

## Effect of Educational Guidelines Regarding Assessment of Fetal Well-being during Pregnancy on Nurses' Performance

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### Abstract:

**Background:** The primary golden aim of fetal well-being assessment is reducing the incidence of fetal distress, perinatal morbidity and mortality. Nurses play a critical role in the assessment of fetal well-being through application and interpretation of fetal well-being assessment methods. **The aim of this study** was to evaluate the effect of the educational guidelines regarding assessment of fetal well-being during pregnancy on nurses' performance. **Subjects and method:** A quasi experimental research design was used. It was conducted at Antenatal, Ultrasound and Fetal Medicine unit at obstetric and gynecological department of Tanta University Hospital. The total study sample was all available nurses (60). **Two tools** were used for collection of data. **Tool (I): Nurses' knowledge regarding assessment of fetal well-being during pregnancy:** It included two parts: **Part (1):** Socio demographic characteristics of nurses and **Part (2):** Nurses' knowledge regarding fetal well-being assessment during pregnancy. **Tool II: Assessment of fetal well-being observational checklist:** It included two parts: **Part (1):** Nurses' practices regarding non-invasive procedures and **Part (2):** Nurses' practices regarding invasive procedures. **Results:** The mean knowledge score and mean practices score of nurses regarding fetal well-being assessment during pregnancy were increased immediately and three months after implementation of the educational guidelines with a statistical significant difference. **Conclusion:** The research hypothesis has been achieved which resulted in a statistically significant positive improvement of nurses' performance immediately and three months after implementation of the educational guidelines. **Recommendations:** Evident and continuous educational programs are to be established at hospitals for nurses to improve their awareness and practices regarding fetal well-being assessment during pregnancy.

**Keywords:** Educational Guidelines, Fetal well-being, Performance

### Introduction

The pregnancy and birth of a healthy newborn are among the most momentous events in the maternity cycle. The whole obstetrical science is dedicated to make this event as uneventful as possible, resulting in a maternal and fetal well-being (**Jain & Acharya, 2022**). Ensuring fetal well-being is one of the core aims of antepartum care which entail the evaluation of the fetal well-being indicators (**Limbo & Denny, 2020**).

Assessment of fetal well-being during pregnancy refers to the estimation of the health status of the fetus during pregnancy by a variety of techniques in order to prevent developmental diseases, injuries or death of the fetus. The primary golden aim of fetal well-being assessment during pregnancy is reducing the incidence of fetal death, perinatal morbidity and maternal distress. (**Baker et al., 2021; Brancel, 2020**).

There are many approaches in the assessment of fetal well-being during pregnancy which includes non-invasive and invasive methods. Non-invasive methods include; ultrasonography which entails 2 dimension ultrasound, 3 dimension ultrasound, 4 dimension ultrasound, 5 dimension ultrasound, Doppler ultrasound and fetal echocardiography. In addition ,fetal biophysical profile, modified fetal biophysical profile, fetal heart sound assessment, fetal movement assessment , non-stress test, contraction stress test, fetal acoustic stimulation test, non-invasive prenatal DNA testing, and transcervical retrieval of trophoblast

cells (**Abozaid et al., 2022**). While, invasive methods used for the assessment of fetal well-being during pregnancy include; amniocentesis, chorionic villus sampling, percutaneous umbilical blood sampling and fetoscopy. The variety of these methods makes obstetrics practice in dire need to highlight the importance of assessment for fetal well-being and raise the awareness regarding them among governmental stakeholders, policy- makers and health care providers especially maternity nurses (**David & Spencer, 2022**).

Nurses play a critical role in the assessment of fetal well-being during pregnancy as well as early detection of high risk fetuses. They have important responsibilities on application and interpretation of fetal well-being assessment methods. Also, they have to be equipped with the requisite knowledge, and skill for safe and effective practice of both non-invasive and invasive fetal well-being assessment methods (**Pillirrtteri, 2018**). During the application of fetal well-being assessment methods, nurses can perform some procedures or assist in proper preparation of the pregnant woman for ensuring accurate result, and woman and fetus's safety. (**Sexena,2021**).

Furthermore, nurses should provide counseling to the pregnant women which include; discussion of the findings with them, providing more clarifications if the results were abnormal or confusing, reinforce information given by the obstetrician regarding the results and the need for

further appraisal or treatment or referral that in turn will help the women to make informed decisions (Rosenberger et al.,2023).

### Significance of the study

Globally, literature revealed that about 6.3 million of perinatal deaths occur each year, and 99% of them occur in developing countries. Moreover, 80% of them occur during pregnancy. In Egypt, there is no registration of perinatal mortality while neonatal mortality rate was 10.3 deaths per 1,000 live in 2020 (Bellussi et al., 2020; United Nations, World Population Prospects.2021). The major cause of perinatal mortality refers to inadequate assessment of fetal wellbeing during pregnancy and care during labour by the skilled health professionals. As the primary golden aim of assessment of fetal well-being is reducing the incidence of perinatal morbidity and mortality. So, improving nurses' performance regarding assessment of fetal well-being is certainly a worthwhile endeavor (Ramadan et al., 2018).

**The aim of this study was to:** evaluate the effect of the educational guidelines regarding assessment of fetal well-being during pregnancy on nurses' performance.

### Research Hypothesis:

Nurses' performance is expected to be improved after implementation of the educational guidelines regarding assessment of fetal well-being during pregnancy.

