Efficacy of Educational Program on the Performance of Internship Nursing Students Regarding Electronic Fetal Monitoring

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Abstract: **Background: Electronic fetal monitoring is an obstetric technology that helps to record any changes in fetal heart rate and uterine activity. The aim of this study was to determine the efficacy of educational programs on the performance of internship nursing students regarding electronic fetal monitoring in obstetrics and gynecology departments. Design: A quasi-experimental research design (pre- and post-test) was used. Sample: A convenient sample of all internship nursing students (180 internship nursing students) from the Faculty of Nursing at Menoufia University during the academic year 2022-2023). The instruments of this study were a structured, self-administered interview questionnaire consisting of two parts: the socio-demographic characteristics of the study participants and an assessment of internship nursing students' knowledge regarding electronic fetal monitoring (pre- and post-test). Observational checklist to assess internship nursing students' performance regarding EFM. Results: There were highly statistically significant differences between the internship nurses' students' knowledge and performance on the pretest and posttest. Conclusion: An educational program on electronic fetal monitoring carries a vital value for enhancing internship nursing students' knowledge and performance, which ultimately leads to improved maternal and fetal outcomes. Recommendation: Regular educational programs and workshops about electronic fetal monitoring should be encouraged for all internship nursing students.**

Keywords: **Educational program, Electronic fetal monitoring, Performance of internship nursing students.**

1. INTRODUCTION

Electronic fetal monitoring (EFM) is a type of ante- and intrapartum test used to illustrate a view of the beat-to-beat fetal heart rate and the mother's contractions (Cecil, 2020). It is a very important process to assess fetal status during labor. It will be most useful when all healthcare personnel who care for women in labor use consistent language to describe fetal heart rate patterns and other fetal monitoring information (Tamber et al., 2020).

Electronic fetal monitoring has become the most widely used method of assessing fetal well-being during labor. Consequently, the ability to interpret EFM tracings accurately and reliably has become a fundamental skill required of nurses and all who are responsible for caring for women during pregnancy and labor. Failure to use EFM when clinically indicated, misrecognition and misinterpretation of abnormal FHR patterns, inappropriate action after abnormal FHR pattern

identification, and inconsistency in the interpretation of EFM tracings have all been identified as problems associated with the use of EFM (Kelly et al., 2021).

Kelly et al. (2021) stated that fetal heart rate monitoring is the process of checking the condition of the fetus during labor and delivery by monitoring the fetus's heart rate with special equipment. Fetal heart rate monitoring may help detect changes in the normal heart rate pattern during labor. If certain changes are detected, steps can be taken to help treat the underlying problem. Fetal heart rate monitoring can also help prevent treatments that are not needed. A normal fetal heart rate can reassure both the woman and other healthcare professionals that it is safe to continue labor if no other problems are present.

The nurse plays an important role in emergency measures during fetal heart rate monitoring, which include repositioning the patient in a lateral position to increase uteroplacental perfusion or relieve cord compression. Administer oxygen at 10 to 12 L/min or per hospital protocol via face mask. Discontinue oxytocin if infusing. Correct maternal hypovolemia by increasing IV as ordered. Assess FHR pattern changes, such as maternal hypotension. Notify the physician of the finding observed (Akyıldız et al., 2021).
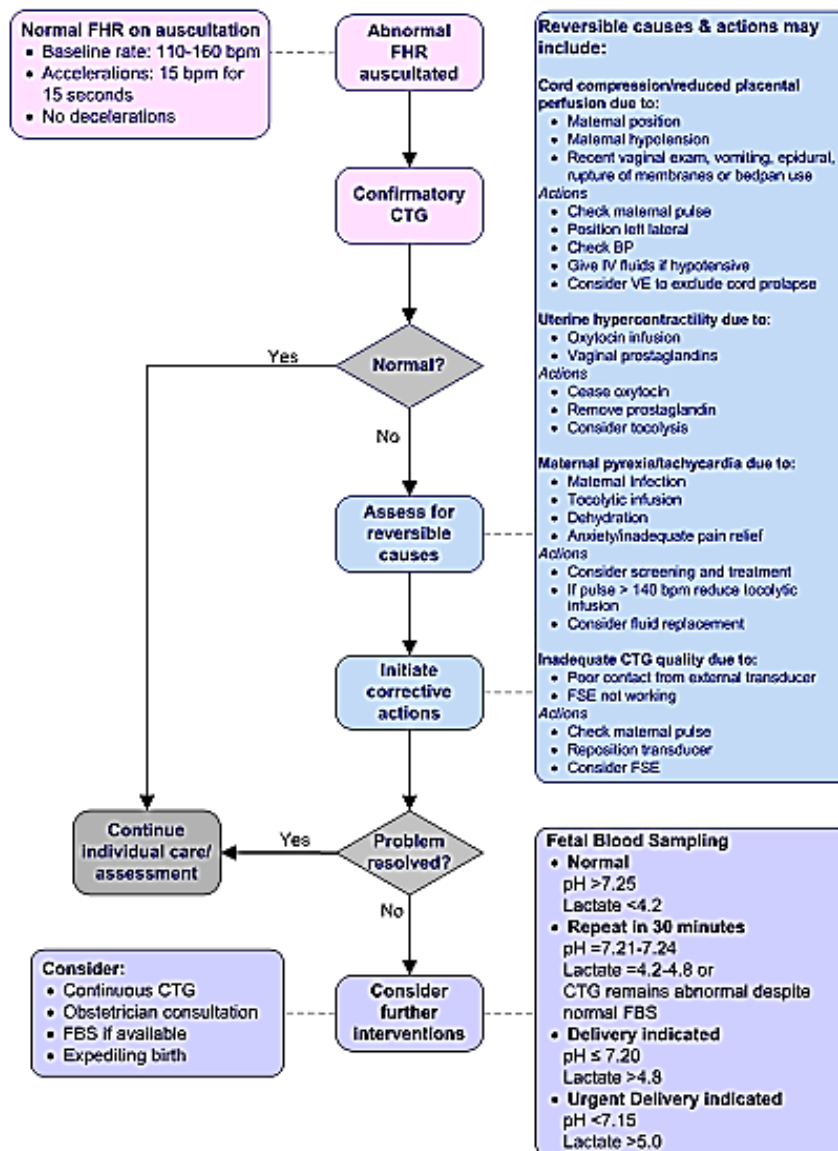

