for the

hemoglobin level test, each nurse received a briefing on the process. Participants' BMIs were classified based on their height and weight.

Tool Validity:

To establish validity, the tool was tested by a panel of five experts in the field of medical surgical and adult care nursing at Faculty of Nursing, Minia University and little modifications were needed and done.

Tool Reliability:

Reliability was assured statistically by using the Alpha Cronbach test to guarantee that the research tools were reliable. The nurse intern students' knowledge and practice level reliability were (0.76 and 0.81) respectively.

Pilot Study:

A pilot study was conducted on 10% of sample in the selected settings to test the study process and to evaluate the efficiency and applicability of tools that were used in the study, the necessary modifications were done. it aided in estimating the time needed to complete the questionnaires (20: 30 minutes).

Statistical analysis:

Data analysis was carried out using SPSSV.24. Frequencies, percentages, Mann-Whitney test, and Spearman's correlation coefficient were utilized for data presentation and analysis.

Results

1-Demographic traits of participants: Table (1); shows the distribution of participants regarding to their demographic characteristic, it came to clear that the majority of study participants aged 23-27 years (54.8%), males (51.5%), rural residents (54.2%), at the end of internship (84.4%), and non-smokers (92.0%).

Fig. (1) shows distribution of participants regarding to IDA prevalence among them. It cleared up that IDA prevalence among the study participants is 28.9.

Table (2) presents distributions of study participants according to their knowledge about IDA. At the overall level, it cleared up that more than half of study participants (64.5%) have high knowledge about IDA, whereas 19.6% of them have moderate knowledge, while the last percent of them (15.9%) have poor knowledge about IDA.

Concerning the anemic study participants, it became clear that about half of them (54.4%) have high knowledge about IDA, whereas 26.2% of them have poor knowledge, while the last percent of them (19.4%) have moderate knowledge about IDA. However, it came to light that about from the non-anemic study participants (68.6%) have high knowledge about

IDA, whereas about 19.7% of them have moderate knowledge, while the last percent of them (11.7%) have poor knowledge about IDA.

Table (3) demonstrates the distribution of participants regarding to their practices related to IDA prevention. It can be observed at the overall level that the majority of study participants (72.8%) have bad practices, while the rest of them (27.2%) have medium practices, and there are no study participants in the good practices category.

About the anemic study participants, the results show that the majority of them (86.4%) have bad practices, whereas the rest of them (13.6%) have medium practices, and there are no study participants in the good practices category.

As for the non-anemic study participants, it cleared up that the majority of them (67.3%) have bad practices, while the rest of them (32.7%) have medium practices, and there are no study participants in the good practices category.

Table (4) represents distribution of participants according to their body composition indicators. According to Body Mass Index (BMI), it became clear that about half of study participants (49.5%) have normal weight and about 43.4% were overweight and obese. The results also show that the highest

percentage of study participants have above average fat mass (61.8%), while all the study participants have below average fat free mass percentage and the majority of study participants (93.8%) have below average visceral fat mass.

Fig.2 shows Mann-Whitney test results for the difference between anemic and non-anemic study participants concerning their knowledge about IDA. It became clear that there's a high significant variance of knowledge about IDA between anemic and non-anemic study participants ($Z= 5.092$, $P< 0.001$), with greater mean rank for non-anemic study participants compared to anemic study participants, which means that knowledge about IDA of non-anemic study participants is significantly higher than of anemic study participants.

Fig. (3) Shows Mann-Whitney test results for the difference between anemic and non-anemic study participants concerning their practices related to IDA prevention. It became clear that there's a significant difference of practices related to IDA prevention between anemic and non-anemic study participants ($Z= 8.196$, $P< 0.001$), with greater mean rank for non-anemic study participants compared

to anemic study participants, which means that practices related to IDA prevention of non-anemic study participants is significantly higher than practices related to IDA prevention of anemic study participants.

Table (5); Shows that there are significant correlations between IDA-related knowledge & practices (each separately) and hemoglobin level, which means that the study participants who have high knowledge about IDA tend to have high haemoglobin level ($r_s=0.160$, $p\leq 0.01$), and the study participants who have good practices related to IDA prevention tend to have high hemoglobin level ($r_s=0.210$, $p\leq 0.01$).

The results also show that there is statistical negative insignificant correlation between knowledge about IDA or practices related to IDA prevention and the body composition indicators (BMI, fat mass, fat free mass and visceral fat mass).

Table 6 shows that there is a significant correlation between study participants' knowledge about IDA and their practices related to IDA prevention ($r_s=0.252$, $p\leq 0.01$), which means that the study participants who have high knowledge about IDA tend to have

good practices related to IDA prevention.

Table 1: Distribution of participants regarding to their demographic data (N= 662)

Demographic data	Categories	Frequency	Percentage
Age	20 ≤ 23	299	45.2
	23 – 27	363	54.8
Gender	Female	321	48.5
	Male	341	51.5
Region of Origin	Rural area	359	54.2
	Urban area	303	45.8
Internship Status	At the beginning of internship	103	15.6
	At the end of internship	559	84.4
Smoking	Non-smoker	609	92.0
	Was a smoker and quit	20	3.0
	Smoker	33	5.0

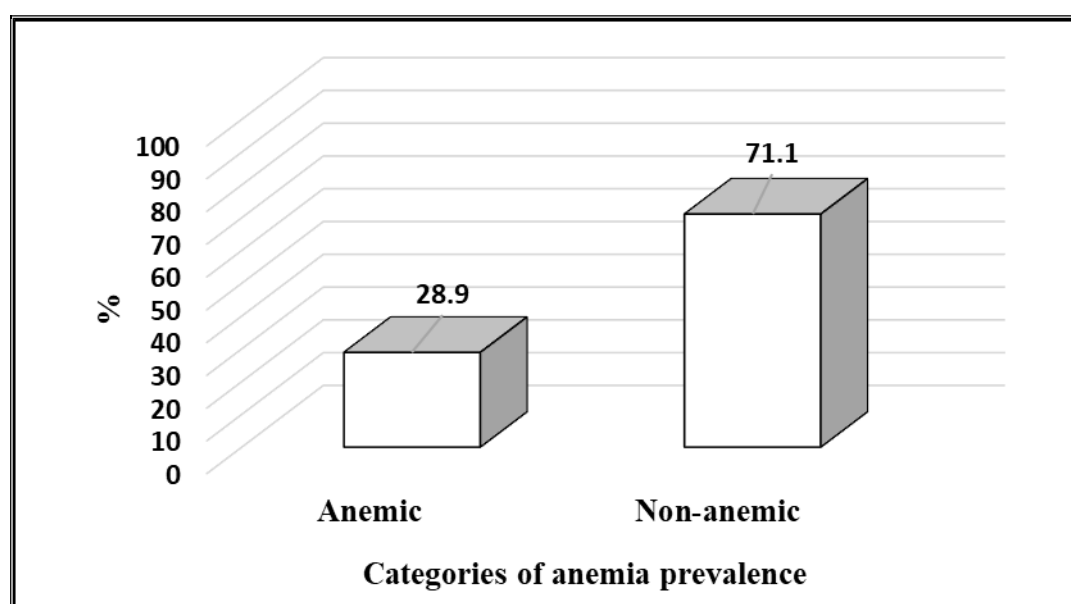


Figure.1. Distribution of participants regarding to IDA prevalence among them (N= 662)

Table 2: Distribution of participants regarding to their knowledge about IDA (N= 662)

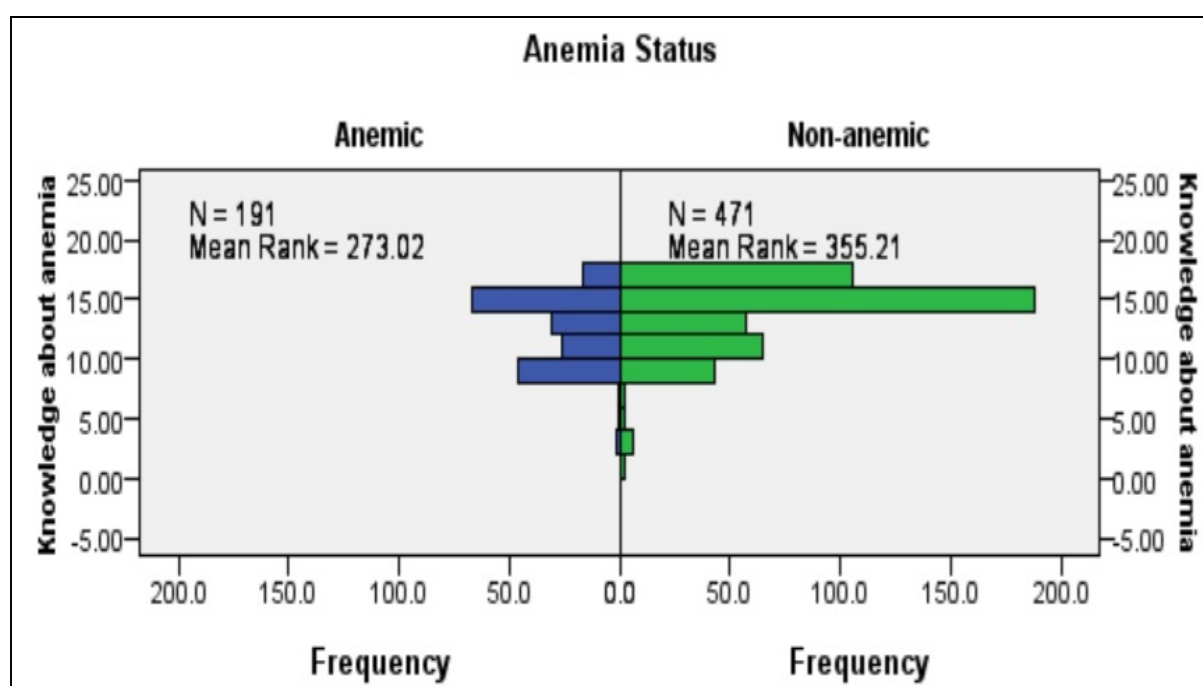
Categories of knowledge level	Anaemic		Non-anaemic		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Poor knowledge level	50	26.2	55	11.7	105	15.9
Moderate knowledge level	37	19.4	93	19.7	130	19.6
High knowledge level	104	54.4	323	68.6	427	64.5
Total	191	100.0	471	100.0	662	100.0

Table 3: Distribution of participants regarding to their practices related to IDA prevention (N= 662)

Categories of practices	Anemic		Non-anemic		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Bad healthy practices	165	86.4	317	67.3	482	72.8
Medium healthy practices	26	13.6	154	32.7	180	27.2
Good healthy practices	-	-	-	-	-	-
Total	191	100.0	471	100.0	662	100.0

Table 4: Distribution of participants regarding to their body composition indicators (N= 662)

Body Composition Indicators	Categories	Frequency	Percentage
Body Mass Index (BMI)	Underweight	47	7.1
	Normal Weight	328	49.5
	Overweight	186	28.1
	Obese	101	15.3
Fat Mass	Below average	135	20.4
	Average	118	17.8
	Above average	409	61.8
Fat Free Mass	Below average	662	100.0
	Average	-	-
	Above average	-	-
Visceral Fat Mass	Below average	621	93.8
	Average	29	4.4
	Above average	12	1.8

**Figure. (2) illustrate frequency distribution of study participants regarding to mean rank of knowledge about IDA**

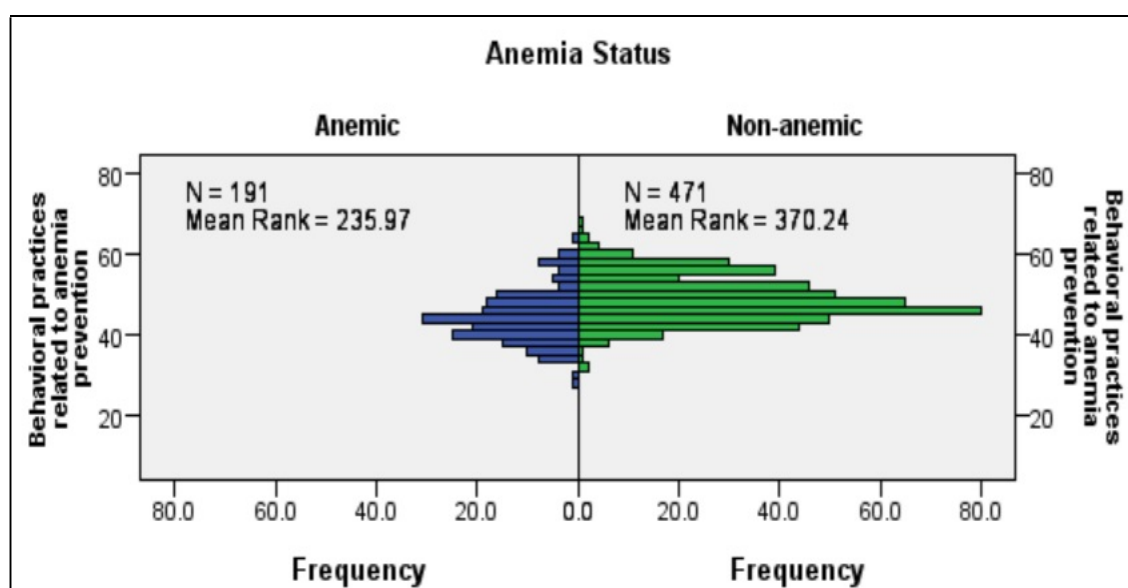


Fig. (3) Frequency distribution of participants regarding to mean rank of practices related to IDA prevention

Table 5: Spearman's correlation coefficients for the relationship between body composition indicators and IDA-related knowledge & practices

Body composition indicators	knowledge about IDA	Practices related to IDA prevention
Hemoglobin level	0.160**	0.210**
Body Mass Index	-0.006	-0.033
Fat mass	-0.012	-0.011
Fat free mass	-0.025	-0.036
Visceral fat mass	-0.023	-0.010

** Correlation is significant at the 0.01 level.

Table 6: Spearman's correlation coefficient for the relationship between study participants' knowledge about IDA and their practices related to IDA prevention

	Practices related to IDA prevention
Knowledge about IDA	0.252**

** Correlation is significant at the 0.01 level.

Discussion

The WHO states that IDA is the most prevalent kind of anemia. Without a doubt, nurses are the foundation of health education and awareness for all facets of society. Therefore, to be an effective advocate of health, it is essential to make sure that their health knowledge and practices are current. Even though IDA awareness is taught in nursing schools, it's crucial to provide nurses some knowledge and skills about this illness, particularly after they graduate and start working.

Results of this study found that about half of participants were aged 23-27 years, females, and about one third of them (28.9%) were anemic. This result is consistent with **Wahba et al., (2026)** who documented that anemia is highly incident (35.8%) among adolescent female in Beni-Suef governorate, Upper Egypt. And **Salama et. al., (2021)** who conduct a research, and found anemia was more common in females (27.3%) than in males (4%) among first-year students at Pharos University in Alexandria, Egypt.

Furthermore, **Al-Sejari and Meshari (2020)** conduct a thesis in Kuwait about IDA prevalence among Kuwaiti University students and it was 21.7% between participants. **Hamali et.al, (2020)**

reported that, in the Gulf countries, thirty percent of women between the ages of seventeen and twenty-four suffer from anemia. Studies reported that anemia prevalence in Indonesia is estimated at 30% (**Utami et.al., 2022**). While, **Almasmoum et.al., (2023)** conduct a thesis in Makkah, Saudi Arabia and document according to the test data, thirteen percent of female medical students had iron deficiency anemia with hemoglobin (Hgb.) concentrations less than 12 g/dL.

Finally, **Bakry and Elhefny (2022)** reported in mini-review research conducted in the Kingdom of Saudi Arabia revealed that school and university students had a comparatively high frequency of anemia.

Concerning residence, results of this study revealed that over fifty percent of study participants were from rural area. This is inconsistent with **Wahba et.al., (2026)** who found that urban residents have a high prevalence of anemia, which is explained by a quant of variables, including biological, circumstance, food, and socioeconomic ones. Poor eating habits including skipping meals, consuming few foods high in iron, and relying too much on junk food are all encouraged by urbanization.

The study's researchers demonstrate that these variables may have an impact on our findings since those from rural regions who go to attend university lead similar urban lives. This was supported by **Wahba et.al., (2026)** who document that higher education combined with hectic schedules and academic stress might result in bad food diversity and meal skipping.

Regarding Knowledge distribution among study participants, nearly half of the anemic study participants have poor and moderate knowledge about IDA compared to one third among non-anemic with significant variances between anemic as well as non-anemic study participants. The results of earlier, related investigations are corroborated by the current investigation the high prevalence of IDA is associated with poor knowledge. **Abu-Baker et.al., (2021)** reported that, even though over half of the participants showed sufficient general awareness regarding IDA, many lacked sufficient understanding of relevant topics, including prior knowledge of IDA, its consequences, or foods that improve iron absorption.

Moreover, Mok et.al., (2024) document in their study including 674 Malaysian university students revealed that over half of the participants lacked sufficient

understanding about anemia and those students with good knowledge were 1.1 times more inclined to have better anemia levels than those with bad knowledge. **Ali et.al., (2022)** who reported that, among 160 student nurses, over 50% of them knew very little about IDA. This might be connected to the age group difference since over half of the participants in the investigated sample were under the age of 18, whereas the same number in our study were between the ages of 23 and 27, indicating that they had finished their curriculum, which reflects their knowledge.

Wahba et.al., (2026) concluded that, improving young adult well-being, maternal health, and general community development all benefit from treating anemia at this time of life.

The current results show that, the majority of all participants, three-fourths, have bad practices regarding IDA prevention which is high among anemic study participants (86.4%) compared to (67.3%) among non-anemic study participants. This is reflected by significant difference of practices related to IDA prevention between anemic and non-anemic study participants.

This result is consistent with research by **Al-Jamea et al., (2019)**, who found that individuals who

regularly ate breakfast had a lower chance of having IDA than those who did not (UOR = 0.5, $P = 0.024$) when comparing dietary practices and clinical characteristics of participants against anemic and non-anemic groups. Additionally, **Okolosi et al. (2024)** noted that IDA was a significant problem and found that only 46.0% of survey participants had a positive attitude.

Additionally, just forty-five percent of all participants reported general healthy practices linked to IDA, according to **Abu-Baker et al. (2021)**. **Mok et al. (2024)** noted that study participants did not apply the knowledge to their dietary habits. According to **Khani et al., (2021)**, students in the experimental group had significantly higher mean scores for knowledge, attitude, and performance both immediately and one month after the intervention.

Regarding Body composition indicators of IDA among study participants the current result reflects that about nearly one half of study participants overweight and obese, and majority of study participants have fat mass above normal rang. **Ameen, Kamel, Hind at (2025)** were highlighted in their thesis done on 200 Egyptian male students from the Faculty of Physical Education the fact that BMI values did not

significantly correlate with nutrient intake or awareness scores.

Current results also show that there is statistical negative un-significant correlation between knowledge about IDA or practices related to IDA prevention and the composition indicators of the body (BMI, fatty mass, fat free mass and visceral fat mass) which indicate that decrease in study participants' knowledge and practice associated with increase the body composition indicators. In addition, it was found that, there is a positive significant correlation between study participants' knowledge about IDA and their practices related to IDA prevention.

This is in line with **Mok et.al., (2024)** found that female students who knew more about IDA were more likely to have better IDA status than those who didn't, demonstrating a strong protective effect of knowledge against IDA and suggesting that having more knowledge may reduce the likelihood of IDA. In line with these results, some earlier research revealed that teenagers had inadequate IDA-related information, attitudes, or behaviours. Students enrolled in health-related colleges such as human nutrition, medicine, nursing, pharmacy, and others are expected to be more attentive to their

eating habits (Quiliche Castañeda et.al, 2021).

Conclusion

Findings of this study stand on the presence of IDA among some nursing intern students documented with decreased Hgb. Most participants have degree of poor knowledge about IDA, consistent with bad health practice regarding IDA prevention, which was reflected on their BMI as there is about 43% were overweight and obese.

Recommendation

- 1) Continuous updated for healthy lifestyle interventions among nursing intern students
- 2) More work is needed to raise intern nursing students' understanding of this in order to improve their present and future health.
- 3) Using social media to spread health awareness among different segments society about iron deficiency and how to avoid iron deficiency IDA.
- 4) Encourage healthy practice in eating habits to promote healthy stomach and so maintain health absorption to what we eat.
- 5) Performing this study on a large number of male and female students from various Minia University faculties will yield comprehensive information regarding the forms and incidence of IDA among them.

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Effect of Training Program on Swallowing Function of Ischemic Stroke Patients with Dysphagia

Mostafa Mohamed Elbadry^{1,2}, Hend Mohamed Mohamed El-Azazy³,
Elsayed Ali Mohamed Tag-Aldin⁵, and Fatma A Salem⁴

¹Nursing Specialist, Kafr Elsheikh Health Affairs Directorate, Kafr Elsheikh.

²Master student of Medical Surgical Nursing, Faculty of Nursing, Tanta University, Egypt.

^{3,4}Professor of Medical Surgical Nursing Faculty of Nursing, Tanta University.

⁵Professor of Neurology Faculty of Medicine, Tanta University.

Corresponding author: Mostafa Mohamed

Email: Mostafaelbadry252511@gmail.com

Abstract

Background: Dysphagia following ischemic stroke can result in serious complications such as aspiration pneumonia, malnutrition, dehydration, and prolonged hospitalization. Early swallowing training may reduce these risks.

Aim of the study: To evaluate the effect of a swallowing training program on swallowing function among ischemic stroke patients with dysphagia.

Study design: A quasi-experimental research design. **Study setting:** This study conducted in in the neurological wards at Tanta Main University Hospital and the Psychiatric Neurology Centre.

Study subjects: A purposive sample of 80 adult patients, randomly assigned into study and control groups.

Tools of data collection: Three tools were used. **Tool I:** Patient Assessment Structured Interview Questionnaire, **Tool II:** Swallowing Ability Assessment Questionnaire and **Tool III:** Dysphagic Patients' Reported Practice Checklist.

Results: before implementation of the training program, more than half of the control group (57.5%) and more than two thirds of the study group (67.5%) were dependent on tube nutrition, and all patients in both groups had unsatisfactory swallowing ability. After two weeks, significant improvements were observed in the study group; (57.5%) who achieved a full oral diet without restrictions compared to persistence of tube dependency in (25.0%) of the control group. Satisfactory swallowing ability was achieved in (75.0%) of the study group versus (32.5%) of control group ($p < 0.001$). Additionally, (72.5%) of the study group demonstrated adequate reported practice compared to (45.0%) of control group. **Conclusion:** The training program significantly improved swallowing function and patient practices. **Recommendations:** Early and continuous swallowing rehabilitation of stroke patients, and further studies are recommended.

Key words: Dysphagia, Ischemic Stroke, Swallowing Function, Training Program.

Introduction

Stroke is categorized into two major types including ischemic and hemorrhagic, ischemic stroke is the most common type of stroke and occurs when a blood vessel in the brain is blocked. The blockage can be caused by; “the formation of a clot within a blood vessel of the brain or neck, which is called thrombosis; the movement of a clot from another part of the body such as the heart to the brain, (embolism); or a severe narrowing of an artery in or leading to the brain, (stenosis) **(Hui et al., 2024)**.

Dysphagia is a common complication among patients who experience ischemic stroke. It can lead to serious consequences including malnutrition, dehydration, aspiration pneumonia, and even increased mortality. Rehabilitation programs, especially those involving structured training for patients and caregivers, are crucial for improving swallowing function and overall recovery outcomes **(Balcerak et al., 2022; Song et al., 2024)**.

Dysphagia is characterized by difficulty in swallowing due to neurological impairment, resulting from damage to cortical or brainstem areas responsible for coordinating the swallowing reflex **(Wen et al., 2023)**. The prevalence of post-stroke dysphagia varies depending on the

stroke subtype, severity, and timing of assessment. Studies suggest that the condition is more common in brainstem infarcts due to disruption of the medullary swallowing center, while cortical lesions may impair volitional and sensory aspects of swallowing **(Gu & Ren, 2025)**.

Oropharyngeal dysphagia has no specific pharmacological treatment; therefore, management primarily depends on rehabilitation strategies. The main objective of swallowing rehabilitation is to restore safe oral intake to the most normal level possible. This rehabilitation process should start only after conducting a comprehensive swallowing assessment. Since swallowing impairment and its related complications are frequently observed among stroke patients, it is essential to evaluate swallowing function in all individuals during the acute phase of stroke. Accordingly, the rehabilitation program is tailored based on the specific type and severity of swallowing difficulties **(Zaki et al., 2024)**.

Swallowing rehabilitation programs for patients with dysphagia are typically multifaceted, they include dietary adjustments, such as altering the consistency of solid foods and liquids to promote safer and easier swallowing, proper positioning of

the head and neck is also emphasized to aid bolus movement through gravitational assistance, additionally, specific swallowing strategies are introduced to minimize food retention and protect the airway, oral motor exercises are incorporated as well to enhance the strength and coordination of the muscles involved in swallowing **(Gomah et al., 2020; Salem, 2010)**.

The International Dysphagia Diet Standardization Initiative (IDDSI) is a globally recognized framework developed to provide standardized terminology and definitions for texture-modified foods and thickened liquids for individuals with dysphagia **(Cichero et al., 2020)**.

Swallowing training exercises is essential to improve swallowing function for neurogenic dysphagia in acute stroke patients. These exercises approach target specific muscles or groups of muscles active in deglutition or swallowing. They include effortful swallow, Shaker's exercise, Masako maneuver, Mendelsohn maneuver and supraglottic maneuver, that probably constitute the most widespread treatment approach for patients with neurogenic dysphagia **(Dziewas et al., 2021; Krekeler et al., 2021)**.

Effortful Swallowing Training (EST) is done by pushing the tongue

firmly against the palate while swallowing as forcefully as possible. This training aims to increase the posterior motion of the tongue base toward the posterior pharyngeal wall. Recently, EST was reported as a remedial method for the treatment of oropharyngeal dysphagia **(Park et al., 2019)**.

The Shaker exercise (also called the head-lift exercise) is another rehabilitative swallowing exercise, and aims to strengthen the suprahyoid muscles responsible for elevating the hyoid bone and larynx during swallowing, and increase the amplitude and duration of hyolaryngeal excursion, thereby improving Upper Esophageal Sphincter (UES) opening and reducing post-swallow residue and aspiration risk **(Tuomi et al., 2022)**.

The Masako maneuver (also called the "tongue-hold" exercise) is used in post-stroke dysphagia rehabilitation, and used to strengthen the pharyngeal constrictor muscles by anchoring the tongue anteriorly while swallowing saliva, and increase the posterior bulging of the pharyngeal wall and promote greater contact between the tongue base and posterior pharyngeal wall, thereby enhancing pharyngeal pressure and bolus clearance **(Aoyagi et al., 2021)**.

The Mendelsohn Maneuver (MM) is a behavioral swallowing intervention commonly used in patients with post-stroke oropharyngeal dysphagia, and aims to prolong the duration of Upper Esophageal Sphincter (UES) opening, thereby facilitating bolus flow into the esophagus and reducing pharyngeal residue (**Inamoto et al., 2018**).

Likewise, the supraglottic maneuver is used to close the airway before and during swallowing, and strengthen the retraction of the base of the tongue, thus increase the pressure generated, as well as increase the clearance of the residue after swallowing (**Zavala-Solares et al., 2020**).

Effective dysphagia rehabilitation requires a multidisciplinary team approach, in which the nurse is an integral member. Identifying swallowing difficulty in stroke patients is an important task in nursing care, this implies that care needs to be adapted and when rehabilitation strategies are applied, it reduces the risk of complications related to dysphagia. Frequently the nurse is the first health team member to detect, and assess signs and symptoms of dysphagia. Consequently, the nurse has her/his role in managing the patient's mealtime, documenting progress, teaching safe feeding practices, and

reinforcing the compensatory strategies for successful rehabilitation (**Guo et al., 2024**).

Significance of the study:

Dysphagia is a serious life-threatening medical condition that affects many patients in the first few hours and days after stroke. Persistent dysphagia can result in an excess production of saliva, drooling, coughing or choking during eating, and even difficulty speaking or a hoarse voice. These signs associated with poor outcome and increased mortality and morbidity due to dysphagia complications as aspiration pneumonia, dehydration, malnutrition, and death (**Kagaya & Inamoto, 2022**). According to a recent systematic review and meta-analysis, the prevalence of post-stroke dysphagia in ischemic stroke patients is approximately 43.6% (**Song et al., 2024**).

Implementation of a structured post ischemic stroke dysphagia training program has been shown to improve objective swallowing function, reduce the proportion of patients with severe dysphagia, decrease aspiration risk, and improve oral intake and short-term nutritional status (**Choy et al., 2023**). Previous research investigations have demonstrated that the incidence of dysphagia related problems can be

decreased with prompt and efficient nursing care. Thus, in clinical nursing, the recognition, evaluation, and management of dysphagia should be highly regarded (Luo et al., 2022).

The aim of the study was to:

Evaluate the effect of training program on swallowing function of ischemic stroke patients with dysphagia.

Research hypothesis:

Ischemic stroke patients who receive dysphagia training program may exhibit improvement regarding swallowing function compared to patients in control group.

Subjects and Method

Study design:

Quasi experimental study design was used in this study.

Study settings:

This study was conducted in neurological wards of Tanta Main University Hospitals that consist of 28 beds and Psychiatric Neurology Centre that consist of 21 beds.

Study subjects:

A purposive sample of 80 adult ischemic stroke patients of both genders, who admitted to the above-mentioned settings.

The sample was calculated according to the power analysis based on patient's admission rate in hospitals and expected improved of patient's outcomes among studied

groups considering level of significance of 5%, and power of study of 80%, the sample size is calculated using the following formula:

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

Tools of data collection:

Three tools were used for data collection in the study.

Tool (I): Patient Assessment Structured Interview

Questionnaire: it was developed by the researcher to collect data after extensive review of related references (El-Nshar et al., 2024; Gamal et al., 2020). It consists of two parts.

Part one: Sociodemographic data of patients, it includes (Age, Gender, Marital Status, Educational Level, occupation, and residence).

Part two: Patients' Clinical data, it includes data regarding diagnosis, stage of dysphagia, past medical history, history of smoking, previous cerebrovascular accident, type of ischemic stroke, affected side, the pattern of speech (dysarthria, receptive aphasia, expressive dysphasia, both receptive and expressive aphasia) and consistency of prescribed diet (liquid, semisolid).

Tool (II): Swallowing Ability Assessment Questionnaire:

Part One: Functional Oral Intake Scale (FOIS): this tool was adopted

from **Crary et al., 2005** to evaluate the level of oral intake thickness or consistencies for dysphagia in stroke patients, and ranged from NBO to total oral diet with no restrictions.

Part two: Stroke Patients Swallowing Ability Observational Checklist: it was developed by **Logemann et al., 1999**, updated by **Audag et al., 2019**, and adopted by the researcher to assess patient ability to swallow food and fluid safely and effectively. It consists of six items which are apraxia of swallow, oral residue, coughing/throat clearing, delayed pharyngeal swallow, reduced laryngeal elevation and multiple swallows per bolus. The patient' response was rated on a 3-point Likert scale as; (never=3, sometimes=2, and always=1).

Part Three: Oral Motor Structures and Reflexes Assessment Questionnaire: This tool was developed by **Kumar et al., 2010** and **Kim, 2015**, and adopted by the researcher to assess oral motor structure and reflexes related to swallowing. It consisted of 11 items as; assessment of lips which include (four items), tongue (three items) and jaw (one item), complete swallowing reflex, intact gag reflex and effective voluntary cough, each item was scored as; Yes= 1 point

(normal/adequate function), No= 0 points (impaired/abnormal function).

Tool (III): Dysphagic Patient's Reported Practice Checklist: This tool was developed by **Gamal et al., 2020**, and was adopted and adapted by the researcher after extensive review of the related literatures (**Alali et al., 2018; Balou et al., 2019**). It included 10 practices to assess patient reported practice of safe and effective swallow.

Method

1-Obtaining approval:

An official permission was obtained from the Dean of Faculty of Nursing, Tanta University and directed to the head of Neurology Department at Main Tanta University Hospitals and Psychiatric Neurology Centre.

2-Ethical considerations:

- Approval of the Scientific Research Ethical Committee of the Faculty of Nursing was obtained, code number **(658/5/2025)**.
- An informed oral consent was obtained from all studied patients or their caregivers to participate in the study after providing an appropriate explanation about the purpose of the study.
- Each patient was informed that he/she has the right to withdraw from the study at any time with no effect on the treatment.

- The nature of the study was not causing any harm or pain for the studied sample.
- Confidentiality for data and privacy for participants was maintained by using code instead of patient's name, securing data in private personal computer (PC), and using the obtained data for the purpose of the current study only.

3-Field of the work:

-Study tool I (part A and B) was developed by the researcher to assess patient socio-demographic and clinical data, tool II (part A, B and C) was adopted by the researcher, while tool III was adopted and adapted by the researcher

-Validity: the studied tools were tested for face and content validity by a jury of five professors' expertise in the field of medical surgical nursing and neurology specialist professors before conducting the study.

-Pilot study:

A pilot study was carried out by the researcher on 10% of the patients for testing the tool clarity, applicability and to identify obstacles that may be encountered by the researcher during data collection. Accordingly, the necessary minor modifications were done. These samples were included in the study since there were no major modifications.

-Reliability: the study tools were tested for reliability by using Cronbach's alpha test. It was as following; Tool I Part one (Patients' Socio-demographic data) was scored 0.862 with good reliability, Tool I Part two (Patients' Clinical data) was scored 0.915 with excellent reliability, Tool II Part one; Functional Oral Intake Scale (FOIS) was scored 0.871 with good reliability, Tool II Part two (Stroke Patients Swallowing Ability Observational Checklist) was scored 0.893 with good reliability, Tool II Part three (Oral Motor Structures & Reflexes Assessment Questionnaire) was scored 0.925 with excellent reliability, and Tool III (Dysphagic Patient's Reported Practice Checklist) was scored 0.934 with excellent reliability.

4-Developing swallowing training program:

The swallowing training program was carried out according to the following phases:

I) Assessment phase:

During this phase, the researcher conducted a baseline assessment of patient in both study and control groups by using tools (I , II and III) in order to determine the training needs regarding to dysphagia.

II) Planning phase:

The swallowing training program was planned according to the patient

needs obtained from the assessment phase based on the related literature. It includes the following steps:

A- Setting the goal of swallowing training program:

The goals of the swallowing training program are to:

- Improve swallowing difficulty.
- Prevent life-threatening complications, such as aspiration pneumonia and malnutrition.

B- Preparing contents:

According to the pre- determined needs of the patients and reviewing related literatures to meet the training needs of the studied patients, the content of the program was prepared. It included oral care, starting oral feeding, patient positioning during feeding, and encouraging swallowing exercises, the food consistency given depending on the patient' swallowing level, types of food that should be avoided, steps of feeding, head lifting and neck tilting during swallowing, and using nasogastric tube feeding when needed.

The training methods and audiovisual materials were determined and used in the training sessions to help the patients gain and benefit from the program

- Demonstration and re-demonstration were used as a training method.

- Booklets, power point presentations, and videos, were used as teaching aids.

Implementation phase:

- The researcher met patients with post-stroke dysphagia in the neurological wards at Tanta University Hospitals and Neuropsychiatric Centre according to the convenient dates and times for both selected patients and the researcher.

- The training of swallowing instructions was presented to the patients by the researcher. Three sessions were provided for patients according to actual educational needs.

- Each patient received three sessions one theoretical and two practical sessions, the duration of each session ranged from 30-45 minutes.

-Session (1): (Theoretical) An overview about ischemic stroke and stroke related dysphagia.

- Session (2): (Practical) Swallowing training program: to train patients about swallowing exercises that include effortful swallow and Shaker's exercise.

- Session (3): (Practical) Swallowing training program: to train patients about swallowing exercises that include Masako Maneuver, Mendelsohn Maneuver and Supraglottic maneuver.

IV) Evaluation phase:

The aim of this phase was to evaluate the effectiveness of the swallowing training program on dysphagia of ischemic stroke patients which was done two times as follow:

1) **First time:** one week post implementation of the swallowing training program by using tool II part A, B and C and tool III.

2) **Second time:** two weeks post implementation of the swallowing training program by using tool II part A, B and C and tool III.

5- Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS version 26 (Statistical Package for Social Studies) created by IBM, Illinois, Chicago, USA. The range mean, and standard deviation were calculated for age. For categorical variable the number and percentage were calculated and differences between subcategories were tested by Chi square test. When the chi square was not adequate, Fisher's exact and Monte Carlo exact tests were used. The observation within each group at different periods of follow up was tested using Freidman test. The correlation between the two variables was calculated using Pearson's correlation coefficient.

The level of significance was adopted at $p < 0.05$.

Results

Table (1): Represents the Socio-demographic characteristics of studied groups. It shows that more than half (55.0%) of the control group aged $>49-60$ years with mean+ SD of 49.75 ± 6.40 , and the same proportion are males, and lived in urban areas, while in the study group, less than two thirds (60.0%) aged $>49-60$ years with mean+ SD of 50.75 ± 5.50 , and the same proportion are males, and lived in rural areas. Additionally, there was no statistically significant difference between the control and study groups regarding age, sex, residence, marital status, educational level, employment, or smoking history.

Table (2): Represents the distribution of studied groups according to clinical data. It shows that, more than half (55.0%) of the control group were in the first stage of dysphagia, while almost two thirds (65.0%) of the study group were in the second stage. Regarding comorbidities, almost three quarters (72.5%) of the control group and most (90.0%) of the study group had hypertension. Additionally, there was a statistically significant difference between diet type and the studied groups ($P=0.017$) whereas most of study sample had semisolid food,

while no statistically significant difference was found between the two groups in other items of the clinical data.

Figure (1): Represents the comparison of the total score of functional oral intake at follow up periods between studied groups. It shows that there was a statistically significant difference between the studied groups related to functional oral intake score at one and two weeks after implementation of the training program at $P < 0.001$ and 0.001 respectively.

Figure (2): Represents the comparisons of total scores of stroke patients' swallowing ability at follow up periods between studied groups. This figure shows that there was a statistically significant difference between the studied groups related to stroke patients' swallowing ability total scores at one week and two weeks post implementation of the training program at $P < 0.001$ each.

Table (3): Represents the comparison of the total score of oral motor structures and reflexes at follow-up period between studied groups. This table shows that there was a statistically significant difference between the studied groups related to oral motor structures and reflexes score at one week post implementation of the

training program at $P = 0.012$, in addition there were a high statistically significant differences within control and within study group patients since $P < 0.001$ each.

Table (4): Illustrates the comparison of the level of dysphagic patients' reported practice at follow up periods between studied groups. This table shows that there was statistically significant difference between the studied groups related to level of reported practice one and two weeks post implementation of the training program $P < 0.001$ and 0.012 respectively. Additionally, there were a high statistically significant differences within control and within study group patients since $P < 0.001$ each.

Figure (3): Illustrates the correlation between functional oral intake and stroke patients' swallowing ability one week post implementation of the training program. It shows that there was a highly statistically significant positive correlation between functional oral intake and stroke patients' swallowing ability as $r = 0.741$, $P < 0.001$ one week after implementation of the training program.

Figure (4): Represents the correlation between functional oral intake and stroke patients'

swallowing ability two weeks posts implementation of the training program. It shows that there was a highly statistically significant positive correlation between functional oral intake and stroke

patients' swallowing ability where $r=0.901$, $P<0.001$ two weeks post implementation of the training program.