### Subjects and method:

**Subjects and method of the current study were represented according to the following designs:**

- Technical design.
- Administrative design.
- Operational design.
- Statistical design.
- **Technical Design.**

**i. Research Design:-**A quasi experimental research design was adopted to conduct this study.

**ii. Setting:** The study was conducted at Antenatal unit, Ultrasound and Fetal Medicine unit at obstetric and gynaecological department of Tanta Main University Hospitals.

**iii. Subjects:** All available nurses (60) who were working at the previously mentioned setting at the time of data collection were included in this study.

**iv. Tools of data collection:** Two tools were used to fulfill the purpose of this study.

**Tool I: Nurses' knowledge regarding assessment of fetal well-being during pregnancy:** This tool was developed by the researcher after reviewing of recent related literature (Mahmoud et al., 2023; Ramadan et al., 2018). It included two parts: **Part (1):** Socio demographic characteristics of nurses: It included nurses' basic data; age, level of education, marital status, residence, years of experience and previous training program or workshop regarding assessment of fetal well-being during pregnancy. **Part (2):** Nurses' knowledge regarding assessment of fetal well-being during pregnancy: It included three sections as follows: Section (A): Nurses' basic knowledge regarding assessment of fetal well-being during pregnancy (6 questions). Section (B): Nurses' knowledge regarding non-invasive

methods of fetal well-being assessment during pregnancy (20 questions): it included questions about; types of non-invasive methods of fetal well-being assessment during pregnancy. Section (C): Nurses' knowledge regarding invasive methods of fetal well-being assessment during pregnancy (14 questions).

**Scoring system of knowledge was as follows:** Correct and complete answers were scored as (2). Correct and incomplete answers were scored as (1). Incorrect and didn't know answers were scored as (0). The total score for knowledge was calculated by (40 questions x 2=80) which was categorized as follows:

- Low level of knowledge <60%. ( 0-47)
- Moderate level of knowledge 60-<80%. (48-63)
- High level of knowledge 80-100%. (64-80)

**Tool (II):** Assessment of fetal well-being observational checklist: This tool was developed by the researcher and adapted from **Ramadan et al., (2018), Said & Ali, (2020) and The American College of Obstetricians and Gynecologist, (2021)**. It included the following two parts: **Part (1):** Nurses' practices regarding non-invasive procedures: It included the following procedures: Non-stress test, contraction stress test, fetal heart sound assessment, fetal movement count and ultrasound. **Part (2):** Nurses' practices regarding invasive procedures: It included the following procedures: Amniocentesis and percutaneous umbilical blood sampling.

Scoring system for nurses' practices was as follows:

- Done correctly and completely were scored as (2).
- Done correctly but incompletely were scored as (1).
- Done incorrectly or not done were scored as (0).

The total score of practices were summed up (205 step x 2=410) and converted into percent score as follows:

- **Unsatisfactory practices: < 80%. (0-327)**
- **Satisfactory practices: ≥ 80% (328-410)**

#### **Method**

##### **- Administrative Design:**

The study was implemented according to the following steps:

- i. Official permission and approval was obtained from the responsible authorities from the Faculty of Nursing Tanta University, directed to hospital administrator of obstetric department at Tanta University Hospital to obtain his approval and cooperation.
- ii. Ethical and legal considerations:
  - a. Approval of Faculty of Medicine research ethics committee, Tanta University was obtained (code 22/5/35491) and approval of Faculty of Nursing scientific research ethical committee Tanta University was obtained (code 70/6/2022) .
  - b. All participants were informed about the purpose of the study.
  - c. An informed consent was taken from every participant in the study including the right to withdraw at any time.

- d. The researcher ensured that the nature of the study didn't cause any harm or pain for the entire sample.
- e. Confidentiality and privacy were taken into consideration regarding data collection.
- **Operational design:**  
The study was implemented and carried out according to the following steps:
- 1) Tool I and Tool II were developed by the researcher after reviewing the recent related literature; Tool I was translated into Arabic and both tools were tested for content and construct validity by 5 experts in obstetric and gynaecological nursing field.
  - 2) After the development of the tools, a pilot study was carried out on 10% of the sample (6 nurses) from the previously mentioned setting. The pilot study was conducted before the actual data collection.
  - 3) After implementation of pilot study, it was applicable and there was no change. Cronbach's Alpha of reliability of knowledge tool was 0.845 and for practices tool was 0.873. Data obtained from the pilot study were included from the current study sample because there no major changes were done on the tools.
  - 4) Data collection was conducted in a period of one year from the beginning of September 2022 to September 2023.
  - 5) The educational guidelines was conducted through four phases (Assessment, planning, implementation and evaluation) as follow:
 

**Phase I: Assessment phase (pretest):**

    - This phase was done before giving the sessions. The researcher met nurses at the morning and the afternoon shifts in the previously mentioned setting.
    - Nurses were assessed using Tool I part (1) to collect socio-demographic data and Tool I part (2) to assess nurses' knowledge regarding assessment of fetal well-being during pregnancy before implementation of the educational guidelines. This tool was collected from each nurse individually for any needed clarifications.
    - Tool II was used to assess nurses' practices regarding assessment of fetal well-being during pregnancy before the educational guidelines.
    - Nearly 6 nurses at morning and 6 nurses were met at the afternoon shift each day. Totally the researcher took 3 hours daily for 5 days.

