Interactive Training Session Regarding Fetal Movements Counting and its Effect on Maternal Outcomes among High-Risk Pregnant Women

Amany M. Ahmed [(1)], Mona Hamdy Mostafa[(2)], Rania El-Kurdy [(3)]

(1) Lecturer of Woman's Health and Midwifery Nursing, Faculty of Nursing, Kafrelsheikh University, Egypt.

(2) Lecturer of Psychiatric Mental Health Nursing, Faculty of Nursing, Cairo University, Egypt.

(3) Lecturer of Woman's Health and Midwifery Nursing, Faculty of Nursing, Mansoura University, Egypt.

ABSTRACT

Context: Fetal movement counting (FMC) has been proposed as a primary method of fetal surveillance especially for high-risk pregnancy. **Aim:** This study aimed to examine the effect of interactive training session regarding fetal movements counting on maternal outcomes among high-risk pregnant women. **Methods:** An experimental (pretest-posttest control group) research design was adopted. A simple random sample of 140 high-risk pregnant women was recruited. This study was conducted at the obstetrics and gynecology departments of Mansoura University Hospital, Egypt. Data were collected using two tools: structured interview schedule, and state-trait anxiety inventory. **Results:** the results revealed that pre-intervention, 100.0% of both the intervention and the control groups have a poor level of knowledge. While post-intervention, 90.0% of the intervention group have a high level of knowledge as compared to 100.0% of the control group have a poor level of knowledge. Regarding compliance to FMC, pre-intervention, 14.3% of the intervention group compared to 15.7% of the control group count their fetal movements. However, post-intervention, 100.0% of the intervention group count their fetal movements compared to 15.7% of the control group. Concerning anxiety, pre-intervention, 51.4% of the intervention group has a high anxiety level compared to 48.6% of the control group. While post-intervention, 87.0% of the intervention group has low anxiety level as compared to 62.9% of the control group that reported high anxiety level. **Conclusions:** After implementation of the training session, there is a highly statistically significant difference between the intervention and control groups regarding the level of knowledge, the compliance to FMC, and the level of anxiety ($p < 0.001$). Therefore, conducting such simple and effective training sessions should be encouraged and recommended for high-risk pregnant women.

Keywords: interactive training session, fetal movement counting, maternal outcomes, high-risk pregnant women

Introduction

Pregnancy is a critical or a stressful period in a woman's life because it is a time of significant physical, mental, and social changes **(Murray et al., 2019)**. Although pregnancy is a physiological process, some conditions may endanger maternal or fetal health and put a pregnant woman or her fetus in a significantly increased risk for morbidity and/or mortality **(Murray et al., 2019; de Medeirosa et al., 2016).** These conditions, can turn normal or low-risk pregnancy into a high-risk pregnancy (HRP) and cause women to experience stressful conditions **(de Medeirosa et al., 2016).**

Women with HRP has stressors beyond those of the normal pregnancy **(Leifer, 2019).** Various studies have showed that women with HRP experience negative feelings such as restlessness, fear, loss of control, disability, anger, anxiety, and worries **(Rodrigues et al., 2016; do Carmo et al., 2015; Kent, 2015).** Anxiety, depression, and other stressful feelings during the prenatal period can easily lead to more severe conditions that affect the maternal, fetal and newborn's well-being **(Coussons-Read, 2013)**. Furthermore, decreased fetal activity is a common reason for maternal worries and concerns **(Kapaya et al., 2020).** These maternal worries and concerns for decreased fetal movements are a common reason for unscheduled visits to the

health care providers or labor and delivery unit and warrants further medical evaluation **(Bellussi et al., 2020; Das et al., 2019; Delaram et al., 2018).**

A healthy fetus moves and kicks regularly. On the other hand, decreased or increased fetal movements during pregnancy is associated with adverse fetal outcomes **(Berndl et al., 2013)** and may be a warning sign of an impending fetal demise **(Daly et al., 2011).** Fetal movements counting (FMC), a self‐screening technique, has been proposed as a primary method of fetal surveillance for all pregnancies including HRP **(Dutton et al., 2020).** Maternal regular perception of fetal movements during the third trimester has been considered as an indicator of fetal well-being. FMC is also associated with improved perinatal outcomes as it permits early identification, timely evaluation, and appropriate intervention for fetuses at risk of adverse outcomes **(Bellussi et al., 2020).**