Figure (1): Flow chart summary of abnormal FHR management adopted from http://www.health.qld.gov.au/qcg/ documents/g ifs.pdfimportant p-4.Accessed at April 25, 2022

Significance of the study

Each year, approximately 2.4 million newborns pass away, with nearly one-third of them dying within the first 24 hours of birth because of complications related to childbirth, such as chronic fetal hypoxia, intrauterine growth retardation, congenital malformation of the fetus, and complications related to the mother, such as diabetes, arterial hypertension, and infection. Also, when electronic fetal monitoring is performed without sufficient knowledge and proper training, it can lead to an increase in the rate of cesarean sections and intrapartum asphyxia (Sajida & Iqbal, 2021). Additionally, there are about 2 million stillborn births reported annually, as per the World Health Organization's report from 2021. These deaths can largely be prevented through the implementation of well-known, evidence-based interventions (World Health Organization Report, 2021). Improving neonatal health, one of the unfinished agendas of the Millennium Development Goals, remains a high-priority area in the era of the Sustainable Development Goals (Nso, 2021). So, the researchers decided to conduct this study to improve the performance of internship nursing students regarding electronic fetal monitoring.

The aim of this study was to

Determine the efficacy of the educational program on the performance of internship nursing students' regarding electronic fetal monitoring.

Research Hypothesis

The internship nursing student's performance is expected to improve after the implementation of the educational program regarding electronic fetal monitoring.

Definitions of variables

Educational program regarding electronic fetal monitoring: Educational program refers to an organized set of learning activities designed to enable a student to develop knowledge, understanding, skills, and attitudes relevant to the student's individual needs (Giot et al., 2024). Operationally, it refers to a systematically organized, planned, and developed teaching strategy that was designed and implemented by the researcher to provide information for the internship nursing students regarding electronic fetal monitoring to enhance their knowledge and improve their practices. It was assessed using an assessment of internship nursing students' knowledge (instrument no. I).

Performance of internship nursing students: Performance refers to how well or badly a person does something. Something works; it is also defined as the act or process of performing a task, action, etc. The verb performs means to work or function well or badly, an active process in which the information is selected, received, organized, and interpreted from the outside environment to make it meaningful (Blix et al., 2020). Operationally, it refers to the effectiveness of internship nursing students in performing their roles and responsibilities directly related to patient care by increasing their knowledge and skills regarding electronic fetal monitoring. It was assessed using internship nursing students' performance of electronic fetal monitoring (instrument no. II).

Electronic fetal monitoring refers to recording (graphically) the fetal heartbeat (cardio) and the uterine contraction (toco) during the third trimester of pregnancy and labor.

2. METHOD

Research Design:

A quasi-experimental research design was used in this study (one group pre-test, post-test).

Research settings:

The study was conducted at the obstetric department of Shebin Elkom Teaching Hospital and Menoufia University Hospital in Menoufia Governorate.

Sampling:

Sample type:

A convenient sample of all internship nursing students (180 internship nursing students) from the Faculty of Nursing at Menoufia University and the Technical Institute of Nursing during the academic year 2022-2023, training at the Obstetric

Department of Shebin Elkom Teaching Hospital (98 students) and Menoufia University Hospital (82 students) (32 students from the faculty of nursing and 50 students from the technical institute).

Data collection instruments:

Two instruments were used for data collection.

Instrument 1: Structured self-administered interview questionnaire: this instrument consisted of two parts.

Part I: Socio-demographic characteristics of the study participants included age, sex, place of living during studying, marital status, residence, and educational certification.