**Phase II: Planning phase:**

    - Preparing the content of the guidelines:
    - An educational Arabic booklet was developed by the researcher based on nurses' needs and data from the assessment phase, using recent relevant literatures available locally and internationally. Clarified photographs and diagrams were included in this booklet.
    - Preparation of the educational guidelines: The educational guidelines included 4 sessions for each group (two sessions for theoretical part and two sessions for practical part) and were carried out at the previously mentioned setting given jointly with an educational booklet.

**Phase III: Implementation phase:-**

    - The total number of nurses was 60 nurses. They were divided into 10 groups. Each group included 6 nurses. The educational guidelines were conducted over 3 days per week. The sessions were conducted at morning and afternoon shifts (one session per

shift).The duration of each session ranged from 30 to 45 minutes including periods of discussion.

**- The first session:**

It included basic knowledge about fetal well-being assessment during pregnancy including; definition, importance and indications of assessment of fetal well-being during pregnancy, routine assessment at every antenatal follow up visit. It also included knowledge regarding non-invasive methods of fetal well-being assessment including; ultrasound and fetal biophysical profile. It also comprised knowledge about fetal heart sound assessment, assessment of fetal movement, non-stress test, contraction stress test, fetal acoustic stimulation test, non-invasive prenatal DNA testing (NIPT) and transcervical retrieval of trophoblast cells.

**The second session:**

It included providing nurses with knowledge regarding invasive methods for fetal well-being assessment such as contraindication and types entailed chorionic villus sampling, amniocentesis, umbilical blood sampling and fetoscopy .

**- The third session:**

It included providing nurses with practical skills regarding the applying of non-stress test, contraction stress test and assessment of fetal movement.

**- The fourth session:**

It included providing nurses with practical skills regarding assessment of fetal heart sound by fetoscope and assisting during performing ultrasound, amniocentesis and percutaneous umbilical blood sampling.

**Phase IV: Evaluation phase (Post-test):**

- Evaluation of nurses' knowledge and practices regarding assessment of fetal well-being during pregnancy immediately and three months after implementation of the educational guidelines was done by using Tool I part (2) and Tool II.

- Comparison was done in relation to nurses' knowledge and practices before, immediately and three months after implementation of the educational guidelines to identify the effect of the educational guidelines on nurses' performance regarding assessment of fetal well-being during pregnancy.

**- Statistical design:**

The collected data were coded, entered, tabulated and analyzed using SPSS (Statistical Package for Social Science) version 25 (IBM Corporation, Armonk, NY, USA).

For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups and more was done using Chi-square test ( $\chi^2$ ).

For comparison between means of two groups of non-parametric data of independent samples, Z value of Mann-whitney test was used. For comparison between more than two means of non-parametric data, Kruskal-Wallis ( $\chi^2$  value) was calculated. Correlation between variables was evaluated using Pearson's correlation coefficient (r).

Significance was adopted at  $p < 0.05$  for interpretation of results of tests of significance.

**Results:**

**Table (1)** shows that more than two thirds (70.0%) of the studied nurses, their age was more than 40 years old with mean age  $\pm$  SD =42.54 $\pm$ 9.65. Regarding their educational level, it was observed that two thirds (66.7%) of the studied nurses had completed secondary nursing education. The table also shows that, all the studied nurses (100%) didn't attend any workshops regarding assessment of fetal well-being during pregnancy.

**Figure (1)** shows that only slightly less than one tenth (6.7%) of the studied nurses had high over all total score of knowledge regarding assessment of fetal well-being during pregnancy before implementation of the educational guidelines, while it was significantly improved to the majority (95.0% and 81.6 %) of them respectively immediately and three months after implementation of the educational guidelines.

**Figure (2)** reveals that only 15.0 % of the studied nurses had satisfactory score of practices regarding non-invasive procedures of fetal well-being assessment during pregnancy before implementation of the educational guidelines, while the score significantly improved to 95.0% and 88.3% respectively immediately and three months after implementation of the educational guidelines.

**Figure (3)** reveals that only 3.3 % of the studied nurses had satisfactory score of practices regarding invasive procedures of fetal well-being assessment during pregnancy before implementation the educational guidelines, while the score significantly

improved to 91.7 % and 81.7 % respectively immediately and three months after implementation of the educational guidelines.

**Figure (4)** reveals that slightly less than one fifth (18.3%) of the studied nurses had satisfactory overall total score of practices regarding assessment of fetal well-being during pregnancy before implementation of the educational guidelines, while the score significantly improved to 98.3% and 78.3% respectively immediately and three months after implementation of the educational guidelines.

**Table (2)** shows that there was a strong positive correlation between the studied nurses' total score of knowledge and total score of practices regarding assessment of fetal well-being during pregnancy before, immediate and three months after implementation of the educational guidelines where  $r=0.886$  and  $P=0.0001^*$ ,  $r=0.793$  and  $P=0.0001^*$ , and  $r=0.855$  and  $P=0.0001^*$  respectively.