Table (1): Socio-demographic characteristics of studied groups (n=80)

Variables	Control (n=40)		Study (n=40)		X ²	p
	n	%	n	%		
Age in years:					MCET	0.708
30-39	3	7.5	1	2.5		
>39-49	15	37.5	15	37.5		
>49-60	22	55.0	24	60.0		
Mean +SD	49.75±6.40		50.75±5.50			
Sex:					0.205	0.651
Males	22	55.0	24	60.0		
Females	18	45.0	16	40.0		
Residence:					1.805	0.179
Urban	22	55.0	16	40.0		
Rural	18	45.0	24	60.0		
Marital status:					MCET	0.186
Single	1	2.5	0	0.0		
Married	25	62.5	33	82.5		
Divorced	10	25.0	4	10.0		
Widow	4	10.0	3	7.5		
Educational level:					2.705	0.439
Can't read and write	8	20.0	6	15.0		
Basic education	6	15.0	9	22.5		
Secondary	19	47.5	22	55.0		
University	7	17.5	3	7.5		
Employment:					0.213	0.644
Not employed	16	40.0	14	35.0		
Employed	24	60.0	26	65.0		
Smoking history:					0.201	0.654
Non smoker	20	50.0	18	45.0		
Smoker	20	50.0	22	55.0		

MCET = Monte Carlo exact test

Table (2): Distribution of studied groups according to clinical data (n=80)

Clinical data	Control (n=40)		Study (n=40)		χ^2	p
	n	%	n	%		
Stage of dysphagia:					3.232	0.072
First	22	55.0	14	35.0		
Second	18	45.0	26	65.0		
History of heart disease	7	17.5	3	7.5	1.829	0.176
History of diabetes mellitus					MCET	0.557
Type 1	2	5.0	0	0.0		
Type 2	10	25.0	11	27.5		
Hypertension	29	72.5	36	90.0	4.021	0.45
History of previous cerebrovascular accident	6	15.0	1	2.5	FE	0.108
Type of ischemic stroke					1.829	0.176
Thrombotic	33	82.5	37	92.5		
Embolic	7	17.5	3	7.5		
Hemiplegia:					1.805	0.179
Right	18	45.0	24	60.0		
Left	22	55.0	16	40.0		
Dysarthria	40	100	40	100	-----	-----
Diet					5.698	0.017*
Semisolid	22	55.0	32	80.0		
Liquid	18	45.0	8	20.0		

MCET = Monte Carlo exact test

FE= Fisher's exact test

*Significant

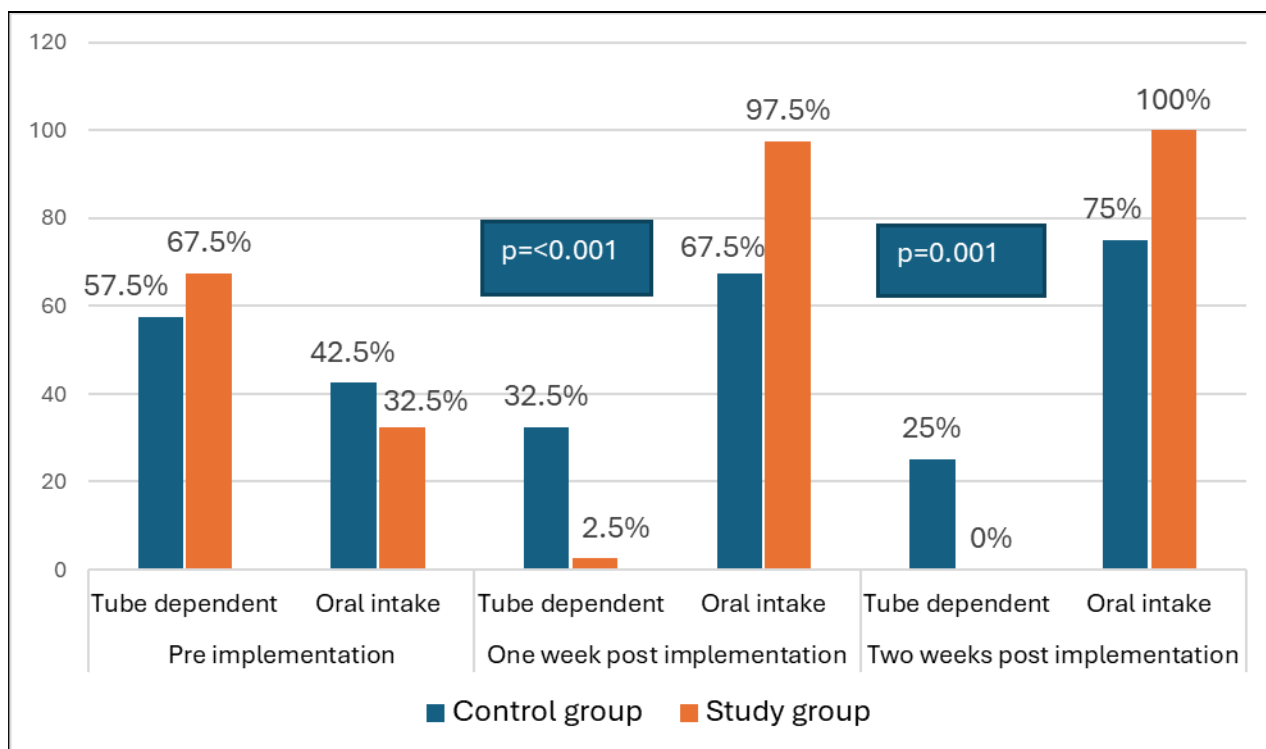


Figure (1): Comparison of the total score of functional oral intake at follow up periods between studied groups (n=80)

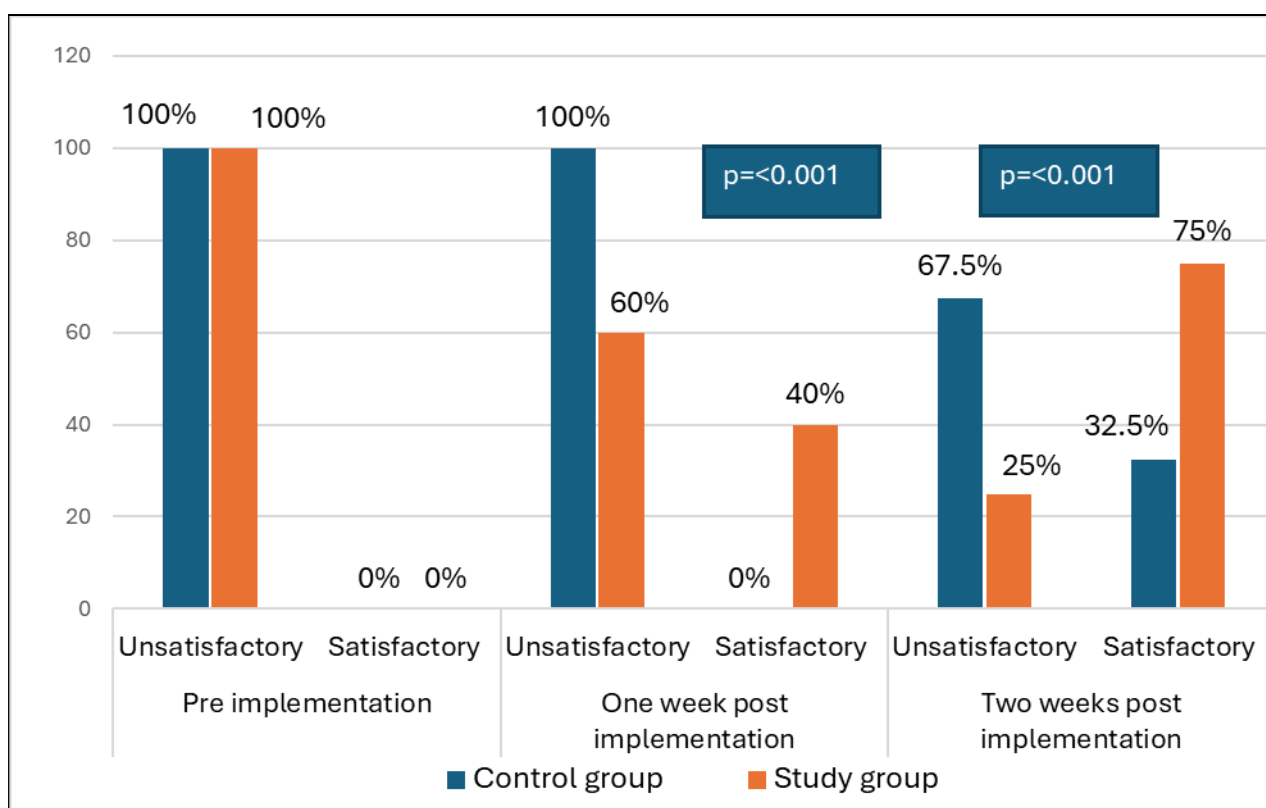


Figure (2): Comparison of the total score of stroke patients' swallowing ability at follow up periods between studied groups (n=80)

Table (3): Comparison of the total score of oral motor structures and reflexes at follow-up period between the studied groups (n=80)

Oral motor structures and reflexes score	Control (n=40)		Study (n=40)		X^2	p
	n	%	n	%		
Pre implementation					5.507	0.064
Severe impairment	13	32.5	23	57.5		
Moderate impairment	18	45.0	13	32.5		
Normal or Mild impairment	9	22.5	4	10.0		
One week post implementation					8.856	0.012*
Severe impairment	13	32.5	5	12.5		
Moderate impairment	18	45.0	14	35.0		
Normal or Mild impairment	9	22.5	21	52.5		
Two weeks post implementation					5.583	0.061
Severe impairment	6	15.0	2	5.0		
Moderate impairment	15	37.5	9	22.5		
Normal or Mild impairment	19	47.5	29	72.5		
Friedman test	28.000		49.226			
p	<0.001*		<0.001*			

*Significant

Table (8): Comparison of the level of dysphagic patients' reported practice at follow up periods between studied groups (n=80)

Dysphagic patients' reported practice level	Control (n=40)		Study (n=40)		X^2	p
	n	%	n	%		
Pre implementation					FE	1.000
Inadequate practice	40	100.0	39	97.5		
Adequate practice	0	0.0	1	2.5		
One week post implementation					20.313	<0.001*
Inadequate practice	38	95.0	20	50.0		
Adequate practice	2	5.0	20	50.0		
Two weeks post implementation					6.241	0.012*
Inadequate practice	22	55.0	11	27.5		
Adequate practice	18	45.0	29	72.5		
Friedman test	32.444		43.786			
p	<0.001*		<0.001*			

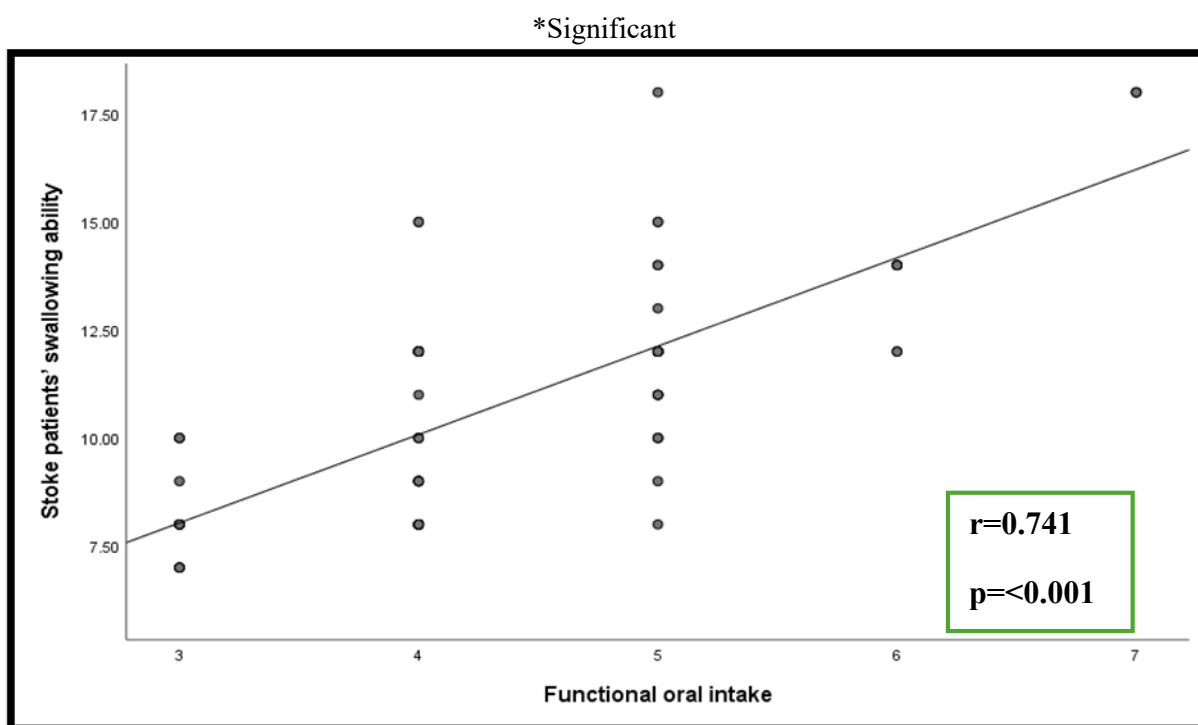


Figure (3): Correlation between functional oral intake and stroke patients' swallowing ability one week post implementation of the training program

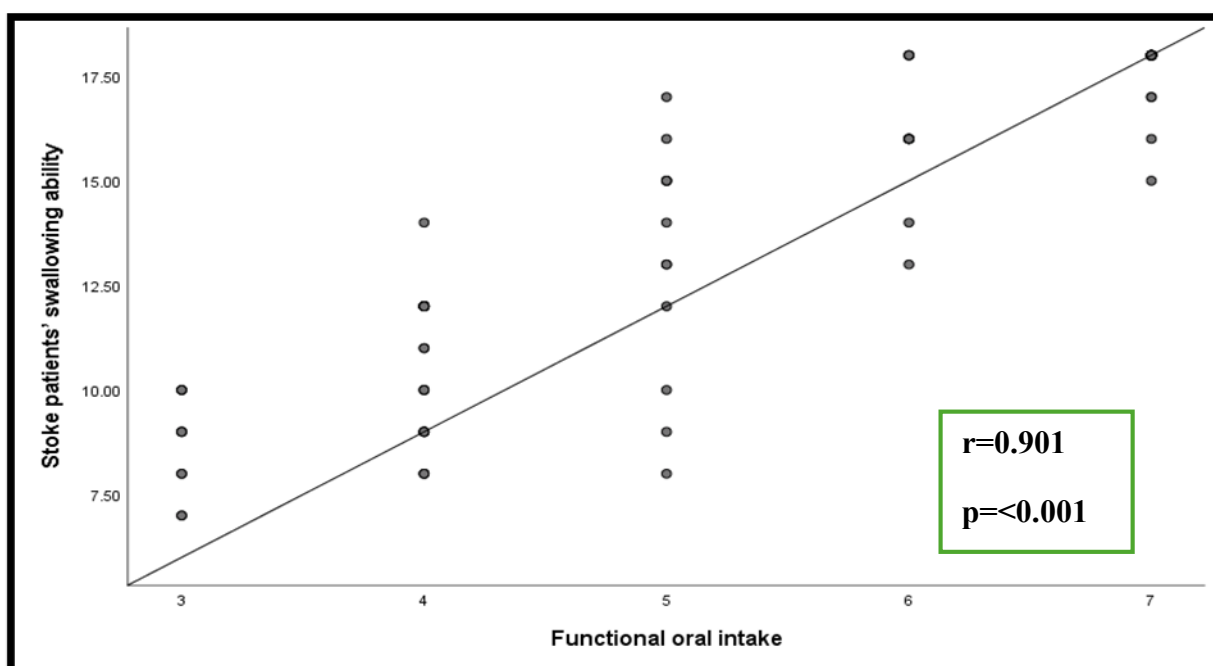


Figure (4): Correlation between functional oral intake and stroke patients' swallowing ability two weeks post implementation of the training program

Discussion

Dysphagia represents one of the most perilous sequelae of stroke, resulting in pulmonary infections and potential mortality among stroke survivors. Consequently, the implementation of thorough screening, assessment, and therapeutic interventions for dysphagia in patients experiencing acute stroke appears crucial for enhancing the quality of life of these individuals and may contribute to the prevention of related complication (**Bakhtiyari et al., 2022; Panebianco et al., 2020**)

In the present study, **socio-demographic characteristics** of the studied patients clarified that more than half of the control group aged >49-60 years with mean and SD of 49.75+6.40, and the same proportion were males, lived in urban areas, and in the study group, less than two thirds aged >49-60 years with mean and SD of 50.75+5.50, and the same proportion are males, lived in rural areas.

This may be attributed to several biological, behavioral, and social factors. Advancing age is a well-established risk factor for many chronic and neurological conditions due to age-related physiological changes, cumulative exposure to risk factors, and the gradual decline in body system functions. Additionally, the higher

proportion of males may be explained by their greater exposure to occupational stress and lifestyle risk factors such as smoking, physical stress, and unhealthy dietary habits, as well as a higher prevalence of certain chronic diseases among men.

This result is supported by the study performed by **Yousef et al., 2020** who mentioned that more than half in both studied groups were over 50 years old. Also, this finding is corroborated by **Murphy, & Werring, 2020** who indicated that older adults face a higher risk of stroke compared to younger adults. Also, these results are in agreement with the study performed by **Liu et al., 2025** who revealed that less than three quarters of the participants were males.

According to clinical data, the current study revealed that more than half of the control group were in the first stage of dysphagia, and almost two thirds of the study group were in the second stage. This may be due to differences in baseline swallowing impairment severity, as patients in the study group presented with more advanced dysphagia stages, making them more suitable for targeted swallowing training and more likely to demonstrate measurable improvements following the intervention.

This result is agreed with the study performed by **Mattavelli et al.,**

2023 who clarified that more than half of patients in the first stage of dysphagia. Also, these results are agreed with the study performed by **Parlak et al., 2021** who found dysphagia in more than half of patients within the first 5 days after stroke. Conversely, these results are inconsistent with the findings of **Mohebi et al., 2023** who clarified that one third of patients had dysphagia after acute ischemic stroke.

Regarding diet, the present study showed that more than half of the control group and the majority of the study group followed a semisolid diet as per physician order, while less than half of the control group and one fifth of the study group followed a liquid diet.

These results are similar with the study performed by **Maciejewska et al., 2024** who stated that there was a statistically significant relation between items of nutrition (normal diet, diet texture modification, nasogastric tube feeding, and Percutaneous Endoscopic Gastrostomy (PEG).

As related to the total score of functional oral intake at follow up periods between studied groups, the present study showed that before the implementation of the training program, more than half of the control group and more than two

thirds of the study group patients were dependent on tube nutrition, while less than half of the control group and less than third of the study group reported oral intake. Additionally, there was a statistically significant difference between the studied groups related to functional oral intake score at one and two weeks after implementation of the training program.

This may be due to the effectiveness of the swallowing training program in improving swallowing safety and efficiency, which enhanced patients' ability to tolerate oral intake and led to significantly higher functional oral intake scores in the study group compared with the control group during follow-up periods.

These results are supported by the study carried out by **Jongprasitkul, & Kitisomprayoonkul, 2020** who revealed that patients admitted at the FOIS score 1–3 (NG tube dependent), less than half improved to the FOIS score 4–6 (no NG tube dependent) before discharge. Also, these results are compatible with **Hafez, & Mohamed, 2023** who found a significant difference in functional oral intake between patients in study and control groups after implementing swallowing exercise training.

Considering the total scores of stroke patients' swallowing

ability, the current study showed that before implementation of the training program, all patients of both groups had unsatisfactory swallowing ability total scores. Additionally, there was a statistically significant difference between the studied groups at one and two weeks post implementation of the training program. This may be due to the structured swallowing training program effectively enhanced oral motor control, coordination, and swallowing efficiency in the study group.

This result is congruent with the study performed by **Abd Elsamea et al., 2024** who indicated that there was a statistically significant difference between the studied groups related to stroke patients' swallowing ability total scores. Conversely, these results are inconsistent with the findings of **Kim, & Park, 2019** who clarified that differences between the study and control groups were not statistically significant at one-week post-intervention.

Considering the total score of oral motor structures and reflexes at follow-up period of the studied groups, the current study proved that before implementation of the training program, less than one quarter of the control group and one tenth of the study group had normal

or mild impairment of the oral motor structures and reflexes. On the other hand, there was a statistically significant difference between the studied groups related to oral motor structures and reflexes score at one-week post implementation of the training program, in addition there were a high statistically significant differences within control and within study group patients.

This finding may be attributed to a structured, targeted dysphagia intervention can generate early improvements in oral–facial sensorimotor control and reflex responsiveness, and the effectiveness of the swallowing training program in enhancing neuromuscular strength, coordination, and reflex integrity of the oral motor structures.

This result finding is compatible with **Li et al., 2025** who reported significantly better swallowing performance when assessed at day 7 compared with usual care. Also, this result finding is agreed with **Zhang et al., 2023** who revealed that there was a statistically significant difference between the studied groups related to oral motor structures and reflexes.

Regarding the level of dysphagic patients' reported practice at follow up periods of the studied groups, the present study revealed

that before implementation of the training program, all participants of control group and almost all of the study group patients had inadequate reported practice level. On the other hand, there were statistically significant difference between the studied groups related to level of reported practice at one and two weeks post implementation of the training program. Additionally, there were a high statistically significant differences within control and within study group patients.

This may be due to the absence of prior training and structured guidance on swallowing care, resulting in inadequate baseline practice, while the implementation of the training program significantly improved patients' awareness, skills, and adherence to recommended swallowing practices over the follow-up periods.

This result is compatible with the study performed by **Zanaty et al., 2024** who revealed that there was a statistically significant difference in the severity of dysphagia in the study group patient throughout pre and post swallowing exercise intervention. Also, the findings are in the same line with **Gamal et al., 2020** who revealed that patient with a mild degree of dysphagia had improved functional oral intake after the exercises.

In relation to correlation between functional oral intake and stroke patients' swallowing ability one week post implementation of the training program, the current study illustrated that there was a highly statistically significant positive correlation between functional oral intake and stroke patients' swallowing ability at one week after implementation of the training program.

This result is contradicting with **Hazelwood et al. 2023** who demonstrated that there was a statistically significant negative correlation between functional oral intake and stroke patients' swallowing ability.

By evaluating correlation between functional oral intake and stroke patients' swallowing ability two weeks post implementation of the training program, the present study indicated that there was a highly statistically significant positive correlation between functional oral intake and stroke patients' swallowing ability where at two weeks post implementation of the training program.

These results are agreed with the study performed by **Mohammed et al., 2024** who clarified a highly statistically significant improvement in functional oral intake and swallowing ability after four weeks

intervention compared to the control group.

Conclusion

Based on the findings of the present study, it can be concluded that the implemented swallowing training program had a statistically significant and clinically meaningful positive effect on dysphagia and swallowing function among ischemic stroke patients. Prior to program implementation, more than half (57.5% and 67.5%) of the control and study groups respectively were on tube-dependent for nutrition. Following implementation, marked improvements were observed in the study group compared to the control group. After one week, almost all (97.5%) of the study group achieved oral intake, compared to more than two thirds (67.5%) in the control group, with a highly statistically significant difference ($p < 0.001$). After two weeks, more than half (57.5%) of the study group progressed to a total oral diet with no restrictions, whereas only one quarter (25.0%) of the control group remained tube-dependent, confirming sustained program effectiveness.

Regarding overall swallowing ability, following implementation, three quarter (75.0%) of the study group achieved satisfactory

swallowing scores two weeks post-intervention, compared to about one third (32.5%) of the control group patients ($p < 0.001$). In addition, the study group patients showed significant improvement in all swallowing ability parameters, including apraxia of swallow, oral residue, coughing/throat clearing, delayed pharyngeal swallow, reduced laryngeal elevation, and multiple swallows per bolus.

Furthermore, oral motor structures and reflexes showed notable enhancement, as near to three quarter (72.5%) of the study group patients demonstrated normal or mild impairment at two weeks post-training compared to less than half (47.5%) of the control group patients. Moreover, dysphagic patients' reported practice showed notable improvement, with near to three quarter (72.5%) of the study group patients reported adequate practice levels, versus less than half (45.0%) in the control group, indicating better adherence to the training. Overall, the swallowing training program proved to be an effective nursing intervention that significantly improved swallowing function, oral intake, oral motor structure and reflexes, and self-reported swallowing practices among ischemic stroke patients with dysphagia.

Recommendations

Based on the findings of the present study, the following recommendations are proposed:

Related to patient:

-Early assessment and rehabilitation of swallowing function should be initiated upon patient admission and continued during hospitalization and follow-up periods to maximize recovery outcomes.

-Regular follow-up and reassessment of swallowing ability are recommended after discharge to maintain the gained improvements and prevent deterioration of swallowing function.

-Educational booklets and audiovisual materials should be provided to patients and caregivers to reinforce correct swallowing practices and promote adherence to recommended feeding strategies at home after discharge.

Administrative:

-Standardized dysphagia management protocols should be developed and applied in neurological and medical units to ensure consistency of care and improve patient safety.

-Multidisciplinary collaboration among nurses, physicians, physiotherapists and speech-language pathologists is essential to optimize dysphagia management and improve patient outcomes.

Further researches:

-Further studies with larger sample sizes and longer follow-up periods are recommended to confirm the effectiveness of swallowing training programs and evaluate their long-term impact on quality of life and nutritional status.

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Effect of Early Lingual Oral-motor Exercise Program on Severity of Dysphagia and Swallowing Ability among Acute Stroke Patients

Shaimaa Ahmed Mohammed Abdel Eltawab¹ Abeer Farouk Elfar² Ahmed Rabea El Raghy Mostafa³Yousria Abdelsalam Seloma⁴

¹Lecturer of Medical Surgical Nursing, Faculty of Nursing, Fayoum University

²Lecturer of Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University, Egypt

³Lecture of Critical and Emergency care Nursing Delta University for Science and Technology

⁴Assistant Professor of Critical Care and Emergency Nursing, Faculty of Nursing / Cairo University

Corresponding author: Abeer Farouk Elfar

Email: abeer –Elfar @nursing.tanta.edu.eg

Abstract

Dysphagia is a critical, frequently occurring complication in the acute phase of stroke, affecting roughly 40%–60% of patients. Early detection and management of dysphagia are crucial in Intensive Care Unit (ICU) and stroke unit settings because of its link to aspiration pneumonia, malnutrition, and higher mortality rates. **Aim of the Study:** to investigate the effect of early lingual oral-motor exercise program on severity of dysphagia and swallowing ability among acute stroke patients. **Study design:** A quasi-experimental research design was utilized in this study. **Setting:** This study was conducted at the neurology intensive care unit& neurology department affiliated to Al-Azhar University Hospital. **Subjects:** A purposive sample of 60 adult patients who were divided into two equal groups (study & control). **Tools:** four three tools were utilized in this study. **Tool I:** Acute Stroke Patient's personal characteristics and medical data Tool: **Tool II:** Acute Stroke Patients' Dysphagia Screening Questionnaire (DSQ). **Tool III:** Acute Stroke Patients' Swallowing Ability Assessment Tool. **Results:** The findings showed that there was a significant statistical difference between intervention and control group post intervention regarding dysphagia severity, severe dysphagia dropped to 10% in the intervention group compared to 36.6% in control group and there was a significant statistical difference in swallowing ability mean scores between the intervention and control group 2 weeks and 1 month post intervention at $p= 0.006$ and <0.001 respectively. **Conclusion:** Acute stroke patients underwent early lingual oral motor exercise program showed less severe dysphagia and improved swallowing ability compared to acute stroke patients who received the routine hospital care only. **Recommendation:** Conducting the study again using a larger probability sample drawn from multiple regions in Egypt and under diverse conditions to generate more generalizable results. Early lingual oral motor exercise should be included in the routine post-acute stroke dysphagia management.

Keywords: Acute stroke, Dysphagia, Lingual Motor Exercise, Swallowing ability.

Introduction

Stroke represents a significant global health issue and is recognized as the second leading cause of disability and mortality worldwide **(Pham, Nguyen, Nguyen, & Le, 2024)**. Each year, approximately 13.7 million individuals experience a stroke globally, and nearly half of them develop varying degrees of functional impairment, which markedly reduces their quality of life. Among these complications, oropharyngeal dysphagia which is one of the most common, occurring in up to 80% of stroke patients. Individuals with this condition often present with symptoms such as aspiration and pharyngeal residue **(Gao et al., 2023)**.

Moreover, dysphagia is a common and significant complication following stroke, affecting approximately 50%–80% of patients. Post-stroke dysphagia (PSD) can result in serious complications, including pneumonia and malnutrition, which negatively impact quality of life and may lead to poor outcomes or even death. These physical and psychological consequences pose considerable challenges for both patients and healthcare providers **(Wang et al., 2025)**.

Furthermore, dysphagia is defined as a disruption in the movement of

food, liquids, and saliva from the mouth to the stomach. Because science swallowing is controlled by an extensive network involving the cortex, subcortex, and brainstem, dysphagia frequently develops during the acute phase of stroke **(Labeit et al., 2024)**. Swallowing serves as the process of moving liquids or solids from the oral cavity to the stomach via the pharynx and esophagus and is a complex sensorimotor activity requiring coordinated action of the muscles of the mouth, tongue, pharynx, larynx, and esophagus **(Yosrika et al., 2023)**.

Despite advances, the management of dysphagia in acute stroke patients, particularly those in ICU settings, remains challenging. The specific effectiveness of lingual motor exercises on dysphagia severity has not been conclusively established **(Smaoui et al., 2020)**. Existing literature reveals a knowledge gap regarding optimal exercise protocols, dosage, and their direct impact on swallowing biomechanics and clinical outcomes **(Krekeler et al., 2021)** **(Al-Apdarrovis et al., 2024)**. Controversies persist about whether strength training translates into functional swallowing improvements or merely increases muscle force without clinical benefit **(Smaoui et al., 2020)**. This gap has

critical implications, as untreated or inadequately managed dysphagia leads to increased morbidity and mortality in ICU stroke patients **(Brodsky et al., 2020)**.

Lingual motor exercise for dysphagia severity in acute stroke patients in intensive care units (ICU) has emerged as a critical area of inquiry due to the high prevalence and severe consequences of dysphagia in stroke patients. Dysphagia affects up to 50% of acute stroke patients and is associated with increased risks of aspiration pneumonia, malnutrition, prolonged hospitalization, and mortality. Over the past two decades, the field has evolved from primarily compensatory strategies to incorporating rehabilitative exercises targeting muscle strength and coordination **(Duncan et al., 2020)**.

Also, Lingual motor exercises have been introduced as a therapeutic approach for improving swallowing disorders, particularly because decreased tongue pressure has been observed in adults with neurogenic dysphagia **(Steele, 2016)**. A systematic review conducted by **McKenna et al. (2017)** reported consistent evidence that isometric lingual strength training can lead to increased tongue strength. However, the review also highlighted that it is still uncertain whether these

improvements in tongue strength translate into better swallowing function.

The tongue is crucial for swallowing due to its complex muscular structure, which enables rapid and flexible movements during oral activities. During the act of swallowing, the tongue's intrinsic and extrinsic muscles work together to control the bolus, position it correctly, and generate the force needed to propel and push it through the oropharynx. Recent studies have reported encouraging findings regarding tongue-strengthening exercises, demonstrating their effectiveness in improving tongue strength and endurance among both healthy individuals and those with swallowing disorders. Consequently, lingual resistance training protocols have increasingly been incorporated into swallowing rehabilitation programs. Nevertheless, the extent to which these improvements translate into enhanced swallowing function remains uncertain **(Smaoui et al., 2020)**.

Critical care nurses play a vital role in recognizing dysphagia and post-stroke dysphagia to determine appropriate interventions for nutritional management, adequate hydration, and the prevention of aspiration. These interventions include conducting early dysphagia

screening within the first 24 hours after stroke, modifying food consistency through thickened diets based on nutritionist recommendations, performing laryngeal elevation exercises, applying peripheral stimulation techniques, adjusting patient posture, and providing education regarding safe eating and drinking practices (Syahrin et al., 2022).

Additionally, critical care nurses play a critical role in the early identification of swallowing difficulties during the acute phase of stroke. Bedside swallowing screening should be performed by trained nurses before initiating oral intake. Early detection helps prevent serious complications such as aspiration pneumonia, malnutrition, and dehydration. They should collaborate with speech and language therapists for comprehensive swallowing evaluation. Critical care nurses must ensure safe feeding techniques, including modified food textures and thickened liquids as prescribed. Continuous monitoring of nutritional status and fluid balance is a key nursing function. Patient and family education regarding safe swallowing strategies is an important nursing intervention. Ongoing reassessment by nurses supports recovery, prevents complications, and

improves overall stroke outcomes (Madu, & Ajibade, 2025).

Moreover, critical care nurses play a central role in implementing compensatory and rehabilitative interventions. Key nursing responsibilities include adjusting patient positioning during feeding, recommending texture-modified diets, improving oral hygiene, administering thickened liquids, managing enteral feeding, and modifying medication forms to reduce aspiration risk. Critical care nurses also should provide swallowing rehabilitation exercises such as effortful swallow and tongue-strengthening maneuvers (Lu et al., 2025). Therefore, the aim of this study is to investigate the effect of early lingual oral-motor exercise program on severity of dysphagia and swallowing ability among acute stroke patients.

Significance of the study:

Stroke is recognized as the second leading cause of death worldwide, affecting nearly 13.7 million people each year (Maciejewska et al., 2024). Dysphagia is a common complication among stroke patients, with reported prevalence rates ranging from 19% to 80% (Takizawa et al., 2016). Moreover, more than 75% of individuals with early post-stroke dysphagia (PSD) experience moderate to severe

swallowing impairment (**Rommel & Hamdy, 2016**), which markedly affects their daily activities and overall quality of life. Currently, there are no specific pharmacological treatments available for PSD; therefore, existing management strategies mainly rely on interventions such as peripheral and central stimulation techniques, resistance training of swallowing muscles, and traditional Chinese acupuncture (**Xu et al., 2023**).

Lingual muscle exercises used for swallowing have become widely accepted in the management of post-stroke dysphagia (PSD) because of their practicality and low cost, showing considerable clinical benefits (**Cheng et al., 2021**). As an important non-pharmacological approach, these exercises can enhance quality of life among the general population and also improve motor control of the related muscle groups in individuals recovering from stroke (**Hanssen et al., 2022**).

Through practice in intensive care units, it was observed that, high rates of dysphagia among patients with acute stroke, which can affect more than half of cases in the initial post-stroke phase directly impacts the efficiency of the oral phase of swallowing, increasing the risk of aspiration pneumonia, malnutrition,

and dehydration, and delaying the initiation of safe oral feeding. Furthermore, current nursing interventions often focus more on preventing complications than on early rehabilitation of the swallowing muscles, highlighting the need for effective, evidence-based nursing interventions such as lingual motor exercises.

This research hopefully will lead to improve oral muscle strength, reduce the severity of dysphagia, decrease the rates of aspiration pneumonia and accelerate the recovery of the ability to safely feed orally. This may also lead to improved nutritional status, support for neurological recovery, enhanced quality of life, and reduced hospital stays, which positively impacts overall treatment outcomes for acute-stage patients. Also, this research may support expanding the nursing role in early rehabilitation within critical care units by incorporating tongue strengthening exercises into standard care protocols. It also contributes to strengthening evidence-based practice, improving nursing proficiency in assessing and treating dysphagia, and reducing the financial burden resulting from suction complications and prolonged hospital stays.

Aim of the Study:

To investigate the effect of early lingual oral-motor exercise program on severity of dysphagia and swallowing ability among acute stroke patients

Research Hypotheses:

H1: Patients who are exposed to early lingual oral-motor exercise program are expected to have less severe dysphagia than those who don't expose.

H2: Patients who are exposed to early lingual oral-motor exercise program are expected to have improved swallowing ability than who don't exposed

Subjects and Methods:

Study design:

This study employed a quasi-experimental pretest-post test design with a control group. In this approach, the researcher assigns one group to receive the intervention while another group with similar characteristics serves as the control. Both groups first undergo a pretest assessment, then the intervention is administered to the experimental group, and finally, both groups complete an assessment (Gray & Grove, 2023).

Study Setting:

This study was conducted at the neurological intensive care unit and neurology department affiliated to Al-Azhar University Hospital. The intensive care unit consists of 3

ICUs: I, II, and III. The total bed capacities of these ICUs are 32 beds. These ICUs are well equipped with advanced machines, equipment, and the manpower required for patient care. The nurse-patient ratio in the ICU is nearly 1:2.

Study Subjects:

A purposive sample of 60 adult patients admitted to the ICU acute stroke, who met the inclusion and exclusion criteria, was selected. The sample size was determined using the Epi-Info 7 statistical software based on the total ICU admissions for the year 2024 ($n = 150$). The calculation parameters included a 95% confidence level (Z), an error margin of 0.05 (d), and a population size of 150 (p).

The sample was selected according to the following criteria; **Inclusion criteria:** Patients of both genders, after 24 hrs of admission, conscious, aged between 21 and 60 years, and agree to participate in the study.

Exclusion criteria: Patients with a history of seizures, head injury, or neurological disorders other than stroke; those who had undergone neurosurgery, oral or maxillofacial surgery; individuals with dysphagia prior to stroke; patients with gastrointestinal disturbances; those receiving hypnotic or sedative medications; patients with a

tracheostomy tube; and those with limited neck mobility.

The participants were randomly and alternatively assigned into two equal groups, with 30 patients in each group, as follows:

Control group: - consisted of 30 patients who received routine hospital care
Study group: consisted of 30 patients who received early lingual oral-motor exercise program that was implemented by the researchers.

Tools of Data Collection:

The required data will be collected through the following tools:

Tool I: Acute Stroke Patient's personal characteristics and medical data Tool:

This tool was developed by researchers to assess the patients' personal characteristics and medical data. It consists of two parts:

Part I: Acute Stroke Patients' Demographic Data: Such as age, gender, educational level, marital status ...etc)

Part II: Acute Stroke Patients' medical Data: Such as, history of prior cerebrovascular stroke, type of stroke, the affected cerebral hemisphere (left or right), speech characteristics (dysarthria, receptive aphasia, or expressive dysphasia), and the prescribed diet consistency (liquid, semisolid, etc.).

Tool II: Acute Stroke Patients' Dysphagia Screening

Questionnaire (DSQ). This tool was adopted from (Kunieda et al, 2013). It was used to assess the level of dysphagia. The DSQ consists of 15 questions about dysphagia, three points Likert scale was used in the tool scoring system as follows: "1= sever symptom "mild symptom = 2" and "no symptom= 3"

Scoring system:

15-24: severe dysphagia

25-34: mild dysphagia

35-45: no dysphagia

Tool III: Acute Stroke Patients' Swallowing Ability Assessment

Tool: consists of two parts;

Part I: acute stroke patients' oral motor structure assessment and

reflexes: This part was developed by Kim (2015) and adapted by the researchers to assess the oral motor structures and reflexes before and after the lingual exercises. It includes 8 items covering the following; tongue movement, lip closure and strength, jaw movement and strength, soft palate elevation, gag reflex, cough reflex, sensation in the oral cavity and chewing ability.

Scoring system

-Present: 1

-Absent: 0

Part II: acute stroke patients' swallowing ability checklist: This part was adopted from the

Northwestern Dysphagia Patient Checklist, and updated by **Audag et al. (2019)**. This screening tool is designed to evaluate patients' swallowing ability across various food types and quantities. It includes six items: swallowing apraxia, oral residue, coughing or throat clearing, delayed pharyngeal swallow, reduced laryngeal elevation, and multiple swallows per bolus. Each item is rated on a three-point Likert scale, where 1 = never, 2 = sometimes, and 3 = always.

Scoring System

The checklist included six items, with a total possible score ranging from 6 to 18. The overall score was obtained by adding the scores of all items, with higher scores reflecting a greater severity of swallowing impairment.

The total scores were interpreted as follows:

-1–6: Mild dysphagia

-7–12: Moderate dysphagia

-13–18: Severe dysphagia

Validity and reliability of tools:

Content validity: Tools of the study was assessed by a panel of nine experts, including four specialists in emergency and critical care nursing, three intensivists, and two experts in medical biostatistics.

Reliability: Tools reliability was evaluated using Cronbach's alpha test. The results were 0.895, 0.972,

and 0.889 for tools I, II, and III respectively, indicating a high level of reliability.

Pilot study:

A pilot study was conducted on 10% of the study subject before the implementation of the main study to assess the clarity, applicability, and feasibility of the tool items. Data obtained from the pilot sample were excluded from the final study analysis.

Ethical and legal Considerations:

Ethical approval for the study was granted by the Institutional Review Board of Damietta Faculty of Medicine, Al Azhar University, under code DFM-IRB 00012367-25-05-004.

Administrative permission to conduct the study was obtained from the hospital administrators of Al-Azhar University.

The study was designed to ensure that no harm would come to any of the participants.

Informed consent was obtained from each patient or their family after a clear explanation the purpose of study.

Procedure of data collection:

The study was applied in three phases; preparation, implementation and evaluation phase

Preparation phase:

This phase was concerned with preparing and testing the study tools,

obtaining the different approvals to conduct the study and ended by conducting the pilot study.

Implementation phase:

Data was collected from June 2025 to December 2025. Once formal approval was obtained to continue the research, the researchers were approached the head nurses of critical care unit to obtain a list of patients with acute stroke. Then the researchers reviewed patients' data for inclusion criteria to select those who are eligible for the study. Then, patients or relatives (in case of inability to sign consent or cannot read and write) who agreed to engage in the study were interviewed individually by the researchers to clarify the nature and aim of the research and establish rapport and cooperation then written consents were obtained. Then patients' personal characteristics and medical data sheet (tool I) was filled out for all patients (60 patients). This tool took about 15 min to be filled out. Patients were divided into two matched groups 30 patients in each group (control and intervention group). Matching done based on gender, age, type of stroke, site of stroke, and comorbidity diseases. All patients were subjected to the routine hospital care and early lingual oral motor exercise was implemented for the intervention

group only. The control group (who received routine hospital care only) was collected first to avoid contamination of data. Tool II and III were filled out for the control and intervention group before and after the implementation of the lingual exercises for the intervention group. Tool II took about 30 min to be completed and too III took about 45 min to be filled out. After finishing the control group, implementation of the lingual exercises for the intervention group was started. The exercise was repeated three times per day in the morning and at afternoon for seven consecutive days for the intervention group either in the ICU or in the neurology department if the patient is transferred. Furthermore, the critical care nurses/ family caregivers (when possible) were advised to be present at the side of the patients during each meal for the purpose of following up the exercise technique. The lingual exercise for the intervention group was done as follows;

Steps of lingual oral-motor exercise

-Ask the patient to Warm-up & Mobility (Stretching):

Tongue Protrusion: Stick tongue out as far as possible, hold 2s, return.

Side-to-Side: Move tongue tip to each corner of the mouth.

Up/Down: Touch nose, then chin (or upper/lower lips).

-Strength & Endurance Training (Resistance):

Tongue Press (Palate): Push tongue against the hard palate, holding for a few seconds.

Tongue against Resistance: Push tongue against a tongue depressor or researcher's finger.

Endurance: Focus on sustained repetitions to build stamina for meals (swallowing is endurance-based).

The lingual oral motor exercise was done in about 30 min for each patient in the intervention group.

-Functional Movements:

Tongue retraction: Pull tongue back into the mouth.

Bolus Control: Practice moving food/liquid within the mouth (often with thickened liquids initially). Place tongue bulb on early lingual surface of the patients and patients instructed to press his tongue against the roof of the mouth as hard as he/she can for about 2sec

Evaluation phase:

Both groups were assessed for improving dysphagia and swallowing ability level by using tool II and III, after two weeks and after one month either in the ICU or after patient's transfer to the

neurology department or discharge during follow up visits.

Statistical Analysis: The collected data scored, tabulated and analyzed by personal computer using Statistical Package for the Social Sciences program (SPSS) software version 22. Descriptive statistics such as means and standard deviations, frequency and percentage were applied. Tests of significance were performed to test the study hypotheses (i.e. paired and unpaired t- test, chi square test and ANOVA test). Pearson's correlation coefficient was applied between quantitative variables. A significant level value was considered when $p < 0.05$. The smaller the P- value obtained, the more significant is the result.

Results:

Table (1): Distribution of the intervention and control group according to their Demographic characteristics. This table showed that, no significant statistical differences between the intervention and control group in relation to age, gender, education, place of residence, occupation, marital status and number of physician visits at p -values > 0.05 for all. **Table (2): Distribution of the intervention and control group according to their Medical Data.** This table revealed that, no statistically

significant differences were found between intervention and control group regarding family history, previous stroke, stroke type, affected side, speech pattern and recommended food texture at $p > 0.05$ for all.

Table (3): Comparison of dysphagia level in the intervention and control group pre and post the intervention. This table revealed that, there was no significant statistical difference between intervention and control groups regarding dysphagia severity pre the intervention while there was a significant statistical difference between them post intervention. Severe dysphagia dropped to 10% in the intervention group compared to 36.6% in control group. **Table (4): Comparison of oral motor structure assessment and reflexes in the intervention and control group pre and post the intervention.** There was no significant statistical difference between the intervention and control group in relation to oral motor structure assessment and reflexes pre- program while there was a significant statistical difference between the two groups post intervention with improvement in the tongue movement, soft palate elevation, gag reflex, sensation in oral cavity and chewing ability

among the intervention group as compared to the control group at $p=0.023, 0.038, 0.037, 0.05$ and 0.005 respectively. **Table (5): Comparison of swallowing ability in the intervention and control group pre, post 2 weeks and post 1 month,** showed there was no significant statistical difference in swallowing ability between the intervention and control group pre the intervention, while there was highly significant statistical difference between them post 2 weeks and one month from the intervention. **Table (6): Differences in relation between Dysphagia and swallowing ability mean scores and studied patients' demographic data in the intervention and control group post intervention**

This table revealed that, patients less than 60 years showed better swallowing ability also male patients had better swallowing ability and lower dysphagia in the intervention group while there was no effect of other demographic variables.

Table (7): Differences in relation between Dysphagia and swallowing ability mean scores in relation to the studied patients' medical data in the intervention and control group. This table showed that, patients with no history of pervious stroke had better swallowing ability and lower dysphagia also patients on

semisolid food showed better swallowing ability and lower dysphagia while other medical data had no effect. **Figure (1)** illustrated that, there was a significant statistical difference in the mean dysphagia score between the intervention and control group post the intervention at $p= 0.002$. **Figure (2)** illustrated that, there was a significant statistical difference in swallowing ability mean scores between the intervention and control group 2 weeks and 1 month post intervention at $p= 0.006$ and <0.001 respectively. So, hypotheses 1& 2 can be supported.

Personal and medical data of the intervention and control group (table 1 &2) are related.

Table (1): Distribution of the Intervention and Control group according to their Demographic characteristics n= 60

Variable	Intervention group		Control group		Test of significance	
	n=30	%	n=30	%	X ² /t test	P
Age						
30 <35 years	1	3.3	3	10.0	1.305	0.521
35 < 60 years	10	33.3	11	36.7		
> 60 years	19	63.3	16	53.3		
Mean ±SD	58.47±5.92		57.04±4.63		0.156	0.877
Gender						
Male	19	63.3	20	66.7	0.073	0.787
Female	11	36.7	10	33.3		
Educational level						
Unable to read and write	11	36.7	12	40.0	0.078	0.962
Secondary education	15	50.0	14	46.7		
High education	4	13.3	4	13.3		
Place of Residence						
Rural	20	66.7	18	60.0	0.287	0.592
Urban	10	33.3	12	40.0		
Occupation						
Working	11	36.7	9	30.0	0.300	0.584
Not working	19	63.3	21	70.0		
Marital status						
Married	19	63.3	17	56.7	0.364	0.834
Widow	9	30.0	10	33.3		
Divorced	2	6.7	3	10.0		
Number of physician visits						
Daily	2	6.7	0	0.0	2.069	0.355
Weekly	13	43.3	14	46.7		
Monthly	15	50.0	16	53.3		

X²= Chi-Square test

Table (2): Distribution of the intervention and control group according to their Medical Data n=60

Variable	Intervention group		Control group		Test of significance	
	n=30	%	n=30	%	X ²	P
Family history of stroke						
No	24	80.0	27	90.0	1.176	0.278
Yes	6	20.0	3	10.0		
Previous history of stroke						
No	26	86.7	24	80.0	0.480	0.488
Yes	4	13.3	6	20.0		
Type of current stroke						
Ischemic	21	70.0	19	63.3	0.300	0.584
Hemorrhagic	9	30.0	11	36.7		
Affected side						
Right hemisphere	23	76.7	20	66.7	0.739	0.390
Left hemisphere	7	23.3	10	33.3		
Pattern of speech						
Dysarthria	16	53.3	15	50.0	1.500	0.472
Receptive aphasia	12	40.0	10	33.3		
Expressive aphasia	2	6.7	5	16.7		
Recommended current food texture						
Liquid	4	13.3	5	16.7	0.327	0.849
Thick liquid	12	40.0	10	33.3		
Semi-solid	14	46.7	15	50.0		

X²= Chi-Square test**Testing of Research Hypotheses:**

H1: Patients with acute stroke who receive early lingual oral-motor exercise program will exhibit less severe dysphagia than those who don't receive it. Tables 3 and figure 1 are related to this hypothesis.

Table (3): Comparison of dysphagia level in the intervention and control group pre and post the intervention

Variable	Intervention group		Control group		Test of significance	
	n=30	%	n=30	%	X ² / t	P
Pre						
Severe dysphagia	15	50.0	14	46.7	0.388	0.824
Mild dysphagia	12	40.0	14	46.7		
No dysphagia	3	10.0	2	6.6		
Mean ±SD	24.77±6.67		24.83±6.25		0.040	0.968
Post						
Severe dysphagia	3	10.0	11	36.6	9.725	0.008*
Mild dysphagia	12	40.0	14	46.7		
No dysphagia	15	50.0	5	16.7		
Mean ±SD	31.73±7.33		24.67±7.25		3.223	0.002**

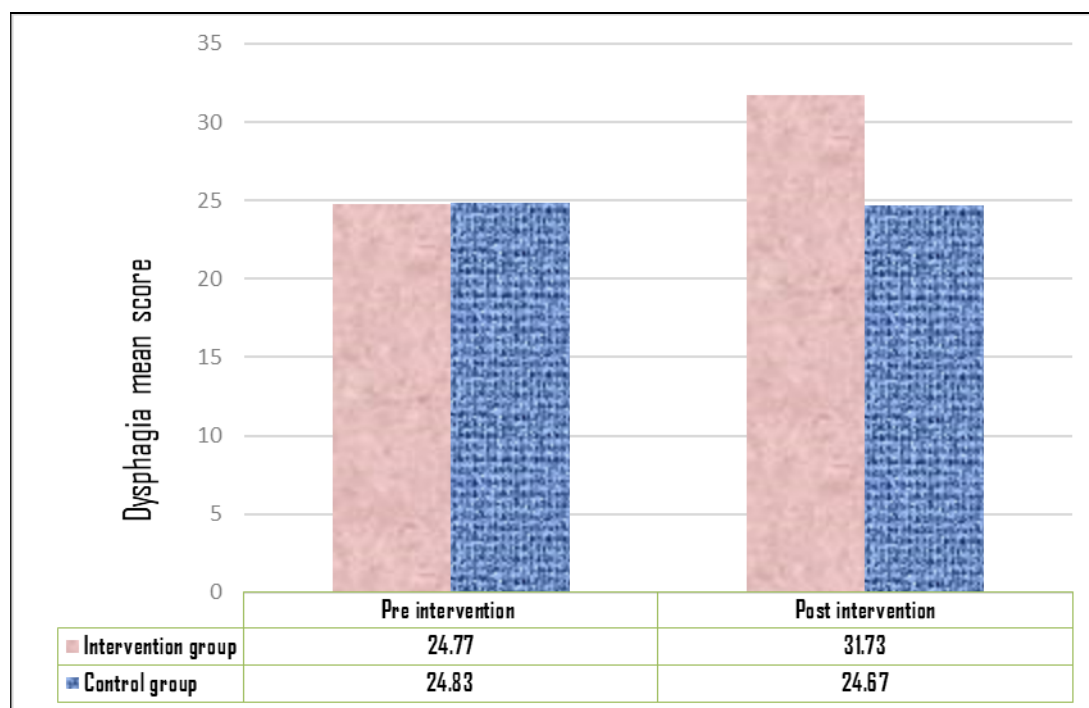


Figure (1): Dysphagia mean score in the intervention and control group pre and post the intervention

H2 states Patients with acute stroke who receive early lingual oral-motor exercise program will exhibit improving swallowing ability than those who don't receive it. Table 4&5 and figure 2 are related to this hypothesis.