Part II: Assessment of internship nursing students' knowledge regarding electronic fetal monitoring (pre- and post-test). It was adopted from (Ahmed et al., 2023), and developed by a researcher to accommodate the research. It consisted of 26 questions, such as the meaning of EFM,

Knowledge's Scoring System:

Knowledge questions were determined and coded accordingly. Each item was assigned as follows: correct answers took (2), incorrect answers took (0), and don't know answers took (1) (Ahmed et al., 2023).

The total score of knowledge was classified as follows:

Good knowledge: > 75% of the total knowledge score.

Average knowledge: 60-75% of the total knowledge score.

Poor knowledge: < 60% of the total knowledge score.

Instrument II: Observational Checklist:

It was adopted from (Blue, 2018), and developed to assess the performance of internship nursing students regarding electronic fetal monitoring, which included 21 steps such as preparing the equipment, explaining procedures for women, and offering the opportunity to ask any questions. Record complete mother identification at the beginning of the monitor strip; perform Leopold's maneuvers to determine fetal position and locate the fetal back; undress; put a wide elastic belt around her back to secure the transducer in place; put the mother in a comfortable position; wash her hands and dry them well to prevent cross-infection. Assess fetal heart tone, place monitor belts under the mother's back, confirm the presence of fetal heart tone with a fetoscope before applying a fetal monitor, connect the ultrasound transducer and the toco-transducer to the fetal monitor, place the toco-transducer on the fundus of the uterus so that the pressure-sensitive button is flush against the maternal abdomen, place the ultrasound transducer on the maternal abdomen over the fetal back, evaluate the FHR strip, remove the electronic fetal monitor, clean the mother's abdomen from gel, and wash hands.

Scoring System:

The checklist items were scored (1) for having done each step correctly and a zero score for not having done it. The total performance score was assigned as follows: Satisfactory performance means ≥ 80% of the total performance score; unsatisfactory performance means <80%.

Ethical Considerations:

An approval from the Ethical Committee of the Faculty of Nursing at Menoufia University was obtained on December 12, 2021. Approaches to ensure ethics were considered in the study regarding confidentiality and informed consent. The researcher introduced herself to the studied internship nurses' students and explained the purpose of the study and nature of the research to obtain their acceptance to be recruited in the study as well as to gain their cooperation.

Confidentiality was achieved using locked sheets with the names of the participating students replaced by numbers. All participating students were informed that the information they provided during the study would be kept confidential and used only for statistical purposes after finishing the study. The study findings would be presented as group data without any personal participant's information remaining.

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A written consent for approval to participate in the study was obtained from the internship nursing students after explaining the purpose of the study. All internship nursing students were informed that participation in the study was voluntary, and they could withdraw from the study whenever they decided to do so. Each participant was free to ask any question about the study details.

Pilot study:

A pilot study was implemented to test the applicability of the instruments, the feasibility of the study, and to estimate the time needed for data collection. It was performed on 10% of the total participants, or 18 total students. They were excluded from the study sample to assure the stability of the results and make the necessary modifications. It was implemented to ascertain the simplicity, clarity, applicability, relevance, and content validity of instruments and to detect any problems peculiar to the statements, such as sequence and clarity, that might interfere with the process of data collection.

Field work:

• An extensive review to formulate a knowledge base relevant to the study area was done, including electronic dissertations, available books, articles, and periodicals.

• The researcher prepared and tested the different data collection instruments regarding validity and reliability.

• A pilot study was conducted, and the necessary modifications were made.

• The data collection for the study was collected over a period of nine months, starting on August 1, 2022, and ending on August 1, 2023. The researcher visited the settings four days per week from 9:00 a.m. to 1:00 p.m., two days for Shebin Elkom Teaching Hospital and the other two days for Menoufia University Hospital.

• During the initial visits, the researcher greeted the internship nursing students, introduced herself, and explained the purpose and nature of the study to them.

• The researcher distributed the total number of students (180) to small groups; each group contained 15-20 students. This means that all students groups were accounted for 10 groups.

• A pretest was done on all internship nurses' students according to their attendance in shifts using the different data collection instruments for assessing nurses' students' demographic data and evaluating knowledge and performance of internship nursing students regarding electronic fetal monitoring.

• After assessing knowledge and performance, the researcher assesses the needs of the internship nurses' students and prepares a guided booklet about the needs of the students, which is then distributed to all nurses on the first day of the training.

• The researchers designed educational sessions based on the assessment results. The overall sessions for each group were five sessions devoted to two theories and three practicals. The duration of each session was approximately 30-45 minutes, including periods of discussion according to their achievement, progress, and feedback.

• **For** the **theoretical part**, **the first session** aimed to emphasize rapport between nurses' students and researchers, identify the purpose of the program, and orient them about the program and its expected outcomes, as well as describe the schedule and content of the program. In addition to teaching the nursing students about the definition of the EFM, the importance of the EFM, the appropriate time for using the EFM, and a maternal and fetal indication of the EFM.

• **Second session:** This session included teaching the internship nursing students about types of EFM, maternal position during the procedure of EFM, area for the application of EFM transducers, normal fetal heart rate, signs of fetal distress, and abnormal uterine contraction.