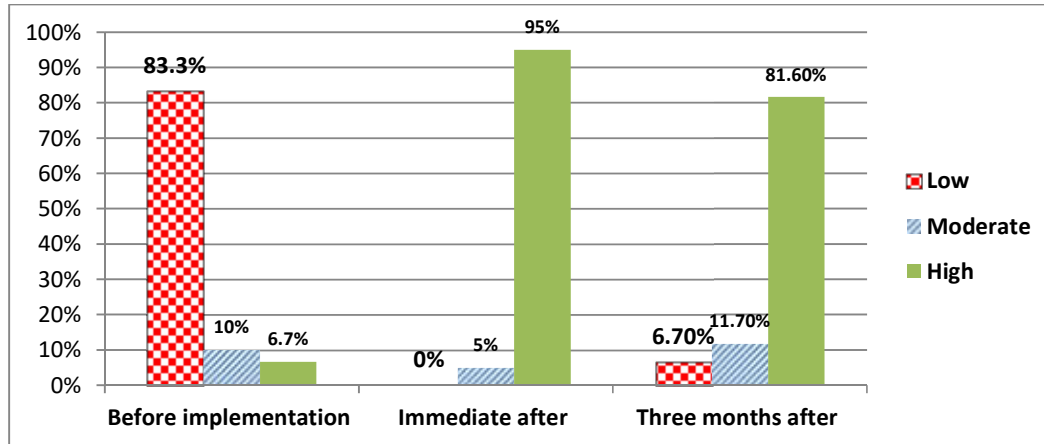
**Table (3)** shows that there was only a statistically significant relationship between total score of the studied nurses' knowledge regarding assessment of fetal well-being during pregnancy with their educational level before implementation of the educational guidelines where  $P=0.0001^*$ .

**Table (4)** shows that there was only a significant relationship between total score of the studied nurses' practices regarding assessment of fetal well-being during pregnancy with their age before implementation of the educational guidelines where  $P=0.029^*$ .

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

Socio-demographic characteristics	The studied nurses	
	N	%
<b>Age (years)</b>		
<20	1	1.6
20-30	14	23.4
31-40	3	5.0
>40	42	70.0
Mean±SD	42.54±9.65	
<b>Educational level:</b>		
Secondary Nursing	40	66.7
Technical Nursing Institute	9	15.0
Technical Health Institute	6	10.0
Bachelor of Nursing	1	1.6
Diploma in Obstetrics and Gynecology Nursing	4	6.7
<b>Residence:</b>		
Rural	24	40.0
Urban	36	60.0
<b>Marital status:</b>		
Single	4	6.7
Married	51	85.0
Widow	4	6.7
Divorced	1	1.6
<b>Years of experience:</b>		
<5	10	16.7
5-10	5	8.3
11-20	4	6.7
>20	41	68.3
Attendance of training program or workshop regarding assessment of fetal well-being during pregnancy		
<b>No</b>	<b>60</b>	<b>100</b>

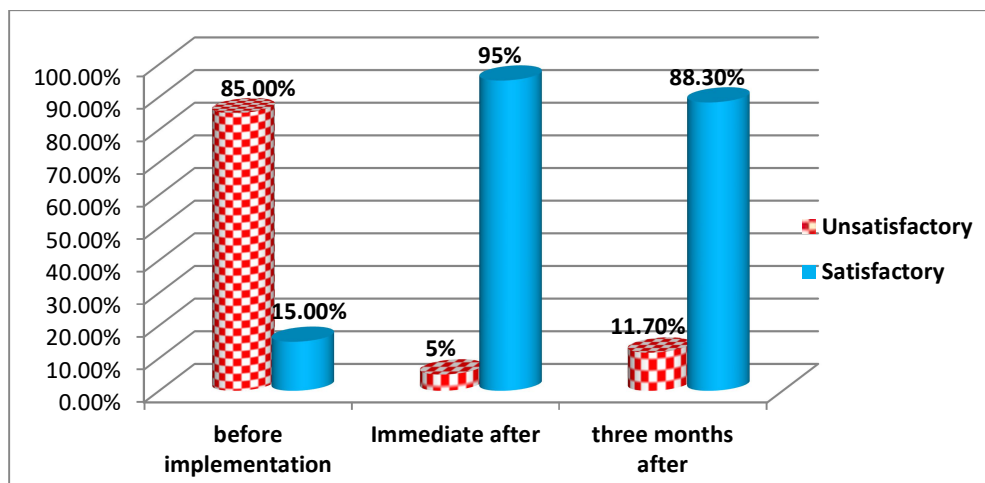




$\chi^2=136.724$

$P= 0.0001^*$ .

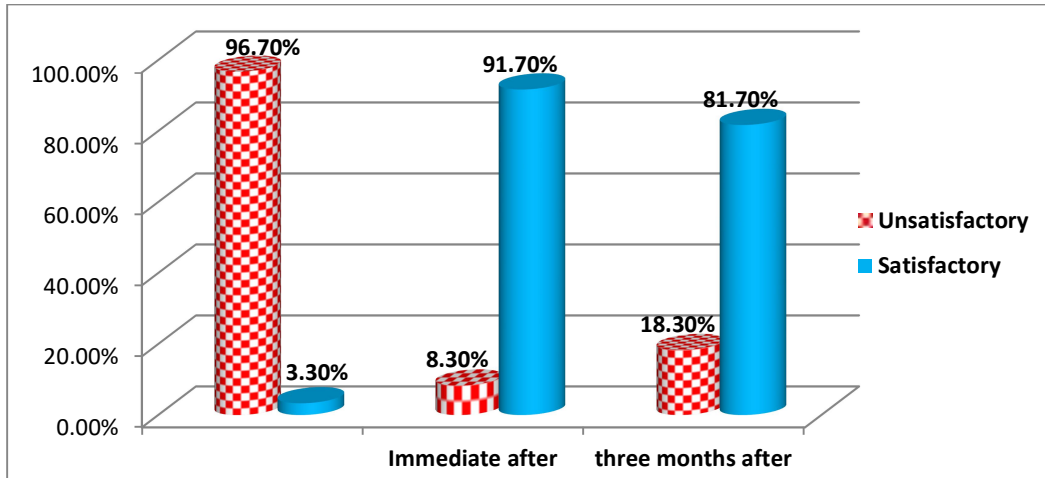
**Fig (1): Overall total score of the studied nurses' knowledge regarding assessment of fetal well-being during pregnancy before, immediate and three months after implementation of the educational guidelines. n=60**