The fetal movement pattern is different for every fetus, and women experience different types of movements. Therefore, an improved understanding of fetal movement patterns and quality, as perceived by pregnant women, is crucial and can be achieved through providing adequate information **(Bradford & Maude, 2018).** When pregnant women have adequate information about normal fetal movement patterns, they can identify and report any deviations that may occur early **(Bradford & Maude, 2018).** Fetal movement counting is a cost effective, reassuring, and easily taught skill that, all pregnant women can benefit from training on fetal movement assessment **(Dutton et al., 2020).** A recent study conducted by **Flenady et al. (2019),** announced that, there is a need to ensure that pregnant women receive adequate information and support about decreased fetal movement.

Significance of the study

The prevalence of HRP is 25.6-75.6% **(Bajalan, et al., 2019).** High-risk pregnancies are associated with adverse pregnancy outcomes with increased risk of perinatal and maternal morbidities and mortalities. For instance, maternal depression and anxiety in high-risk pregnancy has been recorded to occur at a rate of 12.5-44.2% and 16.9-54%, respectively **(Mirzakhani, 2020; Wallwiener et al., 2019).** Furthermore, perinatal mortality and morbidity are a concern in all countries. **Kumar and Yadav (2020)** conducted an observational study to assess perinatal outcome among high-risk pregnancies and their findings reveal that, adverse perinatal outcomes include preterm births (27.9%), intra-uterine fetal death (5.04%), intrapartum still-births (0.7%), neonatal intensive care unit admissions (22.4%), early neonatal deaths (0.9%), and low birth weight (20.7%).

In Egypt, approximately 90,000 perinatal deaths occur annually **(Inter-Agency Group for Child Mortality Estimation, 2014). Ibrahim et al. (2018)** in their study compared neonatal outcomes in low and high-risk pregnancies in an Egyptian Tertiary Health Care Center. Their findings reveal that, neonatal morbidity is higher in the high-risk pregnancy group ($p < 0.05$). The relative risk of low birth weight, poor Apgar score at the first minute, respiratory distress, neonatal intensive care unit admission, endotracheal intubation, and mechanical ventilation was 8.2, 1.85, 5.13, 6.83, 15.37, and 26.42, respectively.

Counting fetal movements increases maternal-fetal attachment among pregnant women. This promotes maternal mental health, maternal social health, and fetal health **(Mesgarzadeh et al., 2020).** In addition, maternal tracking of fetal activity in the third trimester may be the first screening that identifies the events preceding late stillbirth and is likely to prevent perinatal morbidity and mortality **(Bellussi et al., 2020).** In specific, low maternal awareness of fetal movements is associated with poor pregnancy outcomes **(Akselsson et al., 2019).** Various studies have concluded that a large number of still-births can be prevented if women are able to seek medical attention earlier and if they had information and were more aware of fetal movements and what to do if their perception of fetal movements changed **(Koshida et al., 2015).**

Despite these benefits of FMC, in Egypt, very few studies have examined the crucial aspects of fetal movement counting among high-risk pregnant women such as compliance to FMC, knowledge, and the anxiety level of pregnant women who fall within that vulnerable group. Therefore, the present study would contribute to a greater understanding of these aspects through examining the effect of

interactive training session regarding fetal movement counting on maternal outcome among high-risk pregnant women.

Aim of the study:

This study aimed to examine the effect of interactive training session regarding fetal movements counting on maternal outcomes among high-risk pregnant women

Operational definition

In this study, maternal outcome is defined as the level of knowledge, compliance to FMC, and level of anxiety and was measured by using structured interview schedule and State-trait anxiety inventory.

Research hypotheses

Main hypothesis

High-risk pregnant women who participate in interactive training session regarding fetal movement counting exhibit better outcomes compared to those in the control group.