• **For Practical Part: Third Session,** this session included training nurses' students about the care and preparation of mothers for EFM, explaining the procedure to the mother, and obtaining permission to commence. In addition to suggesting the woman empties the bladder, put the mother in a semi-lateral position.

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- **Fourth session:** training the internship nursing students on how to perform Leopold's manoeuvre. To perform an ultrasound, follow these steps: align and insert the ultrasound transducer plugs into the appropriate monitor port labeled "cardio" or "US.". Apply ultrasound coupling gel to the underside of the transducer and place it on the maternal abdomen. It's best to position the transducer over the fetal back or below the level of the umbilicus in a full-term pregnancy with cephalic presentation. If the pregnancy has a breech presentation, place the transducer above the umbilicus. These guidelines are based on Kelly et al.'s 2020 recommendations. It is important to train individuals to perform the following steps while using an ultrasound transducer: Firstly, they should adjust the audio-volume control while moving the transducer over the abdomen. Secondly, they should secure the ultrasound transducer with the abdomen belt or other fixation device. Thirdly, they should observe the indicator signal, which will flash simultaneously with each fetal heartbeat. Fourthly, they should set the record at 1, 2, or 3 cm/min paper speed. Fifthly, they should observe the FHR on the stripe chart, obtain the baseline FHR between contractions or periodic changes, and check the time printed on the monitor stripe. The monitor clock should be reset as necessary. Also, periodically clean the transducer and maternal abdomen with a damp cloth to remove the dried gel. Reposition the transducer whenever the fetal signal becomes unclear, such as when the mother moves or when the fetus descends in the pelvis (Zaghir et al., 2022).

- **Fives session:** This session included training the internship nurse students on how to read CTG and differentiate between types of CTG trace: normal, reduced, and increased variability, acceleration, and deceleration (variable, early, late, and prolonged). In addition, train them to sign and note the date and time on the CTG strips.

- Different methods of teaching and training strategies are used, such as lecture, group discussion, demonstration, and re-demonstration, with the assistance of instructional media such as videos and pictures about the trace of CTG.

- A post-test was given to each internship nursing student at the end of the program 2-3 weeks after the pre-test. The same format of pre-program tools was used to evaluate the effect of the educational program on internship nurse student knowledge and performance.

Statistical Analysis

Data were collected, tabulated, and statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22 (SPSS, Inc., Chicago, Illinois, USA), where the following statistics were applied:

● Descriptive statistics: quantitative data were presented in the form of mean and standard deviation (SD), and qualitative data were presented in the form of numbers and percentages.

● Analytical statistics are used to find out the possible association between the study factors and the targeted variables. The tests of significance used included the following:

● The Chi-squared test ($\chi 2$) is a test of significance used for comparison between two groups with qualitative variables.

● Student t-test: it is a test of significance used for comparison between two groups with quantitative variables.

● Pearson correlation (r) is a test used to measure the association between quantitative variables.

3. RESULTS

Table 1: Socio-Demographic Characteristics of the Internship Nursing Students (N=180)

Sociodemographic characteristics	The studied participants (N=180)	
	No.	%
Age (years)		
20	28	15.6
21	23	12.8
22	80	44.4
23	49	27.2
Mean ± SD	21.83 ± 1.00	

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Gender		
Male	17	9.4
Female	163	90.6
Place of living during the study years		
Home	141	78.3
University housing	39	21.7
Marital status		
Married	38	21.1
Single	142	78.9
Residence		
Urban areas	74	41.1
Rural areas	106	58.9
Previous training courses on electronic fetal monitoring		
Yes	17	9.4
No	163	90.6

Table 1 illustrates the sociodemographic characteristics of the internship nursing students in the sample. It revealed that less than one-half of the internship nursing students (44.4%) had an age of 22 years, with a mean of 21.83 ± 1.00 years. In addition, 90.6 percent of the internship nursing students were female. Meanwhile, more than two-thirds of the internship nursing students lived in their homes while studying (78.3%). Moreover, 78.9% of them were single. Furthermore. Additionally, 58.9% of students lived in rural areas, and 90.6% of them did not have previous training courses on electronic fetal monitoring.

Table 2: Level of Knowledge of the Internship Nursing Students about Electronic Fetal Monitoring before and after the Educational Program (Pre- and Post-test) (N=180)

Variables	The studied participants (N=180)				X^2	P- value
	Before the intervention (pretest)		After the intervention (post-test)			
	No.	%	No.	%		
Role of the internship nurse's student for the pregnant woman who uses the electronic fetal monitor					250.83	.000
Correct	106	58.9	163	90.5		
Incorrect	27	15.0	16	8.9		
Don't know	47	26.1	1	0.6		
Emergency intervention is their priority when there are disturbances or abnormalities in the fetal heart rate.					255.59	.000
Correct	75	41.7	160	88.9		
Incorrect	48	26.7	20	11.1		
Don't know	57	31.7	0	0.0		

Table 2 shows the level of knowledge of the internship nursing students about electronic fetal monitoring before and after the educational program (pre- and post-test). It shows that there was a difference between the pre-test and the post-test that was statistically significant. Also, **t**he table shows that the percentages of correct answers in the posttest are higher than the pretest, with significant differences between both tests (p = 0.000).