$\chi^2= 102.708$

$P= 0.0001^*$

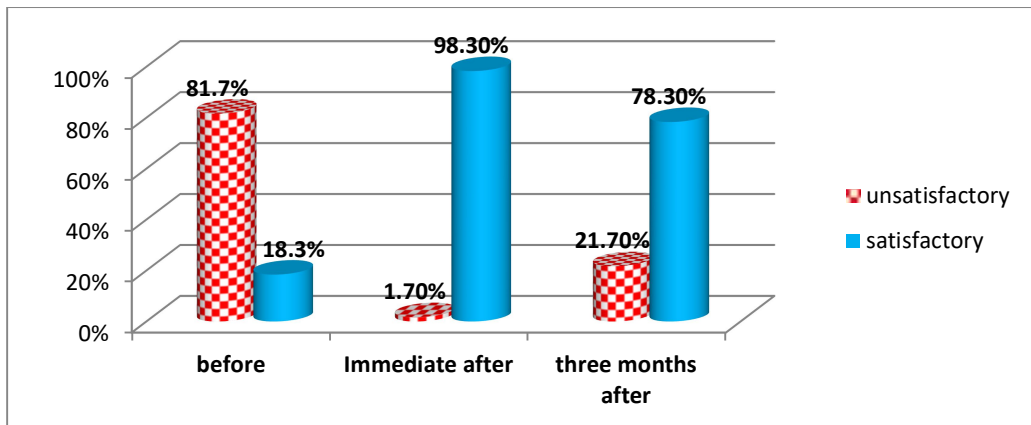
**Fig (2): Total score of the studied nurses' practices regarding non-invasive procedures of fetal well-being assessment during pregnancy before, immediate and three months after implementation of the educational guidelines. (n=60)**



$\chi^2=115.977$

$P= 0.0001^*$

**Fig ( 3): Total score of the studied nurses' practices regarding invasive procedures of fetal well-being assessment during pregnancy before, immediate and three months after implementation of the educational guidelines. (n=60)**



$\chi^2=156.234$

$P= 0.0001^*$

**Fig (4) Overall total score of the studied nurses' practices regarding assessment of fetal well-being during pregnancy (non-invasive and invasive procedures) before, immediate and three months after implementation of the educational guidelines. (n=60)**

**Table (2): Correlation between the studied nurses' total knowledge score and total practices score regarding assessment of fetal well-being during pregnancy before, immediate and three months after implementation of the educational guidelines.**

Variable	Total knowledge score regarding assessment of fetal well-being during pregnancy		
	Before implementation	Immediate after	Three months after
	r P	R P	r P
Total practices score regarding assessment of fetal well-being during pregnancy	0.886 0.0001*	0.793 0.0001*	0.855 0.0001*

r=Correlation Coefficient

\*statistically significant (P<0.05)

**Table (3): Relationship between the studied nurses' total knowledge score regarding assessment of fetal well-being during pregnancy and their socio – demographic characteristics before, immediate and three months after implementation of the educational guidelines.**

Socio-demographic characteristics of the studied nurses	Total knowledge score of the studied nurses		
	Before implementation	Immediate after	Three months after
	$\chi^2$ P	$\chi^2$ P	$\chi^2$ P
Age (years)	3.358 0.302	3.651 0.340	2.624 0.854
Educational level	38.889 0.0001*	3.216 0.522	3.571 0.894
Residence	0.123 0.725	0.936 0.333	0.221 0.895
Marital status	1.176 0.759	3.756 0.289	4.482 0.612
Years of experience	2.886 0.410	3.671 0.299	3.225 0.780

\*Statistically significant (P<0.05)

**Table (4): Relationship between the studied nurses' total practices score regarding assessment of fetal well-being during pregnancy and their socio – demographic characteristics before, immediate and three months after implementation of the educational guidelines.**

Socio-demographic characteristics of the studied nurses	Total practices score of the studied nurses		
	Before implement-ation	Immediate after	Three months after
	$\chi^2$ P	$\chi^2$ P	$\chi^2$ P
Age (years)	9.015 0.09*	0.436 0.933	1.501 0.682
Educational level	1.034 0.905	0.508 0.973	1.735 0.784
Residence	3.103 0.078	1.525 0.217	0.262 0.609
Marital status	0.365 0.947	0.179 0.981	2.322 0.508
Years of experience	6,447 0.092	0.471 0.925	0,556 0.907

\*Statistically significant (P<0.05)

### Discussion

Monitoring fetal well-being is always extremely critical during pregnancy to reduce the occurrence of fetal distress in low and high risk pregnancies (David & Spencer, 2022). Assessment of fetal well-being methods are challenging procedures for health care providers working in the obstetric field especially nurses who are working at antenatal and labor units. They must possess the needed knowledge and skills to assess fetal well-being in a way to provide a safely and effectively care as well as to decrease perinatal morbidity and mortality (Rurangirwa et al., 2018).