Sub-hypotheses

H.1. High-risk pregnant women who participate in interactive training session regarding fetal movements counting will have a high mean knowledge score compared to those in the control group.

H.2. High-risk pregnant women who participate in interactive training session regarding fetal movements counting will exhibit more compliance to FMC compared to those in the control group.

H.3. High-risk pregnant women who participate in interactive training session regarding fetal movements counting will exhibit low anxiety levels compared to those in the control group.

Subjects and method

Research design:

An experimental research design (pretest-posttest control group design) was adopted in this study. In this type of design, subjects are assigned randomly to the intervention group and control group. The baseline measure of the dependent variable was performed for both groups**.** Then experimental group only received the proposed intervention. After that, both groups were post-tested to measure the degree of change in the dependent variable; that is, the measure that captures the outcome of the proposed intervention **(LoBiondo-Wood & Haber, 2018).**

Setting:

This study was conducted at the obstetrics and gynecology departments of Mansoura University Hospital, Egypt. This is a university affiliated hospital. The obstetrics and gynecology departments are located at the 3rd and 4th flour, and they include three wards named 10, 15, and 18.

Sample:

A simple random sample of 140 high-risk pregnant women was recruited and randomly assigned to either of the two groups (i.e., the intervention and the control group) using sealed envelopes containing intervention or control group cards. There were 70 women in each group. The enrollment process was based on the following inclusion criteria: gestational age of 28 week or more, can read and write, and accept to participate in the study. On the hand, the exclusion criteria included: multiple pregnancy and fetal abnormality. The following formula was used to calculate the sample size:

$$n = [(Z_{\alpha/2} + Z_{\beta})^2 \times \{2(SD)^2\}]/ (\mu 1 - \mu 1)^2$$

where,

N= sample size required in each group

SD = standard deviation

$Z_{\alpha/2}$: this depends on the level of significance, for 5% this is 1.96

Z_{β}: this depends on power, for 80% this is 0.84

$\mu 1 - \mu 1$: the mean difference between the two groups

Therefore,

$$n= [(1.96 + 0.84)^2 \times \{2(4.0)^2\}]/ (1.9)^2=69.5$$

Based on the above formula, the sample size required per group is 70.

Tools of data collection

Data pertinent to the study were collected using two tools. These were the structured interview schedule and state-trait anxiety inventory.

1. Structured interview schedule:

This tool was developed by the researchers and consists of four main sections:

A. Personal background data: This section included questions about age, telephone number, residence, level of education, and occupation.

b. Fetal movement count history: This section included four questions about having any previous knowledge about FMC, sources of that knowledge, whether the participants have ever counted fetal movements, and finally, reasons for not counting the movements.

c. Compliance to fetal movement count: Under this section, three questions were formulated to test the compliance of pregnant women. The questions were whether they have ever counted fetal movement; if yes, how many times in the last week; and finally, whether they counted fetal movement regularly.

d. Pre/post-test: This section included 10 MCQs that assessed high-risk pregnant women's knowledge regarding FMC. The questions sought to collect information about the gestational age at which the pregnant women started to feel quickening, the appropriate gestational age for starting FMC, how many times a day fetal movement should be assessed, the appropriate time during a day to assess fetal movement, the correct position to assess fetal movement, the normal number of fetal movements, the importance of FMC, methods that stimulate fetal movements, reasons for the absence of fetal movements, and when pregnant women must contact their physicians.

Scoring system:

A score of 2 was given to the correct and complete answer, while a correct but incomplete answer was given a score of 1. However, when a wrong answer or when a pregnant woman responded that "she does not know," a zero score was recorded. The total knowledge score ranged between 0 and 20 and was classified into three levels: poor knowledge (< 50%), acceptable knowledge (50% to < 75%), and high knowledge (≥75%).

2. State-trait anxiety inventory

The state-trait anxiety inventory (STAI) is a commonly used measure of anxiety developed by Spielberger et al. (1983). This measure includes two subscales, which are: the State Anxiety (S-Anxiety) and the Trait Anxiety (T-Anxiety) subscales. The STAI has 40 statements, with 20 allocated to each subscale. In the current study, the researchers only used the S-Anxiety subscale, which assesses the current state of anxiety, to collect data on how the participants feel "right now" using statements that measure the subjective feelings of tension, apprehension, worry, nervousness, and activation/arousal of the autonomic nervous system.