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Table (3): Level of Performance of the Internship Nursing Students Regarding EFM Procedure before and after the Educational Program (Pre- and Post-test) (N=180)

Variables	The studied participants (N=180)				X^2	P- value
	Before the intervention (pre-test)		After the intervention (post-test)			
	No.	%	No.	%		
Prepare the equipment.					103.69	0.000
Done	88	48.9	174	96.7		
Not done	92	51.1	6	3.3		
Wash hands and dry them well to prevent cross infection					98.93	0.000
Done	89	49.4	173	96.1		
Not done	91	50.6	7	3.9		
Explain the procedure for mothers and offer the opportunity to ask any questions					136.19	0.000
Done	74	41.1	176	97.8		
Not done	106	58.9	4	2.2		
Reassure the woman that FHR monitoring does not mean something wrong					179.205	0.000
Done	54	30.0	176	97.8		
Not done	126	70.0	4	2.2		

Table 3 presents the level of performance of the internship nursing students regarding EFM procedures before and after the educational program (pre- and post-test). Also, it shows how well the nursing students in their internships did on tests about EFM procedures before and after the educational program. Significant differences (improvement) were found between the pretest and post-test regarding the performance of the EFM procedure (p = 0.000).

Table (4): Level of Performance of the Internship Nursing Students Regarding EFM Procedure before and after the Educational Program (Pre- and Post-test) (N=180)

Variables	The studied participants (N=180)				X^2	P- value
	Before the intervention (pre-test)		After the intervention (post-test)			
	No.	%	No.	%		
Record complete mother identification at the beginning of the monitor strip					214.07	.000
Done	40	22.2	176	97.8		
Not done	140	77.8	4	2.2		
Put the mother in a comfortable, semi-lateral position					144.23	.000
Done	70	38.9	176	97.8		
Not done	110	61.1	4	2.2		
Maintain privacy and expose only the abdomen					103.02	.000
Done	92	51.1	179	97.8		
Not done	88	48.9	4	2.2		

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Perform Leopold's maneuvers to determine the fetal position and locate the fetal back.					145.62	.000
Done	71	39.4	177	98.3		
Not done	109	60.6	3	1.7		
Connect the ultrasound transducer and the toco-transducer to the fetal monitor					154.28	.000
Done	72	40.0	170	94.4		
Not done	108	60.0	10	5.6		
Apply gel to the underside of the transducer placed on the maternal abdomen					104.53	.000
Done	93	51.7	177	98.3		
Not done	87	48.3	3	1.7		

Table 4 presents the level of performance of the internship nursing students regarding EFM procedures before and after the educational program (pre- and post-test). It shows that internship nursing students who learned about electronic fetal monitoring did better on the posttest than they did on the pretest in obstetric departments.

Table 5: Relationship between the Total Performance Scores Regarding the EFM Procedure of the Internship Nursing Students and Their Sociodemographic Characteristics after the Intervention (Post-test)

Variables	Total performance scores				X^2	P-value
	Satisfactory		Unsatisfactory			
	No.	%	No.	%		
Age (years)					41.99	.000
20	19	10.5	9	5		
21	17	9.4	6	3.3		
22	80	44.4	0	0.0		
23	49	27.2	0	0.0		
Gender					10.91	.001
Male	12	6.7	5	2.8		
Female	153	85	10	5.6		
Place of living during the study years					0.027	0.870
Home	129	71.7	12	6.7		
University housing	36	20	3	1.7		
Marital status					0.303	0.582
Married	34	18.9	4	2.2		
Single	131	72.8	11	6.1		
Educational certification					42.54	0.000
Faculty of nursing	130	72.2	0	0.0		
Technical institute	35	19.4	15	8.3		
Residence					5.215	0.022
Urban areas	72	40	2	1.1		
Rural areas	93	51.7	13	7.2		
Previous training courses on electronic fetal monitoring					10.91	0.001
Yes	12	6.7	5	2.8		
No	153	85	10	5.6		

Table 5 highlights the relationship between the total performance scores regarding the EFM procedure of the internship nursing students and their sociodemographic characteristics after the intervention. There was a statistically significant

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relationship between the total score of practices and their sociodemographic characteristics in terms of age, gender, educational certification, residence, and previous training courses on electronic fetal monitoring after the intervention. However, there was no statistically significant relationship between the total score of practices, their place of living during the study years, or marital status.