Concerning socio-demographic characteristics of the studied nurses, more than two - thirds of them were more than 40 years old. This finding is in line with Yang et al., (2021) who illustrated that more than half of their study subjects were more than 40 years old. On contrast, Khumujam & Podder, (2019) mentioned that the majority of the nurses in their study aged 18- 40 years old. Moreover, Begum, (2019) reported that nearly four-fifths of the nurses in her study aged 20-35 years old. From the researcher's point of view, the difference might be contributed to the difference in setting between the

studies. As they conducted their studies at private sector hospitals compared to the current study which was conducted at university hospital where average age of nursing staff is high. At the same time, the percentage of hiring new nurses is very low especially at non critical care units such as maternity wards.

**Regarding nurses' educational level,** two-thirds of the studied nurses had completed secondary nursing education. This finding is strongly similar with **Said & Ali, (2020)** mentioned that more than half of the nurses in their study completed secondary nursing education and the minority of them had Baculare of nursing. Moreover, **Olewi & Abbas, (2018)** reported that the highest percentage of their study subjects were graduated from secondary nursing school. On contrast, the current finding is not corresponding with **Abd El-Razek, (2016)** who illustrated that more than half of the nurses in her study attained specialty nursing diploma and the minority of them attained nursing diploma.

The current study also revealed that three - fifths of the studied nurses were from urban and the majority of them were married. These findings match with **Meunier et al., (2015)** who illustrated that nearly three - quarters of the subjects in their study lived in urban area. In addition, **El-Sayed & Saadoon, (2018)** as well as **Olewi & Abbas, (2018)** showed that the majority of the nurses in their studies were married. In the contrary, **Ibrahim & Arief, (2019)** who stated that about three- fifths of their study subjects were

from rural area and only less than one - fifth of them were married. From the researcher's point of view, this dissimilarity appeared because of difference in residence between both studies and younger age of their participants compared to nurses' age in the current study.

**In relation to years of experience** in the present study, approximately two-thirds of the studied nurses had more than 20 years of experience. This finding disagrees with **Zhu et al., (2021)** who illustrated that the highest percentages of the participants had ranged from 1 to 15 years of experiences. Moreover, **Olewi & Abbas, (2018)** reported that nearly half of the nurses had from 1 to 5 years of experience. The researcher's point of view, this discrepancy might be due to the difference regarding subjects' age where three - quarters of the studied nurses aged more than 40 years old in the current study that inturn revealed their years of experience.

**As regard the attending of training workshops regarding assessment of fetal well-being during pregnancy** in the current study, all the studied nurses didn't attend any workshops. This finding matches with **Kumbhakar & Vijay, (2016)** who illustrated that almost all the studied nurses in their study didn't receive any training programs regarding fetal assessment. In addition, **Rosy & Pinary, (2015)** stated that none of the midwives in their study had continuing nursing education programs regarding fetal investigations. From the researcher's point of view, this agreement is might be due to none provision of educational

training program regarding fetal well-being assessment for nurses in hospitals.

Recently, health care providers' knowledge regarding fetal well-being and its assessment measures becomes one of the fundamental steps for prevention and reduction fetal deaths during pregnancy and labor. Nurses employed in prenatal health care setting need to have accurate and up-to-date knowledge regarding assessment of fetal well-being and understand the benefits, limitations and the process of its measures (Fesen et al., 2021).

**Concerning overall total score of knowledge regarding assessment of fetal well-being during pregnancy** in the current study, only slightly less than one-tenth of the studied nurses had high score of knowledge before implementation of the educational guidelines. From the researcher's point of view, it might be due to the fact that all the studied nurses never attended training programs or workshops regarding fetal well-being assessment. At the same time, it might be related to low level of education, as most of the studied nurses were Nursing Diploma and graduated since long period of time.

These findings are supported by **Abdelgilil, (2015)** who assessed knowledge and practice of maternity nurses regarding fetal well-being at Benha university hospital in Egypt. She revealed that most nurses in her study had inadequate total knowledge regarding fetal well-being. Moreover, **Khumujam & Podder, (2019)** who assessed knowledge regarding fetal well-being among the staff nurses working in obstetrics and

gynecological wards in Pune, India. They reported that the minority of the nurses in their study had good total knowledge score regarding all fetal well-being assessment procedures. In addition, **Asafa et al., (2021)** assessed midwives' knowledge and readiness to practice antenatal screening and genetic testing in selected hospitals in Lagos, Nigeria. They stated that only one-third of the midwives in their study had adequate knowledge of antenatal screening and genetic testing for congenital abnormalities.