All the items were rated on a 4-point Likert scale ranging from 1 ("not at all") to 4 ("very much so"). For anxiety-absent statements, reverse scoring was used (e.g., "I feel calm" or "I am happy"). The total score ranged from 20 to 80 for each subscale and were classified into three levels: 20–39: (low anxiety); 40–59: (moderate anxiety); and 60–80: (high anxiety).

Tool validity

The tool developed by the researchers, the structured interview schedule, was submitted to five scholastic nursing specialists in the field of women's health and midwifery and psychiatric health nursing to test its content validity. The tool was validated for clarity, relevance, and completeness of its content. Based on the recommendations of the specialists, the needed modifications were performed.

Tool reliability

The reliability of the proposed tools was tested using Cronbach's alpha coefficient test. For the structured interview schedule, Cronbach's alpha of 0.84 showed a strong, significant positive correlation between the tool's items. For the STAI, the internal consistency coefficients ranged from 0.86 to 0.95, while the test-retest coefficients for this tool in the current study ranged from 0.69 to 0.89.

Ethical consideration

Official permission was obtained from Mansoura University Hospital administrators. After that, each high-risk pregnant woman informed about the aim of the study and its significance. The researchers emphasized that

participation in the study is entirely voluntary, and all high-risk pregnant women were informed that they could withdraw from the research at any time. Anonymity and confidentiality were assured through coding the data. Informed consent was also obtained from the high-risk pregnant women who accepted to participate in the study.

Pilot study

A pilot study was carried out on 10% of the sample (14 high-risk pregnant women) who met the selection criteria to assess the feasibility of the study process, the clarity of the tools, and estimate the time needed to complete the tools. Based on the results of the pilot study, no modifications were performed in the tools. The participants in the pilot study were excluded from this study.

Procedure

Data were collected within a period of eight months—from the beginning of February 2020 to the end of September 2020. The research was conducted in four phases: preparation, assessment, implementation, and evaluation phases. Due to the COVID-19 outbreak, throughout all the four phases, the researchers wore protective gears (i.e., face masks and gloves) when contact with the pregnant women was necessary, and the women also wore face masks.

Preparation phase: During this phase, a review of related literature has been done to construct data collection tools and also prepare the teaching material, i.e., Arabic brochure.

Assessment phase: After enrollment, the researchers hold a meeting with each pregnant woman individually to complete the structured interview schedule and the S-Anxiety Scale. The questions were asked in Arabic, and the researchers recorded the pregnant women's responses. The assessment phase was conducted for both the intervention and control groups. The time taken to complete the tools was about 30 minutes.

Implementation phase: In this phase, the control group received the usual routine care, while the intervention group received one training session on the importance of FMC, how to assess fetal movement, appropriate gestational age for starting FMC, frequency of FMC, appropriate time of FMC, correct position to FMC, normal number of fetal movements, methods that can stimulate fetal movements, reasons for the absence of fetal movements, and when pregnant women should contact their physicians.

During the training session, the researchers utilized the teach-back strategy as the pregnant women were asked to repeat the information they learned in their own words. The researchers asked questions and were open to receiving feedback as this encouraged the active participation of the pregnant women. After the completion of the session, Arabic brochures containing brief information that were presented during the training session and supplemented with colored pictures were distributed. This session lasted for about 30-45minutes.

Evaluation phase: This phase took place two weeks after the implementation phase to assess the three primary outcomes: pregnant women's knowledge about FMC, their compliance to FMC, and their levels of anxiety. This follow-up was done for the intervention and the control groups to examine the effect of the training session. The researchers conducted face to face interviews in instances where the pregnant women were still hospitalized and a telephone interview if the targeted pregnant women had been discharged from the hospital.