Figure 2: The total performance scores regarding the EFM procedure of the internship nursing students before and after the educational program (pre- and post-test)
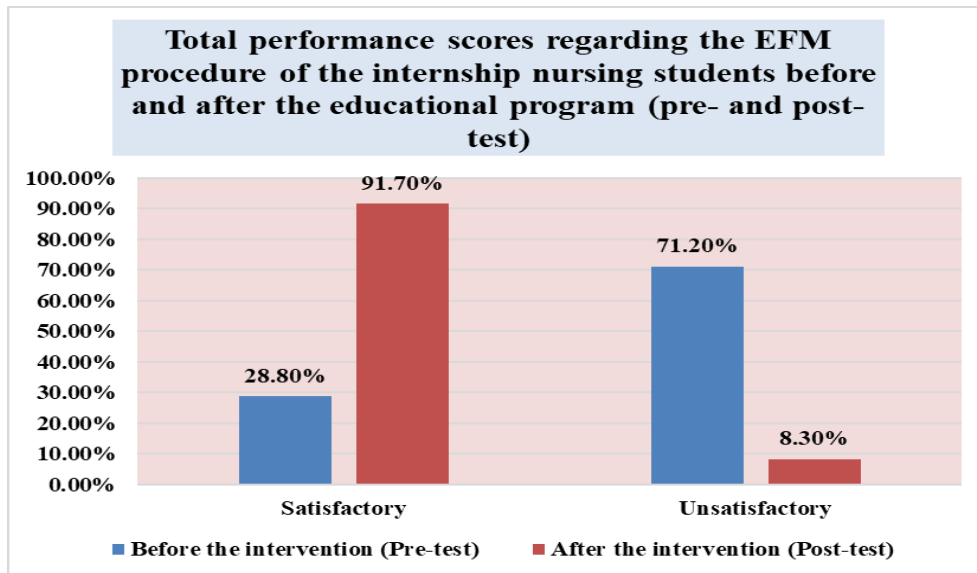
Figure 2 illustrates the total performance scores regarding the EFM procedure of the internship nursing students before and after the educational program (pre- and post-test). It shows that the internship nursing students did better on the EFM procedure after the educational program (91.7 percent satisfactory performance) than they did before (28.8 percent satisfactory performance).

Figure 3 Pearson correlation between the total knowledge scores about electronic fetal monitoring and the total performance scores regarding EFM procedures of the internship nursing students.

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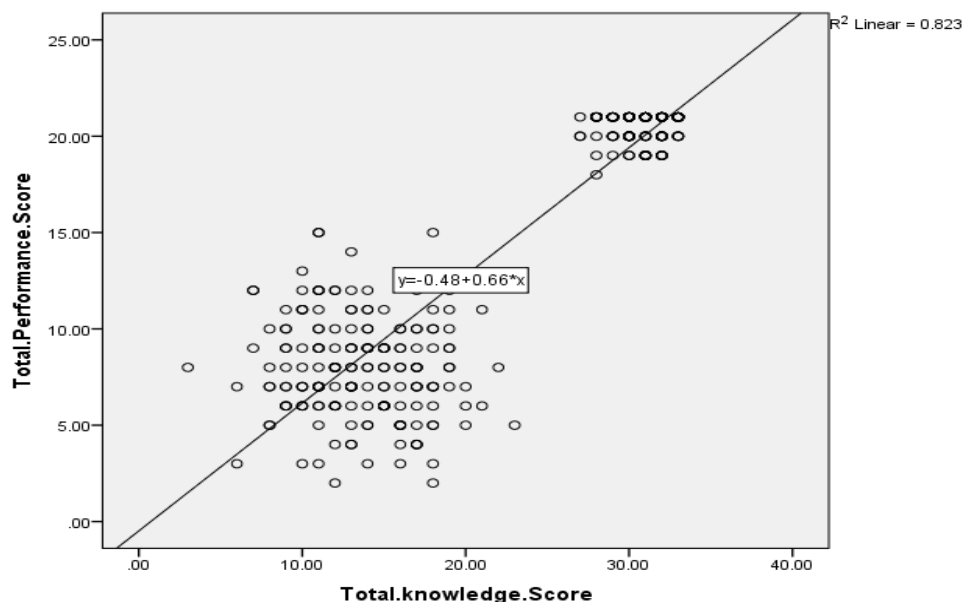
Figure 3 illustrates the Pearson correlation between the total knowledge scores about electronic fetal monitoring and the total performance scores regarding the EFM procedure of the internship nursing students. Also, it shows that there was a significant positive correlation between the total knowledge scores and the total performance scores regarding the EFM procedure of the internship nursing students, which means that when the total knowledge scores about electronic fetal monitoring increase, the total performance scores regarding the EFM procedure increase.