Table (4): Comparison of oral motor structure assessment and reflexes in the intervention and control group pre and post the intervention

Variable	Intervention group		Control group		Test of significance	
	n=30	%	n=30	%	X ²	P
Pre						
Tongue movement (forward, upward, side to side)	21	70.0	22	73.3	0.082	0.774
Lip closure and strength	19	63.3	18	60.0	0.071	0.791
Jaw movement and strength	22	73.3	23	76.7	0.089	0.766
Soft palate elevation	19	63.3	21	70.0	0.300	0.584
Gag reflex	17	56.7	15	50.0	0.268	0.605
Cough reflex	25	83.3	23	76.7	0.417	0.519
Sensation in the oral cavity	21	70.0	20	66.7	0.077	0.781
Chewing ability	14	46.7	12	40.0	0.271	0.602
Post						
Tongue movement (forward, upward, side to side)	29	96.7	23	76.7	5.192	0.023*
Lip closure and strength	27	90.0	23	76.7	1.920	0.166
Jaw movement and strength	27	90.0	25	83.3	0.577	0.448
Soft palate elevation	28	93.3	22	73.3	4.320	0.038*
Gag reflex	26	86.7	19	63.3	4.356	0.037*
Cough reflex	27	90.0	25	83.3	0.577	0.448
Sensation in the oral cavity	27	90.0	21	70.0	3.750	0.05*
Chewing ability	26	86.7	16	53.3	7.937	0.005**

Table (5): Comparison of swallowing ability in the intervention and control group pre, post 2 weeks and post 1 month

Variable	Intervention group						Control group						Test of significance	
	Never		Sometimes		Always		Never		Sometimes		Always		X ²	P
	No	%	No	%	No	%	No	%	No	%	No	%		
Pre intervention														
Apraxia of swallow	10	33.3	6	20.0	14	46.7	12	40.0	5	16.7	13	43.3	0.310	0.857
Oral residue	12	40.0	4	13.3	14	46.7	13	43.3	3	10.0	14	46.7	0.722	0.688
Coughing/throat clearing	5	16.7	3	10.0	22	73.3	4	13.3	2	6.7	24	80.0	0.398	0.820
Delayed pharyngeal swallow	11	36.7	5	16.7	14	46.7	10	33.3	4	13.3	16	53.3	0.292	0.864
Reduced laryngeal elevation	20	66.7	4	13.3	6	20.0	17	56.7	6	20.0	7	23.3	0.720	0.698
Multiple swallows per bolus	13	43.3	9	30.0	8	26.7	15	50.0	10	33.3	5	16.7	0.888	0.642
Post 2 weeks														
Apraxia of swallow	20	66.7	5	16.7	5	16.7	7	23.3	10	33.3	13	43.3	11.481	0.003**
Oral residue	18	60.0	6	20.0	6	20.0	6	20.0	11	36.7	13	43.3	10.050	0.007**
Coughing/throat clearing	18	60.0	5	16.7	7	23.3	3	10.0	10	33.3	17	56.7	16.548	<0.001**
Delayed pharyngeal swallow	17	56.7	8	26.7	5	16.7	8	26.7	5	16.7	17	56.7	10.478	0.005**
Reduced laryngeal elevation	21	70.0	5	16.7	4	13.3	9	30.0	10	33.3	11	36.7	9.733	0.008**
Multiple swallows per bolus	23	76.7	5	16.7	2	6.7	12	40.0	11	36.7	7	23.3	8.485	0.014*
Post 1 month														
Apraxia of swallow	25	83.3	3	10.0	2	6.7	10	33.3	9	30.0	11	36.7	15.659	<0.001**
Oral residue	23	76.7	4	13.3	3	10.0	10	33.3	10	33.3	10	33.3	11.462	0.003**
Coughing/throat clearing	22	73.3	3	10.0	5	16.7	6	20.0	7	23.3	17	56.7	17.288	<0.001**
Delayed pharyngeal swallow	20	66.7	5	16.7	5	16.7	11	36.7	5	16.7	14	46.7	6.876	0.032*
Reduced laryngeal elevation	25	83.3	3	10.0	2	6.7	14	46.7	9	30.0	7	23.3	8.880	0.012*
Multiple swallows per bolus	25	83.3	3	10.0	2	6.7	30	100.0	15	50.0	11	36.7	7.738	0.021*

X²= Chi-Square test

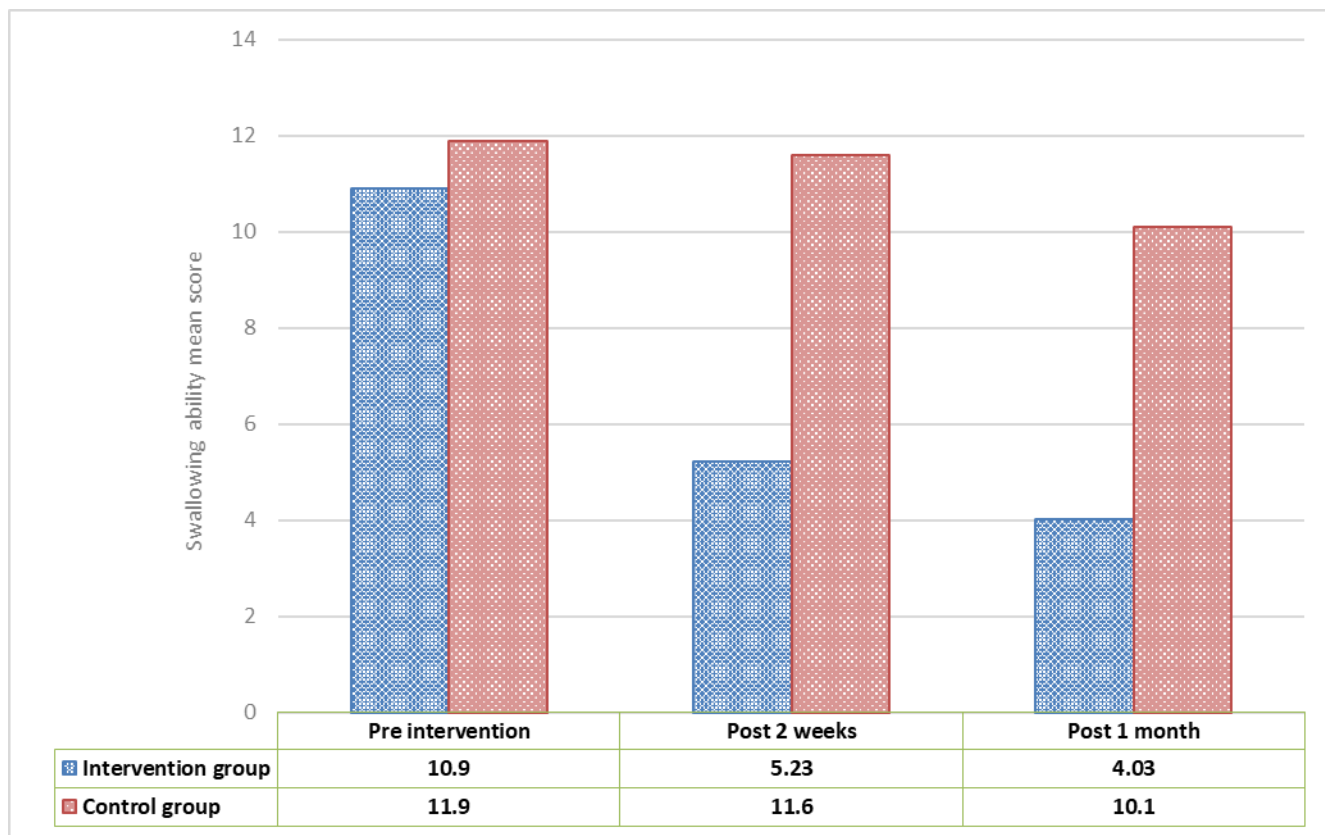


Figure (2): Swallowing ability mean score in the intervention and control group pre, 2 weeks and 1 month post the intervention

Table (6): Differences in relation between Dysphagia and swallowing ability mean scores and studied patients' demographic data in the intervention and control group post intervention

Variable	Dysphagia*		Swallowing ability [#]	
	Intervention group	Control group	Intervention group	Control group
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
Age				
30 <35 years	27.8±5.79	26.91±4.28	6.07±4.04	11.00±0.00
35 < 60 years	23.47±6.8	24.19±7.38	8.27±2.76	12.00±4.70
> 60 years	19.00±0.00	20.67±3.79	10.00±4.90	12.11±4.42
Test of significance (P)	1.869 (0.174)	1.394 (0.265)	2.968 (0.042) *	0.615 (0.513)
Sex				
Male	31.45±4.34	30.9±4.38	6.64±0.92	14.1±3.6
Female	20.89±4.25	21.8±4.64	9.6±0.97	14.47±3.36
Test of significance (P)	6.502 (<0.001) **	7.531(<0.001) **	5.153(<0.001) **	0.116 (0.91)
Educational level				
Unable to read and write	24.36±8.29	26.08±5.79	10.42±4.68	12.64±5.39
Secondary education	24.4±6.34	24.64±6.5	11.53±4.56	12.29±4.97
High education	27.25±2.06	21.75±7.27	9.00 ± 2.45	12.75±3.59
Test of significance (P)	0.304 (0.740)	0.718 (0.497)	0.875 (0.428)	0.645 (0.533)
Place of Residence				
Rural	24.3±6.47	24.56±6.37	11.4±4.82	11.61±4.88
Urban	25.7±7.33	25.25±6.33	11.58±4.52	12.00±4.67
Test of significance (P)	0.535 (0.597)	0.325 (0.748)	0.293 (0.772)	0.016 (0.988)
Occupation				
Working	24.09±6.63	23.22±4.68	12.00±4.29	13.00±4.21
Not working	25.16±6.85	25.52±6.80	11.37±5.01	11.00±4.81
Test of significance (P)	0.416 (0.681)	0.921 (0.365)	0.350 (0.729)	1.081 (0.289)
Marital status				
Married	24.68±6.52	27.35±6.15	10.24±3.77	13.00±4.31
Widow	26.22±7.16	21.40±4.40	12.89±5.69	15.00±3.16
Divorced	19.00±5.66	22.00±7.21	13.67±6.66	16.00±0.00
Test of significance (P)	0.960 (0.396)	1.054 (0.362)	1.815 (0.135)	1.436 (0.203)
Number of physician visits				
Daily	15.50±0.71	---	15.00±0.00	---
Weekly	25.69±5.28	24.86±5.89	10.38±5.20	10.29±4.05
Monthly	25.20±7.42	24.81±6.75	12.75±4.97	11.80±3.90
Test of significance (P)	2.267 (0.123)	0.019 (0.985)	2.555 (0.096)	2.175 (0.151)

*Higher scores denotes lower dysphagia *Lower scores denotes better swallowing ability

Table (7): Differences in relation between Dysphagia and swallowing ability mean scores in relation to the studied patients' medical data in the intervention and control group n=60

Variable	Dysphagia*		Swallowing ability [#]	
	Intervention group	Control group	Intervention group	Control group
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
Family history of stroke				
No	22.50±6.45	22.17±5.88	11.46±4.79	11.25±4.46
Yes	25.12±6.76	25.50±6.28	12.50±4.51	13.00±5.62
Test of significance (P)	0.724 (0.475)	1.175 (0.250)	0.406 (0.688)	0.818 (0.420)
History of Previous stroke				
No	33.5±4.81	35.67±5.13	10.22±4.49	13.00±4.19
Yes	22.58±5.12	23.63±5.15	6.00±0.00	6.00±0.00
Test of significance (P)	4.719 (<0.001)**	3.840 (0.001)**	4.037(<0.001)**	2.362 (0.025)*
Type of current stroke				
Ischemic	24.24±7.25	24.32±5.57	10.89±4.99	10.55±4.91
Hemorrhagic	26.00±5.27	25.73±7.5	12.33±4.49	12.21±4.53
Test of significance (P)	0.656 (0.517)	1.324 (0.196)	0.589 (0.561)	0.942 (0.354)
Side of affection				
Right hemisphere	22.71±7.16	24.45±6.16	10.96±4.58	11.25±4.74
Left hemisphere	25.39±6.56	25.60±6.70	12.3±4.64	13.71±4.79
Test of significance (P)	0.927 (0.362)	1.382 (0.178)	0.468 (0.643)	0.575 (0.570)
Pattern of speech				
Dysarthria	22.94±6.55	23.87±4.93	12.94±4.52	12.13±4.66
Receptive aphasia	26.33±6.80	26.10±7.72	10.58±4.76	10.8±4.42
Expressive aphasia	30.00±1.41	25.20±7.53	7.00±0.00	11.60±5.90
Test of significance (P)	1.612 (0.218)	2.024 (0.152)	0.376 (0.690)	0.233 (0.794)
Recommended current food texture				
Liquid	21.86±4.88	21.7±6.45	11.29±4.3	13.8±4.39
Thick liquid	25.00±6.35	24.4±4.63	9.00±5.03	11.73±4.53
Semi-solid	34.25±4.43	32.4±4.28	5.80±1.10	7.50±1.73
Test of significance (P)	7.957 (0.002)**	2.848 (0.05)*	7.000 (0.004)**	4.754 (0.017)*

*Higher scores denotes lower dysphagia *Lower scores denotes better swallowing ability

Discussion:

The effectiveness of early lingual oral-motor exercise programs remains unclear due to a significant lack of research on their impact. Therefore, this study aimed to investigate the effect of early lingual oral-motor exercise program on severity of dysphagia and swallowing ability among acute stroke patients

Regarding demographic and medical variables of the intervention and control groups, the study showed that, no significant statistical differences between the intervention and control group in relation to age, gender, education, place of residence, occupation, marital status and number of physician visits. Also, there were no statistically significant differences between both groups regarding family history, previous stroke, stroke type, affected side, speech pattern and recommended food texture. These results may be due to strict matching of the two groups according demographic and medical data to control the extraneous variables.

These results are congruent with **Moon, et al, (2019)** who found that no significant difference between the two groups of acute stroke patients with dysphagia in terms of general characteristics and swallowing

function prior to the intervention. Also, the results are in the same line with **Seo, et al (2021)** who stated that, there were no statistically significant differences in demographic factors among the studied groups, showing homogeneity between intervention group and the control group. In addition, **Dehaghani (2023)** demonstrated that, there were no significant differences between the two studied groups regarding demographic variables.

As regards, dysphagia severity, the study demonstrated that, there was a significant statistical difference between both groups post intervention. In addition, severe dysphagia dropped to 10% in the intervention group as compared to 36.6% in control group, and there was a significant statistical difference in the mean dysphagia score between the intervention and control group post the intervention at $p \text{ value} = 0.002$. These results may be due to a lingual oral-motor exercise program which improved the muscle of swallowing and so decreased the severity of dysphagia. These results are in the same line with **Yousef, et al (2020)** whose study revealed that, the severity of dysphagia in the study group significantly decreased to its lowest level following two weeks and one

month of the swallowing training program. In contrast, no such reduction was observed in the control group receiving routine hospital care. In the same line with this result, **Dehaghani (2023)** stated that, there was a remarkable reduction in dysphagia severity in the experimental group, after 20 sessions of intervention.

Regarding oral motor structure assessment and reflexes, the study showed that, there was no significant statistical difference between the intervention and control group in relation to oral motor structure assessment and reflexes pre-program while there was a significant difference between the two groups post intervention with improvement in the tongue movement, soft palate elevation, gag reflex, sensation in oral cavity and chewing ability among the intervention group as compared to the control group. This improvement may be due to lingual oral motor exercises program. This result is consistent with systematic review and meta-analysis study by (**Gao, 2023**) a comparison of oropharyngeal muscle strength training with conventional dysphagia therapy in post-stroke patients revealed that, in seven studies, muscle strength training significantly improved the

functional oral intake score and enhanced the vertical movement of the hyoid bone compared to conventional therapy.

In addition, (**Krekeler et al., 2023**) stated that, Lingual strengthening exercise resulted in significant improvements in functional oral intake for patients with post-stroke dysphagia as compared to usual care after 8 weeks. Controversy with this finding; **Lin, et al. (2022)** mentioned that, while confirming that tongue strengthening exercises significantly increase tongue muscle strength, the authors note that previous research showed mixed results for swallowing safety and efficiency, highlighting the need for more comprehensive dysphagia assessment.

In relation to, swallowing ability, the current study found that, there was highly significant statistical difference between the intervention and control group post 2 weeks and one month from the intervention also, there was a significant statistical difference in swallowing ability mean scores between the intervention and control group 2 weeks and 1 month post intervention. This may be attributed directly to the lingual oral motor exercises which given for the intervention group. This result is aligned with a meta-analysis

conducted by **Gao et al., (2023)** who stated that oropharyngeal muscle strength training includes lingual exercises significantly improved both swallowing safety and swallowing ability compared with conventional therapy in patients with post-stroke dysphagia. In addition, **Abe, et al. (2020)**, the findings indicated that tongue strength progressively improves with longer training durations, and no plateau in improvement was observed from baseline up to 8 weeks.

Also, **Dehaghani (2023)** stated that, the group that underwent rehabilitative exercises showed significant improvements in both clinical swallowing function and swallow-related quality of life compared to the group that received only compensatory strategies. In the same line with this result, **Ye, et al (2025)** added, in their meta-analysis study resistance exercises markedly improved swallowing function and increased swallowing safety in patients with post stroke dysphagia. In addition, **Hamed, et al. (2025)** stated that, the mean score for swallowing disturbances in the study group declined significantly from 32.4 ± 4.77 before implementation to 17.05 ± 1.64 after four months ($p < 0.001$), indicating a major reduction in the severity of swallowing issues.

Contradicting this result, **Hägglund, et al. (2020)** stated that, the 5-week oral neuromuscular training enhanced swallowing function in post-stroke dysphagia patients compared to the control group at 12 months post-intervention; however, no significant differences were observed between the groups immediately following the intervention.

As regards to, differences in relation between dysphagia and swallowing ability mean scores in relation to the studied patients' demographic data in the intervention and control group, the study revealed that, patients less than 60 years showed better swallowing ability also male patients had better swallowing ability and lower dysphagia while there was no effect of other demographic variables. This result could be related to, aging changes that lead to declining tongue pressure and motor function of the lips. This result is matched with, **Adams, et al. (2013)** who reported that in their systematic review and meta-analysis reported that tongue strength declines with age, with the anterior tongue generally stronger than the posterior tongue in healthy adults. The study also showed that healthy males tend to have higher tongue strength than females of the same age. Consistent

with these findings, **Arakawa, et al. (2021)** observed in their meta-analysis that sex-related differences in tongue strength were present only in individuals under 60 years, but not in older adults.

Regarding, differences in relation between dysphagia and swallowing ability mean scores in relation to medical data of patients in the intervention and control group, the study revealed that, patients with no history of pervious stroke had better swallowing ability and lower dysphagia also patients on semisolid food showed better swallowing ability and lower dysphagia while other medical data had no effect. This result is congruent with, **Wang, et al. (2025)** who stated that, a prior stroke is a proven independent risk factor for developing more severe or protracted dysphagia after a later acute stroke. This is because the brain connections that regulate swallowing may sustain lingering, frequently asymptomatic, damage as a result of the first stroke. This damage is exacerbated by a second insult, leading to a more severe functional loss. Furthermore, according to **Cichero (2017)**, meals with a semisolid consistency provide the safest swallow because of their homogeneous, cohesive texture and modest flow rate. Better control over

the bolus in the mouth and throat is made possible by these characteristics.

Overall, the results of the current study support the effectiveness of early lingual oral motor exercises in improving swallowing ability among acute stroke patients. Therefore, integrating these exercises into routine nursing care may contribute to better patient outcomes and prevention of dysphagia related complications.

Conclusion:

Based on the findings of the study, it can be concluded that, acute stroke patients underwent early lingual oral motor exercise program showed less severe dysphagia and improved swallowing ability compared to acute stroke patients who received the routine hospital care only. There was a significant statistical difference between the two groups post intervention with improvement in the tongue movement, soft palate elevation, gag reflex, sensation in oral cavity and chewing ability among the intervention group as compared to the control group. There was a significant relation between dysphagia and swallowing ability and the patients' age, history of pervious stroke and semisolid food while there is no effect of other demographic and medical data.

Recommendations:

Based on the result of the current study, the following can be recommended;

1-A multidisciplinary team with a neurologist, nutritionist, speech-language pathologist, and critical care nurse should be established to manage post stroke dysphagia.

2-Conducting the study again using a larger probability sample drawn from multiple regions in Egypt and under diverse conditions to generate more generalizable results.

3-Acute Stroke patients should be evaluated for swallowing issues and treated as soon as possible, preferably while they are still in the intensive care unit.

4-Early lingual oral motor exercise should be included in the routine post- acute stroke dysphagia management.

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Shared Leadership and Its Relation to Nursing Staff Team Performance at Intensive Care Units

Alaa Rashad Ibrahim^{1,2}, Amal Hamdy Abou Ramadan³, Maha Eid Shokir⁴, Seham Aly Mahmoud⁵

¹Nursing supervisor, As-Salam International Hospital, Cairo, Egypt.

²Master Student of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

^{3,4,5} Assistant Professor of Nursing–Administration, Faculty of Nursing, Tanta–University, Egypt.

Corresponding Author: Alaa Rashad Ibrahim

Email: alaarashad1995@gmail.com

Abstract

Background: Effective leadership especially shared leadership is essential-for improving nursing staff team performance, particularly in critical care environments like Intensive Care–Unit (ICU). **Aim of the study to:** assess shared leadership and its relation to nursing staff team performance at intensive care units. **Research design:** A descriptive correlational study design-was used. **Setting:** The study was-conducted in all intensive care units of Tanta Main University Hospital. **Subjects:** included all head nurses (N= 28) and proportionate stratified random sampling from nurses (N= 265). **Tools:** Two tools were employed for data collection: Shared Leadership and Nursing Staff Team Performance Structured Questionnaire. **Results:** 53.6% of nursing staff had a low-level of shared leadership while 37.5% had a high level. 55% of nursing staff had a low level of overall levels of nursing staff team performance while 37 % of them had a high level of overall nursing staff team performance. **Conclusion:** A strong and statistically significant positive relationship was found between shared leadership and nursing staff team performance at intensive care unit. **Recommendations:** Provide special support and onboarding programs for nurses to help them develop confidence in leadership and team roles.

Keywords: Intensive Care Unit, Nursing staff, Shared leadership, Team performance.

Introduction

The intensive care units are a highly specialized and demanding healthcare setting where patients with critical conditions require constant observation, advanced clinical interventions, and timely decision-making. ICU nurses are responsible for managing sophisticated medical equipment, responding rapidly changing patient conditions, and working collaboratively with multidisciplinary teams to deliver safe and effective care (Villagrancia et al., 2025).

Due to the complexity and urgency of care in this environment, strong and adaptive leadership is essential to promote effective communication, teamwork, and high-quality patient outcomes (Sayyed, Sahu, Kanyal, & Sable, 2025).

Shared leadership known as distributed or collaborative leadership. It is a participatory approach that values the collective expertise and contributions of multiple team members in the healthcare setting (Curşeu, van Rijswijk, & Schruijer, 2025). Shared leadership fosters empowerment and engagement among nurses at ICU, enhancing motivation, job satisfaction, and

professional commitment (Ebrahim & Ismail, 2023).

Shared leadership comprises four essential dimensions: collaboration, vision, delegation, and culture (Ebrahim & Ismail, 2023). Collaboration is the cornerstone of this model, promoting teamwork, communication, and mutual trust among nurses (Al-Dhafiri et al., 2024). A shared vision provides a unifying goal that aligns team members' efforts and fosters organizational cohesion (Chin, 2024).

Delegation within shared leadership encourages nurses to engage in decision-making, which enhances self-confidence, trust, and communication within the team (Islam et al., 2025). Moreover, developing a shared leadership culture nurtures adaptability and continuous professional evolution among nursing staff (Hassan et al., 2025). It enhances team performance by enabling multiple leaders to contribute their expertise rather than relying solely on one individual (Ebrahim & Ismail, 2023).

Shared leadership improves team effectiveness, innovation, and learning capacity, particularly in complex healthcare settings (Zhou, Wu, Sun, & Cormican, 2025). Team performance emerges through

nurses' engagement in collaborative processes that facilitate the exchange, integration, and application of knowledge (**Hassan et al., 2025**). Effective teamwork involves both task-oriented work and interpersonal processes that collectively improve service outcomes (**McGuier et al., 2024**).

Team performance can be understood through three dimensions: innovation, efficiency, and information processing (**Zhou et al., 2025**). Team innovation reflects nurses' capacity to develop and apply innovative ideas and solutions ideas and solutions (**McGuier et al., 2024**). Efficiency relates to how effectively teams reduce obstacles and streamline workflows to achieve high-impact results (**Islam et al., 2025**). Information processing involves the collection, transformation, communication, and management of data across the organization to support decision-making and collaboration (**Zhou et al., 2025**).

Significance of study

Shared leadership contributes significantly to nurse's well-being and job satisfaction. Empowering nurses to take part in leadership processes enhances their confidence, resilience, and sense of belonging within the team (**Sharma & Mehta, 2025**). This

empowerment fosters a positive work environment built on trust and respect, which reduces burnout and turnover intentions (**Islam et al., 2025**). Consequently, shared leadership not only improves the functional performance of nursing teams but also establishes a supportive professional culture that enhances both patient outcomes and nurses' retention (**Goens & Giannotti, 2024**). Therefore, this study aimed to assess shared leadership and its relation to nursing staff team performance.

Aim of the study:

The aim of study was to:

Assess shared leadership and its relation to nursing staff team performance at intensive care units.

Research questions:

- What are the levels of shared leadership among nursing staff?
- What are the levels of nursing staff team performance?
- What is the relation between nursing staff shared leadership and staff team performance?

Study design

A descriptive correlation study design was used in the present study.

Setting

The current study was carried out in all intensive care-units at Tanta Main University Hospital including (Cardiology, Neurology, and

Neonate ICUs) and ICU of Oncology, Medical, Chest and Pediatric hospitals. All these hospitals affiliated to Ministry of Higher-Education and Scientific-Research.

Subjects

The study subject consisted on 293 nursing staff divided into

- All head nurses (N= 28).
- Proportionate stratified random sampling of nurses (N= 265) who were working in the aforementioned settings and present throughout the data collection period. Each department was considered as strata of the sample were selected proportionally according to the number of nurses in each department.

The nursing sample size was determined using Epidemiological Information Microsoft software to ensure it was sufficient and a representative size where N= nurse size (842), Z=confidence level at 95% (19.6) d=margin of error proportion (0.05). A total number of samples of nurses 265 out of 842 were included throughout the data collection phase.

Tools of the study

Tool I: Shared Leadership Structured Questionnaire. This tool was developed by the researcher based on related literature (Grille, Schulte, &

Kauffeld, 2015; Wu & Cormican, 2021; Gu, Liang, & Cooke, 2022; Sheppard, 2022). It was used to assess nurses' perception about shared leadership; it consisted of two parts:

Part 1: Personal and work-related characteristics included age, sex, marital status, education level, department, years of experience, and job position.

Part 2: Nurses Share Leadership Structured Questionnaire it consisted of 24 items and categorized into four dimensions as follows:

-Collaboration: included 5 items.

-Vision: included 6 items.

-Delegation: included 6 items.

Culture: included 7 items.

Subjects' responses were measured on five points Likert–Scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The total scores were categorized according to cutoff score obtained by summing the scores of all categories. The total score represented varying level as the following:

-High level of shared leadership > 75 %

-Moderate level of shared leadership 60 - 75 %

-Low level shared leadership < 60%

Tool II: Nursing staff team Performance Structured Questionnaire.

This tool was developed by the researcher guided by **Bouwman, Runhaar, Wesselink, & Mulder, (2017)** and related literatures (**Jamshed & Majeed, 2019; Siangchokyoo & Klinger, 2022; Watkins & Hensley, 2023**). It was used to assess nursing staff performance. It consisted of 22 items and categorized into three dimensions:

-Team innovation: included 5 items.

-Team efficiency: included 8 items.

-Information processing: included 9 items.

Subjects' responses were measured on five points Likert–Scale ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The total scores represented varying levels according to cut off-points as following:

High team performance level >75 %

Moderate team performance level 60 - 75 %

Low team performance level <60 %

Method

Official approval to carry out the study was obtained-from the Dean of the Faculty of Nursing at Tanta-

University and submitted to the relevant authorities.

Ethical considerations

- The approval of the Scientific Research Ethical Committee of the Faculty of Nursing, Tanta University was obtained with Code no (312-10-2023).
- Study subjects provided consent to join the study after being informed about its nature and objectives of the study, the privacy of their data was assured, right to withdraw was confirmed and the study was designed in a way that did not cause any harm to the study subject.

The data collection tools were tested by a jury of five experts in the nursing-administration specialty to assess their content validity of the tools.

Face validity content index of tool (I) 99.4% and tool (II) 97.5%. A pilot study was conducted on 10% (27 nurses, 3 head nurses) and they were not excluded from the sample due to minor modification. The pilot study was done to test the tools for clarity of questions, feasibility, and necessary modifications were done based on the result. Also, a pilot study was conducted to estimate the duration required to complete the questionnaire. The estimated duration required to complete the questionnaire sheet was approximately 20 minutes.

Pearson coefficient Test Re-test was used to test the reliability of tool (I) was 0.904 tool (II) was 0.855.

Data collection phase: The researcher met and engaged with the subjects involved in the study in small groups while they were at work to explain study's objectives and hand out the questionnaire forms to them. The subjects completed their responses under the supervision of the researcher to ensure that any questions were appropriately answered during morning and afternoon shifts.

Data were collected over a three-month period, starting in early August 2024 to October 2024.

Statistical Analysis: The statistical analysis of the data was performed using International Business Machines–Statistical Package for the Social Sciences software version 20.0 (Armonk, New York: International Business Machines Corporation, released 2011). Data for categorical variables were presented as frequencies and percentages, while the Kolmogorov–Smirnov test was used to assess the normality of continuous variables. Continuous variables were summarized using range (minimum and maximum), mean and standard deviation. The used test was Spearman coefficient

to correlate between two distributed abnormally quantitative variables.

Results

Table (1): shows distribution of the nursing staff according to their personal and work-related data. More than half (51,5%) of nursing staff aged less than 25 years with mean age 25.81 ± 4.74 years. Around two thirds (62.5%, 70%, 63.5%) of nursing staff were female, married and have technical nursing diploma, respectively. Regarding department, the highest percent (10.2%, 9.2% and 8.9%) of nursing staff were working at medical, neurology, pediatric and oncology ICU, respectively. Regarding years of experience, majority (81.9%) of nursing staff had less than 5 years of experience with mean 3.25 ± 3.73 years of experience. Also, Majority (90.4%) of them were staff nurse.

Figure (1): illustrates overall levels of shared leadership among nursing staff. More than half (53.6%) of nursing staff had a low-level of shared leadership while more than one third (37.5%) had a high level.

Table (2): illustrates levels of shared leadership dimensions among nursing staff. As observed in the table, more than half (54.3%, 53.2%, and 52, 9%) of nursing staff had a low level in delegation, vision and culture dimensions of shared

leadership respectively. While around half (48.5%) had low level of collaboration dimension, and more than one third had a high level in all dimensions of shared leadership.

Figure (2): Illustrates overall levels of nursing staff team performance. As observed in the figure, more than half percent (55 %) of nursing staff had a low level of overall levels of nursing staff team performance. While more than one third (37 %) of them had a high level of overall nursing staff team performance.

Table (3): illustrates levels of nursing staff team performance dimensions. As observed in the table, more than half percent (54.6%, 50.9%) of nursing staff had a low level of team innovation and information processing and 48.8% had low level in team efficiency dimensions of team performance. Also more than one third had high level for all dimensions of team performance.

Figure (3): illustrates correlation between overall shared leadership and overall nursing staff team performance. As observed in the figure there was a significant positive correlation between overall shared leadership and nursing staff team performance at $P \leq 0.05$ and $R=0.914$.

Table (1): Distribution of the nursing staff according to their personal and work-related data (n = 293)

Personal–data	No.	%
Age		
<25	151	51.5
25 – 35	116	39.6
>35	26	8.9
Min. – Max.	21.0 – 42.0	
Mean ± SD.	25.81 ± 4.74	
Sex		
Female	183	62.5
Male	110	37.5
Marital status		
Married	205	70.0
Un – Married	88	30.0
Educational level		
Technical Nursing Diploma	186	63.5
Bachelor of nursing	89	30.4
Post graduate studies	18	6.1
Department		
CCU	27	9.2
Neurology ICU	27	9.2
Pediatric ICU	21	7.2
Oncology ICU	26	8.9
Neonate ICU	20	6.8
Chest ICU	19	6.5
Medical ICU	30	10.2
Years of experience		
<5	240	81.9
5 – 10	28	9.5
>10 – 15	21	7.2
>15	4	1.4
Min. – Max.	1.0 – 17.0	
Mean ± SD.	3.25 ± 3.73	
Job position		
Staff nurse	265	90.4
Head nurse	28	9.6

SD: Standard deviation

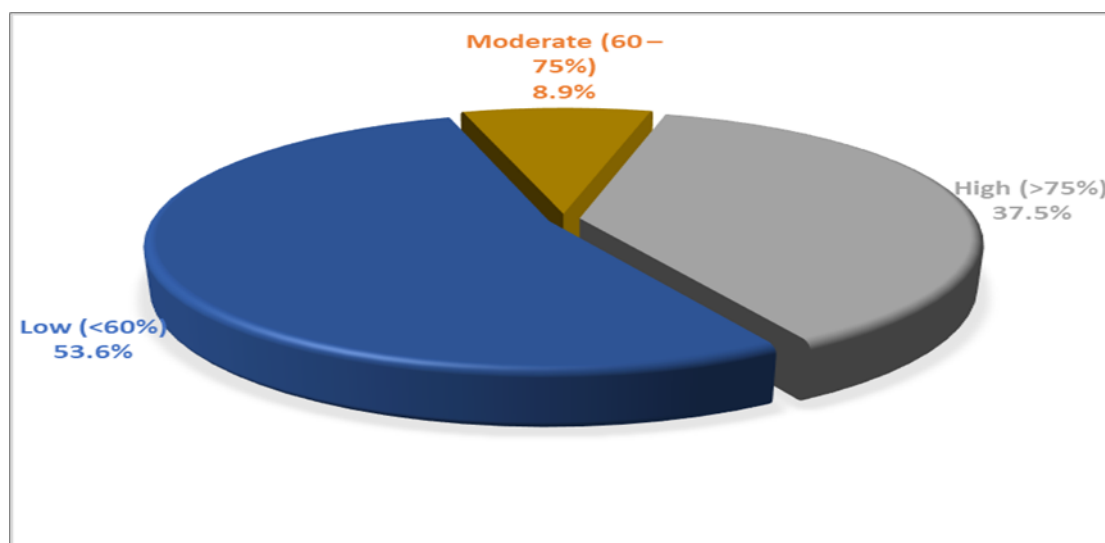


Figure 1: Overall levels of nursing staff shared leadership

Table (2): Levels of nursing staff shared leadership dimensions (n = 293)

Shared leadership dimensions	Low (<60%)		Moderate (60 – 75%)		High (>75%)	
	No.	%	No.	%	No.	%
Collaboration	142	48.5	47	16.0	104	35.5
Vision	156	53.2	32	10.9	105	35.8
Delegation	159	54.3	24	8.2	110	37.5
Culture	155	52.9	21	7.2	117	39.9

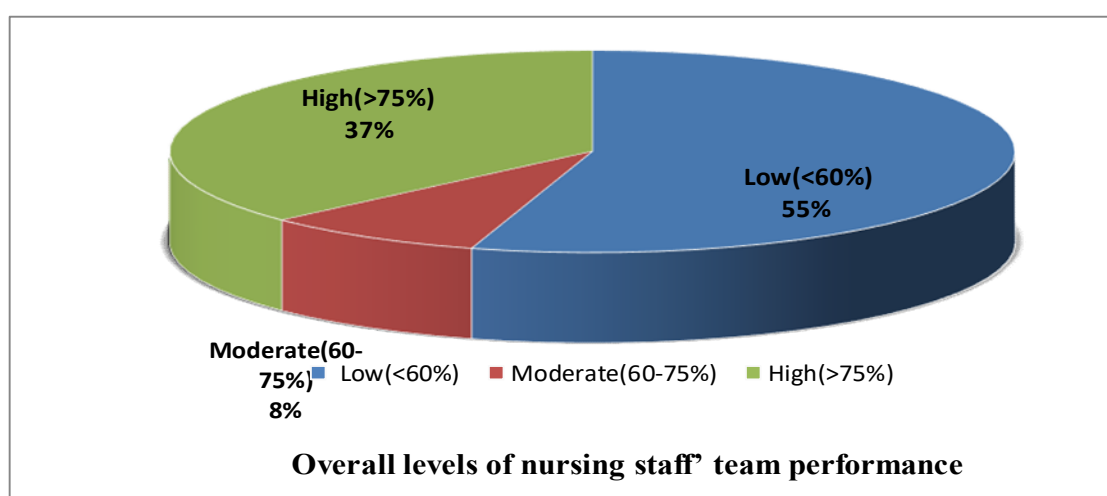
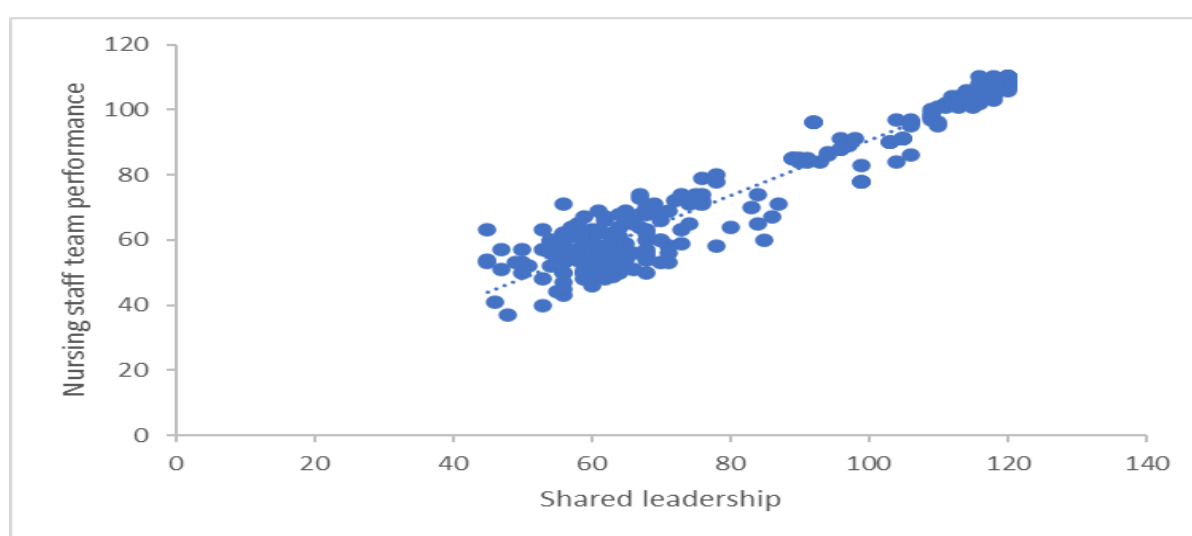


Figure (2): Overall levels of nursing staff team performance

Table (3): levels of nursing staff team performance dimensions (n = 293).

Perception of nurses about challenges	Level for Perception of nurses about challenges					
	Low (<60%)		Moderate (60 – 75%)		High (>75%)	
	No.	%	No.	%	No.	%
Team innovation						
Team efficiency						
Information processing						

**Figure (3): Correlation between–overall shared leadership and overall nursing–staff’ team performance.**

Discussion

In the high-pressure environment as intensive care units, effective team performance is crucial for maintaining patient safety and providing high-quality care. (Hadi-Moghaddam, Karimollahi, & Aghamohammadi 2021; Sweeney, 2024). Therefore, this study aimed to assess relations between shared

leadership and nursing staff team performance at intensive care units.

Overall level of shared leadership

In the current study, more than half of the nursing staff reported a low overall level of shared leadership. This finding in fact due the majority consisted of staff nurses, had less than five years of experience this may diminish their capacity to voice opinions, restrict confidence,

leadership skills and realness to participate in shared decision.

In line with our findings, **Fischer Jones, & Verran (2018)** found that poor levels of shared leadership in his study group. **Jaber et al., (2022)** noted that nurses perceived low shared governance level. Moreover, **Atalla et al., (2025)** indicated that the participating nurses perceived limited shared governance and operated under a conventional management system, with top-level managers overseeing all domains of governance.

In opposite with the findings of this study, **Cogen and Vaidyanathan (2020)** revealed that slightly less than two thirds of nurses had high levels of shared leadership. Also, **Kaddourah, Al-Tannir, Kakish, & AlFayyad (2020)** illustrated that just over half of the nurses studied demonstrated a moderate level of shared leadership. As well, in opposite with the findings of this study, **Janssens, Simon, Beckmann, & Marshall, (2021)** demonstrated that more than half of the head nurses were perceived by staff nurses to demonstrate a moderate level of shared leadership.

According to the current study, nearly half of the nursing staff reported low level in the collaboration dimension of shared

leadership. This may be due to work overload at ICU.

In consistence with our findings, **Moore et al. (2023)** found that nurses had the lowest mean score toward perception of collaboration behavior. Also, **Degu, Amsalu, Kebede, & Adal (2023)** found that near half of nursing staff had ineffective collaboration during their professional activities. Moreover, **Schwarzkopf et al., (2024)** found that nurses in ICU reported lowest ratings of the quality of collaboration compared to physicians and other care settings.

On the other hand, **Serrano-Gemes and Rich-Ruiz, (2017)** showed that more than half of nursing staff obtained average inter professional collaboration values. Furthermore, **Ylitörmänen, Turunen, Mikkonen, & Kvist (2019)** reported that nurses had the highest mean scores of collaboration behavior in the majority of collaboration behavior items. Also, **Abd El, Maged, Bassiouni, & Atalla (2021)** demonstrated that near half of nurses had a fair level of the collaborative dimension of shared leadership.

The study result revealed that, more than half of the nursing staff had a low level in the vision dimension of shared leadership. The fact that

majority of the participants still fell into the low category indicates a gap between formal vision statements and practical engagement. The team can set short term goals, reflecting a gap between the vision and its practical implementation and to move department in the right direction and nurse's team purpose and goals are understood from all members in team. Practice is frequently underdeveloped among nurse leaders, which may contribute to limited understanding or commitment to short-term objectives among nursing staff.

This result supported by **Alharbi & Almansour (2025)**, **Kallstrom, (2024)** and **Atalla et al., 2025**, mentioned this result congruent with that nurse may not fully internalize or operationalize the articulated vision in their routine work. This discrepancy reflects a broader issue in nursing leadership where formal strategic visions, although communicated at administrative levels, fail to effectively permeate frontline activities, leading clinicians to perceive them as abstract directives rather than actionable guides for team behavior.

According to the current study, more than half of the nursing staff had a low level in the delegation

dimension of shared leadership. This may be due to the team members are assigned shared tasks to enable them to learn and build knowledge collaboratively, in team task assigned based on expertise & capabilities, feel confident for taking leadership responsibilities in this team and formal leaders disagreed to delegate some control tools to informal leaders. This may be due to inadequate training for nursing staff on delegation.

This result was in line with **Ahmed, (2024)**, who found that the delegation dimension was the lowest rank among the shared leadership dimensions. In addition, **Wilson, (2025)** revealed that nurses working in emergency department, adult acute and intensive care and reported the lowest levels of familiarity with delegation.

According to the current study, more than half of the nursing staff had a low level in the culture dimension of shared leadership. This is may be leadership roles available in team result from their needs , all team members know what strengths and skills they possess in other team and when team members function collectively as leaders, they share common beliefs, values, and objectives.

Comparable with findings, **Sutter, (2020)** round Staff demonstrated a

low level of perception of the organizational culture due to rigid rules and policies applied in managing staff. Also, in line with findings **Mansoor et al., (2025)** found that more than half of nursing staff had low and moderate in the culture dimension of shared leadership.

Nursing staff's performance

In the present study, more than half of nursing staff had a low level of overall team performance. This may be due to high workload of ICU, time pressure and high emotional stress inherent to ICU practice which negatively affects team work effectiveness.

Supporting our findings, **Sarıköse & Göktepe (2022)** and **Galanis, (2023)** indicated that nurses exhibited lower levels of job-performance. On the contrary, **Goh et al., (2018)** revealed that nearly two thirds of staff nurses had moderate performance. Furthermore **Ahmed (2024)** reported that regarding the studied staff nurses' total level of performance, about half of the staff nurses had a moderate level of performance.

In the present study, more than half percent of nursing staff had a low level of team innovation dimension of team performance. This is may be due to Intensive care units are high-reliability environments where

strict adherence to evidence-based protocols and standardized procedures is prioritized to ensure patient safety. As a result, opportunities for experimentation or the introduction of new practices are limited, and the psychological risks associated with deviating from established routines are considerable.

In line with our findings, **Mohamed, Ghallab, Hussien, & Ragab, (2025)** found that near half of nurses demonstrated a lower level of innovation behavior in their practice. Also, **Fu et al., (2025)** demonstrated that the nurses' innovation behavior was below the medium level. Moreover, **Li et al., (2025)** found that more than half percent of nursing staff had low and moderate level of team innovation dimension of team performance. In contrast, **Kamel & Aref, (2017)** demonstrated that half of staff nurses had high innovative work behavior.