Data analysis

Collected data were organized, coded, and entered into a computer. The Statistical Package for Social Science version 20 was used for the statistical analysis of data. Data analysis was carried out using both descriptive and inferential statistics. The arithmetic mean and standard deviation were used for numerical variables to describe the central tendency of observations and to measure the dispersion of results around the mean. Qualitative variables were expressed as frequency and percentage. The significance of the difference between two means was examined using t-test, while the comparison of categorical variables was made using the chi-square [X^2] test. The P-values that were less than 0.05 were considered as significant and those less than 0.001 were considered as highly significant.

Results

As shown in table (1), 37.1% of the intervention group's age ranged between 25 to

<30 years as compared to 41.4% of the control group. Concerning the place of residence, 65.7% of the intervention group, as compared to 58.6% of the control group lived in rural areas. In relation to education, 57.1% of the intervention group, as compared to 58.5% of the control group had completed their secondary education. Regarding occupation, 82.9% of the intervention group, as compared to 81.4% of the control group, were housewives. There were no significant differences between the intervention group and the control group regarding all sociodemographic data (p> 0.05).

Regarding FMC history, table (2) shows that 55.7% of the intervention group, as compared to 61.4% of the control group, had previous knowledge about fetal movement count. In relation to the source of their knowledge, 53.8% of the intervention group, as compared to 55.8% of the control group, identified physicians as the source of their knowledge. Concerning performance of FMC, 85.7% of the intervention group, as compared to 84.3% of the control group, reported that they have never counted their fetal movements. In addition, 65.7% of the intervention group, as compared to 52.9% of the control group, reported that they did not know how to perform FMC, and this was the reason why they were not counting their fetal movements.

As shown in table (3), pre-intervention, 100.0% of both the intervention and control groups had poor level of knowledge about FMC, and there was no statistically significant difference between both groups in relation to levels of knowledge (P= 1.000). While post-intervention, the level of knowledge in the intervention group improved and 90.0% of the participants recorded high level of knowledge as compared to 100.0% of the participants in the control group, who still recorded poor level of knowledge. In addition, post-intervention, there was also a highly statistically significant difference between the intervention and the control group regarding the level of knowledge (p < 0.001).

Regarding compliance to FMC, table (4) shows that pre-intervention, only 14.3% of the intervention group, compared to 15.7% of control group, counted their fetal movement. Concerning the number of times that the participants counted fetal movements per week, 30.0% of the intervention group, compared to 36.4% of the control group, counted their fetal movements two times per week. However, no participant in both groups performed FMC regularly. Moreover, there were no statistically significant differences between the intervention and the control group in relation to all questions of compliance (P> 0.05).

However, post-intervention, 100.0% of the intervention group counted their fetal movements compared to 15.7% of the control group. Concerning times of fetal movements counting per week, 92.8% of the intervention group counted their fetal movements seven times per week as compared to 27.3% of the control group, who only counted the movements three times per week. In relation to regularity in performing FMC, 92.8% of the intervention group counted fetal movements regularly as compared to 0.0% of the control group. There were highly statistically significant differences between the intervention and the control group regarding all the questions of compliance (P < 0.001) (table, 4).

In relation to the level of anxiety, table (5) shows that pre-intervention, 51.4% of the intervention group had high level of anxiety as compared to 48.6% of the control group. However, post-intervention, 87.0% of the intervention group had low level of anxiety as compared to 62.9% of the control group that had high level of anxiety. Furthermore, post-intervention, the difference between the intervention and the control groups regarding the level of anxiety was highly statistically significant (p < 0.001).