On the other hand, the current study revealed that the studied nurses' overall total knowledge score regarding assessment of fetal well-being during pregnancy was significantly improved. Where the majority of them had high total score of knowledge immediately and three months after implementation of the educational guidelines. These findings are in line with **Pushpaveni, (2015)** who assessed the effect of the self-instructional module on fetal well-being measures among nurses in Bengaluru, India. He concluded that the total knowledge of staff nurses regarding fetal well-being measures in his study was significantly improved among the majority of them post self-instructional module. Moreover, **Mahmoud et al., (2023)** examined the effect of instructional package on maternity nurses' knowledge and practices regarding assessment of fetal well-being in Benha, Egypt. They concluded that the instructional package had a positive influence on total knowledge regarding assessment of fetal well-being among maternity nurses in their study immediate and during follow-up stages of the package.

From the researcher's point of view, this improvement in the total score of knowledge regarding assessment of fetal well-being in the current study might be due to the immediate effect of the educational guidelines supported by a booklet which was helpful as ongoing reference about the subject. As well as it might be attributed to the need and interest of the nurses to gain and update their knowledge regarding this topic .

Nowadays, non-invasive fetal well-being procedures are widely spread in obstetric field and it becomes a cornerstone in management of high risk pregnancy which are usually done by trained obstetrician or delegated to the nurses by primary care provider. Therefore, these procedures are one of the primary responsibilities of the maternity nurses in the current obstetric practice (Farley et al.,2018). **Concerning the total score of practices regarding non-invasive procedures of fetal well-being assessment during pregnancy**, it was found that less than one -fifth of the studied nurses had satisfactory score of practices before implementation of the educational guidelines. While, the score was significantly improved to the majority of them immediately after the sessions and three months after implementation of the educational guidelines.

These findings are strongly similar with **Ramadan et al., (2018)** who examined the effect of educational intervention on maternity nurses' performance regarding non-invasive fetal well-being measures at Benha, Egypt. They reported that only less than one-fifth of the maternity nurses in their study had satisfactory practices regarding non-invasive fetal well-being measures before the educational intervention compared to

90% of them after the intervention. Moreover, **Mahmoud et al., (2023)** reported that only less than one- fifth of the nurses had satisfactory practices regarding non-invasive methods of fetal well-being assessment. While after the instructional package, their practices were significantly improved.

There have been several advances in the aspect of fetal well-being assessment in the last 25 years which have led to promotion of fetal health and to determine whether the fetus has certain abnormalities, including certain hereditary or spontaneous genetic disorders. Therefore, the fetal medicine is in dire need for more invasive prenatal tests. However, invasive fetal well-being measures are performed by obstetrician, the nurse has an important role as assistant in counseling, preparing and monitoring the pregnant woman during these measures (Jenifer et al., 2017).

**Concerning the total score of practices regarding invasive procedures of fetal well-being assessment during pregnancy**, only 3.3% of the studied nurses had satisfactory score of practices before implementation of the educational guidelines. From the researcher's point of view, there might be several reasons for lacking practices regarding invasive procedures; **first**, it might be contributed to the current study explored that the majority of the studied nurses had low knowledge score regarding invasive methods of fetal well-being assessment that in turn affect their capabilities in counseling the pregnant woman before and after the procedures. **Second**, it might be related to that invasive procedures

require specific qualifications and mostly done by obstetrician. So, nurses' role is limited to only assistance (prepare, handle equipment as well as document the procedures) as mentioned by them during the sessions. As well as the lacking of continuous in-service training program regarding fetal well-being assessment.

**Final reason** for lacking of the studied nurses' knowledge and practices regarding invasive procedures might be that Fetal medicine unit at Obstetric and Gynaecological department of Tanta Main University Hospitals was recently established from two years. Moreover, this service (invasive procedures) was provided to the pregnant women only from one year before the time of data collection. As, nearly three-quarters of the studied nurses aged more than 40 years old as well as workloads that limit their times to seek for learning new skills that introduced to their traditional practice which in turn affect on their performance. This finding agrees with **Abdelglil,(2015)** who explored that the minority of the nurses in her study had satisfactory practices regarding studied aspects of fetal well-being assessment such as fetal umbilical blood sampling and amniocentesis.

On the other hand, the current study revealed that the studied nurses' practices regarding invasive procedures was significantly improved where the majority of them had satisfactory practices immediately after the sessions and three months after implementation of the educational guidelines. These findings agree with **Cordier et al., (2016)** who assessed the effectiveness

of two simple simulators in training for teaching invasive prenatal procedures in France. They reported that the scores in the practice of invasive prenatal procedures were improved among the majority of the subjects in their study after the training. Moreover, **Vivanti et al.,(2021)** examined the impact of simulation-based prenatal invasive procedure training on professional practice at the Antoine Bécélère maternity hospital in France. They mentioned that the training had a significant impact on the professional practices of the majority of the participants regarding prenatal invasive procedures in their study.

**Concerning overall total score of practices regarding assessment of fetal well-being during pregnancy** in the current study, slightly less than one-fifth of the studied nurses had satisfactory score of practices before implementation of the educational guidelines. This finding match with **Abdelglil, (2015)** who concluded that less than one-third of the nurses in her study had satisfactory total practices regarding all aspects of fetal well-being measures. On the other hand, in the current study the overall total practices score was significantly improved as the majority of the studied nurses had satisfactory score immediately after the sessions and slightly more than three-quarters of them three months after implementation of the educational guidelines. These findings are also supported by literature reviews published by **Limbo & Denny,(2020)** who pointed out that education and training programs are very critical for



nurses which lead to enhance their skills regarding all aspect of fetal assessment .