According to these findings, less than half of nursing staff had a low level of team efficiency dimension of team performance. This is due to the team spent time identifying the barriers that make work more difficult than it should be, team achieved its goals, team members had the skills and competencies to come up with innovative and new

solutions for facing problems, team reviewed results and performance frequently to make sure team doing high quality work, team came up with ways to reduce barriers.

Comparable with our findings, **Mostafa and Mahfouz, (2021)** indicated that less than half of subjects had low perceptions' level regarding leadership effectiveness. Also, **Meneses-La-Riva et al., (2025)** reported that more than half of the nursing staff scored at high level for teamwork which is closely tied to efficiency in team performance.

In the present study, more than half of the nursing staff had low level of information processing dimension of staff team performance. This finding may be due to the fact that information processing is closely linked to the quality of communication structures within the unit. When documentation systems are fragmented, electronic records are not fully integrated, or handovers are inconsistent, the flow of critical information becomes disrupted. These challenges may be compounded in teams with a predominance of less experienced nurses, who often lack the clinical schemas to filter and prioritize large volumes of data efficiently.

Supporting this finding **Ahn et al., (2021)** reported that nurses

frequently experience communication challenges during handovers, including missing essential patient information, difficulty accessing data, interruptions, and one-way communication. These barriers limit nurses' ability to effectively process, integrate, and utilize information, resulting in information being exchanged at a superficial level rather than being critically analyzed or reflected upon.

Correlation between shared leadership and nursing staff team performance

According to the current study, there was a significant positive correlation between overall shared leadership and nursing staff team performance. Teams that distribute influence through shared goal setting, mutual monitoring, and peer coaching tend to coordinate faster and adapt better in high-acuity work such as ICUs. Shared leadership strengthens the “team operating system which in turn raises efficiency and collective outcomes (**Janssens et al., 2021**).

In agreement with our findings, a study conducted by **van Knippenberg, Pearce & van Ginkel, (2025)** found that shared leadership predicts team effectiveness more accurately than

traditional hierarchical leadership, particularly under complex conditions such as those in ICUs. Additionally, **Kim & Lee, (2025)** demonstrated that there is a significantly positive relations between shared leadership behaviors and team effectiveness.

Conclusion:

Based on the findings of the present study, it was concluded that more than half of nursing staff had a low level of shared leadership. Moreover, more than half of nursing staff had a low level of nursing staff team performance. There was a highly statistically significant positive correlation between shared leadership and nursing staff team performance.

Recommendations:

For hospital administrator:

- Provide special support and onboarding programs for nurses to help them develop confidence in leadership and team roles.
- Institutionalize the team's shared vision by documenting, communicating, and reinforcing it through visible goals and regular departmental planning meetings
- Foster a more robust innovation culture within ICU teams by implementing structured quality improvement and innovation initiatives.

- Increase resource availability (equipment, staffing, training time) to improve team efficiency.
- Foster a psychologically safe environment encouraging feedback, open dialogue, and error reporting.

For head nurses:

- Enhance collaboration mechanisms by introducing formal team-building strategies and tools for continuous communication and feedback
- Strengthen delegation skills among nurses through targeted leadership training and mentoring programs
- Provide coaching in conflict resolution and decision-making.
- Adopt rotating leadership roles during shifts to promote staff empowerment and leadership exposure.

For Staff Nurses:

- Attend leadership and team-performance workshops offered by the hospital.
- Engage actively in shared leadership activities by participating in unit-based councils, decision-making discussions, and collaborative problem-solving meetings.
- Demonstrate initiative in daily clinical tasks by volunteering for leadership opportunities during shifts to improve autonomy and shared responsibility.

- Pursue continuous self-improvement through reflective practice and independent learning to strengthen leadership competencies and clinical effectiveness.

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Organizational Ambidexterity in Relation to Strategic Improvisation and Workaholism among Nurses

Soha Mamdouh Elkholy¹, Hanaa Mahmoud Moustafa²

¹Assistant Professor of Nursing Administration, Faculty of Nursing, Menoufia University, Egypt.

²Infection Control Unit, Colleague of Menoufia University Hospitals, Menoufia University, Egypt.

Corresponding author: Soha Mamdouh Elkholy

Email: sohammdh@gmail.com

Abstract

Background: Due to rapid updates of digital health care systems, Organizational ambidexterity has been widely established as necessary for economic sustainability in the healthcare services sector which guides improvisation to create more flexibility and make more spontaneous decisions serving safe, quality working environment and care services.

Aim: explore nurses' perspective on organizational ambidexterity and its association with strategic improvisation and work holism. **Design:** A descriptive, correlational research design was used.

Setting: The current study was conducted in Shebin El-Kom Teaching Hospital, Menoufia governorate, Egypt. **Study subjects:** A convenient random sample (370) of nurses working in Intensive Care Units (ICU), Operating theaters (OR), Hemodialysis Unit, and general departments.

Instruments: Three instruments were used namely, Organizational Ambidexterity Scale, Strategic Improvisation Scale, and Workaholism Scale. **Results:** The results revealed statistically significant positive correlation between organizational ambidexterity and strategic improvisation ($r = .404, p < .001$). Moreover, a strong positive and statistically significant correlation was found between organizational ambidexterity and workaholism ($r = .607, p < .001$). In addition, strategic improvisation was positively correlated with work holism ($r = .526, p < .001$).

Conclusion: The current study concluded that work holism, demonstrated the highest mean percentage, followed by strategic improvisation, while organizational ambidexterity ranked third. Also, revealed statistically significant positive correlation between organizational ambidexterity and strategic improvisation and workaholism. **Recommendations:** Hospital administration should pay attention to strategic knowledge, developing organizational capabilities, determining strategic precedence, enhancement of strategic improvisation as well as developing further survey instruments that measure indicators of workaholism.

Keywords: Organizational Ambidexterity, Strategic Improvisation, Workaholism, and Nurses

Introduction

Entities need fresh cognitive frameworks to facilitate agile strategic choices and implement those choices into strategic adaptations. Readiness, agility, and strategic adaptability are essential elements for navigating uncertainty and intricacy. An entity's capacity to uphold a competitive edge by utilizing current strengths while innovating and developing new skills is vital for its survival. Organizations must perpetually seek out new prospects and leverage their existing resources to stay robust in complicated settings. Striking a balance between exploration and utilization is essential for resilience and sustainability in contemporary organizations (Qi, et al., 2024).

Organizational ambidexterity has been extensively recognized as essential for economic viability in the healthcare services industry. It refers to an organization's capability to be both aligned and effective in management to fulfill customer requirements while also adapting to shifts in the environment. Additionally, organizational ambidexterity denotes the organization's proficiency in being coordinated and efficient in management to achieve its objectives (Hafeez, et al., 2025).

As environmental changes grow more intricate and swifter, possessing dynamic capabilities has emerged as an effective strategy for organizations to gain a competitive edge. These dynamic capabilities represent the organizational skills evident in the decision-making of top management, enabling both the utilization of existing competencies and the cultivation of future ones. Consequently, ambidexterity serves as an important enhancement to the dynamic capabilities' viewpoint, as it elucidates the advantages and limitations of management choices in identifying and capitalizing on opportunities, as well as reorganizing internal processes (Astuti, et al., 2025).

Organizational ambidexterity is defined as an organizational capacity to simultaneously engage in both exploratory and exploitative activities. This balance is achieved by effectively managing opportunity-seeking and advantage-seeking endeavors. Specifically, it enables organizations to compete in established technologies and markets by focusing on efficiency, control, and incremental improvements, while also thriving in emerging technologies and markets that demand flexibility, autonomy, and experimentation (Altaee, et al., 2024).

Organizations have always strived for survival, growth, and a competitive edge. However, the volatile environment, rapid changes, and competitive interdependencies among organizations, all driven by the pursuit of goals and control, necessitate addressing challenges and seizing opportunities. This is where strategic improvisation becomes crucial, as these dynamic factors are now central considerations when developing plans and programs **(Al-Bashqali, 2021)**.

Improvisation is the ability to generate novel responses spontaneously, without forethought or certainty of outcomes. Essentially, it's the concurrent planning and execution of a strategy, a process that highlights formal strategic planning and control. In fast-paced settings, dynamic capabilities are honed through experimental activities like improvisation, prototyping, real-time information gathering, and experimentation. This happens because, in improvisation, the formulation and execution of an action become one and the same **(Daoud & Justiniano, 2024)**.

The use of available materials and the spontaneity of improvisation are the primary considerations. This utilitarian scenario highlights the

circumstances in which environmental pressures lead to acts that lack generality by forcing improvisations to make use of the resources at hand. Improvisation happens at work, and the person is unable to put off thinking about and planning solutions to problems. Also, improvisation is the process of coming up with new solutions without any prior planning or knowledge of the implications, i.e., the future of the work produced. According to **Crossan and Co (2024)**.

In actuality, improvisation may be viewed as the idea of creating the greatest possible answers while waiting for the right approach to be taken again. Improvisation is the exception: there is a possibility to go back when things aren't done correctly. When an issue arises within an organization, it is a divergence from the current approach or knowledge. Improvisation may be used by an organization to rectify and modify subpar management, employee errors, or abrupt changes in the surroundings, or it may be used by management to promote greater adaptability and allow for more impromptu choices **(Shetty al., 2024)**.

Workaholism, conversely, denotes a compulsive urge to labor excessively

and a failure to disengage from work duties, even when it harms health, connections, or overall life balance. Unlike healthy dedication or commitment to a career, workaholism is propelled by an overpowering internal pressure to keep working, which fosters burnout, stress, and diminished job satisfaction. People with workaholic tendencies may wrestle with guilt or anxiety when not at the desk, and their sense of self becomes overly entwined with professional success. Over time, workaholism can corrode mental well-being and strain both personal and professional relationships (Andersen et al., 2023).

Recent studies have increasingly focused on the phenomenon of workaholism, defined as “the compulsion or the uncontrollable urge to work constantly.” Workaholism comprises two primary dimensions: excessive working and compulsive working. Workaholics dedicate substantial time and energy to their jobs, surpassing formal requirements; their efforts extend beyond what is reasonably expected to satisfy organizational demands. They work longer and harder than their peers, committing more to overtime, evening, or weekend hours (Aziz & Covington, 2024).

Moreover, workaholics are consumed by their labor; their minds dwell on their jobs constantly, even when not on the clock. An inner duty propels them to think about their work with relentless persistence. In other words, they are driven from within to toil with extraordinary intensity, “not due to external factors such as financial rewards, career prospects, or organizational culture.” Through relentless and compulsive effort, workaholics forfeit chances to engage in leisure and generally struggle more to “switch off” physically and mentally from their work (Aziz & Covington, 2024).

The chief origin of workaholism lies in the intrinsic human tendency tied to a diminished sense of control and detachment from heightened work activity, and, similar to other addictions, the physiological dependence mechanism that makes individuals derive greater satisfaction from work than from other life activities. Additionally, a drive to achieve and to impose very high standards, influenced by family and personality type, fuels a strong inner compulsion to work and a discomfort when work ceases, accompanied by fears, a lack of security, constant anxiety, and low self-acceptance (Ebrahim, et al., 2023).

Significance of the study

Hospitals now house the most cutting-edge and quickly changing specialties, necessitating ongoing adjustments to procedures, equipment, and laws. Therefore, strategic improvisation and organizational ambidexterity are essential to guaranteeing effectiveness in the environment. Nurses are essential to patient care, and hospital performance, treatment quality, and patient safety are all directly impacted by their adaptability (Rosing and Zacher, 2023). Although there is evidence that strategic improvisation and organizational ambidexterity are important, their combined impact on nurses' workaholism in specialized hospital settings has not received much attention. By filling this gap, evidence-based tactics that support nurse workaholism and enhance results in high-demand clinical settings can be developed. Furthermore, improving the safety environment and the intrinsic motivation of nurses will indirectly improve workaholism, engagement, and retention, which will help long-term healthcare performance and readiness for any changes.

Aim of the Research

The present study sought to explore nurses' perspective on Organizational ambidexterity and its

relation to strategic improvisation and work holism among nurses at Shebin Elkom Teaching Hospital.

Research Questions

1. What are Organizational ambidexterity levels from nurses' perspective?
2. What are strategic improvisation and work holism levels from nurses' perspective?
3. Is there a relationship among Organizational ambidexterity, strategic improvisation and work holism from nurses' perspective?

Subjects and Method**Research Design**

Descriptive correlational research design was employed in the conduction of this study.

Setting

The current investigation was conducted within critical care settings comprising 12 intensive care units, 9 operating rooms, 2 Hemodialysis Units, and 7 general departments at Shebin El-Kom Teaching Hospital, Menoufia Governorate, affiliated to the General Organization for Teaching Hospitals and Institutes. It delivers healthcare services with a focus on high-quality care in a manner that is convenient for both patients and the healthcare team. It serves the intended audience by offering 600 active beds.

Subjects

The study group consisted of 370 nurses from total number of (1233) nurses who were selected at random and had at least one year of experience. They are employed in general departments, hemodialysis units, operating rooms, and intensive care units (ICUs).

Data Collection Instruments

Three instruments were employed in this study alongside the socio-demographic data. These comprised the Organizational Ambidexterity, Strategic Improvisation, and Workaholism Questionnaire.

Instrument I: It included two parts as follows: Part I: Socio-demographic data: This instrument was developed by the researchers to collect the socio-demographic information of the participating nurses (age, gender, marital status, educational level, working unit, and years of experience).

Section II: The Organizational Ambidexterity tool seeks to understand nurses' perceptions of their organization's characteristics. 24 descriptive items make up this self-administered questionnaire, which was created by Neider & Schriesheim. From 1 (strongly disagree) to 5 (strongly agree), each item was given a score on a five-point Likert scale. The items were organized into three subscales:

Exploration (8 items), Exploitation (8 items), and financial performance (8 items). The organizational ambidexterity score was computed via equal-width intervals and categorized into three levels: low, moderate, and high (total score range 24–120). Specifically, 24–56 denotes low, 57–88 moderate, and 89–120 high. The instrument demonstrated a Cronbach's alpha of .889.

Instrument II: Strategic Improvisation Questionnaire. This instrument was employed to evaluate Strategic Improvisation from nurses' viewpoints. It was adopted by Ali, Alaa, and Ibtisama, R. (2024). It comprises 15 items answered on a 5-point Likert scale ranging from 1 to 5, where 1 and 2 signify None, 3 and 4 signify Some, and 5 signifies A Lot. The Strategic Improvisation total score is obtained by summing the three subscales: Strategic vigilance (5 items); Microstructural (5 items); and Organizational memory (5 items). A higher score indicates greater Strategic Improvisation experienced by the nurses. Scores were calculated and categorized as follows: total score range 15–70, with 15–35 deemed low, 36–55 moderate, and 56–70 high. Reliability for this instrument is

established via Cronbach's alpha (total scale 0.741).

Instrument III: Workaholism Questionnaire: The Workaholism Questionnaire serves to gauge nurses' views on Workaholism. The instrument, developed by Aziz, Uhrich, Wuensch, and Swords, (2013), comprises 29 descriptive items. Each item is rated on a five-point Likert scale where 1 = strongly disagree and 5 = strongly agree. The total Workaholism Questionnaire score is obtained by summing all 29 items, with a possible range of 29–145. Nurses scoring 29–67 points are categorized as having a “low level of nursing work holism,” those scoring 68–106 points as “moderate level of nursing work holism,” and those scoring 107–145 points as “high work holism.” The Cronbach's alpha for the total scale is 0.904.

Pilot Study

A preliminary trial with 37 nurses outside the research sample was conducted to assess the practicality and suitability of the study instruments, uncover any challenges, and gauge the time needed to complete the questionnaire. Following the pilot results, certain questions were revised and clarified as needed.

Methods of Data Collection

In the Menoufia governorate of Egypt, the medical and nursing executives of Shebin El-Kom Teaching Hospital agreed to conduct the study. The questionnaires were translated into Arabic then distributed for completion after all nurses gave their oral agreement. The researchers informed the nurses that the information gathered would only be used for research reasons and that the study's findings were published in aggregate form. The questionnaire took each participant fifteen to twenty minutes to complete. The study's data collection phase took place between January 10, 2025, and January 30, 2026.

Ethical considerations; Before collecting data, researchers obtained written approval from Ethical and Research Committee at Faculty of Nursing, Menoufia University (**Ethical approval No 194**). Also, oral consent from each nurse involved in the study was taken. The researchers explained the study's objectives to all participants before gathering data. Full anonymity and confidentiality of participants' information were ensured. Participation in the study was entirely voluntary for all involved. They were made aware of their right to withdraw from the study at any

time without having to give an explanation.

Statistical Analysis

To accommodate the computer entry process, data were coded and transformed into a specially created form. SPSS (Statistical Package for Social Science) version 26 was used for entry and analysis. Normality was assessed with the Kolmogorov-Smirnov and Shapiro-Wilk tests and indicated normal distribution ($p > 0.05$), justifying the use of parametric tests. Quantitative data are presented as mean ($\bar{X}$) and standard deviation (SD). The Pearson correlation coefficient assessed the relationship between two quantitative variables. Qualitative data are shown as frequency and percentage and analyzed with the chi-square (χ^2) test. If any cell's expected value fell below 5 in a 2x2 table, Fisher Exact test was applied (for 4-cell tables). The level of significance was set at $P \leq 0.05$ for all significant tests.

Results

Table 1 presents the distribution of nurses' sociodemographic characteristics ($n = 370$). The results indicate that roughly two-thirds were female and married (60.5% each). More than two-thirds of the nurses (71.4%) were aged 21–28 years, with an average age of 29 ± 6 years (range: 21–52). Furthermore, almost

two-thirds possessed a technical associate degree and worked in critical care units (60.8% and 60.0% respectively). About three-quarters (79.2%) had 2–8 years of experience, with a mean of 6.45 ± 6 years (range: 2–30).

Figure 1 illustrates the distribution of levels of organizational ambidexterity, strategic improvisation, and work holism among nurses. Concerning organizational ambidexterity, the majority of nurses (80.0%) exhibited a high level, while one-fifth of the sample (20.0%) fell within the moderate level. Regarding strategic improvisation, nearly two-thirds of the nurses (61.6%) demonstrated a high level, whereas slightly more than one-third (38.4%) reported a moderate level. Similarly, more than half of the nurses (56.7%) showed a high level of work holism, whereas slightly less than half (43.3%) reported a moderate level.

Table 2 presents the descriptive statistics of organizational ambidexterity, strategic improvisation, work holism, and their related dimensions among nurses. The findings indicate that work holism demonstrated the highest mean percentage (83.6%), followed by strategic improvisation (73.3%), while organizational ambidexterity ranked third (72.1%).

For organizational ambidexterity dimensions, exploitation recorded the highest mean percentage (85.6%), while financial performance ranked lowest (60.1%). Regarding dimensions of strategic improvisation, microstructural practices showed the highest mean percentage (77.8%), whereas strategic vigilance ranked last (70.4%).

Figure 2 & 3 and Table 3 show the Pearson correlation coefficients among organizational ambidexterity, strategic improvisation, and work holism from nurses' perspective. The results revealed statistically positive significant correlation between organizational ambidexterity and strategic improvisation ($r = .404$, $p < .001$).

Moreover, a strong positive and statistically significant correlation was found between organizational ambidexterity and work holism ($r = .607$, $p < .001$). In addition, strategic improvisation was positively correlated with work holism ($r = .526$, $p < .001$).

Table 4 shows the relation between nurses' sociodemographic characteristics and their levels of organizational ambidexterity, strategic improvisation, and work holism. The results revealed no statistically significant relationships between the sociodemographic variables (gender, age, marital status, educational level, years of experience, and unit) and the three study variables, as all $p > 0.05$.

Reliability of instruments

Reliability Statistics	Cronbach's Alpha	No of Items
Organizational ambidexterity	.889	24
Strategic improvisation	.741	15
Workaholism	.904	29

Table 1. Distribution of Sociodemographic Characteristics of nurses (n = 370)

Sociodemographic Characteristics		n	%
Gender	Male	146	39.5
	Female	224	60.5
Age (years)	21 – 28	264	71.4
	29 – 36	69	18.6
	37 – 44	20	5.4
	45-52	17	4.6
	Mean $\pm$SD (29$\pm$6) Range (21-52)		
Marital status	Single	141	38.2
	Married	224	60.5
	Divorced	3	.8
	Widow	2	.5
Educational level	Technical associate diploma	225	60.8
	Bachelor degree	133	35.9
	Post-graduate	12	3.3
Unit	Critical care unit	222	60.0
	Departments	148	40.0
Experiences (years)	2 – 8	293	79.2
	9 – 16	40	10.8
	17 – 23	20	5.4
	24-30	17	4.6
	Mean $\pm$SD (6.45$\pm$6) Range (2-30)		

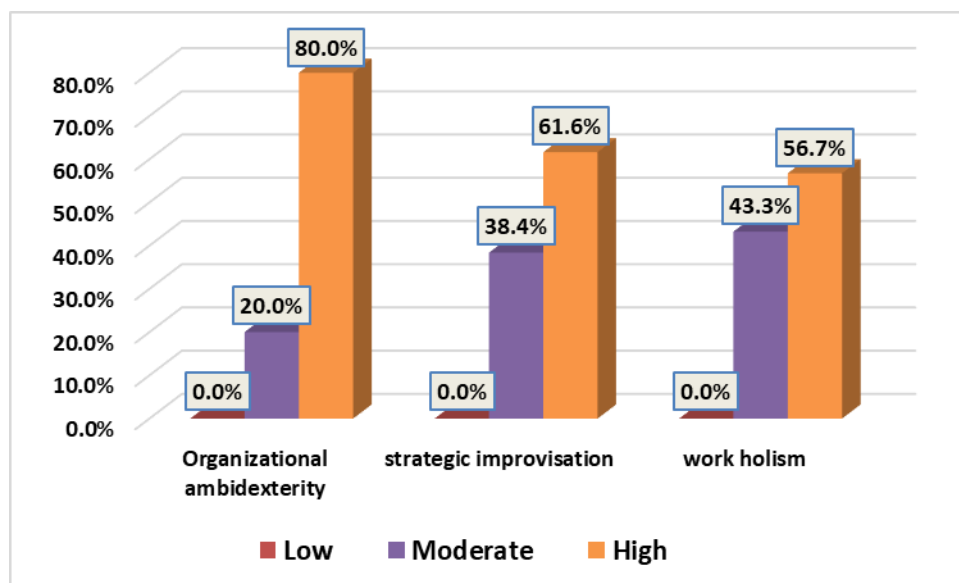


Figure 1. Levels of Organizational ambidexterity, strategic improvisation and work holism from nurses' perspective (n = 370).

Table 2. Descriptive Statistics of Organizational ambidexterity, strategic improvisation and work holism and their dimensions among nurses (n = 370)

Variables	Mean	SD	Min	Max	Mean %	Ranking
Organizational ambidexterity (24 items)	69.19	8.44	52.00	84.00	72.1%	
Exploration (8 items)	22.37	2.60	18.00	30.00	74.6%	2
Exploitation (8 items)	23.98	2.60	16.00	28.00	85.6%	1
Financial performance (8 items)	22.85	6.21	12.00	38.00	60.1%	3
Strategic improvisation (15 items)	44.73	4.88	37.00	59.00	73.3%	
Strategic vigilance (5 items)	13.38	2.44	11.00	19.00	70.4%	3
Microstructural (5 items)	16.34	4.24	11.00	21.00	77.8%	1
Organizational memory (5 items)	15.02	1.97	11.00	21.00	71.5%	2
Work holism (29 items)	96.10	20.32	61.00	115.00	83.6%	

Table 3. Pearson correlation coefficient among Organizational ambidexterity, strategic improvisation and work holism from nurses' perspective (n = 370)

Variables		Organizational ambidexterity	strategic improvisation	Work holism
Organizational ambidexterity	r.	1	.404**	.607**
	P value		.000	.000
strategic improvisation	r.	.404**	1	.526**
	P value	.000		.000

** Highly statistically significant at $p < 0.0001$

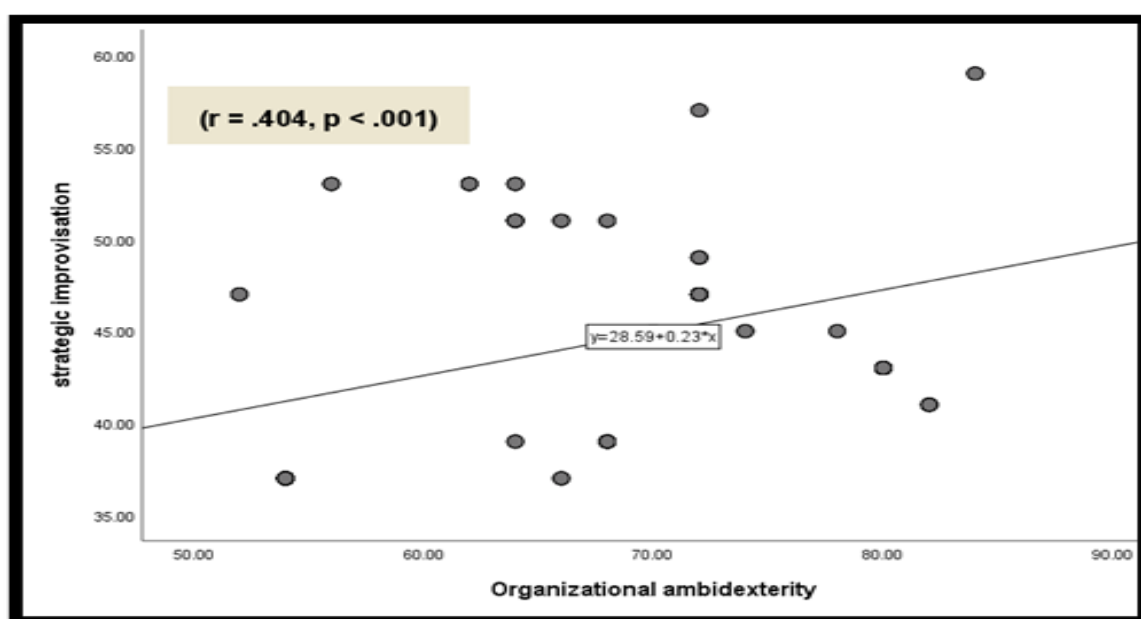


Figure 2. Correlation between total score organizational ambidexterity and strategic improvisation

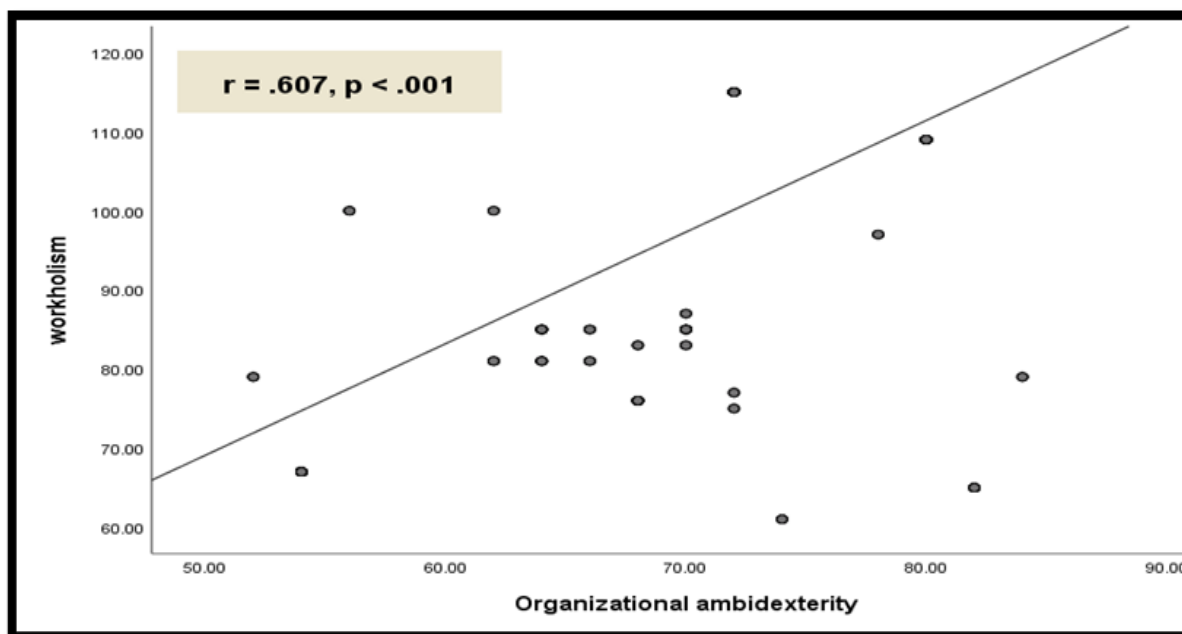


Figure 3. Correlation between total score organizational ambidexterity and work holism

Table 4. relations among Sociodemographic Characteristics, levels of strategic improvisation, Organizational ambidexterity, and work holism from nurses' perspective (n = 370)

Sociodemographic characteristics		Organizational ambidexterity						X ² / Fisher	P							X ² / Fisher	P	Work holism						X ² / Fisher	P
		Low		Moderate		High				Low		Moderate		High				Low		Moderate		High			
		N	(%)	N	(%)	N	(%)			N	(%)	N	(%)	N	(%)			N	(%)	N	(%)	N	(%)		
Gender	Male	0	(.0)	29	(39.2)	117	(39.5)	0.003	0.958	0	(.0)	55	(38.7)	91	(39.9)	0.051	0.821	0	(.0)	64	(40.8)	82	(38.5)	0.315	0.575
	Female	0	(.0)	45	(60.8)	179	(60.5)			0	(.0)	87	(61.3)	137	(60.1)			0	(.0)	93	(59.2)	131	(61.5)		
Age	21 - 28	0	(.0)	51	(68.9)	213	(72.0)	0.339	0.952	0	(.0)	98	(69.0)	166	(72.8)	0.745	0.863	0	(.0)	112	(71.3)	152	(71.4)	0.187	0.980
	29 - 36	0	(.0)	15	(20.3)	54	(18.2)			0	(.0)	28	(19.7)	41	(18.0)			0	(.0)	29	(18.5)	40	(18.8)		
	37 - 44	0	(.0)	4	(5.4)	16	(5.4)			0	(.0)	9	(6.3)	11	(4.8)			0	(.0)	8	(5.1)	12	(5.6)		
	45-52	0	(.0)	4	(5.4)	13	(4.4)			0	(.0)	7	(4.9)	10	(4.4)			0	(.0)	8	(5.1)	9	(4.2)		
Marital status	Single	0	(.0)	30	(40.5)	111	(37.5)	1.411	0.703	0	(.0)	56	(39.4)	85	(37.3)	4.630	0.201	0	(.0)	62	(39.5)	79	(37.1)	0.316	0.957
	Married	0	(.0)	44	(59.5)	180	(60.8)			0	(.0)	82	(57.7)	142	(62.3)			0	(.0)	93	(59.2)	131	(61.5)		
	Divorced	0	(.0)	0	(.0)	3	(1.0)			0	(.0)	2	(1.4)	1	(.4)			0	(.0)	1	(.6)	2	(.9)		
	Widow	0	(.0)	0	(.0)	2	(.7)			0	(.0)	2	(1.4)	0	(.0)			0	(.0)	1	(.6)	1	(.5)		

Table 4. relations among Sociodemographic Characteristics, levels of strategic improvisation, Organizational ambidexterity, and work holism from nurses' perspective (n = 370)

Sociodemographic characteristics		Organizational ambidexterity						X ² / Fisher	P							X ² / Fisher	P	Work holism						X ² / Fisher	P
		Low		Moderate		High				Low		Moderate		High				Low		Moderate		High			
		N	(%)	N	(%)	N	(%)			N	(%)	N	(%)	N	(%)			N	(%)	N	(%)	N	(%)		
Educational level	Technical associate degree	0	(.0)	46	(62.2)	179	(60.5)	1.679	0.432	0	(.0)	85	(59.9)	140	(61.4)	2.089	0.352	0	(.0)	95	(60.5)	130	(61.0)	0.243	0.886
	Bachelor degree	0	(.0)	24	(32.4)	109	(36.8)			0	(.0)	50	(35.2)	83	(36.4)			0	(.0)	56	(35.7)	77	(36.2)		
	Post-graduate	0	(.0)	4	(5.4)	8	(2.7)			0	(.0)	7	(4.9)	5	(2.2)			0	(.0)	6	(3.8)	6	(2.8)		
Experiences year	2 - 8	0	(.0)	57	(77.0)	236	(79.7)	0.343	0.952	0	(.0)	109	(76.8)	184	(80.7)	0.886	0.829	0	(.0)	124	(79.0)	169	(79.3)	0.197	0.978
	9 - 16	0	(.0)	9	(12.2)	31	(10.5)			0	(.0)	17	(12.0)	23	(10.1)			0	(.0)	17	(10.8)	23	(10.8)		
	17 - 23	0	(.0)	4	(5.4)	16	(5.4)			0	(.0)	9	(6.3)	11	(4.8)			0	(.0)	8	(5.1)	12	(5.6)		
	24-30	0	(.0)	4	(5.4)	13	(4.4)			0	(.0)	7	(4.9)	10	(4.4)			0	(.0)	8	(5.1)	9	(4.2)		
Unit	Critical care unit	0	(.0)	44	(59.5)	178	(60.1)	0.011	0.915	0	(.0)	84	(59.2)	138	(60.5)	0.069	0.793	0	(.0)	98	(62.4)	124	(58.2)	0.505	0.477
	Departments	0	(.0)	30	(40.5)	118	(39.9)			0	(.0)	58	(40.8)	90	(39.5)			0	(.0)	59	(37.6)	89	(41.8)		

Discussion

The rapid changes and developments in the work environment have forced organizations to adopt contemporary work cycle trends to adapt to these changes. Among these contemporary trends are strategic improvisation and organizational ambidexterity. Organizational ambidexterity refers to an organization's ability to simultaneously engage in exploiting current organizational capabilities and exploring future opportunities. Others have described it as a dynamic capability that emphasizes management's role in adapting, integrating, and reshaping various skills and resources. Strategic improvisation is the behavior followed by organizational leaders to control a dynamic, rapidly changing (Sattar & Dhaheer 2022).

Workaholism, in contrast, denotes an overpowering urge to labor endlessly and a failure to detach from work tasks, even when it harms health, relationships, or life balance. Unlike healthy devotion or commitment to a career, workaholism is propelled by an uncontrollable inner drive to keep working, often resulting in burnout, tension, and reduced job satisfaction. Those exhibiting workaholic traits may wrestle with guilt or anxiety when not on the clock, and their sense of self becomes excessively

tied to professional success (Aziz & Covington, 2024).

The results highlight the intricate and varied character of workaholism, which results from a confluence of sociocultural influences, individual personality traits, and cognitive distortions. The prevalence of workaholism in contemporary workplaces emphasizes the necessity of tackling this problem holistically. Workaholism has far-reaching effects on a person's relationships, general life satisfaction, and health and well-being of the individual.

Regarding strategic improvisation, our present study revealed that nearly two thirds of nurses demonstrate a high level, this result is in alignment with (Sarah & Bydaa, 2023) who mentioned that in his study regarding strategic improvisation and organizational sustainability all responders have a high degree of response toward strategic improvisation.

Regarding nurses' perception toward dimensions of strategic improvisation, the result of this study showed that less than three quarters nurses have a high-level perception regarding all dimensions of strategic improvisation, in agreement with Sarah and Bydaa (2023), who mentioned and demonstrated the high level of

response exhibited by the participants in all aspects of his research.

Regarding organizational ambidexterity, our study showed that, Majority of nurses exhibited a high level toward it, in agreement with **(Tarique, et al., 2025)** who stated that employees exhibited a high-level organizational ambidexterity and increased performance in their study.

Regarding our third variable, our study concluded that more than half of study subjects had a high level of workaholism, in the same line with **(Belal ,2024)** who described that individuals developed a high level of workaholism due to individuals and organizational factors in his study (Understanding Workaholism: Causes, Effects and Solutions).

The results of our study indicate that organizational ambidexterity and strategic improvisation have a statistically positive correlation. This is consistent with the findings of **Muayad and Hussein (2021)**, who found a highly statistically significant correlation between organizational ambidexterity and strategic improvisation in their study. On the other hand, the present study concluded that, there was a statistically positive significant correlation between strategic improvisation and workaholism, in

the same line with **(Xueling & Ting, 2024)** who mentioned that there was a strong relation between strategic improvisation and workaholism in the study (Effect of improvisational strategic orientation and entrepreneurial bricolage on new venture performance).

Conclusion

The current study concluded that work holism, demonstrated the highest mean percentage, followed by strategic improvisation, while organizational ambidexterity ranked third. Also, revealed statistically significant positive correlation between organizational ambidexterity and strategic improvisation. In addition, strategic improvisation was positively correlated with workaholism. Moreover, a strong positive and statistically significant correlation was found between organizational ambidexterity and work holism.

Recommendations

The current study recommended that:

- Hospital management adopt application of strategic knowledge and increase cooperation with other suppliers to activate strategic improvisation and increase quality of service provided.
- Hospital should integrate modern technology in nursing field and medical services to preserve patient

information for easy reference when needed.

-There is a requirement to explore reinforcement learning techniques to foster real-time exploration, exploitation trade-offs in competitive edge.

-Maintain competent staff by providing material and moral incentives, as well as providing a climate of positive work environment.

-Health care organizations should pay attention to strategic knowledge, developing organizational capabilities, determining strategic precedence, and improving the organization's environment for enhancement of strategic improvisation.

-Develop new measures that accurately reflect the varied cultural meanings of workaholism indicators.

-Future research agenda emerging themes of organizational ambidexterity, including ambidextrous leadership, sustainable practices, supply chain ambidexterity and global innovation.

The necessity of resorting to finding tangible and clear changes in the organizational structures, leading to the improved organizational transformation of strategic improvisation.

-Additional attention to forecasting and charting future paths, in the

strategic direction of the organization to expand its services and improve the level of organizational sustainability by reducing the costs of internal operations, considering it a major goal that increases its competitive strength.

-Resorting to conducting performance analysis, reviewing work methods and identifying deviations to address problems immediately through evaluation.

-Organization should foster a culture of innovation among employees by providing a supportive environment that encourages the development of creative solutions and new services and products.

-Organization should enhance their ability to recognize and predict risks by adopting advanced strategic analysis tools and developing effective plans to address potential threats. This proactive risk awareness is the cornerstone of building strong organizational improvisation.

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Effect of Malocclusion on the Oral Health Related Quality of Life, Self-esteem and Social Interaction of Adolesce

Gehad Mohamed Abed-Elmonem Dalieb^{1,2}, Hanan Abo El Gamelen Ebrahim³, Samia. E., Khaton⁴, Nahed Karam Mohmoud Elsehry⁵

¹Head nurse, Faculty of Dentistry, Tanta university

²Master Student of Community health Nursing Faculty of Nursing. Tanta university. Egypt.

^{3,4}Professor Community Health Nursing. Faculty of Nursing. Tanta university. Egypt.

⁵Assistant Professor Community Health Nursing. Faculty of Nursing. Tanta university. Egypt.

Corresponding author: Gehad Mohamed

Email: gehadmohameddalib@gmail.com

Abstract

Background: Malocclusions are one of the major oral health problems, ranking third after dental caries and periodontal disease. Among adolescents it can have negative impact on oral related quality of life and also aesthetic and psychosocial behavior of adolescents. **Aim of the study:** to assess the effect of malocclusion on the oral health related quality of life, self-esteem and social interaction of adolescents. **Design:** A descriptive cross-sectional research design. **Setting:** This study was conducted at the Orthodontics Clinic of Faculty of Dentistry, Tanta University. **Subjects:** A convenience sample of 455 adolescents, who attended the previous setting. **Tools:** Four tools were used. **Tool (I):** Knowledge of adolescent regarding malocclusion questionnaire: which consisted of two parts: **part (1):** Bio-Socio-demographic characteristics of adolescent. **Part (2):** Knowledge of adolescent regarding malocclusion. **Tool (II):** Orthodontic Quality of life questionnaire (OQLQ). **Tool (III):** Rosenberg's self-esteem scale (RSES). **Tool (IV):** Social interaction of adolescent with malocclusion. **Results:** the majority (84.2%) of the studied adolescents had a low level of knowledge about malocclusion and most (95.8%) of them had poor oral health related quality of life. Additionally, more than two thirds (68.8 %) of the studied adolescents had a low self- esteem and most of them had negative social interaction. **Conclusion:** the highest percentages of studied adolescents who affected with malocclusion found to have poor oral health quality of life, low self-esteem and negative social interaction. In addition, they had low level of knowledge about malocclusion. **Recommendation:** Continuous education and awareness programs about malocclusion and its effect on oral function and psychosocial health of adolescents should be encouraged to support early detection and early management.

Key words: Malocclusion, Oral Health, Quality of Life, Self-esteem and Social Interaction.

Introduction

Dental esthetics have greater impact on psychological wellbeing of individuals. The adolescence period is a critical time of growth that involves anatomical, physical, and most importantly, psychological changes that might affect all aspects of adolescents' life. Usually, adolescents are more apprehensive about their body image which plays an important role in the psychological wellbeing, social acceptance, and educational achievement.

Malocclusion is a developmental disorder and a public dental health problem having high prevalence and treatment needs (**Holm et al., 2023**). Malocclusion refers to the misalignment of teeth and jaws when the upper and lower teeth do not fit together properly (**Spanemberg, Cardoso, Slob, & López-López, 2019**).

Worldwide, malocclusion affects greatly in large number of population especially among adolescents. Where the most severe malocclusions and aesthetic impairments were associated with lower oral health-related quality of life (OHRQoL) (**Devi, Keisam, & Singh, 2022**). It can alter oral functions like mastication, speech, swallowing, and may lead to orofacial adaptability. Which consequently disturbs the adolescent's physical, psychological and social wellbeing as it may affect adolescents' self-awareness and self-acceptance more than its functional effect causing a negative impacted

on oral health related quality of life (**Devi, Keisam, & Singh, 2022**). Malocclusion problems can be perceived differently by the affected adolescents. Its degree and aesthetic impairments are associated with different aspects of adolescents' well-being. The psychological and social impact of such problem may affect the daily life of adolescents. or have an adverse effect on the general quality of life (**Salih, Ali, & Nasir, 2023**).

According to systematic review and meta-analysis, conducted by **Lombardo et al., 2020**, to assess worldwide prevalence of malocclusion in the different ages of dentition, 81% of children and adolescents suffer from malocclusion in Africa which have the highest prevalence followed by Europe 72% then America 53% and Asia 48%. (**Lombardo et al., 2020**)

The etiology of malocclusion and related

abnormalities of the skeletal components of the face is complex and can vary. These conditions can arise due to specific, isolated causes, genetic factors, environmental causes, or a combination of these factors. Examples of specific causes can be disturbances in the embryological process due to mutations, leading to cleft lip or palate or other craniofacial conditions. (**Li et al., 2024**).

The severity of malocclusion is categorized into different degrees based on the extent of misalignment and its impact on oral functions, aesthetics, and psychological well-

being. Mild malocclusion involves slight misalignment of teeth, such as minor crowding or spacing. It has a minimal impact on chewing or speech functions and may not necessarily require orthodontic treatment. However, in some cases, cosmetic treatment is recommended for aesthetic purposes. This condition is often caused by habits like thumb-sucking or minor jaw development issues (Närhi, 2023).

Moderate malocclusion is more noticeable and affects both the bite and the alignment of the jaws. It can lead to difficulty in chewing, slight speech problems, and discomfort in the jaw. Additionally, it affects aesthetic appearance, which may impact self-esteem and social interactions, particularly among adolescents. Orthodontic treatment, such as braces or aligners, is usually required to correct the bite and improve alignment (Närhi, 2023).

Severe malocclusion involves a significant misalignment between the upper and lower jaws, such as severe overbite, under bite, or cross bite. This condition leads to functional problems, including difficulty in chewing, speaking, and even breathing. It may also cause jaw pain, headaches, and temporomandibular joint disorders (TMJ). Beyond physical issues, severe malocclusion has a profound psychological impact, leading to low self-esteem and social isolation. Comprehensive orthodontic treatment or even surgical intervention is often required in extreme cases (Närhi, 2023).

Community health nurse has a unique role in raising awareness of the community, especially adolescent about preventive measures of malocclusion. She / he has an important role in maintaining oral health and healthy oral habits and clarifying its association with prevention of malocclusion (Cofré & Rodríguez, 2018).

Community health nurse can play a crucial role in empowering adolescents to make decisions regarding their dental medical care, treatment, and promotion of health care. Nurses can combine screening, and risk assessment for oral health problem with health education not only among adolescents but also among all age groups to improve dental health (Clement, 2020).

Significance of the study

Malocclusion is one of the most significant and widespread oral health problems (Anthony, Zimba & Subramanian, et al., 2018). Which ranked as the third most frequent disease of the oral health. In addition, it is a common oral ailment that affects people all over the world (Clement, 2020). Malocclusion prevalence varies widely by region and among different age groups and genders. Adolescents are still affected in large numbers than any other populations (Tak et al., 2013). The American Psychology Association highlighted the importance of self-image among the adolescents with malocclusion and being accepted by their peers and highlighted the effect of peer rejection among those

adolescents that was reflected upon them causing several negative behaviors and isolated social life. Hence, this age group is considered an appropriate one for studying the social impact caused by esthetic perceptions and malocclusion (Lima et al., 2023). So, this study was carried out to assess the effect of malocclusion on the oral health related quality of life, self-esteem and social interaction of adolescents. **Aim of the Study:** The study aimed to assess the effect of malocclusion on the oral health related quality of life, self-esteem and social interaction of adolescents.

Subjects and method:

Subjects

Study design: A Descriptive cross-sectional research design was utilized to conduct this study. **Study**

settings: This study was conducted at the Orthodontics Clinic of Faculty of Dentistry, Tanta University.

Study subjects: The study included a convenience sample of 455 adolescents who attended the previous setting and who were willing to participate and who met the inclusion criteria were included in the study.