Table 1. Comparison of the sociodemographic characteristics between the intervention group and the control group

	Intervention group		Control group		Chi square test	
	n	%	n	%	χ^2	p
Age in years						
20 – <25	17	24.3	12	17.1		
25 – <30	26	37.1	29	41.4		
30 – <35	19	27.1	22	31.4		
35 – 39	8	11.4	7	10.0	1.312	0.726
Mean ±SD	28.1 ±4.5		28.2 ±4.2		0.213*	0.831
Residence						
Urban	24	34.3	29	41.4		
Rural	46	65.7	41	58.6	0.759	0.384
Educational level						
Primary	11	15.8	13	18.6		
Secondary	40	57.1	41	58.5		
University	19	27.1	16	22.9	4.538	0.209
Occupation						
Housewife	58	82.9	57	81.4		
Working	12	17.1	13	18.6	0.049	0.825

** t value, Student's t test*

Table 2. Comparison of fetal movement count history between intervention group and control group

	Intervention group		Control group		Chi square test	
	n	%	n	%	χ^2	p
Do you have any knowledge about fetal movement count?						
No	31	44.3	27	38.6		
Yes	39	55.7	43	61.4	2.072	0.150
If yes, what is/ are the sources of your knowledge?*						
Mother	15	38.5	12	27.9		
Neighbors	11	28.2	7	16.3		
nurses	0	00	0	00		
Physician	21	53.8	24	55.8	0.519	0.771
Did you ever count your fetal movement before?						
No	60	85.7	59	84.3		
Yes	10	14.3	11	15.7	0.056	0.813
If no, what are the reasons that make you does not count it?*						
It is time consuming	20	28.6	25	35.7		
I did not know how to perform it	46	65.7	37	52.9		
I never hear about it	4	5.7	8	11.4	2.865	0.239

* Number is not mutually exclusive because some pregnant women reported multiple answers

Table 3. Comparison of the knowledge level between the intervention group and the control group pre and post-intervention

	Intervention group		Control group		Chi square test	
	n	%	n	%	χ^2	p
Pre-intervention						
Poor	70	100.0	70	100.0		
Acceptable	0	0.0	0	0.0		
High	0	0.0	0	0.0	0	1.000
Mean ±SD	5.3 ±1.6		5.8 ±1.7		1.592*	0.114
Post-intervention						
Poor	0	0.0	70	100.0		
Acceptable	7	10.0	0	0.0		
High	63	90.0	0	0.0	140.000	<0.001
Mean ±SD	18.1 ±1.2		6.1 ±1.1		2.635*	<0.001

** t value, Student's t test*

Table 4. Comparison of the compliance to fetal movement counting between the intervention group and the control group pre and post-intervention

	Intervention group		Control group		Chi square test	
	n	%	n	%	χ^2	p
Pre-intervention						
Did you count your fetal movements?						
No	60	85.7	59	84.3		
Yes	10	14.3	11	15.7	0	1.000
If yes, how many times in the last week?						
One time	0	0.0	5	45.4		
Two times	3	30.0	4	36.4		
Three times	7	70.0	2	18.2	4.418	0.110
Did you count fetal movements regularly?						
No	70	100.0	70	100.0		
Yes	0	0.0	0	0.0	0	1.000
Post- intervention						
Did you count your fetal movement?						
No	0	0.0	59	84.3		
Yes	70	100.0	11	15.7	101.975	<0.001
If yes, how many times in the last week?						
One time	0		1	9.0		
Two times	2	2.9	7	63.7		
Three times	3	4.3	3	27.3		
Seven times	65	92.8	0	0.0	81.000	<0.001
Did you count y fetal movement regularly?						
No	5	7.2	70	100.0		
Yes	65	92.8	0	0.0	140.000	<0.001

Table 5. Comparison of anxiety between the intervention group and the control group pre and post-intervention

	Intervention group		Control group		Chi square test	
	n	%	n	%	χ^2	p
Pre-intervention						
Low anxiety	0	0.0	1	1.4		
Moderate anxiety	34	48.6	35	50.0		
High anxiety	36	51.4	34	48.6	1.072	0.585
Mean ±SD	59.8 ±12.7		58.7 ±13.0		0.512*	0.610
Post-intervention						
Low anxiety	61	87.0	5	7.1		
Moderate anxiety	9	13.0	21	30.0		
High anxiety	0	0.0	44	62.9	121.333	<0.001
Mean ±SD	26.0 ±4.1		63.3 ±13.8		21.658*	<0.001