From the researcher's point of view, this improvement in total practices in the current study might be due to the immediate effect of the educational guidelines as this study provides nurses opportunities to assume their roles beyond primary responsibility, gaining new knowledge and skills to work and learn. On the other hand, three months later, studied nurses' practices scores were somewhat decreased but still significant might be due to absence of continuing education and also work overload. Also, the educational guidelines was effective in raising studied nurses' knowledge and practices which reinforce the continuing need for more education about methods of fetal well-being assessment.

**Concerning the correlation between the total knowledge score and the total practices score regarding assessment of fetal well-being during pregnancy** in the current study there was a strong positive correlation between them before, immediate and three months after implementation of the educational guidelines. This finding is in agreement with **Lamé et al., (2019)** whose study aimed to improve the practice of intrapartum electronic fetal heart rate monitoring with cardiotocography for safer childbirth in England. They concluded that there was an improvement among nurses' practice as well as their knowledge pre and post implementation of the program.

Also, **Ramadan et al., (2018)** found a high positive correlation between total knowledge and practice score of the studied nurses regarding non-invasive measures of fetal well-being at pre and post intervention phase. Moreover, the result of the current study is in line with **Said & Ali , (2020)** who assessed the effect of supportive nursing instructions for maternity nurses regarding electronic fetal monitoring in Benha city,Egypt. They found a statistically significant correlation between the total scores of maternity nurses' knowledge and practices regarding fetal monitoring before and after nursing supportive instructions.

**As regard the relation between the total knowledge score regarding assessment of fetal well-being during pregnancy and socio – demographic characteristics,** there was a statistically significant relationship between total score of the studied nurses' knowledge and their educational level before implementation of the educational guidelines. This finding agrees with **James et al., (2019)** who assessed knowledge levels of midwives regarding the interpretation of Cardiotocography at labour units at KwaZulu-Natal public hospitals in South Africans. They revealed that inadequate knowledge of respondents in their study regarding fetal assessment which significantly associated with their education level. In the contrary, **Meena, (2018)** assessed the knowledge of staff nurses regarding antenatal assessment of fetal well-being at Mahila Chikitsalaya Sanganeri Gate Jaipur Rajasthan in India. They

reported that there was no significant association between knowledge of the staff nurses regarding antenatal assessment of fetal well-being and selected demographic variables. In addition, **Pushpaveni, (2015)** found that there was no significant association between level of knowledge regarding fetal well-being measures and any of the demographic data of the nurses in both studies.

**Concerning the relation between the total practices score regarding assessment of fetal well-being during pregnancy and socio – demographic characteristics,** there was a statistically significant relationship between total score of the studied nurses' practices and their age before implementation of the educational guideline. The present findings are supported by **Sukumaran et al., (2021)** who studied cardiocograph changes and maternal and neonatal outcomes in chorioamnionitis and/or funisitis confirmed on histopathology in England. They found that there was a highly statistically significant relationship between nurses' practices and their age.

Furthermore, **Devane et al., (2017)** who studied cardiocography versus intermittent auscultation of fetal heart on admission to labour ward for assessment of fetal well-being in Ireland. They found that there was a highly statistically significant relation between nurses' performance and their age. On contrast, **Sowmya et al., (2013)** examined the effectiveness of cardiocography training program on knowledge and skill among nurses working at maternity units in Chennai,

India. They reported that there was no significant association between the level of skill with selected demographic variables among nurses in their study.

Antenatal care is essential for all expectant mothers and assists in reducing maternal and perinatal mortality rates thus addressing the Sustainable Development Goal. Nowadays, the main focus of antenatal care is towards the evaluation of fetal health to assess fetal well-being because two thirds (60%) of fetal deaths worldwide occurs during the antepartum period compared to the majority (80%) of them in developing countries according to WHO report 2022. These deaths are caused by perinatal complications that can be prevented or reduced or managed by frequent fetal well-being assessment measures during pregnancy (**World Health Organization, 2022; World Health Organization, 2022**).

So, early booking and early detection of any abnormality during pregnancy through special investigations of fetal well-being have beneficial effect on the fetus and can increase fetal survival. The maternity nurse plays an imperative role in fetal assessment in various ways through planning, implementation, the testing program, education and support of the pregnant women as well as assisting the obstetrician or performing specialized investigations (**Edelman & Kudzma ,2022; Evans, 2019**).

#### **Conclusion:**

- The research hypothesis has been achieved, where significant improvement of nurses' performance regarding assessment of fetal well-

being during pregnancy were found immediately and three months after implementation of the educational guidelines among the studied nurses. .

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

- Maternity nurses have to update their knowledge and improve their practices regarding fetal well-being assessment procedures through reading up recent references such as; researches, textbook and articles as well as attend scientific meetings and conferences regarding that topic.
- Provide periodic in-service training programs about fetal well-being assessment during pregnancy depend on recent evidence based guidelines for all nurses working in Antenatal unit, Ultrasound and Fetal Medicine unit and Maternal and Child health centers
  - Further studies are needed in this field to assess:
    - Effect of health care providers' compliance with fetal well-being assessment procedures on pregnancy and labor outcomes among high risk pregnant women.
    - Knowledge and attitudes of the primigravida women as well as their satisfaction regarding assessment of fetal well-being during pregnancy.

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