Figure 4: Correlation between the total interpretation of fetal heart rate patterns scores and the total performance scores regarding the EFM procedure of the internship nursing students.
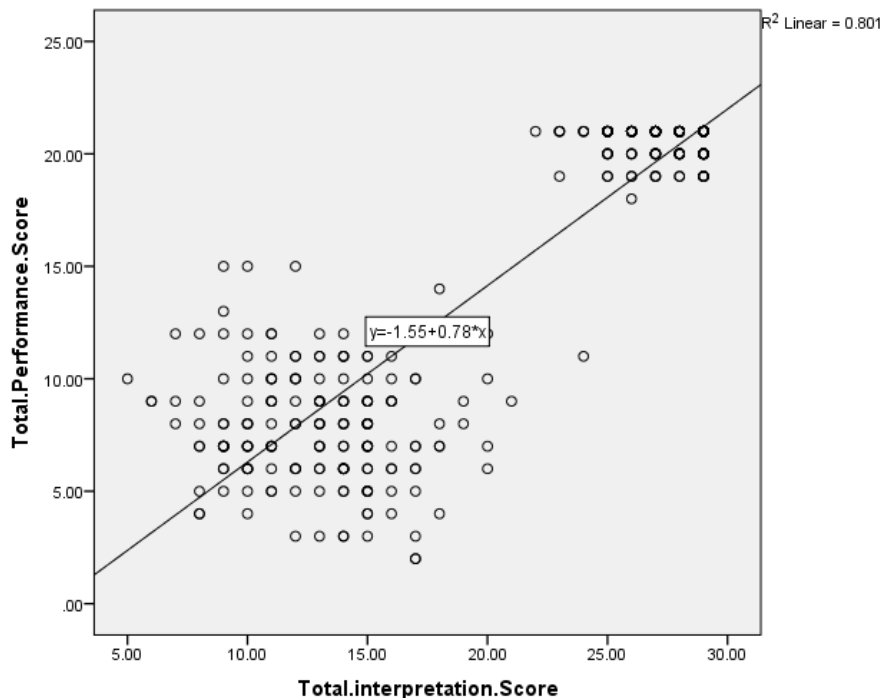

Figure 4 shows the Pearson correlation between the internship nursing students' total scores for interpreting fetal heart rate patterns and their total performance scores regarding the EFM procedure. Otherwise, it shows that there was a significant positive correlation between the total interpretation of fetal heart rate patterns scores and the total performance scores regarding the EFM procedure of the internship nursing students. This means that when the total interpretation scores for fetal heart rate patterns go up, so do the total performance scores regarding the EFM procedure.

4. DISCUSSION

Regarding the socio-demographic characteristics of the studied subjects, the result of the present study showed that less than one-half of the internship nursing students had an age of twenty-two years. In addition, most of them were single, female, and from the faculty of nursing. Meanwhile, more than two-thirds of the internship nursing students lived in their homes while studying, and more than half of the students lived in rural areas.

This result comes in agreement with the study of Ahmed et al. (2023), who studied "Training Program Effectiveness on Knowledge and Interpretation Skills of Fetal Cardiotocography among Undergraduate Nursing Students" and stated that more than half of them were female, from rural areas, and lived at home during their studying years. However, more than two-thirds of them did not have previous training courses on CTG interpretation, and most of the studied samples were single. On the other hand, Daglar et al. (2020), who applied their study to perform a national assessment on teaching residents EFM, found that in this study, about three-fourths of the sample lived in urban areas. Dissimilarities appeared because of the difference in location between both studies.

Regarding the age, the current research results demonstrated that the range of age was from twenty to twenty-three years, which is the corresponding age of studying in the university, but that was less than other studies conducted by Abd El-Razek (2016), who investigated the effect of training programs on assessing methods of fetal viability during pregnancy in between nurses and reported that more than one-third were twenty to thirty years. This result disagrees with Oleiwi & Abbas's (2020) study in maternity hospitals in the city of Baghdad to evaluate the effectiveness of cardiotocography education programs on nurse midwives' knowledge and reported that most of the nurse midwives ages ranged between 25 and 29 years old, which is more than our study.

From the researcher's point of view, this may be because most of those nurses were newly graduated, young, and tolerated the nature of the work. It may also be explained by the fact that younger nurses are active, more interested, and more motivated than older nurses.

Concerning the level of education, the present finding reported that most of the students in the sample were from the faculty of nursing, and the rest were from the technical institute. The current findings disagreed with El-Sayed (2018), who studied "the effect of educational sessions about cardio-tocography on nurses' knowledge and skills at labor and high-risk units" in Egypt and reported that more than two-thirds of nurses had a diploma. The current findings were also in disagreement with Zaghir et al. (2022), who found that more than half of nurses had a technical nursing institute in a study on forty maternity nurses in the cardiotocography room of the Obstetrics and Gynecological Department at the Hospital of Benha University. From the researcher's point of view, this difference may be attributed to the differences among the participants in the data collection.

Concerning attending training courses on electronic fetal monitoring, the result of the current study showed that the majority of the studied nurses' students didn't attend any training courses related to EFM. This result is nearly in line with Ramadan et al. (2018), who studied "Maternity Nurses' Performance Regarding Non-invasive Fetal Wellbeing Measures: Educational Intervention, Egypt" and showed that most of the studied nurses had not attended any training courses regarding EFM.

On investigating the ability of internship nursing students to interpret electronic fetal heart rate monitoring tracing during different phases of educational program implementation, the findings of the current study revealed that most internship nursing students during the preprogram had an unsatisfactory score. After the implementation of educational programs, the most common of them had satisfactory scores. This finding reflects the importance of educational programs as a cornerstone element in improving knowledge and practice. Therefore, there is a need for continuous education programs for nurses to increase awareness about this issue.

Relevant to the total score of internship nursing students' performance level, the results of the current study showed that the most common of the studied students had unsatisfactory scores during preprogram. From the researcher's point of view, this unsatisfactory performance level was due to the poor knowledge of internship nursing students regarding EFM, and before the implementation of the educational program, the internship nursing students believed that EFM was a procedure only performed by the physician.