Inclusion criteria for adolescents:

- Both sexes.
- Adolescents have malocclusion before starting orthodontic treatment.
- Aged from 10-19 years

Tools of data collection:

The researcher used Four tools to collected the necessary data for this study.

Tool (I) Knowledge of adolescent regarding malocclusion questionnaire:

This questionnaire was used by the researcher in order to obtain the necessary data for the study. It was developed by the researcher after reviewing the related literatures (Ajwa et al., 2022; Bianco .et al 2021; Dhar, 2020; Taibah et al., 2017). It consisted of two parts as following: **Part1: Bio-Socio-demographic characteristics of adolescent:** It covered the sociodemographic characteristics of the studied subjects as regard age, sex, grade, parents' education and occupation, monthly family income, place of residence and the health history of the adolescents regarding dental problems, degree of malocclusion and problems associated with malocclusion.

Part 2: Knowledge of adolescent regarding malocclusion: This part assesses adolescents' knowledge about malocclusion regarding definition, causes, risk factors, degree (Classes), complications, prevention, and treatment of malocclusion. This part consisted of (8) multiple choice questions with a number of options that the adolescents could choose one or more than one correct answer. The total score of knowledge equals 40 points.

The scoring system of the adolescents' knowledge was carried out as follow:

Each right or correct answer scored as one point, while incorrect or do not know answer scored as Zero

point. Responses of adolescents to were summed up to calculate total score. The total score of adolescents' knowledge was converted into percentage then classified in to the following categories:

- Low level of knowledge < 50% of total score (< 20 points)
- Moderate level of knowledge 50% to 75% of total score (20 - 30 points)
- High level of knowledge > 75% of total score (> 30 points)

Tool II: Orthodontic Quality of life questionnaire (OQLQ):

Orthodontic quality of life questionnaire (OQLQ) which Was developed by **Cunningham,2002 and Marusamy, 2021 (Cunningham, Grah and Hunt, 2002; Marusamy et al., 2021)** was adapted by the researcher to assess the effect of malocclusion on the oral health related quality of life of adolescents. It consisted of 22 items that were grouped into four dimensions; facial aesthetics (5 items) as (I am self-conscious about the appearance of my teeth and oral function (5 items) as (I have problems in biting; self-awareness of facial deformity (4 items) as (I spend a lot of time studying my teeth in the mirror) ; and social aspects (8 items) as (I try to cover my mouth when I meet people for the first time).

The scoring system:

Responses of adolescents was measured on a 3-point Likert scale ranging from agree (1), neutral (2), disagree (3). The sum of all the items reflects the OQLQ ranged between 22–66The adolescents'

levels of OHQL were categorized as follows:

- Good quality of life: a scoring of $\geq 60\%$ of the total score.
- Poor quality of life: a scoring of < 60% of the total score.

Tool III: Rosenberg's self-esteem scale (RSES): -

Rosenberg's self-esteem scale (RSES) was developed by **Rosenberg,1965** and updated by Sinclair, Blais&Gansler,2010, It was adapted by the researcher to assess the effect of malocclusion on the self-esteem among adolescents. It included ten items which divided into two parts: positively warded self-esteem (PSE) (Items 1,3,4,7and 10) as (I am satisfied with myself and I am able to do things as well as most other people) and negatively warded self-esteem (NSE) with the remaining items (2,5,6,8,9) as (I think I'm not good at all, I feel as I don't have much too proud of).

In PSE, responses of adolescents were measured on a 3 points Likert scale ranging from disagree (1), neutral (2), agree (3). While in NSE the scoring was reversed as agree (1) to disagree (3).

The scoring system: -The total score of all the items reflects the RSES range between 10–30 where the high score indicated a higher level of self-esteem:

The adolescents' response was summed up and converted in to percentage then, and it was categorized as follow:

- Low self-esteem:** a scoring of < 70 % of the total score.

-High self-esteem: a scoring of ≥ 70 % of the total score.

Tool IV: Social interaction of adolescent with malocclusion: - Social interaction among orthodontic adolescent patients' questionnaire was developed by the researcher after reviewing related literatures (Al-Hummayani, 2017; Bianco et al., 2021; Marusamy et al., 2021; Taibah) to assess the effect of malocclusion on the social interaction among adolescents. It was divided into three dimensions; **The first dimension; social impact of malocclusion** which included four statements as I think having straight teeth makes me more popular. **Second dimension; social welfare.** It included seven statements such as I avoided smiling/laughing when around other children and **the Third dimension; psychological dimension** which included four statements such as I concerned with what other people think and I argued with other children about being bullied.

The scoring system social interaction:

the responses of adolescents were measured on three likert scale where disagree (3), nutural (2) and agree (1).

The sum of all the items reflects the social interaction among the orthodontic adolescents ranged between (15 - 45). The responses of the studied adolescents were summed up, converted into percent and categorized as follows:

- **Positive** social interaction: ≥ 70 % of the total score.

- **Negative** social interaction: < 70 % of the total score.

Method

The study was conducted as follows:

1-Obtaining approval:

- An official permission letter was obtained from the Dean of Faculty of Nursing to the manager of Orthodontics Clinics, Faculty of Dentistry, Tanta University in order to obtain his permission to collect the necessary data.

2- Ethical considerations

- Approval of the Faculty of Nursing Scientific Research Ethical Committee, Tanta University was obtained (code number: 307 – 10 – 2023).
- The study was conducted with careful attention to ethical standards of research and rights of the participants.
- An informed consent was obtained from the study subjects after providing appropriate explanation about the purpose of the study.
- Privacy and confidentiality were considered.
- Nature of the study didn't cause any harm or pain for the entire sample.
- Anonymity was ensured by using coding number instead of names.

3- Developing the tools of the study:

Tool I and IV were developed by the researcher after reviewing related literature.

Tool II and III, were adapted by the researcher to suit the Egyptian subjects.

4-The study tools were tested for face and content validity by jury of five experts in the field of

community health nursing before conducting the study and the needed modifications were done.

5- A pilot study:

It was carried out by the researcher on 10% (45) of the subjects for testing the tool for its clarity, applicability and to identify obstacles that may be encountered with the researcher during data collection. Accordingly, the necessary modifications were done as paraphrasing of some items, omission of some questions and adding more explanation of others. So, this sample was excluded from the study.

6- Reliability of the study tools:

-Cronbach's Alpha test was used to assess the reliability of the study tools. It was found to be (0.878) for the entire tools, (0.850) for knowledge part, (0.850) orthodontic quality of life, (0.661) for Rosenberg self- esteem and (0.831) for social interaction tool.

7- Actual study (field work):

The data were collected by the researcher over a period of 3 months starting from the First of March to the end of May 2024.

- In order to gain the adolescents' confidence and participation, the researcher met with them in the waiting area at the Orthodontics Clinics after completing their clinical checkup at Faculty of Dentistry at Tanta University and explained the purpose of the study.
- The researcher met adolescents in the previously mentioned settings three days per week.
- The study tools were distributed to be filled by adolescents themselves

in the presence of the researcher to provide them with the needed explanation, while others were filled by the researcher through question / answer technique for young students.

- The average numbers of adolescents interviewed per day ranged between 12- 14 adolescents.

Statistical Analysis:

The data were organized, tabulated and statistically analyzed using statistical package for social studies (SPSS) version 23. The mean, standard deviation and range were calculated for quantitative data. For categorical variables numbers and percent were calculated. Comparison was done using chi-square test (χ^2). Pearson's correlation coefficient (r) was used to identify correlation between variables. A significance was adopted at $P < 0.05$ for interpretation of results of tests of significance (*). Also, highly significant was adopted at $P < 0.01$ for interpretation of results of tests of significance (**).

Results:

Table (1): Shows the distribution of the studied adolescents according to their socio-demographic characteristics. The table shows that, the age of the studied adolescents ranged from 9- 19 years, with the mean age of 16.08 ± 2.287 years, and less than two thirds (60.7%) of them were more than 15 years of age. Regarding to the educational stage of the studied adolescents, more than two fifths (41.5%) of them were secondary students while more than one quarter

(30.8%) of them were preparatory students, nearly about one fifth of them (20.7%) were university students and only (7.0%) of the studied adolescents were primary students. Also, the table shows that, slightly more than one half (50.8%) of the studied adolescents were females. Concerning to adolescents' parents' education, it was noticed that, less than half of the studied adolescents their fathers and mothers had university education (37.4% and 46.8%) respectively followed by nearly about one third (33.4%, and 31.0%) of them respectively had secondary education. On the other hand, a small percentage (11.6%, and 9.9%) of them respectively were illiterate or just read and write.

Also, this table shows that regarding to the occupation of studied adolescents' parents, more than one half (52.5%) of mothers and the majority of their fathers (87.3%) were working. In addition, slightly more than two fifths (40.6%) of the studied adolescents had enough family income, and more than half (59.6%) of them lived in urban area.

Table (2): Shows the distribution of the studied adolescents according to their history of malocclusion. It was clear that, more than half (59.8%) of the studied adolescents had family members affected by malocclusion and more than two thirds (69.5%) of affected family members were fathers or mothers. In addition, more than two thirds (40.0% and 42.9%) of the studied adolescents categorized as first or third class of

malocclusion respectively while less than one fifth of them (17.1%) were of second class.

Regarding to problems associated with malocclusion, less than half (44.4%) of the studied adolescents complain of inappropriate general appearance, where slightly less than one quarter (24.8% and 24.0%) of them had trouble breathing or problems of swallowing respectively. Less than one fifth (17.8%) of them had chewing problem. Regarding to the time of starting malocclusion, it was observed that, less than two thirds (60.0%) of the studied adolescents affected by it since childhood while more than one fifth (21.1%) of them affected by it since entering school and the rest (18.9%) of them since the beginning of adolescence.

Figure (1): Shows the distribution of the studied adolescents according to their levels of knowledge about malocclusion. It was observed that, the majority (84.2 %) of the studied adolescents had a low level of knowledge about malocclusion. Less than one fifth of the studied adolescents (13.0%) had moderate level of knowledge and only 2.8% had high level of knowledge.

Table (3): Demonstrates the distribution of the studied adolescents according to their mean score of each dimension of orthodontic quality of life questionnaire. It was observed that, the mean $\pm$ SD of total orthodontic quality of life score of the studied adolescents were (37.272 ± 7.195)

with range of (23 – 65) followed by (12.72 ± 3.652) for social aspects, then (9.06 ± 2.419) for oral function then (8.96 ± 1.886) for facial aesthetics. While the lower mean was (6.53 ± 1.441) observed in self-awareness of facial deformity with range of (4-12).

Figure (2): Shows the distribution of the studied adolescents with malocclusion according to their levels of oral health related quality of life. It was noticed that, most (95.8 %) of the studied adolescents had poor oral health related quality of life.

Figure (3): Presents the distribution of the studied adolescents with malocclusion according to their level of self-esteem. It showed that, more than two- thirds (68.8%) of the studied adolescents had low self-esteem while nearly about one- third of them (31.2%) had high self - esteem.

Table (IV): Percentage distribution of the studied adolescents according to their mean score of each dimension of social interaction. It was observed that, the mean $\pm$ SD of total social interaction score of the studied adolescents, was (24.307 ± 4.721) with range (15 – 40) followed by (11.26 ± 2.768) with range of (7-21) for social welfare, then (6.96 ± 1.847) with range of (4-12) and finally (6.09 ± 1.464) with range of (4-10) for social impact.

Figure (4): Illustrates the distribution of the studied adolescents with malocclusion according to their levels of social

interaction. It showed that, most of (99.3%) the studied adolescents with malocclusion had negative social interaction while only (0.7%) of them had positive social interaction.

Table (5): Correlation between total knowledge score, total quality of life, total self-esteem and total social interaction scores of the studied adolescents. The table shows that, there were highly statistically significant positive correlations between total quality of life score, total knowledge and total social interaction of the studied adolescents at ($p = 0.001$ and 0.001). On the other hand, there were statistically significant negative correlations between total self-esteem, total quality of life and total social interaction of the studied adolescents ($p = 0.001$ and 0.001).

Table (1): Distribution of the studied adolescents according to their socio-demographic characteristics

Socio -demographic characteristics	The studied adolescents n=(455)	
	No	%
Adolescents age		
<12	33	7.3
13-15	146	32.0
> 15	276	60.7
Range	9-19	
Mean ± SD	16.08 ± 2.287	
Sex		
Male	224	49.2
Female	231	50.8
Educational stage		
Primary	32	7.0
Preparatory	140	30.8
Secondary	189	41.5
University	94	20.7
Level of mother’s education		
Illiterate or read and write	53	11.6
Elementary education	80	17.6
Secondary education	152	33.4
University / post university education	170	37.4
Level of father’s education		
Illiterate or read and write	45	9.9
Elementary education	56	12.3
Secondary education	141	31.0
University / post university education	213	46.8
Mother's occupation		
Working	239	52.5
house wife	216	47.5
Father's occupation		
Working	397	87.3
Not working	58	12.7
Family income		
Not enough	170	37.4
Enough	185	40.6
Enough and save	100	22.0
place of residence		
Rural	184	40.4
Urban	271	59.6

Table (2): Distribution of the studied adolescents according to their history of malocclusion

History of malocclusion	The studied adolescents n=(455)	
	No	%
Family members affected by malocclusion		
Yes	272	59.8
No	183	40.2
Kinship relation with this family members affected by malocclusion (n=272)		
Father or mother	189	69.5
Grand father or mother	83	30.5
Age of starting malocclusion among adolescents (n = 455)		
Since childhood	273	60.0
Since entering school	96	21.1
Since the beginning of adolescence	86	18.9
The degree or severity of dental malocclusion among the adolescence		
Class I (The lower teeth overlap with the upper teeth to an extent)	182	40.0
Class II (The lower and upper teeth overlap significantly)	78	17.1
Class III (Advancement of the lower jaw or swelling of the corners of the lower jaw)	195	42.9
# Problems associated with malocclusion		
Chewing problems	81	17.8
Trouble breathing	113	24.8
Problems of swallowing	109	24.0
Inappropriate general appearance	202	44.4

More than one choice

Table (3): Distribution of the studied adolescents according to their mean score of each dimension of orthodontic quality of life questionnaire

Orthodontic quality of life questionnaire dimensions	Mean $\pm$ SD	Range
Facial aesthetics	8.96 $\pm$ 1.886	6 – 19
Oral function	9.06 $\pm$ 2.419	5 -15
Self-awareness of facial deformity	6.53 $\pm$ 1.441	4 – 12
Social aspects	12.72 $\pm$ 3.652	8 – 24
Total quality of life score	37.272 $\pm$ 7.195	23 – 65

Table (4): Distribution of the studied adolescents according to their mean score of each dimension of social interaction n= (455)

Social interaction dimensions	Mean $\pm$ SD	Ranges
Social impact of malocclusion dimension	6.09 $\pm$ 1.464	4 – 10
Social welfare dimension	11.26 $\pm$ 2.768	7 – 21
Psychological dimension of malocclusion	6.96 $\pm$ 1.847	4 – 12
Total social interaction score	24.307 $\pm$ 4.721	15 – 40

Table (5): Correlation between total knowledge score, total quality of life, total self-esteem and total social interaction scores of the studied adolescents.

Variables	Total knowledge score	Total quality of life	Total self-esteem	Total social interaction
	r p	r p	r p	r p
Total knowledge score	-	0.157 0.001**	0.067 0.155	0.326 0.001**
Total quality of life	0.157 0.001**	-	-0.444 0.001**	0.697 0.001**
Total self-esteem	0.067 0.155	-0.444 0.001**	-	-0.272 0.001**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

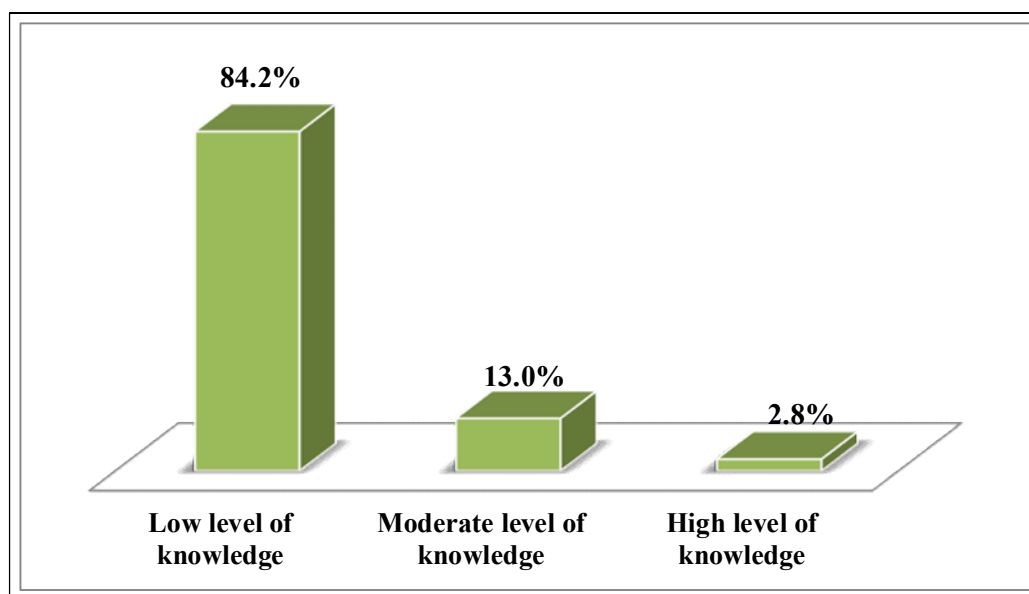


Figure (1): Distribution of the studied adolescents regarding to their total level of knowledge about malocclusion (mean $\pm$ SD 14.419 $\pm$ 7.312).

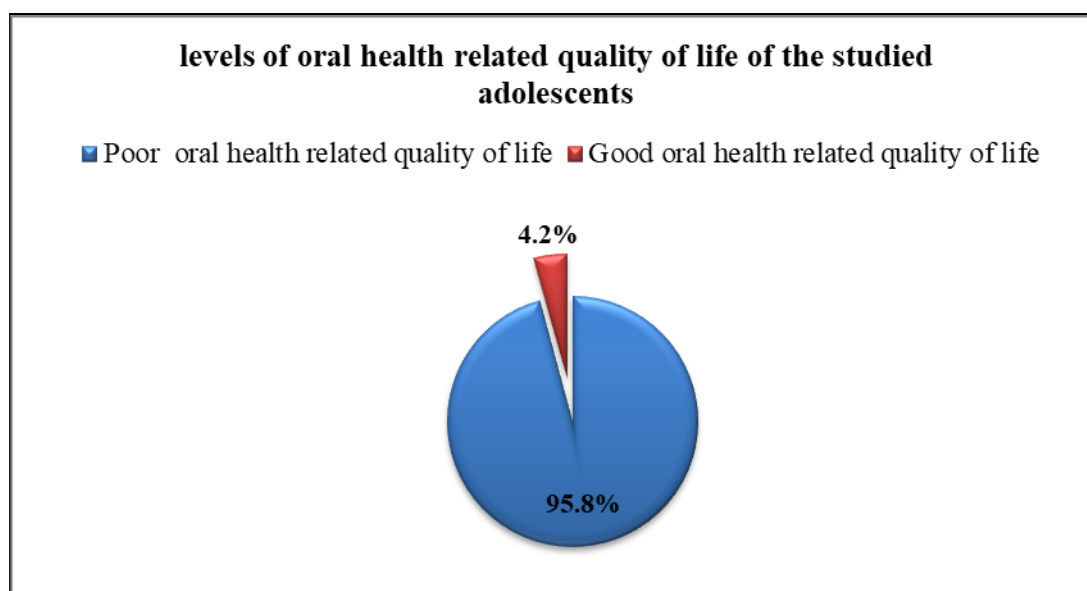


Figure (2): levels of oral health related quality of life of the studied adolescents with malocclusion

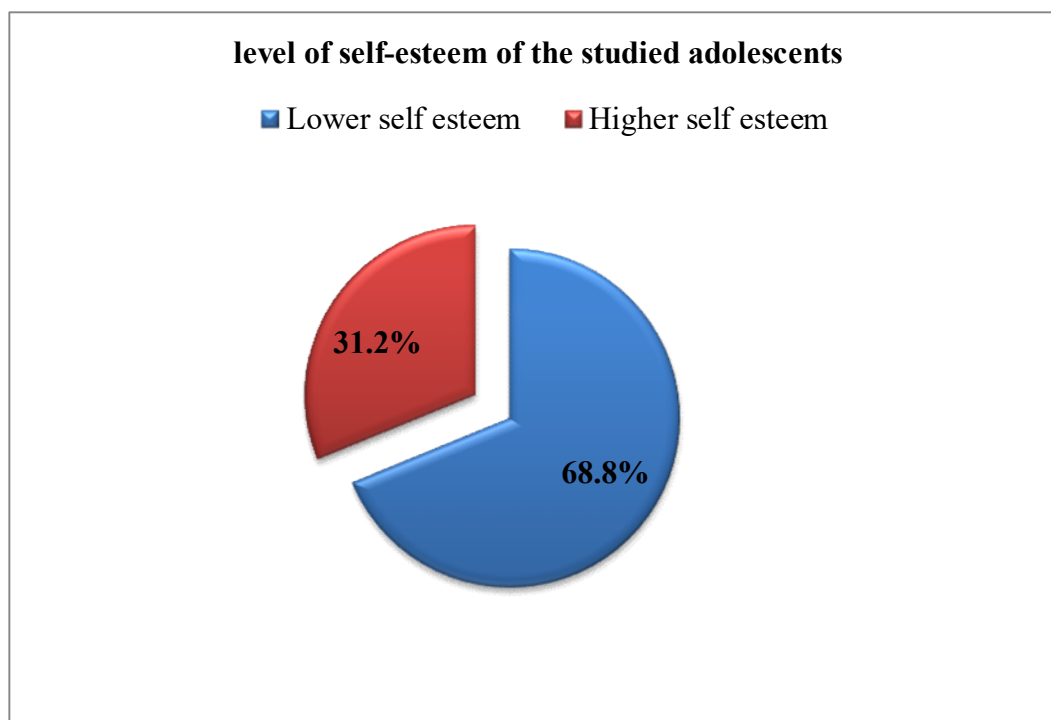


Figure (3): Distribution of the studied adolescents according to their level of self-esteem

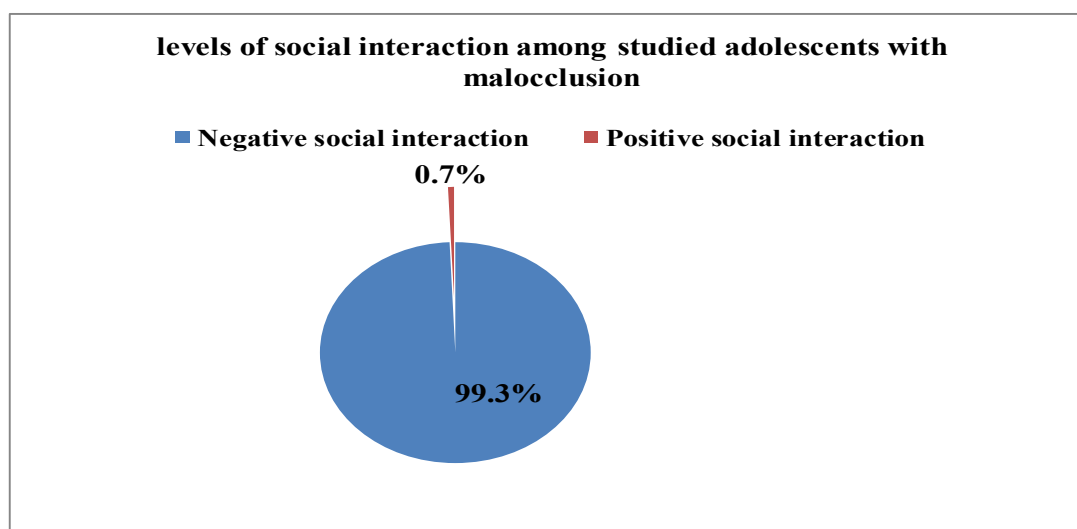


Figure (4): levels of social interaction of the studied adolescents with malocclusion

Discussion:

Oral health and general health are intricately connected, with oral diseases potentially affecting distant organs and overall well-being. Malocclusions, like other dental condition, significantly negative impact on the aesthetics and psychosocial behavior of adolescents, thus influencing their self-esteem and social interactions. Adolescents often become more concerned with dental appearance as they grow, and malocclusion can lead to feelings of embarrassment and lower self-confidence (**Kaur et al, 2017**). So, the present study aimed to evaluate the impact of malocclusion on the oral health related quality of life, self-esteem and social interaction of adolescents.

Regarding history of malocclusion among the studied adolescents, the current study shows that over one thirds of adolescents class **I** and class **III** of malocclusion respectively while only more than one sixth had the second degree. **Table (II)**. This result contrasted to (**Abozena., Rmadan., and Ismael. 2024**) who studied the prevalence of malocclusion in primary schools with different socioeconomic level in Gharbia Governorate and stated that the prevalence of class I malocclusion 61.5%, class II 12.9% of the total and class III was

observed among 23.6%. Also, these findings were disagreed with the results of (**Salim. et al 2021**) who study Prevalence of malocclusion and assessment of orthodontic treatment needs among Syrian refugee children and adolescents was determined to be 83.8% (52.6% class I 24.2% class II and 7% class III). Knowledge of malocclusion among adolescents varies according on their educational background, family awareness, and access to dental treatment. While some adolescents understand the causes, types, and effects of malocclusion, others have limited awareness, often influenced by parental education and socioeconomic status (**Liu and Li, 2024**).

Regarding to studied adolescents to levels of knowledge about malocclusion the study revealed that, the majority of the studied adolescents had a low level of knowledge about malocclusion. Less than one fifth of the studied adolescents (13.0%) had moderate level of knowledge and only 2.8% had high level of knowledge **Figure (1)**. This may be due to a lack of school health instruction or inadequate family and media guidance. Such lack of knowledge could delay early diagnosis and treatment, emphasizing the need for

targeted awareness programs for adolescents.

These findings are conducted by **Zang. et al. (2025)** who studied knowledge, attitude, and practice of orthodontic treatment among students patients preparing for or undergoing treatment" as well as the study of (**KhattarB. et al 2024**) who study the knowledge, Awareness, and Attitude on malocclusion in nursing. They discovered that their subjects exhibited moderate level of knowledge of malocclusion. This differences in knowledge level may be attributed to the difference in the study subjects whom may had greater concern of the Governale and oral health in their countries.

Concerning to studied adolescents mean score of each dimension of orthodontic quality of life questionnaire, it was observed that, the mean $\pm$ SD of total orthodontic quality of life score of the studied adolescents were (37.272 ± 7.195) with range of (23 – 65) and this means that most adolescents have poor oral health related quality of life. **Table (3)**

This finding is contradicted with (**El naghy and Hasanin, 2023**), whose study entitled Impact of malocclusions on oral health-related quality of life among adolescents, which found that malocclusion, measured by the Dental Aesthetic

Index (DAI), had a significantly negative impact on the OHRQoL of adolescents between aged 11–14 years. The pooled indicating a higher likelihood of impaired quality of life among adolescents with malocclusion.

However, it disagreed with the study conducted by (**Oliveira et al. 2024**) Whose study entitled Severe malocclusion and oral health-related quality of life in adolescents aged 12-15 years, which found that although some domains, such as psychological discomfort and social disability, showed slight negative effects, the overall OHRQoL scores were not negatively impacted.

Regarding distribution of the studied adolescents according to the total levels of oral health-related quality of life, **Figure (2)** It was found that, the majority (95.8 %) of the studied adolescents had poor oral health related quality of life and only 4.2% had good oral health related quality of life. These results agreed with (**Guerino, Ortiz, Marquezan, Ardenghi & Ferrazzo, 2024**), whose study the "impact of orthodontic treatment on OHRQoL of adolescents" and reported that adolescents with a high need for orthodontic treatment were 3.32 times more likely to experience poor oral health-related quality of life (OHRQoL) than those with low

need. This indicating that severe malocclusion significantly affects adolescents' psychosocial well-being, self-perception, and daily activities.

Regarding adolescents' level of self-esteem, the present study presents that more than two-thirds of the studied adolescents with malocclusion had low self-esteem, while nearly one-third had high self-esteem **Figure (3)**. These results are in agreement with the findings of (**Zakai et al., 2024**), who conducted a study to assess the impact of malocclusion severity on self-confidence and facial appearance among orthodontic patients a longitudinal study and found that 47.3% of participants experienced reduced self-confidence due to malocclusion, and 71% reported negative effects on facial appearance.

Concerning to the mean score of social interaction dimension among studied adolescents. It was observed that, the mean $\pm$ SD of total social interaction score of the studied adolescents, was (24.307 ± 4.721) with range of (15 – 40). **Table (4)** This result was consistent with the findings with (**Bittencourt et al. 2020**) in Brazil, whose study entitled Negative effect of malocclusion on the emotional and social well-being of Brazilian adolescents: a

population-based study and reported that the presence of definite malocclusion was associated with a higher negative impact on social well-being (PR = 1.18; 95% CI = 1.02–1.36), severe malocclusion with an even greater impact (PR = 1.46; 95% CI = 1.21–1.76), and handicapping malocclusion had the highest negative impact (PR = 1.61; 95% CI = 1.35–1.94) on social aspects of oral health-related quality of life. Also this finding is consistent with (**Baskaradoss et al.2022**), whose study entitled the impact of malocclusion on the oral health-related quality of life of 11–14-year-old children and reported that , the social well-being domain had the lowest mean score (2.08 ± 2.98) of the CPQ11–14 domains, but children with handicapping malocclusion had significantly higher scores in this domain, indicating a poorer social quality of life. Although the scales differ, both studies demonstrate that more severe malocclusion is associated with greater negative impact on social aspects of oral health-related quality of life.

However, this result conducted with the findings of **Foster Page et al. 2020**) in New Zealand, whose study entitled “Validation of the Child Perceptions Questionnaire (CPQ11–14) in a population-based sample of

11–13-year-old children”, which evaluated that the overall OHRQoL among adolescents. Although the CPQ11–14 includes the social well-being domain as part of the overall assessment, the study reported that the social well-being domain had the lowest mean score (2.2 ± 2.8), indicating limited impact of malocclusion on social interaction. Additionally, there was no statistically significant correlation ($p > 0.05$) between malocclusion and social well-being. This suggests that the social consequences of malocclusion may vary across populations and could be influenced by cultural norms, social tolerance, and self-perception differences among adolescents.

Regarding the distribution of the studied adolescents with malocclusion according to their levels of social interaction. It showed that, most of (99.3%) the studied adolescents with malocclusion had negative social interaction while only (0.7%) of them had positive social interaction. **Figure (4).** The present study showed that, most of the studied adolescents with malocclusion had negative social interaction. Finding is in contrast with (Doughan et al., 2024) who evaluated the psychosocial parameters in adolescents seeking orthodontic

treatment and reported that the studied adolescents did not report significant social withdrawal. They also suggested that malocclusion may have a greater influence on self-image and emotional well-being than on actual social interaction, particularly among adolescents who are self-motivated to seek orthodontic treatment.

Regarding to correlation between total knowledge score, total quality of life, total self-esteem and total social interaction scores of the studied adolescents. the present study presents that there is a highly statistically significant positive correlation between total knowledge score, total quality of life and total social interaction of the studied adolescents at ($p = 0.001$ and 0.001). On the other hand, there were statistically significant negative correlations between total self-esteem, total quality of life and total social interaction of the studied adolescents ($p = 0.001$ and 0.001). This result is consistent with the findings of (Alrashed & Algerban, 2021), who study entitled the relationship between malocclusion and oral health-related quality of life among adolescents and reported a strong positive correlation between health literacy and psychosocial well-being among adolescents with dental issues.

Conclusion:

Based on the results of current study. It was determined that, most of the studied adolescents had low level of knowledge about malocclusion. The majority of them had poor oral health related quality of life negative social interaction. Additionally, more than two thirds of them had a low self- esteem.

Moreover, among the studied adolescents, there were highly statistically significant positive connection between total quality of life score, total knowledge and total social interaction at ($p= 0.001$ and 0.001).

Recommendations:

According to the study results, the following recommendations were suggested:

1-Lunch a school- based oral health education for adolescents that explain malocclusion, its impact on oral function and psychosocial health.

2-Encourage parental engagement in early orthodontic screening and in seeking timely referral.

3-Implement periodic screening in school to identify obvious malocclusion and provide a clear dental referral pathway to dental clinics or orthodontic.

4-Integrate counseling or peer support for adolescents with visible malocclusion to mitigate negative

social interaction and low self - esteem.

5-Advocate for the low-cost orthodontic care for low-income families.

6-Further research studies are needed to explore factors affecting adolescents' self-esteem, quality of life and social interaction related to malocclusion and to evaluate intervention strategies.

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Relation between Workplace Incivility and Communication Skills Among Nursing Staff

Lamiaa Adly Abd Elhamid^{1,2}, Fouada Mohamed Shabaan³, Reda Abd-El Fattah Abo-Gad⁴, Zohor Zakaria El Saeed⁵

¹Educator nurse, Kafr El-Sheikh University Hospital, Egypt.

^PMaster Student of Nursing Administration, Faculty of Nursing, Tanta University, Egypt

^{3,4}Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt.

⁵Assistant Professor of Nursing Administration, Faculty of Nursing, Tanta University, Egypt.

Corresponding Author: Lamiaa Adly Abd Elhamid

Email: lamiaaadel999@gmail.com

Abstract

Background: Workplace incivility is recognized as a subtle but harmful form of negative behavior that can occur in healthcare settings. **Aim of the study:** to assess relation between workplace incivility and communication skills among nursing staff. **Method:** **Setting** Tanta University Emergency Hospital. **Subject:** All head nurses (N= 40), all licensed nurses (N= 129), all technician nurses (N= 126) **Research design:** A descriptive correlational study design. **Tools:** tool (1) Nursing Staff Workplace Incivility Self-Report tool (2) Nursing Staff Communication Skills Self-Report. **Results:** majority (89,2%) of nursing staff were at low risk of workplace incivility. And minority fell either into moderate or high-risk workplace incivility. While (50.8%) of nursing staff showed high level of communication skills. There was statistically non-significant positive correlation between the level of overall workplace incivility and communication skills among nursing staff ($p = 0.177$). **Conclusion:** Tanta University Emergency Hospital nursing staff work in a respectful environment with limited incivility, and most of them possess satisfactory communication skills. **Recommendations:** Periodical training programs on incivility and supportive hospital policies were needed.

Keywords: Collaboration, communication skills, nursing staff, teamwork and workplace incivility.

Introduction

Incivility in the nursing profession is defined by lack of basic respect and courtesy among colleagues. It includes actions such as refusing to assist a coworker, engaging in gossip, and failing to acknowledge or appreciate others' contributions (Clark, 2024). Workplace incivility significantly increases nurses' stress, anxiety, and job burnout (Shiroyeh & Miri, 2025). When left unaddressed, these behaviors can create a hostile environment that not only compromises the health and well-being of the nursing staff but also directly affects the quality of patient care and safety (Nassar et al., 2024).

Incivility categorized under eight dimensions including hostile climate, inappropriate jokes, inconsiderate behavior, gossip rumors, free riding, abusive supervision, lack of respect and displaced frustration. Hostile climate is characterized by the words and actions of a supervisor or colleague that seriously hinder a nurse's ability to perform their job duties (Jamison, 2023). The inappropriate jokes in the workplace can be hurtful and offensive, leading to a negative work culture and a decline in morale among nurses (Wong & Chen, 2024). Inconsiderate behavior involves a nurse disregarding the

feelings of their colleagues (Martinez & Garcia, 2023). Gossip and Rumors involve nurses engaging in informal communication to share information, often about other colleagues or work situations (Özlük & Özcan, 2021).

Free riding happens when a member of a group contributes minimally to a collective project, expecting to receive the same credit or grade as their more productive peers. This behavior can lead to significant frustration for contributing members and is a major source of conflict in collaborative work (Clark et al., 2024). Abusive supervision is defined as a subordinate's perception of their manager's or supervisors sustained display of hostile verbal and nonverbal behaviors, excluding physical contact. This can include public humiliation, ridicule, and withholding important information (Xu et al., 2024). Lack of respect in the workplace is characterized by a condescending attitude or manner. This can take many forms, from being ignored in decision-making to a general disregard for a colleague's opinions or contributions.

This behavior is a significant source of job dissatisfaction among nurses and is a key factor in staff turnover (Ahmadi et al., 2019). Displaced frustration is a psychological

defense mechanism where a person redirects their anger or frustration from its original source to a less threatening target. In a healthcare setting, this could involve a nurse taking out their frustration from a stressful situation on a colleague or a patient, rather than the true cause of their stress **(Muytjens et al., 2022)**. Nursing staff incivility has a significant and detrimental effect on their job satisfaction, team relationships, and communication. It can lead to increased burnout, reduced productivity, and a decline in overall team cohesion, ultimately affecting the quality of patient care **(Al-Hamdan et al., 2024)**.

Communication skills are considered a fundamental component of effective healthcare delivery, facilitating clear and persuasive information exchange among nursing professionals **(Svensson & Lee, 2023)**. These abilities enable nursing staff to express themselves with clarity, assertiveness, and empathy **(Adams & Chen, 2024)**. Furthermore, they help nurses become receptive to feedback and capable of adapting their communication style to fit the needs of their audience **(Garcia, 2024)**. When nurses possess strong communication skills, they experience fewer problems, make fewer errors, and utilize resources

more efficiently **(Patel & Miller, 2023)**. They are also better equipped to handle disagreements and conflicts effectively **(O'Connor, 2024)**.

Communication skills dimensions including informative communication, empathy, respect and authenticity, social skills, listening skills, use of silence and conversation skills. The informative communication refers to how nursing staff effectively obtain and convey essential data within the clinical setting **(Roberts & Khan, 2023)**. Empathy reflects the capacity of nurses to understand the feelings of their colleagues and to visibly demonstrate that compassion in their professional relationships **(Davis, 2024)**.

Respect and authenticity are evaluated by the level of congruence that nurses show in their professional interactions **(Patel, 2023)**. Social skills encompass a nurse's ability to be assertive and exhibit professionally skillful behaviors within their working relationships with colleagues **(Lee & Wilson, 2024)**. Listening skills are crucial for nurses to accurately and effectively receive information during daily communication with others **(Rodriguez, 2023)**. The use of silence involves intentionally not speaking in moments where words

might be expected, serving as a deliberate communication tool (Kim, 2024). Lastly, conversation skills are the specific qualities that enable nurses to interact with each other in an effective and constructive manner (Anderson & Baker, 2023).

Significance of study

Tanta University Emergency Hospital is a complex and dynamic environment in which nurses work under pressure from limited time and resources, physical stress, and the knowledge that their failure will have serious implications. Yet lack of nursing staff communication skills considers one of important factor in creating incivility. Nursing staff communication skills is essential for building morale, strengthening relationships, and maximizing productivity in the workplace. Incivility could be aggravated by nursing staff lack of communication skills. The present study aims to assess and present the relation of nursing staff communication skills and workplace incivility.

Aim of the study

Assess relation between workplace incivility and communication skills among nursing staff.

Research Questions

-What are the levels of nursing staff workplace incivility?

-What are the levels of nursing staff communication skills?

-What is the relation between workplace incivility and communication skills among nursing staff?

Subject and methods

Research design

A descriptive-correlational design was used to achieve the aim of the study.

Setting

The current study was conducted at Tanta University Emergency Hospital, affiliated with the Ministry of Higher Education and Scientific Research. Its capacity 222 beds, including various departments (Neurosurgery, General Surgery, Orthopedics, Internal Medicine, Toxicology, Radiology, Burn Unit, Vascular Surgery, Medical ICU, Anesthesia ICU, Recovery unit and Reception).

Subject

The study subject consisted of a stratified sample of nursing staff (n= 295) selected from total number of nursing staff (n=840) the sample size and power analysis were calculated using Epi-info software statistical package.

the criteria use for sample size z= confidence level at 99% d= error proportion (0.05).

Tools of data collection

Tool I: Nursing Staff Workplace Incivility Self-Report Developed by the researcher, guided by **Alipitio Boo et al. (2022)** and related literature, to assess nursing staff workplace incivility. It consisted of two main parts: **Part 1:** Personal data includes characteristics such as age, gender, marital status, educational level, residence, position, years of experience, and department name.

Part II: Workplace incivility self-report consisted of (35 items) classified into eight dimensions (Hostile climate, inappropriate jokes, inconsiderate behavior, gossip and rumors, free riding, abusive supervision, Lack of respect and Displaced frustration). Nursing staff responses measured on a 5-point and summing score of all categories. High level of workplace incivility > 75%. Moderate level of workplace incivility 60% -75%. Low level of workplace incivility < 60%. **Tool II: Nursing Staff Communication Skills Self-Report** Developed by the researcher, guided by **Leal-Costa et al. (2020)**, and relevant literature, to evaluate the communication skills of nursing staff. It includes 38 items under 7 subscales as follows: Informative communication, empathy, respect and authenticity, social skills, listening skills, use of

silence and conversation skills. The total scores represented varying levels according to cut-off points as follows: High level of communication skills > 75%. Moderate level of communication skills 60% - 75%. Low level of communication skills < 60%.

Methods

An official permission was obtained from the Dean of Faculty of Nursing to the authoritative personal that submitted to the previously mentioned setting.

Ethical considerations

-An approval was obtained from the Scientific Research Ethics Committee before conducting the study with code number (310) on 10/2023.

-Nature of the study was not causing harm to the entire sample.

-Confidentiality and anonymity were maintained regarding data collection and the participants have right to withdrawal.

-The tools were developed by researcher translated into Arabic and presented to a jury of five experts in the area of specialty to check their content validity. The face validity value of workplace incivility self-report questionnaire was 99.97%, and for communication skills self-report questionnaire was 100%.

-A pilot study was carried out on a sample (10%) of the subject (n=30). A pilot study was carried out after

the experts' opinion and before starting the actual data collection.

-Reliability of tools were tested using Cronbach's Alpha Coefficient test. Reliability of workplace incivility questionnaire= 0.910 and reliability of communication skills questionnaire = 0.930. Workplace incivility self-report and communication skills self-report was used to collect data from identified subjects.

Data collection phase

The data were collected from nursing staff by the investigator. The investigator met the respondents' nursing staff in different areas under study during working hours to distribute the questionnaire. The subjects recorded the answer in the presence of the investigator to ascertain that all questions were answered. The data was collected over a period of 6 months (start May 2024 until the end of October 2024).

Statistical Analysis

-Data were organized, tabulated, and statistically analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using numbers and percentages. The Kolmogorov- Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. The

significance of the obtained results was judged at the 5% level.

The chi-square test was applied for categorical variables to compare differences between groups. When more than 20% of expected cell counts were below five, Monte Carlo and Fisher's exact tests were used as corrections for the chi-square test. For normally distributed quantitative variables, the student's t-test was utilized to compare two groups. Pearson's correlation coefficient was employed to assess the strength and direction of the relationship between shared leadership scores and team performance scores.

Results

Table (1): Shows personal data of nursing staff. Majority (82.4%) of nursing staff were aged 20 -<30 years, with a mean age (26.68 ± 3.60) year. Nursing staff (64.4%) were female 51.5% unmarried and 71.5% had < 5 years of experience with mean score of (3.96 ± 2.818) years. Nursing staff graduated from technical nursing institute where (44.7 %) while (43.1%) held bachelor's degree in nursing and (12.2%) had postgraduate studies. Regarding position, 43.7% were licensed nurses, 42.7% were nursing technicians and 13.6% held head nurse positions. With respect to years of experience, most (71.5%) of

the nursing staff had less than five years of experience, with mean of (3.96 ± 2.82) years.

Table (2): Describes levels of nursing staff workplace incivility of each dimension. Range (90.2% - 86.1%) of nursing staff reported low level of workplace incivility in all dimensions. Range (12.5% -10.8%) of nursing staff reported moderate level of hostile climate, gossip and rumors and free riding dimension of workplace incivility small proportion (6.8%-3.4%) of nursing staff reported high level of inconsiderate behavior, abusive supervision and lack of respect dimensions of workplace incivility.

Table (3): Shows levels of nursing staff communication skills dimensions. Rang (66.1%-65.4%) of nursing staff had high level in informative communication, conversation skills, respect and authenticity. Nursing staff (55.3% and 52.9%) had high of use of silence and empathy communication skills, respectively. While 36.9% and 28.1% had moderate levels in listening skills and empathy, respectively. In In contrast, (76.9%) of nursing staff had low level in social skills.

Figure (1): Shows Levels of nursing staff overall workplace incivility. Majority of nursing staff participants were at a low risk of workplace

incivility. While minority fell either into moderate or high-risk workplace incivility.

Figure (2): Shows levels of nursing staff overall communication skills. More than half of nursing staff had high level of communication skills, while about one-third had moderate level and below quarter had low level of communication skills.

Figure (3): Illustrates the correlation between level of workplace incivility and communication skills among nursing staff. The figure shows that there is a weak, statistically non-significant positive correlation between the overall workplace incivility levels and communication skills among nursing staff ($r = 0.079$, $p = 0.177$).

Table (1): Personal data of nursing staff (n=295)

Personal data	N	%
Age (in years)		
20	2	0.7
0-<30	243	82.4
0-40	50	16.9
Range	(19-40)	
Mean ± SD	26.68±3.596	
Gender		
Male	105	35.6
Female	190	64.4
Marital status		
Married	143	48.5
Un-married	152	51.5
Educational level		
Technical Nursing institute	132	44.7
Nursing bachelor	127	43.1
Post studies	36	12.2
Residence		
Rural	146	49.5
Urban	149	50.5
Position		
Nursing technician	126	42.7
Licensed nurse	129	43.7
Head nurse	40	13.6
Years of experience		
5	211	71.5
-<10	72	24.4
10	12	4.1
Range	(0-15)	
Mean ± SD	3.96±2.818	

Table (2): Levels of nursing staff overall workplace incivility of dimensions.