** t value, Student's t test*

Discussion

Fetal movements counting is inexpensive, reassuring, and a relatively easily taught skill. Therefore, all pregnant women can benefit from instruction on fetal activity assessment. This study aimed to examine the effect of an interactive training session regarding fetal movement counting on maternal outcomes among high-risk pregnant women. The findings of this study will be discussed in the frame of reference of the following hypotheses: H.1. High-risk pregnant women who participate in interactive training session regarding fetal movements counting will have a high mean knowledge score compared to those in the control group; H.2. High-risk pregnant women who participate in interactive training session regarding fetal movements counting will exhibit more compliance to FMC compared to those in the control group; and H.3. High-risk pregnant women who participate in the interactive training session regarding fetal movements counting will exhibit low anxiety levels compared to those in the control group.

Regarding FMC history, the findings of the current study revealed that less than two-thirds of the intervention and control group participants reported that they had previous knowledge about FMC. In spite of this finding, when the pregnant women were subjected to a pre-test, all of them gave wrong answers. This resulted in poor knowledge scores. This finding

highlights the lack of health literacy among the participants. Most women had only heard about FMC, but they did not have enough and accurate knowledge about it. These findings are corroborated by the findings of **Olagbuji et al. (2014),** who conducted a study to determine maternal knowledge, behavior, and concerns about abnormal fetal movement. Their findings revealed that majority of the mothers (87.6%) had no knowledge on the normal parameters of fetal movements. In addition, **Prabavathy and Dash (2017)** conducted a study to assess pregnant mothers' levels of knowledge about fetal movements count. Their findings revealed that 50% of the subjects had poor knowledge about fetal movements count and only 13.3% of them had good knowledge.

In relation to source of knowledge, more than one-half of the participants in both the intervention and control groups reported physicians as the main source of their knowledge about FMC, while 38.5% of the intervention group, as compared to 27.9% of the control group, reported that mothers were the lead source of their knowledge. On the other hand, no one in both groups reported nurses as the source of their knowledge, which is alarming and could possibly be explained by the work overload experienced by nurses, shortage in nursing staff, and the absence of teaching facilities such as teaching classes, materials, and the most important is the human resources. However, **Olagbuji et al. (2014)** in their study reported that the main sources of women' information about fetal movement were doctors (53.3%), nurses (46.2%) and family members or friends (18.2%).

Regarding the level of knowledge about FMC, the current study revealed that pre-intervention, there was no statistically significant difference between the intervention and the control group in relation to the levels of knowledge (P= 1.000) because all the participants in both groups had poor levels of knowledge. However, post-intervention, the level of knowledge in the intervention group dramatically improved as the majority of the participants now had high levels of knowledge. On the other hand, all the participants in the control group still recorded poor knowledge levels. Therefore, the difference between both groups was highly statistically significant ($p < 0.001$). These findings may be explained by the absence of the role of nurses as educators as no participant reported that nurses were the source of their knowledge. As well as, the absence of maternal health teaching classes can also be another contributing factor. These findings highlight the effectiveness of the training session and the teaching material administered to the participants in this study.

These findings are in line with **Khalil and Shahin's (2020)** findings. Their study reported that pre-intervention, majority of the sample (90.0%) had wrong knowledge, while post-intervention, majority of them (96.6%) had good knowledge and the difference was highly statistically significant ($p < 0.001$). **El-Sayed et al. (2018)** also conducted a study aimed at examining the effect of women monitoring fetal movement on improving their health status. Their findings revealed that the mean score of knowledge about fetal movement improved from 20.14± 0.512 pre-intervention to 39.86± 0.550 post-intervention and the difference was highly statistically significant (P=0.001). Another study conducted by **Ahmed (2016)** to examine the effect of counseling intervention on women's knowledge, practices, and fetal well-being among primigravidas. He reported that pre-intervention, majority of the sample (94.0%) have unsatisfactory knowledge about fetal movement compared to 100% of them who have satisfactory knowledge post-intervention.