This study is in line with Ibrahim and Arief (2019), who studied "Effect of electronic fetal monitoring educational program on knowledge and interpretations of internship nursing students" in Assiut, Egypt, and clarified that more than three-quarters of the studied nurses have an unsatisfactory practice before supportive nursing instructions.

While, during the post program, most common internship nursing students had satisfactory scores. This improvement may be related to improved students' knowledge regarding EFM, which leads to improvement in the performance of the nurses. Also due to the effectiveness of the educational program. In addition, after the implementation of the educational program, the nurses became aware of their role in electronic fetal monitoring procedures.

The current study results were in the same line as those of El-Sayed (2018), who revealed significant improvements were found among pre-program, immediate post-program, and after 3 months post-program. Also, the findings of this study agree with Kelly et al. (2021), who studied training in the use of intrapartum electronic fetal monitoring with cardiotocography and revealed a highly statistically significant difference before and after training instructions during fetal monitoring procedures.

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Also, the current study finding is like the study of Ramadan et al. (2018), who studied "the maternity nurses' performance regarding non-invasive fetal wellbeing measures: educational intervention" in Egypt and showed a significant improvement in the total level of nurses, practice regarding noninvasive fetal wellbeing measures when compared with pre- and post-program implementation.

Also, Zaghir (2022), who studied "the effect of an interactive computer-based simulator on a nurse's performance about electronic fetal heart rate monitoring," reported that there is a highly statistically significant improvement noticed among the intervention group regarding performance after the intervention.

Moreover, the findings of the current study showed a significant positive correlation between the total knowledge scores about electronic fetal monitoring and the total performance scores regarding the EFM procedure, and a significant positive correlation between the total interpretation of fetal heart rate patterns scores and the total performance scores regarding the EFM procedure of the internship nursing students before and after the implementation of the educational program regarding EFM. That's maybe related to the improvement of nurses' performance in relation to the improvement of nurses' knowledge in different phases of the implementation of the educational program.

This finding agrees with Lamé et al.'s (2019), who found that there was an improvement in nurses' practice in relation to improving nurses' knowledge in the pre- and post-implementation of the program. Also, the result of the current study is in line with Said and Ali (2020), who mentioned a statistically significant correlation between the total scores of maternity nurses' knowledge and practices before and after nursing supportive instructions.

Also, this study is in line with Thellesen et al. (2018), who reported highly significant positive correlations were found between the level of knowledge and skills of nurses regarding CTG. This may be explained by providing CTG training to increase the frequency of performing CTG for practices that improve the quality of CTG for pregnant women.

This study also disagrees with Lamé et al. (2019), who studied improving the practice of intrapartum electronic fetal heart rate monitoring with cardiotocography for safer childbirth and showed no significant difference between the total score of knowledge and years of experience. This study is in dispute with Sowmya et al. (2020), who found no significant association between demographic variables and the level of knowledge among staff nurses in preprogram and immediate post-program. study findings disagreed with Pushpaveni (2019), who evaluated the effect of the self-instructional module on fetal wellbeing measures among nurses and showed that there was no significant association between level of knowledge regarding CTG and any of the demographic data of the nurses.

Regarding the relation between the total performance scores regarding the EFM procedure of the internship nursing students and their sociodemographic characteristics, the results of the present study indicate that there was a significant difference among the studied nurses' total performance scores and nurses age, gender, educational certification, residence, and previous training courses on electronic fetal monitoring. On the other hand, there was no statistically significant relationship between the total scores of practices, their place of living during the studying years, and marital status in both the pretest and posttest. This improvement may be related to the effective training program and due to improved nurses' knowledge regarding EFM, the nurse's performance may improve. This finding may be since nurses believe that EFM is a procedure only performed by the physician. However, after the implementation of the program, the nurses realized nursing's role in this procedure.

This study is in line with Ramadan et al. (2018), who showed that there was a highly statistically significant difference between educational qualification and total practice score. In line with this finding, Devane et al. (2019), who studied "Cardiotocography versus intermittent auscultation of the fetal heart on admission to the labor ward for assessment of fetal wellbeing" and found there was a highly statistically significant relationship between nurses' practice and age. The current study findings do not match those of Sowmya et al. (2020), who denoted that there was no significant association between the level of skill and selected demographic variables among nurses.

5. CONCLUSION

Considering the present study results, it can be concluded that the educational program on EFM carries a vital value for enhancing internship nursing students' performance. This finally leads to improved maternal and fetal outcomes. The hypothesis of the present study was being proved by the revelation that there was an improvement in internship nurses' students' performance.

6. RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are suggested:

1. Regular educational programs should be encouraged for all internship nursing students.

2. Regular training workshops should be held for internship nursing students to improve their ability to interpret traces of EFM.

3. New research should be performed to identify the effects of training workshops done to maternity nurses and to assess the staff nurse knowledge and skills about electronic fetal monitoring to evaluate the knowledge of the nurses about the other non-invasive methods of fetal wellbeing assessment.

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