Dimensions	Low		Moderate		High	
	N	%	N	%	N	%
Hostile climate	254	86.1	37	12.5	4	1.4
Inappropriate jokes	261	88.5	29	9.8	5	1.7
Unconsiderate behavior	266	90.2	9	3.1	20	6.8
Gossip and rumors	257	87.1	32	10.8	6	2.0
Free riding	258	87.5	32	10.8	5	1.7
Abusive supervision	261	88.5	23	7.8	11	3.7
Lack of respect	256	86.8	29	9.8	10	3.4
Displaced frustration	257	87.1	28	9.5	10	3.4
Overall workplace incivility	263	89.2	21	7.1	11	3.7

Table (3): Levels of nursing staff communication skills dimensions (n=295).

Dimensions	Low		Moderate		High	
	N	%	N	%	N	%
Informative communication	52	17.6	48	16.3	195	66.1
Empathy	56	19.0	83	28.1	156	52.9
Respect and authenticity	57	19.3	45	15.3	193	65.4
Social skills	227	76.9	40	13.6	28	9.5
Listening skills	86	29.2	109	36.9	100	33.9
Use of silence	60	20.3	72	24.4	163	55.3
Conversation skills	55	18.6	46	15.6	194	65.8
Level of communication skills	58	19.7	87	29.5	150	50.8

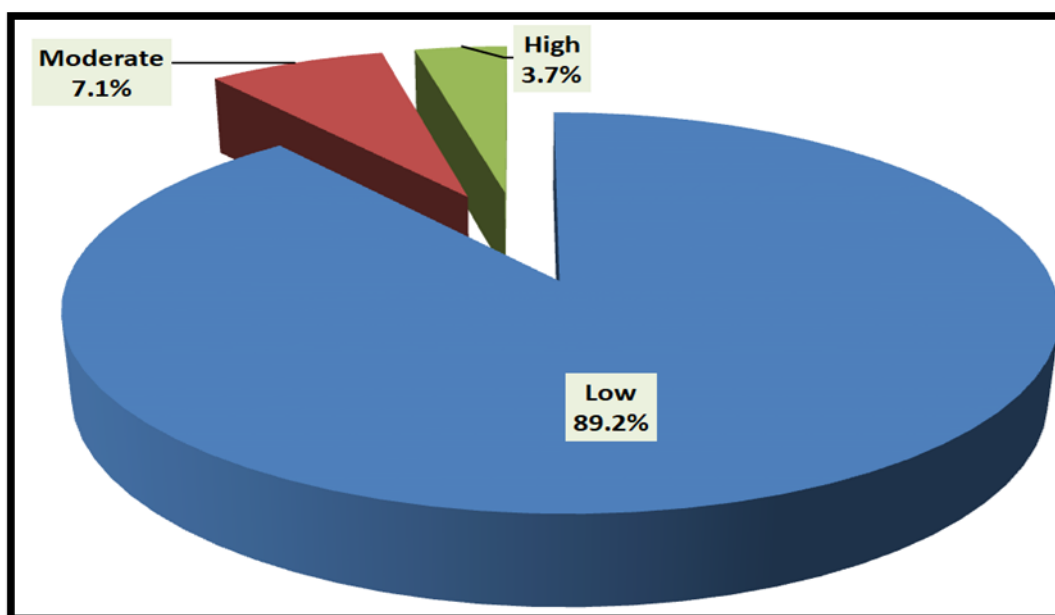


Figure (1): Levels of nursing staff overall workplace incivility.

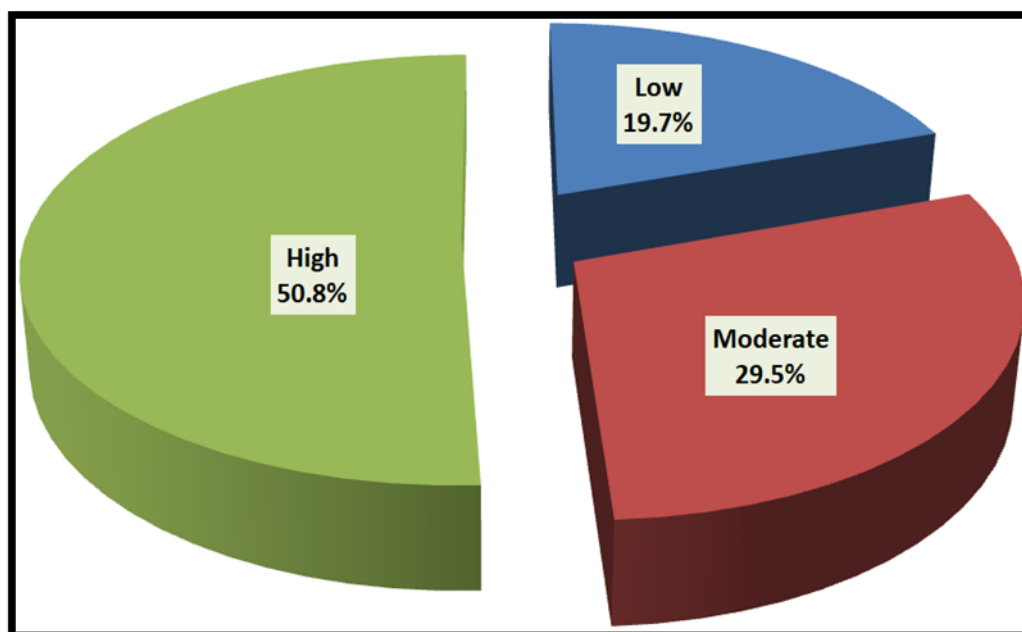


Figure (2): Levels of the nursing staff overall communication skills

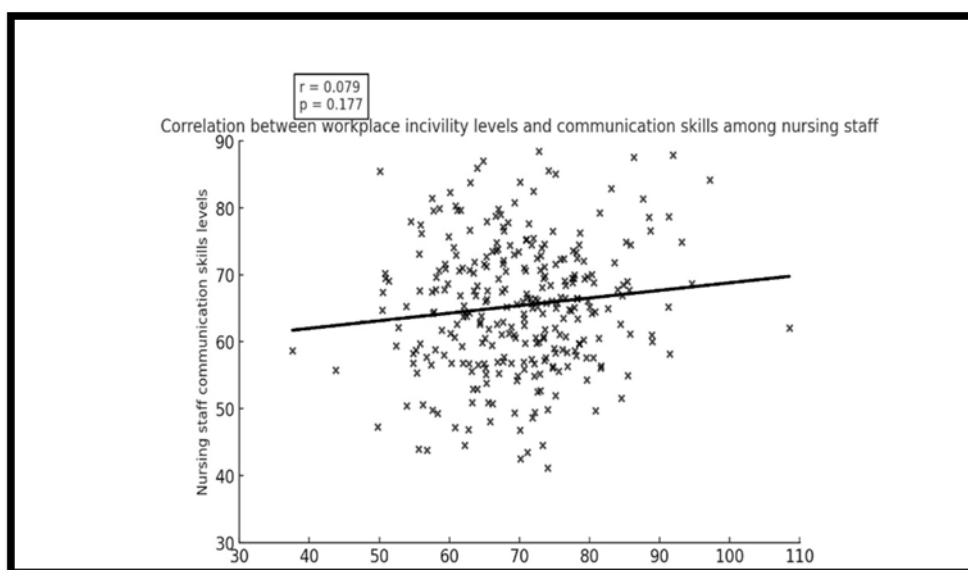


Figure (3): Correlation between nursing staff workplace Incivility and communication skills

Discussion

Workplace incivility has increasingly been recognized as a critical issue affecting nursing staff in healthcare organizations. Nurses are often exposed to subtle negative behaviors, which may undermine their professional role and interpersonal relationships. These behaviors, although low in intensity, can accumulate overtime and negatively influence nurses' morale, teamwork, and organizational commitment (Ibno et al., 2023).

Workplace incivility

According to the current study, majority of nursing staff participants have a low level of overall workplace incivility. This result may

be explained by that Tanta University Emergency Hospital staff nurses are working respectfully and have collaboration with each other, which reduced the likelihood of experiencing frequent incivility. That low level of incivility could be attributed to the presence of clear hospital policies that regulate professional conduct, and the supportive role of nursing leadership in maintaining a positive workplace climate. Really those nursing staff benefited from the effective teamwork communication, less interpersonal conflict, shared responsibilities and mutual understanding. Most probably their hospital organizational culture discourages behaviors such as

gossip, hostile climate and abusive supervision but encourages civility, respect and mutual understanding.

Clark et al. (2021) study on fostering civility in nursing education and practice found that nurses in institutions recognized for high professionalism reported minimal exposure to incivility, directly attributing the low rates to clear, formalized standards of conduct and visible management support. Similarly, **Lee (2020)** study on unit cohesion, communication effectiveness, and their influence on workplace incivility among nurses demonstrated that strong unit cohesion and effective communication practices were powerful buffers against uncivil behaviors, leading to a low perception of incivility among the staff.

Furthermore, **Johnson (2019)** study on leadership practices, conflict resolution, and workplace incivility among healthcare teams argued that supportive leadership and transparent conflict resolution mechanisms successfully mitigate daily stressors, thereby reducing the likelihood of displaced aggression and lack of respect within the team. But **Taylor and Chen (2022)** study on workload, staffing adequacy, and workplace incivility among nursing staff reported moderate levels of

incivility among nursing staff and emphasizing that factors like high workload, stressful working conditions, and chronic understaffing increase staff frustration, leading directly to behaviors such as lack of respect and displaced aggression.

Additionally, **Varghese et al. (2021)** study on communication practices, managerial support, and workplace incivility among nurses found that poor communication practices support often escalate low-intensity conflicts into chronic incivility, severely impacting the workplace climate.

Communication skills

Current study revealed that more than half of the nursing staff had high level of overall communication skills. This result were interpreted by that nursing staff had effective communication strategies, which enhanced their ability to understand and respond to their colleagues' needs and concerns. As well as fostered better teamwork among themselves and other unit. Beside improved the overall work environment and efficiency. Furthermore, the high communication proficiency allowed for effective conflict resolution within the team and promotes culture of mutual respect and

psychological safety among nursing staff.

The present study's findings are supported by **Salem et al. (2024)** study about communication abilities, collaboration, and clinical error reduction among nurses in high-pressure units. They emphasized that strong communication abilities not only enhance collaboration but also reduce clinical errors, particularly in high-pressure units. The study highlighted that effective communication fostered trust among colleagues, improved patient satisfaction, and strengthened organizational culture. Aligning directly with the current study's observation that more than half of nursing staff demonstrated high communication proficiency.

Findings of present study contradict with **Farouk et al. (2024)** study about organizational transparency, leadership support, and their influence on communication outcomes among nurses. They reported that even nurses with high communication skills may struggle if institutional systems lack transparency or leadership support. Their findings suggest that communication outcomes depend not only on individual skills but also on organizational culture. The study argued that without supportive leadership and clear communication

channels, even highly skilled nurses may experience frustration, misinterpretation, and reduced efficiency, which challenges the assumption that communication proficiency alone guarantees success.

Correlation

Result of present study illustrated that there is a weak and statistically nonsignificant positive correlation between workplace incivility levels and communication skills among nursing staff. Those nurses who experienced higher incivility did not show clear changes in their communication skills. This means that incivility may not strongly affect how nurses communicate. Yet it is important to note that even weak relationships can have practical meaning in some cases. Nurses working in uncivil environments may still need support to maintain good communication. These findings illustrated that improving workplace culture may help nurses feel safer and communicate better, even if the statistical link is weak.

Findings of the current study are supported by **Maha R. Al-hawaiti et al. (2025)** whom explained that nurses who communicate clearly and respectfully can reduce the negative effects of incivility. Their findings illustrated that strong

communication may protect nurses from emotional harm. On the same vein, **Taghreed Al-bed Bamoussa et al. (2024)** explained that high self-esteem and confidence helped nurses stay calm in difficult situations. Their findings illustrated that good communication could exist even in stressful environments. And **Fatma Elvira P. Ibno et al. (2024)** illustrated that professional behaviour supports communication even under pressure.

Findings of present study contradict with **Nora Elsayed Mohammed et al. (2024)** study on workplace incivility which explained that uncivil behaviour increased stress and reduced nurses' ability to communicate effectively. Their findings illustrated that incivility may weaken teamwork and clarity. Additionally, **Shaimaa Hassan Mekawy et al. (2023)** study on silent behaviour in nursing explained that silence caused by incivility reduced engagement and harmed communication. Their findings illustrated that uncivil environments may block open dialogue. Also, **Jingyi Zou et al. (2025)** explained that nurses who face incivility often avoid speaking up, which lowers communication quality. Their findings illustrated that incivility could lead to silence and weak interaction.

Conclusion

Findings of this study conclude that there is direct a significant relationship exists between nursing staff years of experience and high level of communication skills and workplace incivility at Tanta University Emergency Hospital. The majority of nursing staff reported low level of workplace incivility, reflecting a generally respectful work environment. In contrast, half of the nurses demonstrated a high level of communication skills, while the remainder showed moderate to low levels. These findings highlight that nursing staff good communication skills helped them maintain a civil workplace atmosphere and Vis versa. Really nursing staff communication abilities enhances not only teamwork but also maintaining a supportive civil workplace environment.

Recommendations

1. Establish and enforce mandatory, recurrent in-service training programs specifically focused on assertiveness, conflict resolution, and stress management techniques relevant to the emergency setting.
2. Ensure that the orientation program for new hires and transferred staff includes an intensive module on professional communication

standards and expectations specific to the hospital culture.

3. Further research should explore the underlying organizational and leadership factors (e.g., workload, staffing ratios, and unit leadership style) that may mediate or moderate the relationship between communication skills and incivility.

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Quality of Healthy Life among Children Suffering from Multiple Sclerosis

Nagafa Hafez Farag ¹, Doaa Ebraheem Fathy Ebraheem ^{2,3}, Nahla Abd Elnaby El- kandooz⁴

^{1,4}Assistant Professor of Pediatric Nursing Faculty of Nursing Tanta University.

²Teacher at Kafer Elshiekh Nursing School.

³Master student on Pediatric Nursing, Faculty of Nursing Tanta University, Egypt

Corresponding author: Doaa Ebraheem Fathy Ebraheem.

Email: foonteba49@gmail.com

Abstract

Background: Multiple sclerosis (MS) is the most prevalent chronic inflammatory demyelinating autoimmune disorder of the central nervous system. It induces neurological changes that have a detrimental effect on numerous aspects of life including social, cognitive, visual, motor, sensory, bowel and bladder function and standards of living. **Aim:** This study aimed to assess quality health of life among children suffering from multiple sclerosis. **Design:** A descriptive correlational research design was utilized. **Settings:** General Authority for health insurance, Gharbia branch and Multiple sclerosis committee. **Subject:** A stratified random sample of children (n=150) with multiple sclerosis. **Tools:** Tool I: Children knowledge regarding multiple sclerosis: Tool II: Multiple Sclerosis Quality of Life (MSQOL) scale. Tool III Localized pain assessments scale (Numerical rating pain scale). **Results:** More than half of studied children (51.3%) had poor level of knowledge about Multiple Sclerosis, and nearly half of studied children (49.3%, 46%) had fair quality of life about Multiple Sclerosis and moderate pain respectively. **Conclusion:** Studied children had poor level of knowledge, fair quality of life about Multiple Sclerosis and moderate pain score. **Recommendations:** Design an educational program for children and adolescence about multiple sclerosis to improve their quality of life.

Keywords: Children, Multiple sclerosis, Quality of Healthy life.

Introduction

Degenerative, autoimmune-inflammatory disease of the central nervous system (CNS) known as multiple sclerosis (MS) is characterized by a variety of clinical manifestations and courses, as well as various areas of demyelinating lesions in the CNS (**Gold et al., 2024**). Childhood MS occurs when the first clinical symptoms appear before the age of 18 and occurs infrequently. Compared to MS in adulthood. The multiple sclerosis International Federation estimates that there are at least 30,000 children and teenagers worldwide who are living with MS. The prevalence of the condition was found to be 0.69 to 26.92 per 100,000 children, while the number of occurrences was 0.05 to 2.85 per 100,000 children, as per a recent comprehensive review (**Mohamed, El-Naggar & Fouad, 2023**).

Multiple sclerosis etiology remains unknown; however, it is most likely the result of intricate interactions between genetic and environmental factors, as well as additional factors such as a deficiency of vitamin D and exposure to the Epstein-Barr virus (**Haki, Al-Biati, Al-Tameemi, Ali & Al-Hussaniy, 2024**). It is classified as an autoimmune disorder in which the central nervous system is targeted by the body's immune system.

Multiple sclerosis has been associated with early exposure to certain types of viruses or other infections (**Abdallah, Mohammed, Rabee & Abd Elwhab, 2022**).

Multiple sclerosis-induced sensory disturbances are characterized by a sensation of pins and needles, tingling, or numbness in various body regions. The face, limbs, trunk, or entire body may be impacted by disturbances. Motor deficit manifestation is characterized by muscle weakness and stiffness, which impede movement and result in coordination issues. Tremors and muscle cramps may also manifest. Mobility and fine motor skills are impacted by these motor deficits (**Thornton, Cockerell & Spencer, 2024**).

Optic nerve inflammation is a prevalent initial manifestation of multiple sclerosis. It has the potential to result in a complete loss of vision in one eye, pain with eye movement, or blurred or loss of vision. One of the most prevalent symptoms of multiple sclerosis is fatigue. That is not necessarily associated with physical activity. It has a substantial effect on the quality of life and daily functioning. Cognitive function is impacted by multiple sclerosis in certain individuals. Memory, attention, concentration, information processing speed, and problem-

solving may be affected (**Thornton, Cockerell & Spencer, 2024**).

The mental changes that MS induces are significant and range from mild to severe, affecting work, relationships, and overall functioning. The cerebellum and other regions of the central nervous system that are responsible for coordination and balance are disrupted by MS. In turn, individuals with MS may experience balance issues, vertigo, dizziness, and an unsteady gait. Multiple sclerosis impairs the normal functioning of the bladder and bowel, resulting in urinary urgency, frequency, incontinence, constipation, or a loss of bowel control. Depression, anxiety, mood swings, and irritability, emotional and psychological changes may manifest. The physical burden of the disease, as well as its impact on daily life and relationships, is responsible for these changes. (**Thornton, Cockerell, & Spencer, 2024**).

Multiple sclerosis is categorized into distinct categories, each of which delineates a specific pattern of disease progression, the prognosis for the child, the frequency of the attacks, and the child's condition between attacks. These categories are benign, relapsing-remitting, primary-progressive, and secondary

progressive (**Abdallah, Mohammed, Rabee & Abd Elwhab, 2022**).

The primary objectives of treatment are to expedite the recovery process from attacks, mitigate the occurrence of new relapses, slow the progression of the disease, and alleviate the symptoms of multiple sclerosis. To alleviate nerve inflammation, corticosteroids, including oral prednisone and intravenous methylprednisolone, are the primary treatment for multiple sclerosis. If the symptoms are severe and steroids have not been effective, plasmapheresis may be implemented (**Jacob et al., 2024**).

WHO defines quality of life as the perception of an individual's situation within their environment in relation to their goals, values, prospects, and concerns (**Khatatbeh, et al, 2022**). The four primary dimensions of health-related quality of life (HRQOL) are as follows: physical, mental, social, and functional health. It is imperative to evaluate the influence of the disease or treatment on these four dimensions and on overall well-being. Multiple sclerosis is a progressive and unpredictable disease that has a detrimental impact on the quality of life of the child, as well as that of their family and caregivers (**Mrošková, Klímová, Majerníková, Tkáčová, 2021**).

The nurse plays a critical role in the ongoing care of children with MS and their families. In MS, nursing care is a collaborative endeavor that aims to foster self-awareness and self-responsibility **(Mohamed, Abdullah, & Khalifa, 2022).**

The nurse helps teach energy conservation techniques, such as pacing activities, taking frequent rest breaks, and prioritizing tasks and encourage active participation of the child or family in the learning process, including the use of self-paced instruction as appropriate. The nurse educates on bladder and bowel management strategies. The nurse should provide support for the child and family in coping with the emotional and psychological challenges of MS by encouraging the child to set goals for the future while focusing on what can be done today **(Yuksel, & Yardimci, 2023).**

Significance of the study

Multiple sclerosis impacts over 2.5 million individuals worldwide, according to the World Health Organization. It is anticipated that the figure will exceed 8.5 billion by 2030. In general, multiple sclerosis is diagnosed at an early age. It results in neurological changes that typically have a detrimental effect on a variety of life domains, such as social, cognitive, visual, motor, sensory, bowel and bladder function, and

standards of living. In children with multiple sclerosis, there are numerous domains of social participation that are restricted, such as recreation and leisure, community life, and intimate relationships. These restrictions in participation in social activities result in limitations in children's social life and their academic performance **(Abdallah, Mohammed, Rabee & Abd Elwhab, 2022).**

Aim of the present study was to:

Evaluate quality health of life among children suffering from multiple sclerosis.

Research Questions

- What are the levels of knowledge of children with multiple sclerosis regarding their disease?
- What are the levels of the quality health of life among children with multiple sclerosis?

Subjects & Method

Research design:

This study employed a descriptive correlational research design.

Setting:

This study was carried out at affiliated General Authority for Health Insurance, Gharbia branch and Multiple Sclerosis Committee. It consists of two floor the first floor is reception only and the second floor consists of two room one for registration and the second for medical examination.

Subjects:

A stratified random sample of children (n=150) with multiple sclerosis that was selected from the total number of children (475).

Tools for data collection:

The following three tools were used by the researcher to collect data for the study:

Tool (I): Children knowledge

regarding multiple sclerosis: It was developed by the researcher after reviewing the related literature to collect information about children knowledge regarding multiple sclerosis. It included the following three parts: -

Part (1): Socio-demographic data of the studied children such as gender, age, residence and academic level.

Part (2): Medical history: It covered medical data related to children with multiple sclerosis as family history, disease duration, presence of other autoimmune disease in child family, the type of multiple sclerosis, associated health problems with multiple sclerosis, regular follow up with specialized doctor, and previous hospitalization.

Part (3): Children knowledge: It was constructed by the researcher after extensive review of literature (Carvalho et al., 2023), (Jakimovski, Awan, Eckert, Farooq & Weinstock-Guttman,

(2022). Knowledge of children about multiple sclerosis. It was used to assess children knowledge about Multiple Sclerosis. It consisted of 11 multiple choice question about (meaning-causes- signs and symptoms –diagnosis –types – complication – prevention-risk factors -management and care of multiple sclerosis)

As multiple-choice question had more than one answer, children answers were evaluated as follows:

- Correct complete answer had two score.
- Correct incomplete answers had one score.
- Incorrect / don't know answer had scored zero.

Scoring system

- Score more than 70% (15-20 score) represents high knowledge level.
- Score from 50-70 % (10-14 score) represents moderate knowledge level.
- Score less than 50% (0-9 score) represent low knowledge level.

Tool (II): Multiple Sclerosis**Quality of Life (MSQOL) scale:**

It was developed by the researcher after reviewing the related literature (Vickrey, Hays, Harooni, Myers & Ellison (1995) and (Abdallah, Mohammed, Rabee & Abd Elwhab, 2022): It was adapted and modified by the researcher to suit children reported quality of life. It

was employed to evaluate the health-related quality of life of children with multiple sclerosis. It is divided into (10) subscales. Such as (physical health- Role limitations due to physical and emotional problems- Pain effect on their physical activity- Emotional well-being- Activity- Health perceptions- Social function- Cognitive function- mental health distress)

Scoring system: All questions were scored on scale from 0-100. High score is an indicative of improved outcome. The question had varied scored. The sum of the responses to each dimension from 100, which is contingent upon the distribution of the grades of each dimension. The sum of these scores was then converted to a percentage score. It was categorized into three groups:

- Poor quality of life if score < 60%. (0-59 score).
- Fair quality of life if score 60 – 75%. (60-75 score).
- Good quality of life if score > 75%. (76-100 score).

Tool (III): Localized pain assessments scale (Numerical rating pain scale):

This tool was developed by (**Gürkan & Gürkan, 2018**) and it was adapted by the researcher. It used for children with multiple sclerosis to measure intensity of pain with rating scale. The scale is an ordered number

between 0 -10 ranged from" no pain "to "severe pain". The child placed mark on scale which indicates level of pain.

Scoring system

- No pain was scored zero.
- Mild pain was scored from 1-3.
- Moderate pain was scored from 4-6.
- Sever pain was scored from 7-10.

Method

This study was conducted via performing the subsequent steps:

1-Administrative process: An official permission was obtained from the Dean of the Faculty of Nursing at Tanta University, which was then presented to the head of affiliated General Authority for health insurance, Gharbia branch and Multiple sclerosis committee, following an explanation of the study's objectives in order to secure consent and collaboration for its implementation.

2-Ethical considerations:

a- The Faculty of Nursing's Scientific Research Ethical Committee granted ethical approval with the code number (435-4-2024).

b- The study's nature did not result in any harm or discomfort for the children.

c- Informed consent was obtained from the children who participated in the study after the purpose of the study was explained.

d-They have the right to withdraw from the study at any time.

e- Privacy and confidentiality were carefully considered during the data collection process.

3-Tools Development: Three tools were used in the current study. It was developed by the researcher based on the review of recent and related literatures. The study tools were developed in simple Arabic language to be used by the participants.

4 -Content Validity: The study tools were presented to a jury of five experts in pediatric nursing to check the validity, comprehensiveness, and understanding, applicability of the content and ease of implementation.

5-Pilot study: It was carried out on 10% of the total sample size. (15 adolescent) to test clarity, applicability, feasibility and the necessary modification were done. Those children were excluded from the total sample because some questions were added and some were modified.

6- Tool Reliability: It was evaluated by using Cronbach's alpha coefficient test. It was 0.86 for children knowledge regarding multiple sclerosis, 0.89 for MS quality of life and 0.96 for numerical rating pain scale.

7-Data collection:

-The data were collected over a period of 10 months from the

beginning of January to end of October 2025. The researcher conducted an interview with children with MS in the waiting room (reception).

-The researcher began to explain the aim of the study and obtained informed consent from children. This step took 5 minutes.

-The researcher presented one day every week (Sunday) at the reception from 8AM to 1 PM o'clock.

-The researcher met nearly from 3 to 5 children each day.

-The interview took nearly one hour on one session for every child.

-The researcher collected needed data in following consequence.

1-Interviewer schedule was used for collection of socio-demographic data of studied children, medical history of studied children (Tool I part I, II). children's knowledge regarding MS collected by (tool I part III). The time needed to collect these parts nearly was 20 minutes.

2-The researcher assessed data related to quality of life of children with MS (tool II). The time needed to collect this data nearly was 30 minutes.

3- The researcher assessed pain by using Numerical rating pain scale (tool III). The time needed to collect these parts was 10 minutes.

Statistical analysis:

The data collected was structured, arranged and analyzed using SPSS software version 26 for Statistical analysis. The range, mean and standard deviation were computed for the quantitative data. Chi-square test (χ^2) was utilized for comparing qualitative data.

The relationship between variables was analyzed using the correlation coefficients (r) from both Pearson and Spearman. Results of significance tests were interpreted with a significance level of $p < 0.05$. Similarly, a high level of significance was used at $p < 0.01$.

Results

Table (1): Clarifies distribution of the studied children according to their socio-demographic characteristics. It was clarified that, nearly half (46.7%) of the studied children were in the age group of 16 to 18 years old and more than half (58.7%) of them were females. Regarding studied children residence it was found that 61.3% of studied children were lived in a urban area. Moreover, fifty (50.0%) of them had secondary education.

Figure (1): Shows studied children's total level of knowledge regarding multiple sclerosis, it was observed that more than half of studied children (51.3%) had poor level of knowledge about MS, as compared

to 28.7% of them had good level of knowledge and 20.0% of studied children had fair level of knowledge.

Table (2) Explains distribution of studied children's total score of health-related quality of life domains regarding multiple sclerosis.

It was observed that (43.3%,48.0%,46.7%,59.4%,56.7%,42.0%,53.3% and 46.7%) respectively of studied children had fair quality of life about physical health, role limitation due to physical problems, and emotional problems, emotional well-being, energy, social function, cognitive function and mental health disorder respectively. Also about, (47.3% & 45.3%) of studied children had poor quality of life about effect of multiple sclerosis on bodily pain and general health perception.

Figure (2): Shows that percentage distribution of the studied children according to their total health quality of life regarding multiple sclerosis. It was observed that near to half of studied children (49.3%) had fair quality of life about MS while 28.0% of them had good quality of life and 22.7% of them had poor quality of life regarding multiple sclerosis.

Figure (3): Shows distribution of the studied children according to severity of pain. It was clarified that, nearly half (46.0%) of the studied children had moderate pain, and 39.3% of them had severe pain,

while the minority (14.7 %) of them had mild pain.

Table (3): Shows relation between total knowledge score and socio-demographic data of the studied children. It was evident that, there was a statistically significant relation between children's total knowledge scores regarding multiple sclerosis and their age and level of education ($p = 0.38$, $p = 0.011$) respectively. No statistically significant relation was identified between total knowledge scores and their gender and residence ($p = 0.506$, $p = 0.298$) respectively.

Table (4): Show correlation between total knowledge, total pain severity and total health-related quality score, regarding children with multiple sclerosis. It was evident that, highly statistically significant positive correlation was identified between total knowledge and total health related quality ($p = 0.000$ $r = 0.567$). It was evident that, there were a highly statistically significant negative correlation between total health-related quality score and pain severity score regarding multiple sclerosis ($p = 0.000$, $r = -0.529$).

Table (1): Distribution of the studied children according to their socio-demographic characteristics (n= 150)

Children Socio-demographic data	No	%
Age in (years)		
10 - <13	29	19.3
13 - <16	51	34.0
16 – 18	70	46.7
Mean $\pm$ SD = 14.96$\pm$2.34		
Gender		
Male	62	41.3
Female	88	58.7
Residence		
Rural	58	38.7
Urban	92	61.3
Level of education		
Primary education	25	16.7
Preparatory education	50	33.3
Secondary education	75	50.0

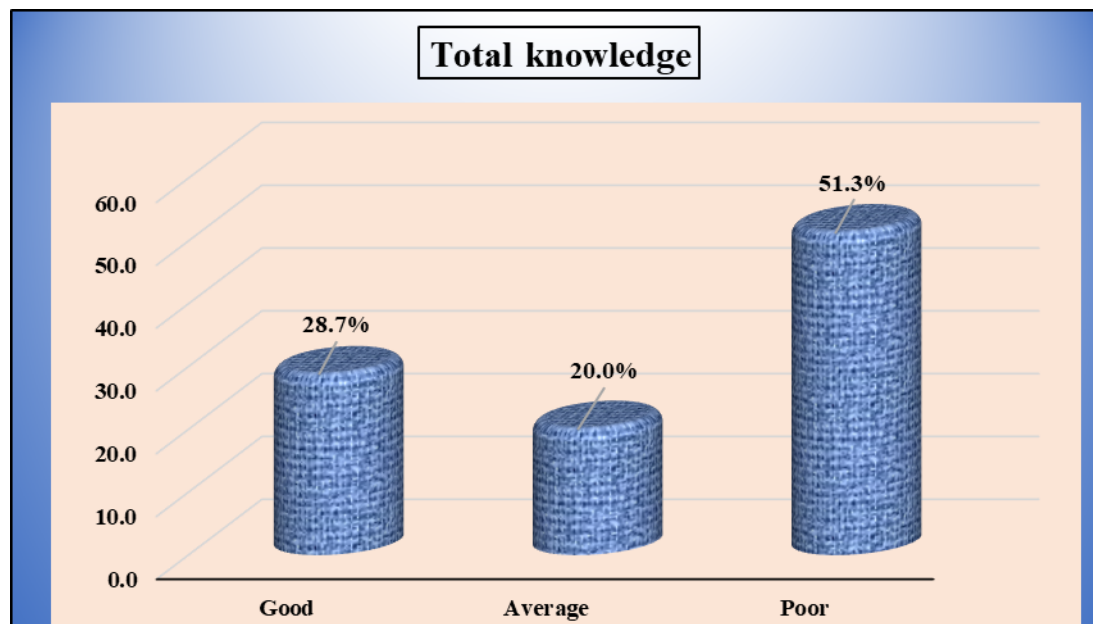
**Figure (1): Studied children's total level of knowledge regarding multiple sclerosis (n= 150)**

Table (2): Distribution of studied children's total score of health-related quality of life domains regarding multiple sclerosis (n=150)

Health-related quality of life domains	Poor quality of life		Fair quality of life		Good quality of life	
	No.	%	No.	%	No.	%
Physical health	55	36.7	65	43.3	30	20.0
Role limitations due to physical problems	48	32.0	72	48.0	30	20.0
Role limitations due to emotional problems	51	34.0	70	46.7	29	19.3
Effect of bodily pain	71	47.3	45	30.0	34	22.7
Emotional well-being	32	21.3	89	59.4	29	19.3
Energy (activity and vitality)	40	26.7	85	56.7	25	16.7
General health perceptions	68	45.3	45	30.0	37	24.7
Social function	37	24.7	63	42.0	50	33.3
Cognitive function	30	20.0	80	53.3	40	26.7
Mental health disorders	41	27.3	70	46.7	39	26.0
Total	34	22.7	74	49.3	42	28.0

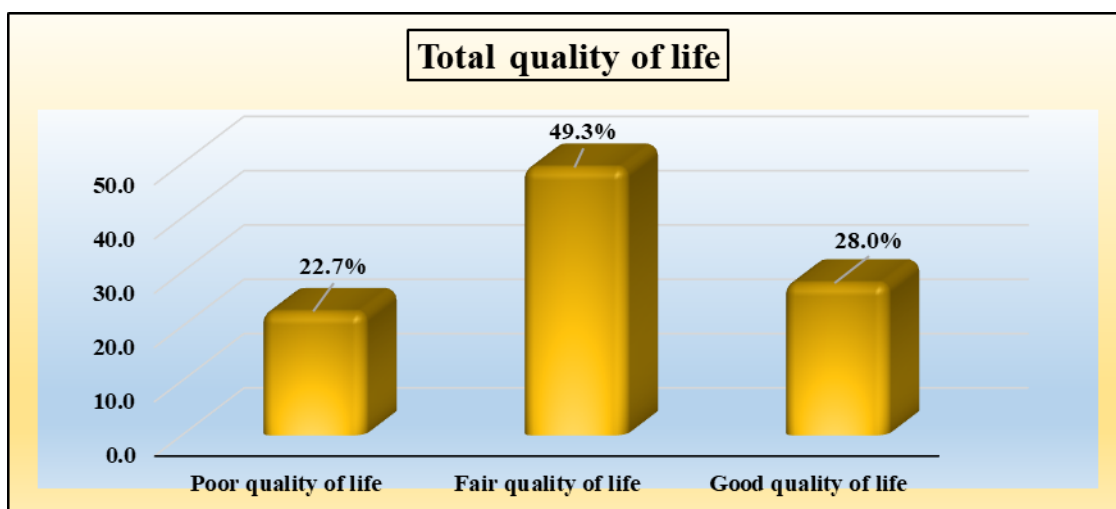


Figure (2): Percentage distribution of the studied children according to their total health-related quality of life regarding multiple sclerosis (n=150)

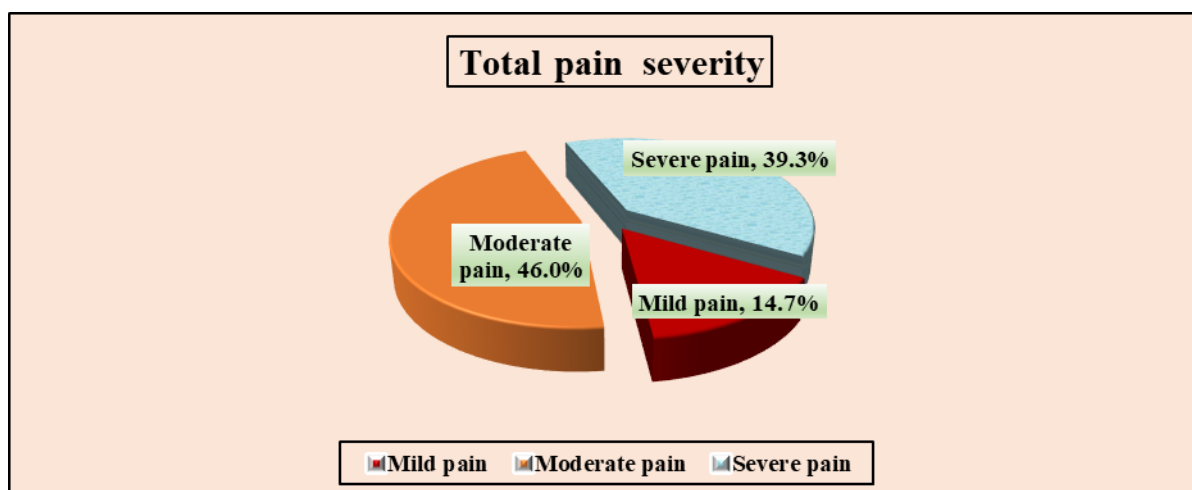


Figure (3): Distribution of the studied children according to severity of pain caused by multiple sclerosis (n =150)

Table (3): Relation between total knowledge score and socio-demographic data of the studied children (n =150)

Socio-demographic data	Total knowledge								
							Chi - squa re test	P- value	
	No	%	No	%	No	%			
Age									
10 - <13	20	26.0	5	16.7	4	9.3	10.17	0.038 *	
13 - <16	30	39.0	9	30.0	12	27.9			
16 – 18	27	35.1	16	53.3	27	62.8			
Gender									
Male	29	37.7	15	50.0	18	41.9	1.36	0.506	
Female	48	62.3	15	50.0	25	58.1			
Residence									
Rural	26	33.8	15	50.0	17	39.5	2.41	0.298	
Urban	51	66.2	15	50.0	26	60.5			
Level of education									
Primary education	19	24.7	4	13.3	2	4.7	13.02	0.011 *	
Secondary education	29	37.7	9	30.0	12	27.9			
University education	29	37.7	17	56.7	29	67.4			

*A Statistically significant $p \leq 0.05$ **A Highly Statistical significant $p \leq 0.001$

Table (4): Correlation between total knowledge, total pain severity and total health-related quality score, regarding children with multiple sclerosis (n=150)

Variables	Total health-related quality	
	r	P value
Total knowledge	0.567	0.000**
Total pain severity	-0.529	0.000**

*A Statistically significant $p \leq 0.05$ **A Highly Statistical significant $p \leq 0.001$.

Discussion

Multiple sclerosis (MS) is a progressive neurological condition that results in an abnormal immune response against the central nervous system (CNS). The immune system attacks the nerve fibers and their myelin, which leads to the formation of scar tissue (sclerosis) and inflammation. A variety of neurological symptoms are caused by the disruption of the nerve impulses that must pass through these damaged nerve fibers (Mohamed, Abdullah, & Khalifa, 2022).

Regarding to total level of knowledge of studied children regarding multiple sclerosis, the current study observed that more than half of studied children had poor level of knowledge about MS,

as compared to less than one third of them had good level of knowledge and minority of studied children had fair level of knowledge. **According the researcher point of view;** this may be due to children with MS might not proactively look for information, despite their illness.

This result is similar to **Mohamed, Hassan and Fala, (2024)**. In study entitled “Evaluating public awareness and knowledge of multiple sclerosis in Tobruk, Libya: a comprehensive cross-sectional study” and found that a low level of MS awareness among participants. Also, these findings agree with **Abozeid, Ahmed, Gendy and khalifa, (2023)** who conducted study entitled “Effect of Educational Guideline on Self-Management and Clinical Outcomes for Patients with

Multiple Sclerosis” and cleared that more than three quarters of the studied patients had unsatisfactory level of total knowledge regarding MS. Also, these results agree with **Elfeky, Omran and Farag, (2024)** who revealed that more than three quarters of patients had unsatisfactory level of total knowledge in pre-implementation phase. Meanwhile, these findings disagree with **Alharbi, Abdel-Mohsen, and El Awady,(2024)** who conducted study in Saudi Arabia entitled “The Quality of Life for Patients with Multiple Sclerosis at King Fahd Neurological Outpatient Clinic” and cleared that nearly half of the studied child had an average level of knowledge about multiple sclerosis, while nearly one-fifth had poor knowledge of the disease. Also, the results disagree with **Hassan, Alabbas, Ahmed, Garanbish, Basheer and Alnasif, (2025)** who conducted study entitled “The assessment of knowledge level among the patient, family and patients diagnosed with multiple sclerosis” cleared that the majority of studied subject had moderate knowledge regarding MS.

Regarding to total health quality of life regarding multiple sclerosis, the current study illustrated that, nearly half of the studied children had fair quality of life regarding

multiple sclerosis. **According to the researcher point of view,** this result may be due to more than two third of studied children diagnosed MS since 1 to 3 years ago and near the majority of studied children had relapsing remitting MS that it characterized by long period improvement after relapse, so their daily activities are moderately affected (Table 2). Also, the symptoms are temporary or intermittent. **(Ibrahim, Hegazy, and Khalfallah, (2020).**

These results were in harmony with **Mohamed, El-Naggar and Fouad, (2023)** who illustrated that more than half of studied children had fair quality of life regarding MS. Also, these results were consistent with **Saad and Elsayed, (2021)** who reported that nearly half of studied children regarding overall quality of life scores have average quality of life. Also, these findings agree with **Abdallah, Mohammed, Rabee and Abd elwahab, (2022)** who revealed that more than half of studied children regarding overall quality of life scores have fair quality of life.

On the other hand, the results disagree with **Alharbi, Abdel-Mohsen, and El Awady, (2024)** who conduct study “The Quality of Life for Patients with Multiple Sclerosis at King Fahd Neurological Outpatient Clinic” and found that

over two-fifths of the studied subject had a low quality of life due to factors such as immobility, social problems, dependence on others, psychological issues, and depression. Also, these findings disagree with **Ali, Afefy and Abdallah, (2022)** who reported that, more than three quarters of the studied children had poor quality of life regarding multiple sclerosis.

Regarding to severity of pain domain, the current study clarified that nearly half of the children under investigation experienced moderate pain. The researcher believes that this outcome may be attributable to the fact that the child was diagnosed at a young age and did not have a significant impact on all aspects of their quality of life, and severe pain was not present. These findings were in same line with **Ismail, ELMotayam, Saadawy, Elfwakhry, Fawzy, and Sarhan (2025)** who conducted study entitled “Neuropathic pain in multiple sclerosis: serum biomarkers and MRI lesion localization” and showed that nearly one quarter of studied children had moderate pain. Also, these results were parallel with **Khedr, El Sayed, and El Wakil, (2022)** who found that about one third of studied subjects had moderate pain.

Regarding to relation between children's total knowledge scores regarding multiple sclerosis and socio-demographic data. The current study showed that a statistically significant relation between children's total knowledge scores regarding multiple sclerosis, their age and level of education. **According to the researcher point of view**, this suggests that a higher level of education enables adolescent to read and comprehend more about the disease.

The result is disagreed with **Hasan, Alabbas, Ahmed, Garanbish, Basheer and Alnasif, (2025)** who conducted study entitled “The assessment of knowledge level among the patient, family, and patients diagnosed with multiple sclerosis” and mentioned that a significant difference was found between age and knowledge level. Moreover, these findings were in agreement with **Alharbi, Abdel-Mohsen, and El Awady, (2024)**. Who cleared that a highly statistically significant relationship between the overall knowledge of the studied subject and their qualifications (level of education). Also, this result supported by **Mohamed, Hassan and Fala, (2024)** who observed that age was found to be significantly associated with MS knowledge.

Regarding to relation between total knowledge scores and their gender and residence, the current study showed that no statistically significant relation was identified between total knowledge scores and their gender and residence. **According to researcher point view**, level of knowledge not affected by gender or residence due to educational program provided to all children regardless their gender or residence. These findings agree with **Alharbi, Abdel-Mohsen, and El Awady (2024)**, who cleared that there is no statistically significant relationship between overall knowledge and gender or place of residence.

Regarding to correlation between total knowledge and total health related quality of life regarding MS. The present study demonstrated a highly statistically significant positive correlation between total knowledge and total health-related quality of life in relation to MS. **According the researcher point view**, higher education and knowledge were associated with a better quality of life, likely due to a better understanding of the disease leading to more effective coping with physical impairments, managing psychological issues, enhancing social relationships, and

improving spiritual and religious activities.

These findings were in agreement with **Alharbi, Abdel-Mohsen, and El Awady (2024)**, who cleared that there is a highly statistically significant correlation between the overall quality of life of patients and their knowledge of multiple sclerosis. Also, these findings matched with **Hassan, Alabbas, Ahmed, Garanbish, Basheer and Alnasif, (2025)** who presented that There is a highly statistically significant correlation between the total knowledge of patients and their quality of life before and after the self-management program.

Regarding to correlation between total health-related quality score and pain severity score regarding multiple sclerosis. The present study demonstrated a highly statistically significant negative correlation between the total health-related quality score and the pain severity score in the context of multiple sclerosis. **According to the researcher point view**, one of the most prevalent symptoms that may be disabling in children with MS is pain. It has profound impact not only on physical function but also on psychological well-being, social interaction and daily activities this lead to poor quality of life. These findings were consistent with those

of **Fujihara et al. (2021)**, who conducted study entitled “Patient-reported burden of symptoms in neuromyelitis optica: A secondary analysis on pain and quality of life” and demonstrated that pain appeared a negative correlation with quality of life.

Conclusion

According to the findings of the present study, it can be concluded that participated children had poor level of knowledge and they had fair quality of life about multiple sclerosis and moderate pain score.

Based on the study result, it could be recommended that:

- 1- Design an awareness program for children about multiple sclerosis to improve their quality of life.
- 2- Creating educational booklet and poster for children attending multiple sclerosis outpatient clinics to improve perception of multiple sclerosis.
3. Encourage children to engage in group discussions to enhance their quality of life and actively participate in their care.
- 4- Mass media must focus on identifying early signs of disease to facilitate early detection and the care of children with multiple sclerosis.
5. Additional research should be conducted in various settings and with a larger sample size to facilitate generalization.