Regarding compliance to FMC, the current study revealed that pre-intervention, only more than one-tenth of both groups counted fetal movements (14.3% and 15.7% of the intervention and control groups, respectively) and no one in both groups did it regularly. However, post-intervention, all the participants in the intervention group counted their fetal movements compared to more than one-tenth (15.7%) of the control group. In relation to regularity in FMC, majority of the participants in the intervention group (92.8%) counted fetal movements regularly compared to no one in the control group. Furthermore, there were statistically significant differences between the intervention and the control group regarding all questions of compliance post-intervention ($P < 0.001$).

This is a logic finding because pre-intervention, two-thirds of the intervention group and more than one-half of the control group indicated that lack of knowledge on how to perform FMC was the reason why they were not counting their fetal movements. Therefore, the level of knowledge of both groups was poor. However, post-intervention, the level of knowledge of the intervention group improved as the training session and the brochures distributed to the pregnant women included information about fetal activity, the importance of FMC, and how to perform it. When pregnant women are equipped with the necessary information about specific health behavior and appreciate its significance, they feel more empowered, more self-confident, and more enthusiastic to use the knowledge they gain and carry out that behavior. This explains the increase in FMC compliance recorded in this study.

The current study had a compliance rate similar to those reported by other studies such as **Khalil and Shahin (2020).** In their study, **Khalil and Shahin** found an improvement in the recording of daily fetal movements in a FMC chart after intervention. According to their findings, pre-intervention, only 1.3% of the sample performed daily fetal movement count and post-intervention, the percentage increased to 96.7% ($p < 0.001$). **Akselsson et al. (2017)** also conducted a study to explore women's attitudes, experiences, and compliance in using Mindfetalness. Their findings revealed that post-intervention, compliance was high as three-quarters of the women (75%) used the method daily.

In relation to the level of anxiety, the findings of the current study revealed that pre-intervention, around one-half of both the intervention and control groups reported high levels of anxiety. However post-intervention, a high percentage of the intervention group (87.0%) reported low levels of anxiety as compared to two-thirds of the control group (62.9%) who still reported high levels of anxiety, and the difference was highly statistically significant ($p < 0.001$). These findings can be explained by the improved level of knowledge and the higher compliance rate obtained post-intervention. Knowledge decreases stress, anxiety, and fear of the unknown. Furthermore, compliance to FMC enhances maternal-fetal attachment, is associated with positive emotions, and it reassures mothers about the well-being of their fetus, which in turn decreases the level of anxiety. This explanation is supported by **Saastad et al. (2012),** who reported that women who have less emotional connection with their babies show less healthy behaviors and higher levels of anxiety and depression and these problems can lead to pregnancy complications.

These findings are congruent with the finding of **El-Sayed et al. (2018),** who reported that pre-intervention, there was no significant difference between the intervention and control groups in relation to the score of anxiety ($p= 0.957$), while post-intervention, the difference between the two groups was significant ($p= 0.048$). Moreover, **Delaram and Shams (2016)** reported that pre-intervention, there was no significant difference in the mean anxiety scores between the intervention and the control groups, while post-intervention, the difference was highly significant ($P < 0.001$). **Delaram et al. (2015)** also studied the effects of fetal movement counting on mothers' mental health. Their findings revealed that after fetal movements counting, the general health of mothers improved in the intervention group, but no improvement was recorded in the control group.

Conclusion

The current study concludes that post-intervention, there is a highly statistically significant difference between the intervention and the control groups regarding the level of knowledge ($p < 0.001$), compliance to FMC ($P < 0.001$), and the level of anxiety ($p < 0.001$). Therefore, the main hypothesis and the sub-hypotheses of the current study were accepted.

Recommendations

Based on the findings of this study, the following are recommended:

- To improve their health literacy, high-risk pregnant women should be provided with adequate health information regarding FMC through effective instructions.

- Constant encouragement by health care professionals is crucial to maintain high-risk pregnant women's compliance to FMC to ensure that any fetal abnormalities are detected early enough.
- Nurses should be encouraged to take an active role in conducting health education sessions for high-risk pregnant women.
- Further studies are necessary and should be conducted to explore factors affecting compliance to FMC.
- Further studies are necessary and should be conducted to explore factors that hinder nurses' roles as educators.
- Replication of such study on a large sample and at other different settings is necessary.

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