6-Explore the psychological effect of multiple sclerosis on children and the effectiveness of support to enhance their quality of life and mental health.

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Knowledge and Attitude of Female Nursing Students About Risk Factors Regarding Early Marriage and Early Pregnancy

Mervat Fayez Nagib¹, Sharbat Thabet Hassanin², Nadia Ahmed El Adham³, OLa Hussien Abo Elmaaty⁴

¹Nursing Specialist and Researcher in community Health Nursing at the Faculty of Nursing, El Fayoum University.

²Professor of community Health Nursing, Faculty of Nursing, Badr University.

³Professor of Family and community Health Nursing, Faculty of Nursing, Damietta University.

⁴Assist. Professor of Family and community Health Nursing, Faculty of Nursing, Damietta University, Egypt.

Corresponding author: Mervat Fayez Nagib.

Email: missmervatfayez1@yahoo.com

Abstract

Back ground: Early marriage and early pregnancy can disrupt education and increase psychological, social, and health risks for adolescents. Understanding female nursing students' knowledge and attitudes is important because they will shape future health education and community awareness. **The aim of study was** to assess knowledge and attitude of female nursing students regarding risk factors of early marriage and early pregnancy.

Research design: This study was conducted using descriptive research design. **Sample:** A convenient sample of all available students (n = 258) was recruited from the Secondary School of Nursing at El Fayoum Health Insurance, Egypt, including students from grade one through grade four. **Tool:** three parts were used in the study: 1st part – Socio demographic characteristics questionnaire, 2nd part – Assessment of secondary student's knowledge regarding early marriage and early pregnancy, 3rd part - Assessment of secondary student's attitude regarding early marriage and early pregnancy. **Results:** Less than 62.4% of nursing students demonstrated satisfactory total knowledge, while 37.6% were classified as unsatisfactory. majority of students reported having knowledge about risk factors (70.5%), while 29.5% reported no risk factors. Less than three quarters 72.9% of nursing students held a positive attitude, while 27.1% expressed a negative attitude. **Conclusion:** Less than two thirds of nursing students demonstrated satisfactory total knowledge. Also, the majority of students reported. having knowledge about risk factors less than three quarters. Finally, less than three quarters of nursing students held a positive attitude. **Recommendations:** The study was recommended that development and implementation of structured educational program for female nursing students focusing on early marriage and early pregnancy, with emphasis on their risk factors, health and psychosocial consequences preventive strategies.

Keywords: Early Marriage, Early Pregnancy, Female Nursing Students.

Introduction

Adolescence is one of the most sensitive stages of human development because it represents a critical transition from childhood to adulthood. During this period, individuals experience rapid physical growth, hormonal changes and noticeable shifts in emotions and thinking patterns. At the same time, adolescents begin to build a clearer sense of identity, independence and future goals. Because of these overlapping changes, adolescents may become more vulnerable to confusion, social pressure and risky decisions. (Crockett et al., 2023)

Many adolescents face emotional and social challenges that may include stress, anxiety, low mood, fear about bodily changes and worries about acceptance by peers and family. For some girls, the pressure to meet cultural expectations can be intense, especially when marriage is presented as an “early solution” to family concerns. Early marriage during adolescence can deepen internal conflict and disrupt normal psychological development. It may limit opportunities for learning, self-discovery and personal growth that usually occur in late adolescence. (Lansford et al., 2024)

In many communities, adolescent girls face additional health and social risks due to limited access to accurate information and restricted freedom to seek help. Girls may have less opportunity to ask questions about reproductive health, body changes, or emotional stress because of embarrassment or social taboo. Some families may avoid open discussions, leaving girls dependent on incomplete or incorrect information from peers or social media. This gap in knowledge can increase vulnerability to early marriage, early pregnancy and harmful myths about fertility and motherhood. (World Health Organization 2024)

Early marriage is commonly understood as a legal or informal union involving at least one partner below the age of 18. It is a practice that disproportionately affects girls and is often linked to social, educational and developmental consequences. Early marriage can interrupt schooling and reduce the girl's ability to complete education, develop skills and build economic independence. It may also reduce exposure to health education and limit social networks that provide emotional support. In many cases, early marriage places a girl in an adult role before she has adequate maturity to manage complex

responsibilities. (Adola & Wirtu 2024)

The causes of early marriage are complex and are usually shaped by multiple interacting factors rather than one single reason. Economic hardship may push families to view early marriage as a way to reduce financial burden or secure perceived stability for the girl. Cultural traditions and social norms can make early marriage appear “normal,” especially in rural or conservative environments. Educational disadvantage also plays a strong role, as girls who leave school early may have fewer alternatives and less protection from family pressure. (Chandel et al., 2025)

Early marriage is frequently associated with early pregnancy, which creates serious health concerns for both mother and child. Adolescent pregnancy can be physically demanding because the body may not be fully ready for pregnancy and childbirth, especially when nutrition and health care are inadequate. Early pregnancy may also occur without sufficient preparation, planning, or awareness of warning signs that require urgent medical care. For many adolescent girls, pregnancy happens in a context of limited autonomy, low health literacy and reduced access to

services. (World Health Organization 2024)

The consequences of early marriage and early pregnancy are not only physical; they also include psychological and social harm. Many young girls experience emotional distress due to sudden responsibility, fear, loneliness, or lack of support. Some may face controlling behavior, domestic violence, or pressure to become pregnant quickly, which adds to psychological strain. Early marriage can also isolate girls from friends and extended family, reducing social support at a time when it is most needed. Dropping out of school can further deepen feelings of loss, hopelessness and reduced self-worth. (Alfiya et al., 2024)

Female nursing students represent an important target group because they are future health professionals who will influence health education, counseling and prevention strategies. Their knowledge about early marriage and early pregnancy risk factors can shape how they assess adolescent needs and how they respond to sensitive cases. Their attitudes are equally important because they affect empathy, communication quality and willingness to challenge harmful norms respectfully. (Ali et al., 2024)

Community health nursing has a central role in prevention and health promotion, especially for adolescent girls at risk. Nurses can provide structured health education about reproductive health, the dangers of early pregnancy and the importance of delaying marriage until adulthood. They can also support families by explaining health consequences using clear and culturally sensitive language. In addition, nurses can help identify girls at risk through school and community engagement and guide them to appropriate support services. When early marriage has already occurred, nurses can provide psychological support, promote safe pregnancy care and refer complex cases to multidisciplinary teams. (Fitria et al. 2024).

Significance of the Study:

Early marriage remains a widespread phenomenon in many regions, with millions of girls entering marriage before the age of 18 each year. This issue is not only a personal or family matter; it is a public health and human development concern because it affects education, health outcomes and the social and economic participation of young women. (UNICEF 2023)

Early pregnancy is also a major contributor to preventable morbidity

and mortality among adolescent girls, particularly in low- and middle-income settings. Pregnancy and childbirth complications are frequently described as leading causes of death among girls aged 15–19 and adolescent births are associated with increased risks for both mothers and newborns. (World Health Organization 2024)

In Egypt, child marriage remains a significant issue despite gradual declines over the past decades. Recent data show that about 16% of women aged 20–24 years were married before the age of 18 in 2021, compared to 27% in 1996. Early pregnancy often follows early marriage, contributing to maternal health risks and poor neonatal outcomes. (Elnakib et al., 2022).

Globally, early marriage and pregnancy remain widespread, with one in five young women worldwide married before the age of 18. The highest prevalence is observed in Sub-Saharan Africa, where rates exceed 35%, while South Asia also reports significant levels. Although progress has been made in reducing child marriage in regions such as Latin America and Southeast Asia, millions of girls continue to face early marriage and pregnancy, leading to increased risks of maternal mortality, poor educational

attainment, and intergenerational poverty (UNICEF. 2022).

Aim of the study:

The overall goal of the study is to assess knowledge and attitude of female nursing students regarding risk factors of early marriage and early pregnancy. It will be achieved through:

- 1- Assess female nursing knowledge and attitude regarding early marriage.
- 2-Assess risk factors of early marriage and early pregnancy for the female nursing students.

Research questions:

- 1-What are the female nursing students knowledge and attitude regarding early marriage?
- 2-What are the risk factors of early marriage for the female nursing students?
- 3-Is there a relationship between female nursing student's demographic characteristics and early marriage?

subjects and method:

The subjects and method for this study were portrayed under the following four main designs:

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

I-Technical design:

Included research design, setting,

subjects and tool for data collection.

A- Research design:

A descriptive research design was utilized in this study.

B- Setting:

The research study was conducted at Secondary School of Nursing at El Fayoum Health Insurance, and included students from grade one to five: grade one (60 students), grade two (63 students), grade three (66 students), grade four (69 students) and grade five (60 students).

Sampling:

All students in Secondary School of Nursing at El Fayoum health insurance from grade one to grade four.

Type of the sample:

A convenience sample was used in the study.

Sample size:

All the available students at Secondary School of Nursing at El Fayoum health insurance from grade one to grade four equal 258 students.

Tool of data collection:

The data was collected through the following tool: A structured questionnaire it was written in plain Arabic, adapted from **Moawad (2022)** and adjusted by the researcher and the students' attitude part was developed by the researcher. It involved of 3 parts:

Part I: Demographic characteristics:

It was contained 2 sub-items as:

-Female nursing students demographic characteristics:

Consisted of 3 items about age, number of sibling and ranking between sibling.

-Demographic characteristics for parents:

Consisted of 14 items such as marriage status of parents, father's age, father's educational level, father's occupation, mother's age, and mother's educational level.

Part II: Assessment of the female nursing students' knowledge about early marriage and risk factors of early marriage and early pregnancy:

It was contained 3 sub-items including:

a-Female students' knowledge about reproductive health involved 6 closed-end questions such as meaning of reproductive health, importance of reproductive health, benefits of reproductive health.

b -Students' knowledge about early marriage involved 8 closed-end questions such as meaning of early marriage, appropriate age for marriage from the point of view of the law, the examinations required for engaged couple before marriage, the causes of early marriage.

Scoring system for knowledge items:

For knowledge scale using

(Correct& complete =2, Correct& incomplete =1, Incorrect =0). Score of less than 60% was unsatisfactory and the score equal or more than 60% was satisfactory.

c- Students' assessment of risk factors for problems resulting from early marriage:

It was contained 3 sub-items including:

1-Risk factors for physical problems:

It was involved (8 items) such as anemia or iron deficiency as a result of deteriorating health, Infection as a result of abortion, immunodeficiency due to infection.

2-Risk factors for psychological problems:

It was involved (9 items) such as increase psychological problems for the wife as a result of violence and psychological stress, increase problems between spouses as a result of having children with disabilities, inability to play the role of mother and wife.

3- Risk factors for social problems:

It was involved (10 items) such as failure to provide good service to the family as a result of overpopulation, increasing the burden on society as a result of having children with disabilities, increasing family disintegration in society as a result of increasing the percentage of ignorance, raising abnormal children

as a result of family disintegration.

Scoring system for risk factors items:

For risk factors scale using (yes =1, no =0) the total score of risk factors was (27).

Score of less than 70% (<19) was no and the score equal or more than 70% (19-27) was yes.

Part III: Evaluating the attitude of students about early marriage and early pregnancy:

It was composed of 13 questions: such as the desire that early marriage not to be before 18 years, feeling that pregnancy is better at a young age, the desire to be a law that prevents early marriage, to have the freedom to choose whether or not to get married early, feeling that early marriage has a role in changing the girl for the better.

Scoring system for attitude items:

For attitude scale using (Agree = 2, Uncertain = 1, Disagree = 0) the total score of attitude was (39). Score of less than 70% (< 28) was negative and the score equal or more than 70% (28-39) was positive.

II-Operational Item:

It included preparatory phase, pilot study, content validity, content reliability and field work.

A) The preparatory phase:

The review encompassed past, current, national, and international literature relevant to the study.

Theoretical knowledge OF various aspects of the research was obtained from reputable sources, including textbooks, scientific articles, online databases, periodicals, and magazines, to ensure comprehensive understanding and in-depth knowledge of the topic.

B) Pilot study:

The pilot study was done on 10% of the sample (26) students to examine the clarity of questions and time needed to complete the study tools and to test the tool's viability, applicability and clarity. Subjects included in the pilot study was modified and included in the study if major modifications are required.

C)Content validity:

Five experts from El Fayoum university faculty of nursing from community health nursing, reviewed the data collection tool and tested its validity and the required adjustments took place.

D)Content reliability:

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

Alpha Cronbach Reliability

Analysis of the Used Tool

Items	Alpha Cronbach	f	P-value
Knowledge	0.815	26.672	<0.001*
Risk factors	0.824	24.951	<0.001*
Attitude	0.793	21.754	<0.001*

This table show reliability in knowledge, risk factors and attitude when alpha Cronbach was > 0.5 .

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 0.81.

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 2 days per week on Wednesday and Thursday, from 9 Am to 12 Pm.

Interviews were conducted with (258) students from grade one to grade four [grade one (60), grade two (63), grade three (66) and grade four (69)] in Secondary School of Nursing at El Fayoum health insurance.

-The time needed to complete the questionnaire sheet was 30-35 minutes.

III. Administrative design:

Approval to carry out this study was obtained from the Dean of Faculty of Nursing University to directors of Secondary School of Nursing at El Fayoum health insurance.

Ethical consideration:

Before the study began, the Supreme Committee for Scientific Research Ethics at Fayoum University granted its approval. The researcher gained the trust and confidence of the students 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 students that they can opt out of the study at any moment and that they could choose not to participate.

IV. Statistical design:

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation and chi-square test was used to compare between groups in qualitative data by (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Significant level: > 0.05 Non significant $< 0.05^*$ significant $< 0.001^*$ High significant.

Results:

Table (1): This table shows that, the majority of nursing students were aged 17 years or older, with 26.7% being 18 years old, the highest percentage. The mean age was 16.56 ± 1.12 years. In terms of siblings, (43.8%) of the students had three or more brothers. Regarding birth order

(32.9%) were second-born, followed by first-borns (27.1%).

Table (2): This table presents that, the majority of students demonstrated correct and complete knowledge of the concept (62.8%) and the importance (65.1%) of reproductive health, with significant percentages providing incorrect answers (37.2% and 34.9%, respectively). Regarding the benefits of reproductive health, 33.3% provided complete knowledge, while 34.9% had incomplete responses. Students showed a somewhat lower level of understanding when it came to the factors affecting reproductive health (32.6% correct), with 37.6% offering incomplete knowledge. Additionally, 41.5% correctly identified ways to protect and maintain female reproductive health, while 32.2% had incomplete knowledge. When asked about places that provide reproductive health services, 49.6% provided correct answers, with 28.7% giving incomplete information.

Table (3): This table displays that, the majority of students demonstrated correct and complete knowledge of the concept of early marriage (66.3%) and the appropriate age for marriage in terms of law (67.8%). However, there were lower levels of complete knowledge regarding examinations

required before marriage (42.2%) and the reasons for early marriage (43.8%). Regarding the negative effects of early marriage, 46.1% of students correctly identified the effects on society, while 41.9% identified the effects on the family, and 35.3% recognized the effects on the girl. When considering solutions to reduce early marriage, 43.4% provided correct answers, with 36.4% offering incomplete knowledge.

Figure 1: The pie chart shows that 62.4% of nursing students demonstrated satisfactory total knowledge, while 37.6% were classified as unsatisfactory.

Figure 2: The data indicate that psychological problems were the most commonly reported risk factors among nursing students, affecting 72.5% of the sample. This was followed by social problems at 69.8% and physical problems at 69.0%.

Figure 3: The results show that 72.9% of nursing students held a positive attitude, while 27.1% expressed a negative attitude.

Table (4): This table highlights significant relationships between **total risk factors** and various demographic variables. **Age** plays a crucial role, with older students (especially 18 years old) showing a lower incidence of **risk factors**

compared to younger students ($p < 0.001$). Similarly, students with **3 or more brothers** experience a higher prevalence of **risk factors** than those with fewer siblings, particularly **1 brother** ($p < 0.001$). The **birth order** also significantly affects the presence of **risk factors**, with first-born and second-born students having fewer **risk factors** than later-born children ($p < 0.001$). Students residing in **rural areas** exhibit a higher occurrence of **risk factors** than those in urban areas ($p < 0.001$). Additionally, the number of people living in the household and the number of rooms in the house correlate with risk factors, where students from larger households and with fewer rooms report more risk factors ($p < 0.001$). Lastly, family income is another key determinant, with students from families with insufficient income showing a higher prevalence of risk factors, while those from overflowing income families report the least ($p < 0.001$).

Table (5): This table illustrates the regression model was statistically significant overall ($F = 6.558$, $p < 0.001$), indicating that the included demographic variables collectively predicted total risk factors. In terms of individual predictors, number of brothers ($B = -0.607$, $p < 0.001$)

showed a strong negative association with total risk factors, while number of rooms in the house ($B = 0.527$, $p = 0.002$) was a significant positive predictor. Other factors, including age, birth order, place of residence, household size, and family monthly income, did not show significant relationships ($p > 0.05$).

Table (6): This table illustrates the regression model was statistically significant (ANOVA = 6.558, $p < 0.001$), indicating that the demographic variables collectively influenced total attitude. Among the predictors, number of people staying in the house ($B = -0.193$, $p = 0.049$) and monthly family income ($B = -0.224$, $p = 0.004$) were significant negative predictors, suggesting that larger household size and higher income were associated with lower attitude scores. Other factors, including age, number of brothers, birth order, place of residence, and number of rooms, did not exhibit significant effects ($p > 0.05$).

Table (1): Distribution of demographic characteristics of female nursing students (N = 258)

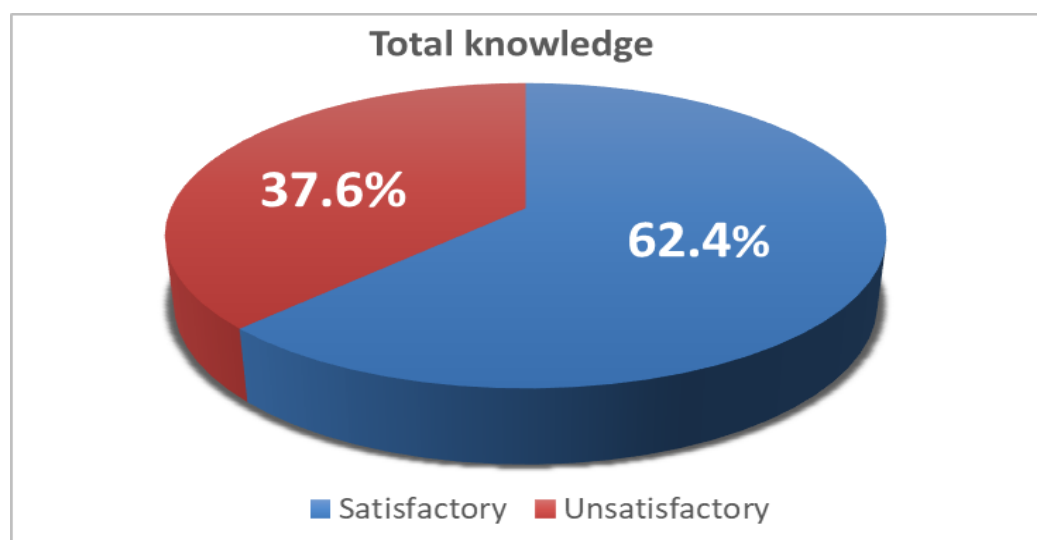
Items	N=258	%
1- Age		
15	60	23.3
16	63	24.4
17	66	25.6
18	69	26.7
Mean $\pm$ SD	16.56$\pm$1.12	
2- Number of brothers		
1	50	19.4
2	95	36.8
3 or more	113	43.8
3- Order of student		
First	70	27.1
Second	85	32.9
Third	55	21.3
Fourth or more	48	18.6

Table (2): Distribution of knowledge about reproductive health among female nursing students (N = 258).

Knowledge about reproductive health	Correct& complete		Correct& incomplete		Incorrect	
	N	%	N	%	N	%
-The concept of reproductive health is	162	62.8	0	0.0	96	37.2
-The importance of reproductive health is	168	65.1	0	0.0	90	34.9
-Reproductive Health Benefits	86	33.3	90	34.9	82	31.8
-Factors affecting reproductive health are	84	32.6	97	37.6	77	29.8
-The ways in which female reproductive health can be protected and maintained are.	107	41.5	83	32.2	68	26.4
-The places that provide health services related to reproductive health are.	128	49.6	74	28.7	56	21.7

Table (3): Distribution of knowledge about early marriage among female nursing students (N = 258).

Knowledge about Early marriage	Correct& complete		Correct& incomplete		Incorrect	
	N	%	N	%	N	%
- The concept of early marriage is	171	66.3	0	0.0	87	33.7
- The appropriate age for marriage in terms of law is	175	67.8	0	0.0	83	32.2
-Examinations required for engaged before marriage	109	42.2	67	26.0	82	31.8
-The reasons for early marriage are	113	43.8	72	27.9	73	28.3
-The negative effects of early marriage are						
Effects on the girl	91	35.3	103	39.9	64	24.8
Effects on the family	108	41.9	91	35.3	59	22.9
Effects on society	119	46.1	76	29.5	63	24.4
-The solutions and methods that must be available to reduce early marriage are.	112	43.4	94	36.4	52	20.2

**Figure 1: Total Knowledge of Female Nursing Students (N = 258).**

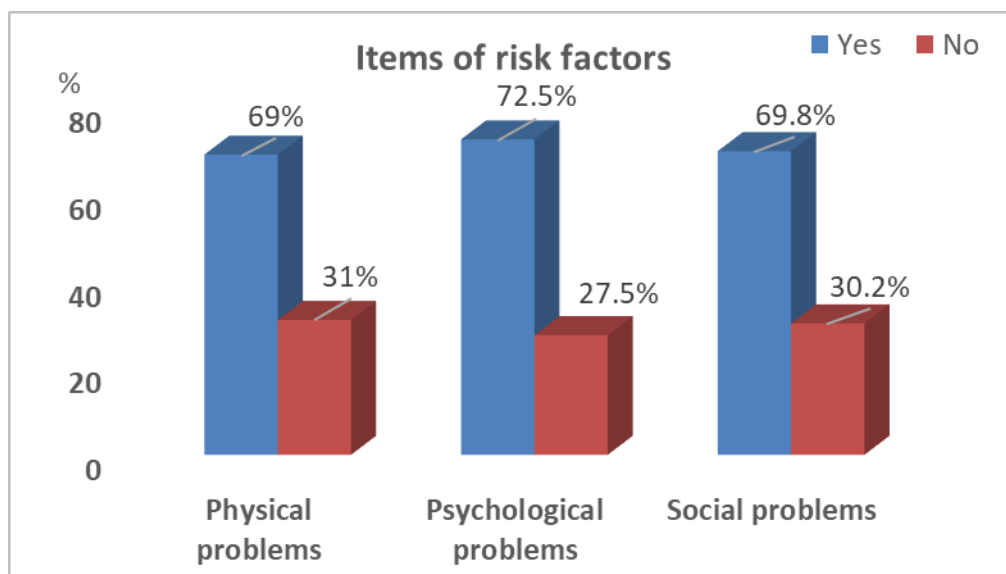


Figure 2: Distribution of Risk Factors Among Female Nursing Students (N = 258)

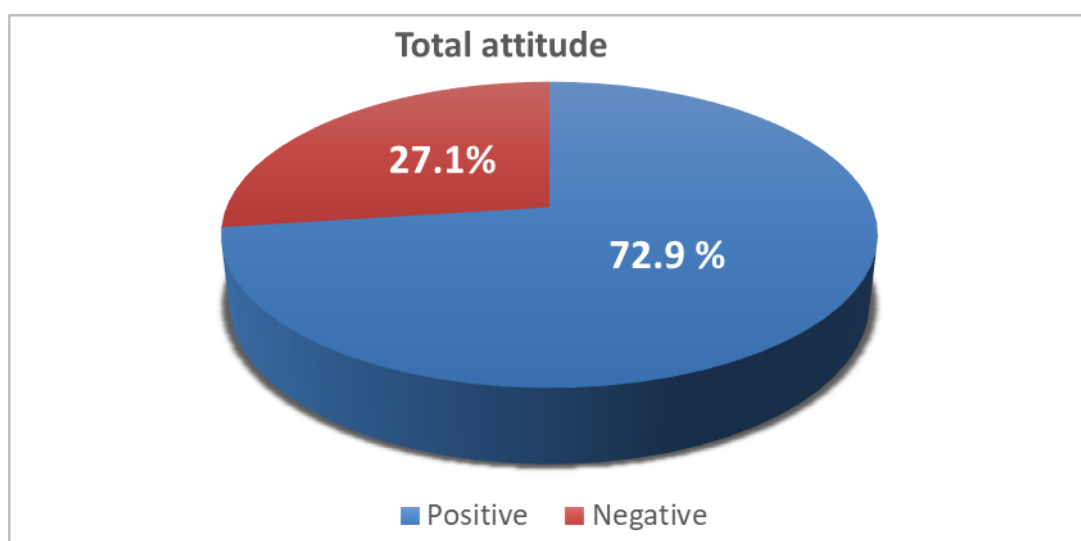


Figure 3: Distribution of Overall Attitudes Toward Early Marriage and Early Pregnancy Among Female Nursing Students (N = 258).

Table (4): Relation Between Total risk factors and Demographic Factors Among Female Nursing Students (N = 258).

	Total risk factors					
	Yes		No		Chi-square	
	N	%	N	%	X ²	P-value
- Age						
15	50	83.3	10	16.7	24.310	<0.001*
16	49	77.8	14	22.2		
17	50	75.8	16	24.2		
18	33	47.8	36	52.2		
- Number of brothers						
1	21	42.0	29	58.0	28.295	<0.001*
2	67	70.5	28	29.5		
3 or more	94	83.2	19	16.8		
- Order of Student						
First	33	47.1	37	52.9	28.328	<0.001*
Second	62	72.9	23	27.1		
Third	46	83.6	9	16.4		
Fourth or more	41	85.4	7	14.6		
- Place of residence						
Rural	117	79.6	30	20.4	13.464	<0.001*
Urban	65	58.6	46	41.4		
- Number of people staying in the house						
2	14	40.0	21	60.0	20.498	<0.001*
3	59	69.4	26	30.6		
4 or more	109	79.0	29	21.0		
- Number of rooms in the house						
2	21	44.7	26	55.3	20.133	<0.001*
3	66	71.7	26	28.3		
4 or more	95	79.8	24	20.2		
- Monthly income of the family						
not enough	67	85.9	11	14.1	20.072	<0.001*
enough	109	66.9	54	33.1		
overflowing	6	35.3	11	64.7		

Table (5) Best fitting multiple linear regression model for risk factors

	Unstandardized Coefficients		Standardized Coefficients	t	P-value	95.0% CI	
	B	SE	Beta			Lower	Upper
- Age	-0.088	0.101	-0.215	0.871	0.384	-0.287	0.111
- Number of brothers	-0.607	0.159	-1.008	3.829	<0.001*	-0.920	-0.295
– Order of student	-0.093	0.092	-0.217	1.014	0.312	-0.274	0.088
- Place of residence	-0.041	0.120	-0.044	0.339	0.735	-0.278	0.196
-Number of people staying in the house.0	-0.106	0.105	-0.166	1.011	0.313	-0.313	0.101
- Number of rooms in the house	0.527	0.170	0.870	3.107	0.002*	0.193	0.861
- Monthly income of the family.	0.055	0.084	0.068	0.658	0.511	-0.110	0.220
a. Dependent Variable: Total risk factors							

ANOVA= 6.558, P-value <0.001*

Table (6): Best fitting multiple linear regression model for total effect score (including attitude)

	Unstandardized Coefficients		Standardized Coefficients	t	P-value	95.0% CI	
	B	SE	Beta			Lower	Upper
- Age	-0.060	0.094	-0.149	0.634	0.527	-0.244	0.125
- Number of brothers	0.090	0.147	0.153	0.611	0.542	-0.200	0.380
– Order of student	0.115	0.085	0.274	1.343	0.180	-0.053	0.283
- Place of residence	-0.037	0.112	-0.041	0.331	0.741	-0.258	0.183
- Number of people staying in the house	-0.193	0.098	-0.311	1.981	0.049*	-0.385	-0.001
- Number of rooms in the house	-0.097	0.158	-0.164	0.616	0.539	-0.408	0.213
– Monthly income of the family	-0.224	0.078	-0.281	2.873	0.004*	-0.377	-0.070
a. Dependent Variable: Total attitude							

ANOVA= 6.558, P-value <0.001*

Discussion

Early marriage significantly affects women's independence and access to education, as well as various aspects of adolescent, maternal, and women's health. It is closely associated with increased risks of illness, poor nutrition, and maternal death. These factors collectively create harmful cycles that negatively impact the health, survival, and future well-being of the next generation. Since most women marry before becoming mothers, efforts to delay early childbearing must begin with strategies aimed at delaying the age of marriage (Aychiluhm et al., 2021).

Part (I): Demographic characteristics of female nursing students and their parents.

As regard demographic characteristics of female nursing students; the current study result showed that the majority of nursing students were aged 17 years or older, with more than one quarter of them being 18 years old, the highest percentage. The mean age was 16.56 ± 1.12 years (Table 1).

This result in the same line with Moawad et al., (2022) who applied a study in Egypt among 121 students entitled “Awareness of Female Nursing Students of the Risk Factor Regarding Early Marriage” and reported that less than one quarter of

the studied nursing students their age was 18 years old, while, less than three quarters of female nursing students their age was 19 years, the mean $\pm$ SD of age is 18.86 ± 0.79 years. Additionally, Gomaa et al., (2023) studied in Egypt among 120 students to assess nursing students' perception about the risk factors associated with early marriage and reported that half of the studied nursing students were between age 16-17 years old with mean age 14.6 ± 1.2 years.

From the researcher's point of view, this result may be attributed to the fact that secondary school students typically fall within this age range.

In terms of siblings, the current study result showed that more than two fifths of the students had three or more brothers (Table 1). These findings contrasted with Naghizadeh and Mirghafourvand, (2022) who applied a cross-sectional study in Iran among 270 adolescents to assess Knowledge and attitudes of adolescent girls and their mothers about early pregnancy and reported that highly percentage of the studied students hadn't siblings, while, more than two fifths of them had one brother.

From the researcher's point of view this result may be due to family income and socio culture condition among families.

Regarding birth order among studied students; the current study result revealed that about one third of the studied students were second-born, followed by more than one quarter of them were first-borns (**Table 1**). These findings contrasted with **Ahmed, & Elsayied, (2021)** in a study in Egypt among 137 students to assess knowledge of females' preparatory students regarding early marriage health consequences and revealed that less than one third of them were the first born, while, more than one quarter of them were second-born.

From the researcher's point of view this result may be due to age of the females' parents, family income and common family size patterns where having two or more children is typical.

Part II: Female's knowledge about, the reproductive health, early marriage and the risk factors for problems arising from early marriage.

Concerning to knowledge about reproductive health among female nursing students; the present study result presented that, less than two thirds of students demonstrated correct and complete knowledge of the concept of reproductive health and importance of reproductive health. Regarding the benefits of reproductive health, one third of

them had complete knowledge. Less than one third of students had correct knowledge about a somewhat lower level of understanding when it came to the factors affecting reproductive health. Additionally, more than two fifths of them were correctly identified ways to protect and maintain female reproductive health. When asked about places that provide reproductive health services, about half of them provided correct answers, with more than one quarter of them giving incomplete information. (**Table 2**).

These results agree with **Kyilleh et al., (2018)** studied in Ghana among 80 participants entitled "Adolescents' reproductive health knowledge, choices and factors affecting reproductive health choices: a qualitative study in the West Gonja District in Northern region, Ghana" and reported that the studied adolescents had little or no understanding of adolescent reproductive health services and choices. Moreover, **Alomani et al., (2024)** studied in Saudi Arabia among 347 participants entitled "Reproductive health awareness among female university students at Saudi Arabia" and found that about half of the study's participants had good knowledge of reproductive health, three quarters of them of

health and rehabilitation sciences students had good knowledge, while less than two fifths of community college students had good knowledge of reproductive health.

From the researcher's point of view, this result may be due to inadequate curriculum coverage and lack of focused training. Cultural taboos and limited open discussions on the topic could also restrict learning opportunities.

As regard knowledge about early marriage among female nursing students; the present study result displayed that, two thirds of the studied students demonstrated correct and complete knowledge of the concept of early marriage (**Table 3**). This result in the same line with **Jesse, (2022)** studied in Tanzania among 1001 parents entitled "Parents' Perception Towards Ending Girls' Early Marriage in Uyui District, Tabora, Tanzania" and reported that most respondents less than three quarters of them understand that concept of early marriage.

From the researcher's point of view this result may be due to increased awareness campaigns, educational exposure, and media coverage highlighting its social and health impacts

The current study result showed that the more than two thirds of the

studied students had correct& complete regarding appropriate age for marriage in terms of law. However, more than two fifths of them had complete knowledge regarding examinations required before marriage and the reasons for early marriage respectively (**Table 3**). These findings similar with **Ahmed, & Elsayied, (2021)** in a study in Egypt among 137 students to assess knowledge of females' preparatory students regarding early marriage health consequences and revealed that, less than one third of the studied students had correct knowledge about appropriate age for marriage, more than one quarter of them had correct knowledge about reason for early marriage.

From the researcher's point of view this result may be due to widespread distribution of premarital investigation procedures within the Egyptian community. These efforts have contributed to increasing public knowledge and compliance with legal and health requirements related to marriage.

Regarding to knowledge about negative effects of early marriage, less than half of students correctly identified the effects on society, while more than two fifths of them identified the effects on the family, and more than one third of them recognized the effects on the girl.

When considering solutions to reduce early marriage, more than two fifths of them had correct answers (**Table 3**)

These findings supported with **Taufandas et al., (2023)** who applied a study in Indonesia among 62 students entitled “The effect of early marriage education on the level of knowledge of adolescents about the impact of early marriage” and reported that most of the studied adolescents' knowledge level was poor before being educated about the impact of early marriage. And in accordance with **Ahmed, & Elsayied, (2021)** in a study in Egypt among 137 students to assess knowledge of females' preparatory students regarding early marriage health consequences and revealed that less than one third of them had correct knowledge about disadvantages for early marriage. On the other side, **Hamidah, & Kirani, (2024)** studied in Indonesia among 151 students to assess Knowledge of the early marriage in high school adolescents and reported that less than two thirds of the studied students had correct knowledge about Early marriage will have an impact on the level of family economic welfare.

From the researcher's point of view this result may be linked to educational exposure and

community awareness campaigns highlighting the risks of early childbearing.

Concerning to total knowledge of female nursing students; the current study result (**Figure 1**) showed that less than two thirds of nursing students demonstrated satisfactory total knowledge, while more than one third of them were had unsatisfactory level of knowledge regarding early marriage (**This result answered about first research question**).

This result disagrees with **Pusporini, & Alifiani, (2024)** studied in Indonesia among 91 respondents entitled “The relationship between knowledge and adolescents' attitudes towards early marriage” and reported that more than half of adolescents had insufficient knowledge about early marriage. And **Jadhav, (2023)** who applied a study in India among 100 parents entitled “A Correlational Study to analyze the knowledge and attitude towards early marriage among parents at selected rural areas, Kolhapur District” and found that most of the subjects had average knowledge and minority of them had poor knowledge and more than one tenth of them had good knowledge.

From the researcher's point of view, females had knowledge about early marriage due mothers' awareness

regarding the consequences of early marriage, and may be due to social media enhance their level of knowledge.

As regard risk factors among female Nursing Students; the current study result indicated that **psychological problems** were the most commonly reported risk factors among nursing students, affecting less than three quarters of the sample, followed by **social problems** and **physical problems** respectively (**Figure 2**).

This result agreed with **Sezgin and Punamäki (2020)** who conducted a study in Turkey (n=1569) entitled “Impacts of early marriage and adolescent pregnancy on mental and somatic health: the role of partner violence” and found that more than half of them reported early marriage had physical, psychological and social problems. Additionally, this result was in the same line with **Gandhi et al. (2021)** who conducted a study in India (n=258) entitled “Analysis of survey on violence against women and early marriage: Gynecologists’ perspective” and found that half of them reported females have physical, psychological and social problems regarding early marriage. Moreover, **Abd-El-Kareem et al., (2019)** studied in Egypt among 100 participants Early Marriage and Associated Health Consequences

among Female Children in Giza Governorate” and indicated that less than two thirds of the selected study sample exposed to high biological, psychological and social hazards regarding early marriage respectively.

From researcher's point of view, early marriage is risk factor for physical, psychological and social problems because the female is not mature enough to deal with problems.

Part III: Attitude of Female nursing students regarding early marriage.

Concerning to overall attitudes toward early marriage and early pregnancy among female nursing students; the current study result (**Figure 3**) showed that less than three quarters of nursing students had a positive attitude, while more than one quarter of them expressed a negative attitude regarding early marriage and early pregnancy (**this result answered about first research question**).

These result similar with **Jadhav, (2023)** who applied a study in India among 100 parents entitled “A Correlational Study to analyze the knowledge and attitude towards early marriage among parents at selected rural areas, Kolhapur District” and found that most of subjects had Positive attitude score

and more than one tenth of them had negative attitude score towards early marriage. While, **Wulandari et al., (2023)** who applied a study in Indonesia among 300 students entitled “Adolescent’s Knowledge about the risk of early marriage related to attitude of preventing early marriage in Kecamatan Pare Kabupaten Kediri” and reported that half of the studied sample had a positive attitude about the risk of early marriage related to attitude of preventing early marriage. Meanwhile, **Pusporini, & Alifiani, (2024)** studied in Indonesia among 91 respondents entitled “The relationship between knowledge and adolescents' attitudes towards early marriage” and reported that more than half of the studied female students exhibit negative attitudes towards early marriage.

From the researcher's point of view, this result may be due to their education, awareness of health risks, and understanding of its negative social impacts. While, percentage of negative attitudes may reflect limited personal experience, cultural influences, or lack of exposure to formal reproductive health education before nursing studies.

Part IV: Relation and correlations between variables.

As regard relation between total risk factors and demographic factors

among female nursing students; the current study result showed that age plays a crucial role, with older students (especially 18 years old) showing a lower incidence of risk factors compared to younger students ($p < 0.001$). Similarly, students with 3 or more brothers experience a higher prevalence of risk factors than those with fewer siblings, particularly 1 brother ($p < 0.001$). The birth order also significantly affects the presence of risk factors, with first-born and second-born students having fewer risk factors than later-born children ($p < 0.001$). Students residing in rural areas exhibit a higher occurrence of risk factors than those in urban areas ($p < 0.001$). Additionally, the number of people living in the household and the number of rooms in the house correlate with risk factors, where students from larger households and with fewer rooms report more risk factors ($p < 0.001$). Lastly, family income is another key determinant, with students from families with insufficient income showing a higher prevalence of risk factors, while those from overflowing income families report the least ($p < 0.001$) (Table 4) (This result answered about Research Question number 3).

From the researcher's point of view this result may be due to the fact that factors like age, residence, number of siblings, and parental education influence students' exposure to traditional beliefs, socioeconomic pressures, and community norms. For example, students from rural areas or large families may be more familiar with or affected by early marriage practices, which shapes their awareness and attitudes toward its risks.

As regard best fitting multiple linear regression model for risk factors; the current study result revealed that the regression model was statistically significant overall ($F = 6.558$, $p < 0.001$), indicating that the included demographic variables collectively predicted total risk factors. In terms of individual predictors, number of brothers ($B = -0.607$, $p < 0.001$) showed a strong negative association with total risk factors, while number of rooms in the house ($B = 0.527$, $p = 0.002$) was a significant positive predictor. Other factors, including age, birth order, place of residence, household size, and family monthly income, did not show significant relationships ($p > 0.05$) (Table 5).

From the researcher's point of view this result may suggest that having more male siblings could provide protective support or reduce the pressure for early marriage. On the

other hand, the number of rooms in the house as a positive predictor may reflect better living conditions, which could correlate with increased awareness or reporting of risk factors. The lack of significance in other factors may indicate that they have a more indirect or less consistent impact on perceived or actual risks.

Concerning best fitting multiple linear regression model for total effect score (including attitude); the present study result illustrated the regression model was statistically significant (ANOVA = 6.558, $p < 0.001$), indicating that the demographic variables collectively influenced total attitude. Among the predictors, number of people staying in the house ($B = -0.193$, $p = 0.049$) and monthly family income ($B = -0.224$, $p = 0.004$) were significant negative predictors, suggesting that larger household size and higher income were associated with lower attitude scores. Other factors, including age, number of brothers, birth order, place of residence, and number of rooms, did not exhibit significant effects ($p > 0.05$) (Table 6).

From the researcher's point of view, this result may be due to larger households and higher income levels might create a sense of social stability or reduced urgency around

early marriage, leading to a less critical attitude toward its risks. Additionally, in higher-income families, early marriage may be viewed as a cultural norm rather than a necessity, influencing students' attitudes according.

Conclusion

The findings indicate that less than two thirds of nursing students demonstrated satisfactory total knowledge, while more than one third were classified as unsatisfactory. Also, the majority of students reported having knowledge about risk factors less than three quarters, while less than one third reported no risk factors. Finally, less than three quarters of nursing students held a positive attitude, while more than one quarter expressed a negative attitude.

Recommendations:

Based on the study findings, the following recommendations are suggested:

-Immediate school-based awareness programming

-Launch an official school awareness program on early marriage/early pregnancy because the results show no students reported having school awareness programs.

-Standardize messaging sources by providing verified learning materials, since many students' information comes from

family/friends/advertisements, which increases misinformation risk.

Routine assessment and targeted remediation

-Use short domain checks (mini-quizzes) for the two major knowledge domains reported (reproductive health, early marriage), because a notable proportion still fell in "unsatisfactory" categories across domains.

-Strengthen the role of mass media by delivering continuous, evidence-based campaigns (TV/radio/social media) that correct misconceptions about early marriage and early pregnancy and promote protective health behaviors and timely help-seeking.

Further research:

-Create a school dashboard tracking: knowledge domain scores + attitude score + total risk factors, repeated each term, to measure improvement after implementing awareness programs. (This aligns with how results were structured into parts and tables.)

-Run intervention studies next: compare cohorts (e.g., standard curriculum vs enhanced program) and examine which components reduce risk-factor reporting and improve attitudes most.

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Effect of Implementing Fluid Therapy Guidelines on Clinical Outcomes Among Critically Ill Patients

Rokia Ibrahim EL Nagar¹, Zeinab A. Allam^{2,3}, Sabry Mohamed Amin⁴,
Sheren Mohammed Abdelatief Gad Diab⁵

¹Lecturer of Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University

^{2,5}Assistant professor of Critical Care and Emergency Nursing, Faculty of Nursing, Tanta University, Egypt.

³Assistant Prof of Critical Care Nursing, Nursing Department, Faculty of Applied Medical Science in Rabigh King Abdulaziz University, KSA

⁴Professor of Anesthesia, Surgical intensive unit and Pain therapy, Faculty of Medicine, Tanta University

Corresponding author: Rokia Ibrahim

Email: rokiaibrahim87@gmail.com

Abstract

Background: Fluid therapy is challenging intervention for critical ill patient, since inappropriate administration and inadequate monitoring are associated with increased morbidity and mortality. Standardized fluid management may improve physiological stability and reduce organ dysfunction. **Aim:** To evaluate the effect of implementing fluid therapy guidelines on clinical outcomes among critically ill patients. **Method:** A quasi-experimental non-randomized controlled study with repeated measures. **Setting:** Surgical Intensive Care Unit at Tanta University Hospitals, affiliated with the Ministry of Higher Education and Scientific Research. **Subjects:** A convenience sample of 120 adult critically ill patients **Tools:** Data were collected using two tools: **Tool I:** Critically Ill Patients' Assessment Sheet, **Tool II:** Critically Ill Patients' Clinical Outcomes Regarding Fluid Therapy. **Results:** The intervention group showed statistically and clinically significant improvement in physiological parameters, reduced SOFA severity, and a significantly lower incidence of fluid treatment adverse events across 1st, 4th, and 7th day compared to the control group ($p < 0.001$). **Conclusion:** Implementing structured fluid therapy guidelines has a positive effect on clinical outcomes as physiological stability, reduces organ dysfunction severity, and decreases fluid-related complications among critically ill patients. **Recommendations:** Implement the standardized Fluid therapy guidelines as a basic part of critical nursing care for critically ill patients to enhance clinical outcomes and prevent adverse events and consequently improve patient safety. **Keywords:** Clinical Outcomes, Critically Ill Patients, Fluid Therapy Guidelines

Introduction

A critically ill patient is a person with an acute, life-threatening conditions caused by an acute disease, injury, decompensation of a chronic disease, adverse environmental influence, poisoning, or surgery. It is a time-sensitive condition, and early detection, support, and treatment have a major impact on outcome (**Karunarathna et al., 2022**).

Several critical illnesses, including severe burns, trauma, sepsis, brain injury, and heart failure, cause fluid and electrolyte imbalance. These critical mechanisms include decreased kidney perfusion due to hypovolemia or hypotension, activation of hormonal systems such as the renin-angiotensin-aldosterone system and vasopressin, and tubular damage produced by ischemic or nephrotoxic kidney injury leading to fluid and electrolyte abnormalities which are linked to significant morbidity and mortality rates in critically ill patients (**Gunturi et al., 2021; Zampieri et al, 2021**).

Electrolyte imbalances in critically ill patients can cause a number of clinical signs and symptoms, such as nausea, vomiting, and muscle weakness. Symptoms can range from asymptomatic to life-threatening consequences (**Hassan, 2021**). Furthermore, improper fluid

balance monitoring can cause a variety of complications, including hypervolemia, hypovolemia, hypernatremia, hyponatremia, hyperkalemia, and hypokalemia. Furthermore, fluid therapy has been linked to poor outcomes such as pulmonary edema, sacral edema, and prolonged hospital stay, all of which raise the risk of nosocomial problems (**Bataille et al., 2021**). All of these concerns will exacerbate patients' diseases and increase mortality rates (**Hafez et al., 2022**).

Fluid management is the primary treatment for critically ill patients in order to restore effective blood volume and sustain organ perfusion (**Alshamsi& Alhazzani, 2025**). The goal of fluid management is to be safe, effective, and free of adverse events, especially when long-term therapy is planned (**Tinawi, 2021**). To effectively manage these patients, reliable assessment of fluid balance data gathered during physical examination is required, since it is an important component of the patient's baseline information (**Shankar-Hari et al., 2021**).

Critical care nurses play a vital role in managing critically ill patients through continuous monitoring and detect changes in the patient's condition that require immediate management, such as fluid and

electrolyte imbalances. The nurse should be aware of the basic principles of fluid and electrolyte imbalance in the body which are essential for assessing the patient, planning interventions, and evaluating the effects of care **(Jones,2024)**. Moreover, they should also combine clinical findings with laboratory data such as physical examination results, vital signs, urine output, electrolyte levels, renal function tests, and acid base balance to determine when adjustments in fluid therapy are necessary **(Achanti & Szerlip, 2023)**.

Fluid therapy is a widely recognized, life-saving treatment; however, if it is given too aggressively without proper monitoring and regular reassessment, it may reduce its overall effectiveness and lead to unwanted complications **(Hassan& Mohamaed, 2021)**. Therefore, the National Institute for Health and Care Excellence advocates that critical care nurses should be able to start intravenous fluids according to the organizational policy until they are prescribed by a relevant practitioner and they can play an active role in the prevention of fluid therapy complications **(McDougall et al., 2022)**.

Significance of the study:

Fluid administration represents one of the core interventions in the management of acutely ill patients, with about one-third of patients in the intensive care unit (ICU) receiving resuscitation fluids and many more receiving maintenance fluids **(Messina et al., 2024)**. The Infusion Nurses Society has developed standards of practice for infusion nursing that address every stage of fluid therapy, including patient assessment, ongoing management, and documentation. These guidelines also emphasize that nurses should work collaboratively with other healthcare professionals to determine the appropriate fluid therapy for each individual patient **(Gorski,2021)**. Also, the National Institute for Health and Care Excellence (NICE) developed guidelines for nurses to ensure that fluid management has the best possible quality **(Hahn,2024)**.

Several studies have suggested that the fact that 90%of hospitalized patients receive intravenous fluids make patients at risk for developing complications. Furthermore, several studies found that a positive mean daily fluid balance was a significant predictor of mortality in the intensive care unit **(Monnet&Teboul,2020; Munroe, 2024)**. So, Nurses must follow fluid

guidelines to prevent these complications. Therefore, this study will be carried out to assess the effect of implementing fluid therapy guidelines on clinical outcomes among critically ill patients.

Research Hypothesis:

H1: Critically ill patients who receive structured fluid therapy guidelines are expected to have significant improvement in physiological parameters compared to those who aren't exposed

H2: Critically ill patients who receive structured fluid therapy guidelines are expected to maintain better fluid and electrolyte balance than those who do not.

H3: Critically ill patients who receive structured fluid therapy guidelines are expected to have significantly lower SOFA score and lower incidence of fluid-related adverse events compared to those who do not.

H4: There is a statistically significant relationship among patients' bio-demographic characteristics, SOFA score, and adverse events of fluid therapy.

Operational definition of clinical outcomes including physiological parameters within normal limits, fluid and electrolyte balance, a decreased SOFA score, and fewer fluid-related adverse events.

Subject and methods

Subjects

Research design: This study utilized A quasi-experimental with a baseline pre intervention and three repeated post intervention assessments without full randomization. It enables the assessment of cause-and-effect relationships between implementing fluid therapy guidelines and clinical outcomes for critically ill patients (Capili& Anastasi ,2024).

Setting:

Surgical Intensive Care Unit at Tanta University Hospitals, affiliated with the Ministry of Higher Education and Scientific Research. It was prepared and equipped with 20 beds with advanced technology; nurse-patient ratio 1:2.

Subject:

A convenience sample of 120 adult patients was selected from the previously described setting who met the inclusion criteria. The sample size was determined using the Epi-Info statistical software that ensures accurate and standardized sample size calculation. Based on the total annual ICU admissions (200 patients). (Annual statistics of Tanta Emergency Intensive Care Units, 2023). The sample size calculation assumed a 95% confidence level that Provides high

reliability and scientific rigor, 80% statistical power which lowers the risk of Type II error, a margin of error (d) of 0.05, which guarantees precision and validity, and an estimated population proportion (P). Selecting a moderate effect size ensures that the study is adequately powered to detect clinically meaningful difference between study groups without overestimating the expected impact. Also, the significant improvements attributable to the implementation of fluid therapy guidelines (Lakens, 2022).

Inclusion criteria include:

- Patients were enrolled in the study according to the following inclusion criteria
- Adult patients 21-60 years of both genders
- Newly admitted patients
- Hemodynamically unstable patients requiring fluid therapy

Exclusion criteria:

- Patients with severe chronic kidney disease
- Patients with fluid imbalance ‘as indicated by intake and output
- Patients diagnosed with end-stage liver failure
- Patients with complications such as cerebral edema or pulmonary edema.

These patients were excluded due to highly sensitive to fluid changes and

fluid therapy may worsen their condition making participation unsafe and inaccurate of the study outcome and also, these patients requiring individualized and specialized fluid management protocol to enhance internal validity and homogeneity of the study (Giovanni et al.,2024).

Tools of data collection: Two tools were used in this study to collect patient data related to the aim of the study, as following:

Tool (I): Critically Ill Patients' Assessment Sheet

This part was developed by the researcher after reviewing the related literature (Lim et al., 2021; Miller et al., 2021; Seccombe & Sapey, 2022). It was divided into the following:

a- Patient's Bio-Demographic Characteristics:

This part included: patient code, age, gender, current diagnosis, mode of ventilator support, chief complaint, past medical and surgical history, and current medication.

b-Fluid Volume Status Parameters Assessment sheet: This part was developed by the researcher after reviewing the related literature (Chowhan et al., 2021; Kilic et al., 2020; Wuyts et al.,2024).

This part was used to assess patients' fluid volume status, which consisted of weight, physiological

parameters such as temperature, pulse, respiration, blood pressure, SpO₂, central venous pressure, breathing sound, fluid intake, and output (including insensible loss, urine, nasogastric tube aspiration, and drainage), and serum electrolytes.

Tool (II) Critically Ill Patients' Clinical Outcomes Regarding Fluid Therapy: It included the following:

Part (a): Sequential organ failure assessment (SOFA)

This scale developed by (Vincent et al., 1998) and adopted by the researcher, it was used to determine the extent of a person's organ function or rate of failure and predict outcome during the stay in an intensive care unit (ICU). Sequential organ failure assessment was composed of six different scores, one each for the respiratory, cardiovascular, hepatic, coagulation, renal, and neurology. It is calculated on admission and repeated after the fluid therapy program. The average value is used to predict mortality with a rapid change in score suggesting poor prognosis

Scoring system: - A score of 0 (normal) to 4 (most dysfunction) is awarded to each organ function, giving a total maximum score of 24. A maximum total SOFA scores

greater than 15 correlated with a mortality rate of 90%.

-Low risk of organ failure: 0–5

-Moderate risk: 6–9

-High risk: 10–13

-Very high risk of mortality >14

- >15, mortality approaches or exceeds 90%.

Part (b): Indicators of Fluid Therapy Adverse Events:

This part was developed by the researcher after reviewing related literature (Jacobs et al., 2022; Koenig, 2021; Mohamed et al., 2021; Millington), to assess indicator of adverse events regarding fluid therapy which involved the following: -

A-Systemic complications such as: Pulmonary edema (distended neck veins), Volume depletion (confusion, muscle cramps, postural hypotension, and tachycardia) and peripheral edema.

B-Local complications such as (phlebitis, infiltration, extravasation, and infection

Scoring system

- All items were observed and scored using a dichotomous scale.

Present sign was scored (1), and absent sign was scored (0) (Evans et al., 2021; Kellum & Lameire, 2023).

Method

The study was accomplished through the following steps:

1. Administrative process:

-Official permission to perform this study and collect data was obtained from the Dean of Faculty of Nursing to the director of Surgical Intensive Care Unit at Tanta Emergency Hospital, Tanta University Hospitals.

2. Ethical consideration

- Ethical approval to conduct the proposed study was obtained from The Scientific Research Ethics Committee of the Faculty of Nursing with No (. 339-11-2023).

- An informed written consent was obtained from every patient and their family after explaining the aim of the study, stating the possibility of withdrawing at any time.

- Data confidentiality for patients was assured through the coding of all data.

-The study did not cause any harm to the patient.

3.Tool development: All tools were developed by the researcher after review of related literature except part b in Tool III was developed by (Vincent et al., 1998).

4.Validity of tools: All tools were presented to a jury of nine experts in the field of medical, biostatistics, intensive care, and emergency and critical care nursing to assess the feasibility, clarity, and applicability of the study instruments.

5. Reliability of the tool:

The reliability of tools was measured using Cronbach's alpha test. Cronbach's alpha for tool I is 0.835 and for tool II is .86. These values indicate high reliability, confirming that the tools provided consistent and dependable measurements.

6. A pilot study:

It was conducted before the actual study on 10% of the study sample to test the feasibility and applicability of the tools and to determine any obstacles that may have been encountered during the period of data collection; accordingly, modifications were made, including rephrasing ambiguous items, optimizing the timing of repeated measurements (days 1, 4, and 7), and improving the structure of the fluid therapy adverse events indicators. These modifications were essential to ensure accurate data collection and to enhance the consistency of guideline implementation in the clinical setting and the pilot study was excluded from the study subjects.

7.Data collection

Data were collected from January 2024 to the end of August 2024.

The present study was conducted through four phases: assessment, planning, implementation, and evaluation.

Phase I: Assessment phase:

-A primary assessment was carried out by the researcher in the first day of admission for all patients at the previously mentioned setting to determine who met the inclusion criteria of the study. This phase was started immediately before implementing the fluid therapy guidelines as baseline data, then on 4th and 7th post-days of implementing fluid therapy guidelines program.

-Assess patients' bio-demographic characteristics, and patients' fluid volume status by using tool **I part (a & b)**.

- Also, **tool II part (a, b)**, was used to predict patients' mortality by sequential organ failure assessment, to assess risks for adverse events of fluid therapy on 1st, 4th, and 7th post-days of implementing fluid therapy guidelines.

Phase II: Planning phase: -

Fluid therapy protocol guidelines were planned based on subjects' assessment and guidelines that were available in the relevant literature review (Gorski, 2021; Hassan & Mohamed, 2021; Tailor et al., 2020), which included preparing the content of assessment sheet to document the physiological parameters, fluid volume status, prediction of adverse events of fluid therapy.

Expected clinical outcomes

-Improve physiological parameters, maintain fluid balance, and reduce SOFA scores, Minimize occurrence of complications from fluid therapy among the study group.

Phase III: Implementation phase:

-Fluid therapy guidelines was implemented for patients by researcher during morning and nurses in intensive care unit after they were trained by the researcher during afternoon and night shifts. The content of fluid therapy guidelines was applied according to patients' assessment and monitoring.

Structured Fluid therapy guidelines included the following:**1. The accuracy of fluid therapy assessment and monitoring;**

-Using the ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure)

-The nurse should first evaluate whether the patient is hypovolemic and in need of fluid resuscitation. Signs suggesting a need for fluid replacement include a systolic blood pressure below 90 mmHg, a heart rate greater than 90 beats per minute, capillary refill time longer than 2 seconds or cold extremities, and a respiratory rate exceeding 20 breaths per minute.

2. Resuscitation fluid for critically ill patients;

-Fluid resuscitation was administered according to intensivists' order which included; crystalloids that contain sodium in the range 130–154 mmol/l, with a bolus of 500 ml over less than 15 minutes according to intensivists' order

-Reassess the patient using the ABCDE approach (Neyra et al., 2022).

-Reassess and monitor the patient, and stop IV fluids when no longer needed after notification of intensivist.

-Nasogastric fluids or enteral feeding are preferable when maintenance needs are more than 3 days.

-Inspect the presence of edema by palpating over the tibia, ankles, feet, and sacrum, Increase or restrict fluid intake as ordered.

-Monitor abdominal girth (Gorski et al., 2021; Libório et al., 2020.; Vignonet et al., 2020).

3. Maintenance phase in which, fluids are given to cover the patient's daily basal requirements of fluid, and electrolytes.

4. Replacement and redistribution; according to patient need and adjust the IV prescription and early detect imbalances, such as edema, hyponatremia or hypernatremia, and renal, liver,

and/or cardiac impairment. Monitor and reassess fluid and electrolyte balance by clinical indicator and laboratory monitoring (Mohammed et al., 2020; Messina et al., 2022).

5. Reassessment; -Monitor and routinely reassess patients to adjust or discontinue fluids when clinically appropriate, and integrate clinical and laboratory assessments, including physical examination, vital signs, urine output, electrolytes, renal function, and acid-base status, to identify when changes in fluid therapy are warranted (Pensier et al., 2022).

Phase (4): Evaluation phase:

Evaluation of the both group was done by using tools I part (b) and II pre-implementing fluid therapy guidelines on the 1st day of admission, then 4th and post-7th days of implementation of the fluid therapy guidelines program to program to monitor the temporal effects of fluid therapy, allowing the assessment of immediate(1st day), intermediate(4th day), and short-term patient outcomes(post-7th days), including therapeutic response and adverse events (Arabi et al., 2024).

Statistical analysis of the data

SPSS software statistics computer package version 25 was used to arrange, tabulate, and statistically analyze the gathered data. The range, mean, and standard deviation

were computed for quantitative data. The chi-square test (χ^2) was used to compare qualitative data. A paired samples T-test is used to compare the means of variables in a group before and after an intervention was used. For The F-value of analysis of variance (ANOVA) was computed to compare the means of variables throughout the course of three intervention periods in a group, or for more than two variables. Pearson's and Spearman's correlation coefficients (r) were used to assess the relationship between the variables. The results of tests of significance (*) were interpreted at a significance level of $P < 0.05$. Additionally, a high significance level of $P < 0.01$ was used to interpret the significance test results. (**) (Singh, 2022).

Results

Table (1): Bio-demographic characteristics of the studied patients

This table compares the socio-demographic characteristics of the study and control groups. The findings show that there were no statistically significant differences between both groups regarding age distribution ($\chi^2 = 0.934$, $p = 0.817$) or gender ($\chi^2 = 0.363$, $p = 0.547$). The mean age was nearly similar in both groups (37.07 ± 8.15 vs. 36.83 ± 7.53). This indicates that the two

groups were homogeneous and comparable, reducing the possibility of demographic bias affecting study outcomes.

Table (2): Distribution of clinical data among the studied patients

This table presents baseline clinical data including diagnosis, medical history, surgical history, medication use, and ventilation mode. Results demonstrate no statistically significant differences between study and control groups in current diagnosis ($p = 0.936$), past medical history ($p = 0.992$), past surgical history ($p = 0.938$), medication history ($p = 0.950$), or mode of mechanical ventilation ($p = 0.857$). These findings confirm that both groups were clinically similar before the intervention, supporting the validity of comparing outcomes between them.

Table (3): Breathing sound and fluid daily balance throughout the study periods

This table shows changes in breathing sounds and daily fluid balance over time. No significant difference was found between groups on the 1st and 4th days. However, by the 7th day, a statistically significant improvement was observed in the study group compared to the control group regarding breathing sounds ($\chi^2 = 10.848$, $p < 0.001$). On the other

hand, fluid daily balance remained stable with no significant difference across all days ($p = 0.624$). This suggests that the intervention may have contributed to improved respiratory outcomes without altering overall fluid balance

Table (4): Mean scores of physiological parameters throughout the study period

This table evaluates physiological parameters across three measurement points. Significant improvements over time were found in heart rate, blood pressure, oxygen saturation, CVP, and electrolyte values within both groups (ANOVA $p < 0.001$). Between-group comparisons revealed significant differences favoring the study group on the 4th and 7th days for heart rate, systolic/diastolic blood pressure, SpO_2 , CVP, sodium, and potassium levels ($p < 0.05$). Weight remained unchanged ($p > 0.05$). These results indicate that the intervention positively influenced physiological stabilization in critically ill patients.

Table (5): Distribution of SOFA organ system scores throughout the study period

This table describes SOFA scores across multiple organ systems. Highly significant improvements were noted in the study group over time in respiration, coagulation,

liver, cardiovascular, and renal systems ($p < 0.001$). By the 7th day, the study group demonstrated better recovery trends compared with the control group. The significant chi-square values confirm that organ dysfunction severity decreased more effectively in the study group, reflecting improved clinical outcomes.

Table (6): Total SOFA risk level throughout the study period

This table summarizes overall SOFA risk levels. On the 1st day, no significant difference was found between groups ($p = 0.927$), indicating comparable baseline severity. By the 4th and 7th days, statistically significant differences were observed ($p < 0.001$), with the study group shifting toward lower risk categories. The mean $\pm$ SD SOFA score decreased markedly in the study group (13.18 ± 3.90 to 6.72 ± 2.10), while remaining higher in the control group. This suggests that the intervention contributed significantly to reducing organ failure severity

Table (7): Indicators of fluid therapy adverse events throughout the study period

This table reports systemic and local adverse events. Significant differences emerged by the 4th and 7th days, particularly in pulmonary edema, peripheral edema,

infiltration, and extravasation ($p < 0.001$). The control group experienced a higher incidence of adverse events compared with the study group. These findings indicate that improved fluid therapy management in the study group reduced complication rates over time.

Table (8): Relation between Bio-demographic data, diagnosis, and SOFA mean scores.

This table examines factors influencing SOFA severity. Age showed a statistically significant association with SOFA scores in both groups ($p = 0.011$ in study; $p < 0.001$ in control), with older patients demonstrating higher risk levels. Diagnosis was also significantly related to SOFA scores ($p < 0.001$), especially among patients with shock or acute kidney injury. Gender showed no significant association. These results suggest that age and diagnosis are important predictors of organ failure severity.

Table (9): Relation between SOFA scores and the indicators of fluid therapy adverse events

This table shows that patients who developed systemic or local adverse events had significantly higher SOFA scores compared to those without complications. Pulmonary edema, volume depletion, phlebitis, and infiltration were all significantly

associated with increased SOFA severity in both groups ($p < 0.05$). This confirms that adverse fluid therapy outcomes are linked with worsening organ dysfunction.

Table (10): Relation between physiological parameters of the studied patients and the indicators of fluid therapy adverse events

This table explores the relationship between physiological measures and adverse events. In the study group, pulmonary edema was significantly associated with higher heart rate, blood pressure changes, and lower oxygen saturation ($p < 0.05$). Volume depletion was also linked to significant variations in heart rate, systolic pressure, and CVP. In the control group, fewer parameters reached significance, though SpO_2 and CVP showed consistent associations. These findings highlight the importance of close monitoring of physiological parameters to detect early fluid therapy complications.

Table (1) Bio-demographic characteristics of the studied patients

Characteristics	Study (N=60)		Control (N=60)		Chi-square	
	N	%	N	%	X ²	P-value
Age (in years)						
(21-<30)	9	15.0	12	20.0	0.934	0.817
(30-<40)	30	50.0	26	43.3		
(40-<50)	11	18.3	13	21.7		
(50-60)	10	16.7	9	15.0		
Range	23.-53		22-55			
Mean ± SD	37.07±8.15		36.83±7.53			
Gender						
Male	44	73.3	41	68.3	0.363	0.547
Female	16	26.7	19	31.7		

Table (2): Distribution of clinical data among the studied patients

Clinical data	Study (N=60)		Control (N=60)		Chi-square	
	N	%	N	%	X ²	P-value
Current diagnosis						
Acute kidney injury	3	5.0	4	6.7	0.819	0.936
Traumatic injury	28	46.7	27	45.0		
Respiratory disorder	7	11.7	8	13.3		
Shock	13	21.7	10	16.7		
Neurological disorder	9	15.0	11	18.3		
Past medical history	(N=79)		(N=83)			
None	24	30.4	26	31.3	0.816	0.992
Respiratory diseases	19	24.1	20	24.1		
Heart diseases	8	10.1	7	8.4		
Renal diseases	4	5.1	6	7.2		
Hepatic failure	6	7.6	7	8.4		
Neurological diseases	14	17.7	12	14.5		
Diabetic	4	5.1	5	6.0		
Past surgical history	(N=68)		(N=67)			
None	27	39.7	24	35.8	0.409	0.938
Heart surgery	19	27.9	21	31.3		
vascular surgery	18	26.5	17	25.4		
Abdominal surgery	4	5.9	5	7.5		
Medication history						
None	13	21.7	11	18.3	1.140	0.950
Anti-acids	6	10.0	9	15.0		
Anti-coagulant	8	13.3	7	11.7		
Neurological disorder	4	6.7	3	5.0		
Respiratory disorder	7	11.7	6	10.0		
Cardiac	22	36.7	24	40.0		
Mode of mechanical ventilation						
CPAP	18	30.0	20	33.3	0.310	0.857
PSV	28	46.7	25	41.7		
SIMV	14	23.3	15	25.0		

More than one answer was chosen

Table (3): Distribution of the studied patients regarding the breathing sound and daily balance throughout period of study.

		Study (N=60)				Control (N=60)				Chi-square	
		Normal		Abnormal		Normal		Abnormal			
		N	%	N	%	N	%	N	%	X ²	P-value
Breathing sound											
1st day		10	16.7	50	83.3	13	21.7	47	78.3	0.484	0.487
4th day		21	35.0	39	65.0	15	25.0	45	75.0	1.429	0.232
7th day		37	61.7	23	38.3	19	31.7	41	68.3	10.848	<0.001*
Chi-square	X ²	26.140				1.613					
	P-value	<0.001*				0.447					
Fluid Daily balance											
1st day		51	85.0	9	15.0	49	81.7	11	18.3	0.240	0.624
4th day		51	85.0	9	15.0	49	81.7	11	18.3	0.240	0.624
7th day		51	85.0	9	15.0	49	81.7	11	18.3	0.240	0.624
Chi-square	X ²	0.000				0.000					
	P-value	1.000				1.000					

* Significant at level P<0.05

Table (4): Mean scores of physiological parameters of the studied patients throughout period of study

		1 st day	4 th day	7 th day	ANOVA	
					f	P-value
- Heart rate	Study	111.50±17.99	79.78±9.90	98.62±9.12	90.744	<0.001*
	Control	117.80 ± 18.64	87.40 ± 10.23	104.75 ± 8.96	78.636	<0.001*
	t (P-value)	1.884 (0.062)	4.146(<0.001*)	3.714 (<0.001*)		
- Temperature	Study	36.59±1.14	37.27±0.86	36.91±0.66	8.417	<0.001*
	Control	36.84 ± 1.10	37.52 ± 0.93	37.05 ± 0.48	9.466	<0.001*
	t (P-value)	1.222 (0.224)	1.529 (0.129)	1.329(0.187)		
Blood pressure						
- Systolic	Study	85.83±17.95	91.42±13.84	106.08±11.20	30.799	<0.001*
	Control	90.40 ± 18.12	98.35 ± 14.55	112.67 ± 10.92	34.774	<0.001*
	t (P-value)	1.388(0.168)	2.673 (0.009*)	3.263 (<0.001*)		
- Diastolic	Study	83.42±12.23	90.06±12.70	94.92±11.12	13.805	<0.001*
	Control	85.25 ± 11.94	96.87 ± 13.25	101.40 ± 12.82	25.889	<0.001*
	t (P-value)	0.829(0.409)	2.874 (0.005*)	2.958 (0.004*)		
- SpO2 saturation	Study	83.05±2.18	87.08±2.45	89.50±2.16	123.884	<0.001*
	Control	82.60 ± 2.43	86.30 ± 2.57	88.00 ± 2.05	82.107	<0.001*
	t (P-value)	1.068 (0.287)	1.702(0.092)	3.902 (<0.001*)		
-Weight (in kg)	Study	78.08±12.18	78.55±12.16	78.57±12.18	0.031	0.969
	Control	78.22 ± 12.05	78.36 ± 12.11	78.40 ± 12.09	0.004	0.996
	t (P-value)	0.063 (0.950)	0.086(0.932)	0.077 (0.939)		
-CVP	Study	5.03±0.88	8.55±0.53	10.57±0.56	1033.583	<0.001*
	Control	4.84 ± 0.91	8.10 ± 0.65	10.20 ± 0.60	815.234	<0.001*
	t (P-value)	1.163 (0.247)	4.156(<0.001*)	3.492(<0.001*)		
-Serum electrolyte						
- Na Value	Study	134.87±15.65	142.47±15.20	137.27±16.05	3.703	0.027*
	Control	132.40 ± 13.92	148.10 ± 12.65	142.80 ± 11.72	23.378	<0.001*
	t (P-value)	0.913 (0.363)	2.205 (0.029*)	2.155 (0.033*)		
- K+ Value	Study	2.97±0.86	4.13±0.55	4.19±0.49	66.392	<0.001*
	Control	3.15 ± 0.74	4.45 ± 0.63	4.48 ± 0.58	81.032	<0.001*
	t (P-value)	1.229(0.222)	2.964 (0.004*)	2.959(0.004*)		
-.Daily Fluid Balance (in litre)						
- Total intake	Study	3260.02±675.65	2666.83±504.45	1876.93±380.98	101.228	<0.001*
	Control	3348.5±702.3	2785.4±532.22	1960.85±395.16	94.016	<0.001*
	t (P-value)	0.703(0.483)	1.252 (0.213)	1.184(0.239)		
- Total output	Study	1976.33±505.78	1377.33±695.88	1137.00±351.33	38.945	<0.001*
	Control	1888.6±480.25	1285.45 ±670.32	1050.2±330.88	42.640	<0.001*
	t (P-value)	0.974 (0.332)	0.737 (0.463)	0.607 (0.545)		

* Significant at level P<0.05

Table (5): Distribution of the studied patients regarding sequential organ failure assessment (SOFA) throughout period of study.

Organ System, Measurement	SOFA Score	1 st Day				4 th Day				7 th Day				Chi-square			
		Study		Control		Study		Control		Study		Control		Study		Control	
		N	%	N	%	N	%	N	%	N	%	N	%	X ²	P-value	X ²	P-value
Respiration (PaO2/FiO2, mmHg)	Normal	1	1.7	2	3.3	30	50.0	5	8.3	40	66.7	8	13.3	123.768	<0.001*	13.462	0.097
	<400	5	8.3	4	6.7	24	40.0	7	11.7	14	23.3	9	15.0				
	<300	12	20.0	15	25.0	4	6.7	18	30.0	4	6.7	21	35.0				
	<200	20	33.3	19	31.7	1	1.7	19	31.7	2	3.3	14	23.3				
	<100	22	36.7	20	33.3	1	1.7	11	18.3	0	0.0	8	13.3				
	X ² (P-value)	0.899(0.925)				60.622(<0.001*)				50.980(<0.001*)							
Coagulation (Platelets x103/mm3)	Normal	5	8.3	4	6.7	29	48.3	6	10.0	38	63.3	7	11.7	88.438	<0.001*	3.554	0.895
	<150	6	10.0	8	13.3	18	30.0	9	15.0	17	28.3	11	18.3				
	<100	20	33.3	19	31.7	10	16.7	17	28.3	5	8.3	20	33.3				
	<50	18	30.0	16	26.7	2	3.3	16	26.7	0	0.0	15	25.0				
	<20	11	18.3	13	21.7	1	1.7	12	20.0	0	0.0	7	11.7				
	X ² (P-value)	0.707(0.950)				40.126(<0.001*)				53.641(<0.001*)							
Liver (Bilirubin, mg/dL (μmol/l))	Normal	10	16.7	11	18.3	36	60.0	14	23.3	46	76.7	16	26.7	98.303	<0.001*	5.462	0.707
	1.2-1.9	7	11.7	9	15.0	19	31.7	11	18.3	11	18.3	13	21.7				
	2.0-5.9	5	8.3	6	10.0	3	5.0	8	13.3	3	5.0	9	15.0				
	6.0-11.9	22	36.7	23	38.3	2	3.3	19	31.7	0	0.0	17	28.3				
	>12.0	16	26.7	11	18.3	0	0.0	8	13.3	0	0.0	5	8.3				
	X ² (P-value)	1.337(0.855)				35.848(<0.001*)				39.683(<0.001*)							
Cardiovascular (hypotension)	Normal	0	0.0	0	0.0	9	15.0	3	5.0	38	63.3	5	8.3	186.463	<0.001*	12.802	0.119
	MAP<70	1	1.7	2	3.3	45	75.0	6	10.0	20	33.3	9	15.0				
	Dopamine <5	20	33.3	18	30.0	3	5.0	20	33.3	1	1.7	17	28.3				
	Dopamine >5	26	43.3	25	41.7	3	5.0	21	35.0	1	1.7	22	36.7				
	Dopamine >15	13	21.7	15	25.0	0	0.0	10	16.7	0	0.0	7	11.7				
	X ² (P-value)	0.601(0.896)				68.889(<0.001*)				69.894(<0.001*)							
Glasgow Coma Score	Normal	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	7.781	0.255	7.304	0.294
	(13-14)	2	3.3	1	1.7	6	10.0	3	5.0	6	10.0	4	6.7				
	(10-12)	1	1.7	3	5.0	7	11.7	5	8.3	7	11.7	7	11.7				
	(6-9)	54	90.0	50	83.3	47	78.3	43	71.7	47	78.3	37	61.7				
	<6	3	5.0	6	10.0	3	5.0	9	15.0	3	5.0	12	20.0				
	X ² (P-value)	2.487(0.478)				4.441(0.218)				6.921(0.074)							
Renal (Creatinine, Urine output)	Normal	5	8.3	6	10.0	14	23.3	9	15.0	46	76.7	12	20.0	123.618	<0.001*	7.846	0.449
	1.2-1.9	12	20.0	11	18.3	34	56.7	12	20.0	11	18.3	14	23.3				
	2.0-3.4	10	16.7	13	21.7	10	16.7	15	25.0	3	5.0	13	21.7				
	3.5-4.9	32	53.3	28	46.7	2	3.3	22	36.7	0	0.0	16	26.7				
	>5.0	1	1.7	2	3.3	0	0.0	2	3.3	0	0.0	5	8.3				
	X ² (P-value)	1.126(0.890)				31.275(<0.001*)				47.541(<0.001*)							

* Significant at level P<0.05

Table (6) Distribution of the studied patients regarding total sequential organ failure assessment (SOFA) risk level throughout period of study.

Total SOFA Risk Level	1 st Day				4 th Day				7 th Day				Chi-square			
	Study		Control		Study		Control		Study		Control		Study		Control	
	N	%	N	%	N	%	N	%	N	%	N	%	X ²	P-value	X ²	P-value
Very High (≥14)	0	0.0	0	0.0	9	15.0	3	5.0	38	63.3	5	8.3	167.003	<0.001*	9.280	0.158
High (10–13)	1	1.7	2	3.3	45	75.0	6	10.0	20	33.3	9	15.0				
Moderate (6–9)	20	33.3	18	30.0	3	5.0	20	33.3	1	1.7	17	28.3				
Low (0–5)	26	43.3	25	41.7	3	5.0	21	35.0	1	1.7	22	36.7				
Mean ± SD	13.18±3.90		12.98±2.74		7.03±1.61		10.84±2.56		6.72±2.10		10.42±2.16					
X ² (P- value)	0.465(0.927)				45.426(<0.001*)				51.328(<0.001*)							

* Significant at level P<0.05

Table (7): Distribution of studied patients regarding indicators of fluid therapy adverse events throughout period of study.

Indicators of fluid therapy		1 st Day				4 th Day				7 th Day				Chi-square			
		Study		Control		Study		Control		Study		Control		Study		Control	
		N	%	N	%	N	%	N	%	N	%	N	%	X ²	P-value	X ²	P-value
Systemic adverse Events																	
Pulmonary edema	Absent	60	100	60	100	57	95	48	80.0	59	98.3	45	75.0	3.580	0.167	16.471	<0.001*
	Present	0	0	0	0	3	5	12	20.0	1	1.7	15	25.0				
X ² (P-value)		0.000(1.000)				6.171(0.013*)				14.135(<0.001*)							
Volume depletion	Absent	60	100	60	100	58	96.7	54	90.0	59	98.3	53	88.3	2.034	0.362	7.130	0.028*
	Present	0	0	0	0	2	3.3	6	10.0	1	1.7	7	11.7				
X ² (P-value)		0.000(1.000)				2.143(0.143)				4.821(0.028*)							
Peripheral edema	Absent	60	100	60	100	60	100	49	81.7	60	100	47	78.3	0.000	1.000	14.135	<0.001*
	Present	0	0	0	0	0	0	11	18.3	0	0	13	21.7				
X ² (P-value)		0.000(1.000)				12.110(<0.001*)				14.579(<0.001*)							
Local adverse Events																	
Phlebitis	Absent	60	100	60	100	58	96.7	59	98.3	59	98.3	59	98.3	2.034	0.362	1.011	0.603
	Present	0	0	0	0	2	3.3	1	1.7	1	1.7	1	1.7				
X ² (P-value)		0.000(1.000)				0.183(0.669)				0.000(1.000)							
Infiltration	Absent	60	100	60	100	57	95	44	73.3	59	98.3	42	70.0	3.580	0.167	21.176	<0.001*
	Present	0	0	0	0	3	5	16	26.7	1	1.7	18	30.0				
X ² (P-value)		0.000(1.000)				10.568(<0.001*)				18.072(<0.001*)							
Extravasation	Absent	60	100	60	100	59	98.3	46	76.7	60	100	45	75.0	2.011	0.366	17.346	<0.001*
	Present	0	0	0	0	1	1.67	14	23.3	0	0	15	25.0				
X ² (P-value)		0.000(1.000)				12.876(<0.001*)				17.143(<0.001*)							
Infection	Absent	60	100	60	100	59	98.3	57	95.0	60	100	59	98.3	2.011	0.366	3.580	0.167
	Present	0	0	0	0	1	1.7	3	5.0	0	0	1	1.7				
X ² (P-value)		0.000(1.000)				1.034(0.309)				1.008(0.315)							

* Significant at level P<0.05

Table (10): Relation between physiological parameters of the studied patients and the indicators of fluid therapy adverse events

	Pulmonary edema											
	Study						Control					
	Present		Absent		T-test		Present		Absent		T-test	
	Mean	SD	Mean	SD	t	P-value	Mean	SD	Mean	SD	t	P-value
Heart rate	98.74	5.25	92.33	4.15	2.581	0.012*	108.35	9.12	104.92	9.05	1.173	0.246
Systolic	106.81	6.08	100.45	4.9	2.171	0.034*	118.1	10.92	112.83	10.78	1.511	0.136
Diastolic	97.12	3.98	91.2	4.85	2.072	0.042*	107.45	12.85	101.65	12.70	1.424	0.159
SpO2 saturation	88.56	2.24	92.05	2.3	2.564	0.013*	91.36	2.25	88.23	2.12	4.521	<0.001*
Weight	78.83	12.05	75.1	11.95	0.527	0.600	82.74	12.4	78.65	12.21	1.035	0.305
CVP	10.62	0.59	9.95	0.61	1.856	0.068	10.95	1.64	10.28	1.53	3.325	<0.001*
Na Value	137.45	15.92	142.68	16.1	0.549	0.585	138.25	11.72	143.10	11.85	1.271	0.208
Ka Value	4.23	0.52	4.47	0.58	0.701	0.486	4.78	0.58	4.52	0.55	1.449	0.153
Total intake	1878.64	382.15	1810.5	379.6	0.303	0.763	2018.65	396.2	1962.40	396.20	0.440	0.662
Total output	1135.42	349.87	1182.35	351.1	0.226	0.822	1095.25	330.88	1048.70	329.95	0.437	0.664
	Volume depletion											
	Study						Control					
	Present		Absent		T-test		Present		Absent		T-test	
	Mean	SD	Mean	SD	t	P-value	Mean	SD	Mean	SD	t	P-value
Heart rate	103.85	5.94	96.25	4.86	2.165	0.035*	110.42	9.05	105.33	8.92	1.324	0.191
Systolic	101.56	4.65	108.72	4.92	2.025	0.047*	114.28	10.7	120.65	10.84	1.367	0.177
Diastolic	91.74	5.52	97.18	4.65	1.621	0.110	103.22	12.1	109.54	12.32	1.194	0.237
SpO2 saturation	90.15	2.18	92.4	2.26	1.385	0.171	88.65	2.08	92.05	2.22	3.578	<0.001*
Weight	75.6	11.7	80.42	11.88	0.564	0.574	79.12	12.06	84.33	12.25	0.990	0.326
CVP	9.78	0.59	10.85	0.61	2.440	0.018*	10.24	0.65	11.02	0.72	2.538	0.014*
Na Value	142.12	15.98	136.8	15.65	0.472	0.638	139.15	11.4	144.05	11.78	0.969	0.336
Ka Value	4.58	0.55	4.35	0.5	0.638	0.526	4.82	0.52	4.62	0.73	0.651	0.518
Total intake	1828.4	377.8	1905.2	380.44	0.281	0.780	1975.32	390.67	2042.85	392.12	0.400	0.690
Total output	1152.6	346.1	1190.8	349.25	0.152	0.879	1055.67	327.9	1103.26	328.74	0.336	0.738

Discussion

This study evaluated the effects of a structured fluid management protocol on physiological stability and organ dysfunction in critically ill patients. Overall, implementation of the protocol was associated with improved physiological parameters and reduced severity of organ dysfunction as measured by Sequential Organ Failure Assessment (SOFA) scores.

Socio-demographic characteristics of the studied patients

the two groups were comparable in age (mean 37.07 ± 8.15 vs. 36.83 ± 7.53 years). Traumatic injury was the most common admitting diagnosis in both groups, followed by shock; acute kidney injury was less frequent. These findings were symmetrical with **Elsaeed et al (2022)**, who carried out a study about “Internal jugular vein distensibility variation and inferior vena cava collapsibility variation with fluid resuscitation as an indicator for fluid management in spontaneously breathing septic patients” and revealed that the highest percentages of the studied patients were in the third and fourth decades. On the other hand, **Hermis and Abed (2021)** proved that more than half of the studied patients were in the age group (40-<50), and more

than half and a majority of them were female.

Regarding the patient's fluid daily balance, it was found that no significant difference among both groups on the 1st and 4th days. However, by the 7th day, a statistically significant improvement was observed in the study group compared to the control group regarding breathing sounds. On the other hand, fluid daily balance remained stable with no significant difference across all days. This suggests that the intervention may have contributed to improved respiratory outcomes without altering overall fluid balance. It is plausible that improved respiratory outcomes without altering overall fluid balance is consistent with a body of evidence showing that care processes and timing of fluids can change respiratory status even when net balance appears similar, although most large studies also find that cumulative positive balance itself is an important independent risk factor (**Giovanni et al.,2024**).

This is consistent with the findings reported by **White et al., (2025)** supported the current study's finding that there were no changes in daily fluid balance for the studied patients. The finding in the present study is

incongruent with **Mohamed et al., (2020)**, who indicated that there was a statistically significant difference between the studied groups regarding the positive cumulative fluid balance.

Regarding physiological parameters across the three measurement points, both groups demonstrated significant improvements over time in heart rate, blood pressure, oxygen saturation (SpO₂), central venous pressure (CVP), and serum electrolyte levels.

Between-group comparisons showed statistically significant differences in favor of the study group on the 4th and 7th days for heart rate, systolic and diastolic blood pressure, SpO₂, CVP, as well as sodium and potassium levels. This finding may be related to standardized fluid management strategies applied to all patient, which help minimize adverse events regardless of underlying diagnosis. Consistent adherence to fluid therapy guidelines ensures careful monitoring and adjustment of fluid administration according to individual patient needs rather than diagnosis alone.

This is consistent with **Jacobs et al. (2022)**, who conducted a study about “Fluid management, intra-abdominal hypertension, and the abdominal compartment syndrome” and found

that clinical improvement was more significant in relation to physiological parameters, which include respiratory rate, mean arterial pressure, and SpO₂. On the other hands, **Faltys et al. (2024)** reported that fluid therapy was associated failed to induce a positive CO or MAP response for ICU patients after cardiac surgery.

As concern of the Sequential Organ Failure Assessment (SOFA), there were highly significant improvements over time in the study group across the respiratory, coagulation, hepatic, cardiovascular, and renal components. By the 7th ICU Day, the study group demonstrated a more pronounced decline in SOFA scores and better recovery trends than the control group, following implementation of the nursing protocol for fluid therapy management. The significant reduction in SOFA scores in the study group underscores the effectiveness of fluid management strategies. Indicates that interdisciplinary approaches to fluid resuscitation improve organ function and decrease mortality in critically ill patients.

Studies consistently use serial SOFA scores over the first ICU week to track organ dysfunction and response to therapy; decreasing

SOFA indicates recovery in systems such as respiratory, coagulation, liver, cardiovascular, and renal function. Early reductions in SOFA over days 1–7 strongly correlate with better survival and less prolonged multi-organ failure **Rees et al. (2025); Polok et al. (2023); Chapalain et al., (2019)**. Moreover, **Hu et al. (2023)** reported that lower SOFA/APACHE II after in early restrictive fluid resuscitation strategy in the nursing care of patients with sepsis in the emergency department.

On the contrary, **Loyrion et al. (2021)** carried out a study about “Dynamic SOFA score assessments to predict outcomes after acute admission of octogenarians to the intensive care unit.” reported that more than half of the studied patients were at high risk on the 7th day.

Concerning adverse events, it was found a significant difference emerged by the 4th and 7th days, particularly in pulmonary edema, peripheral edema, infiltration, and extravasation. The control group experienced a higher incidence of adverse events compared with the study group. These findings indicate that improved fluid therapy management in the study group reduced complication rates over time. This indicates that the fluid

therapy guidelines were effective in preventing over-resuscitation and maintaining euvolemia.

Notably, the reduced incidence of pulmonary edema and infiltration in the study group suggests that better fluid management practices may mitigate the risks linked to overhydration. Also, **Mekontso Dessap, et al. (2025)** supports this conclusion, indicating that targeted fluid therapy can decrease the risk of complications while promoting recovery. Additionally, research by **Zhang et al. (2021)** highlights the critical role of monitoring fluid balance to minimize adverse effects in critically ill patients. Additionally, **Kow et al. (2022)**, conducted a study about “Fluid Resuscitation with Lactated Ringer's Solution versus Normal Saline in Acute Pancreatitis: A Systematic Review” and reported a statistically significant reduction in the development of local complications. This result was in disagreement with **Yang et al., (2024)**, who conducted a study about the “Impact of staged goal-directed fluid therapy on postoperative pulmonary complications in patients undergoing McKeown esophagostomy” and indicated that the majority of studied patients have pulmonary edema post fluid therapy.

Relation between bio-demographic data, diagnosis, and SOFA mean score

Age showed a statistically significant association with SOFA scores in both groups, with older patients demonstrating higher risk levels. Diagnosis was also significantly related to SOFA scores, especially among patients with shock or acute kidney injury. Gender showed no significant association. These results suggest that age and diagnosis are important predictors of organ failure severity. Conversely to this finding in a Swiss nationwide sepsis cohort, men had slightly higher admission SOFA than women; differences were driven by coagulation, liver, and renal subscores and were more marked in patients <52 years (Zimmermann et al., 2024).

Relation between SOFA scores and indicators of fluid therapy adverse events this result shows that patients who developed systemic or local adverse events had significantly higher SOFA scores compared to those without complications. Pulmonary edema, volume depletion, phlebitis, and infiltration were all significantly associated with increased SOFA severity in both groups. This confirms that higher baseline or rising SOFA scores identify patients

at greater risk of fluid related adverse events especially fluid overload, AKI, and mortality which are commonly used as global indicators of harm from resuscitation strategies in critical illness. The current finding was consistent with Esmoris et al., (2021) who demonstrated that adults with acute traumatic spinal cord injury, higher SOFA on day 0 and more positive fluid balance on day 4 were independent predictors of ICU mortality, suggesting that patients with higher SOFA are more vulnerable to harm from liberal fluids.

Relation between physiological parameters and fluid therapy adverse events in the study group, pulmonary edema was significantly associated with higher heart rate, blood pressure changes, and lower oxygen saturation. Volume depletion was also linked to significant variations in heart rate, systolic pressure, and CVP. In the control group, fewer parameters reached significance, though SpO₂ and CVP showed consistent associations. It attributed by adverse events from fluid therapy are most closely related to cumulative positive fluid balance/overload and chloride load, reflected in weight/fluid balance, lung and kidney function, lactate and central hemodynamics (Zampieri et

al.,2023). These results are in the same line with the study performed by **Chen et al., (2020)** entitled “Elevated central venous pressure is associated with increased mortality and acute kidney injury in critically ill patients,” who found that low CVP represents volume depletion. Additionally, **De Backer (2020)** reported that a negative association between heart rate and volume depletion during assessment of hemodynamics as indicators of volume status.

Conclusions: In conclusion, the current study demonstrates that a structured fluid therapy management protocol can significantly enhance physiological stabilization and reduce SOFA severity in critically ill patients. These findings support the implementation of evidence-based fluid management strategies and highlight the need for continuous monitoring to prevent adverse events. Future research should focus on exploring the long-term impacts of fluid therapy protocols and their effects on patient outcomes across diverse populations.

Recommendations: The following recommendations are suggested:

- Implement and integrate the standardized guidelines and clinical protocols for fluid therapy management in routine patient care

to unify nursing practice and improve patient safety.

- Conduct larger-scale studies across different hospitals and ICUs to validate the effectiveness of fluid therapy training programs and explore their long-term impact on patient outcomes.

- Strengthen the role of critical care nurses in monitoring fluid balance, assessing hemodynamic status, and detecting early signs of complications.

- Promote adherence to structured assessment tools and clinical protocols in fluid management.

- Enhance nurses’ competencies through continuous training on evidence-based fluid therapy guidelines.

- Promote interdisciplinary collaboration between nurses, physicians, and pharmacists for optimal patient outcomes.

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