International Journal of Nursing, Midwife and Clinical Practices, Volume 13 (1), 2025 | ISSN: 3068-904X

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HEART TO HEART: STRENGTHENING EMOTIONAL BONDS BETWEEN MOTHER AND UNBORN CHILD

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DOI: https://doi.org/10.5281/zenodo.17100660

Abstract: Attachment during pregnancy is a vital component of maternal-fetal bonding, influencing the long-term development of both the mother and the unborn child. This emotional connection, beginning before conception and continuing throughout pregnancy, profoundly impacts the physical, emotional, and cognitive well-being of the infant. Maternal-fetal attachment is characterized by various maternal behaviors that reflect the emotional bond with the fetus. These behaviors encompass aspects of self-care such as proper nutrition, adequate sleep, and physical exercise, as well as abstaining from harmful substances like alcohol and drugs. Furthermore, maternal-fetal attachment fosters the mother's desire to connect with and understand her unborn child. This emotional connection is not only instrumental in ensuring a favorable pregnancy outcome but also in promoting the health of both mother and neonate. In this paper, we explore the significance of maternal-fetal attachment and its multifaceted role in prenatal care.

Keywords: Maternal-fetal attachment, prenatal bonding, pregnancy health, maternal behaviors, neonatal health.

Introduction

Attachment is a stable emotional bond between two individuals **(McNamara, 2019).** Motherhood starts before conception. A woman is given the trust by God obliged to take care of and pay attention to the health and development of the fetus in her womb. It is necessary because it is a critical period for physical, emotional and mental development of the infants where the closeness of the relationship between the baby and the mother began to form with the consequences that will give long impact especially with regard to the ability and intelligence of the baby in the womb or called prenatal **(Laufer-Ukeles et al., 2018).**

Maternal fetal attachment involves behaviors and actions that indicate the mother's emotional bond with the fetus. These behaviors cause the early start and continuation of parental care, proper nutrition, sleep and exercise, abstinence from alcohol and drugs, and the desire to get to know the fetus during pregnancy, which ultimately

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result in a desirable pregnancy outcome and promote maternal and neonatal health **(Heidary & Akbarzadeh 2019).**

These behaviors also play a key role in parental identity formation, the future relationship between the mother and the neonate, and the infant's growth and development **(McLean et al, 2018).** A wide range of attachment behaviors emerge during pregnancy, such as talking to the fetus and touching and caressing the belly. This attachment may begin with pregnancy or during the first ultrasound or when feeling the first movement of the fetus and improve gradually with gestational age and with the increase in fetal movements **(Mountain et al, 2017).**

Maternal fetal attachment plays a key role in both the maternal and fetal health**.** Prolongs the pregnancy, and affects the child's future social-emotional and cognitive relationships **(Korja et al., 2017).** Women who experience higher levels of maternal fetal attachment present better self-care behaviors during pregnancy and perform better health practices. In contrast, women with low attachment levels are more likely to give birth to babies with poor health conditions due to their lower compliance with health practices during pregnancy **(Meighan, 2017).**

Various factors affect maternal fetal attachment, such as communication within the family, pregnancy acceptance and support, the mother's mental self-image, a previous history of pregnancy, obstetric and medical complications during pregnancy and the pregnancy being unwanted **(Wonch Hill et al., 2017).** Increasing maternal fetal attachment encourages the mother to perform healthy behaviors during pregnancy, such as smoking withdrawal, proper nutrition, exercise, ongoing pregnancy care, education about the fetus, and participation in childbirth preparation classes, which cause a satisfactory pregnancy outcome and promote the mother's and child's health **(Eichler et al., 2019)**

The prenatal period is a proper chance for evaluating maternal fetal attachment. Since all of the mother's behaviors, actions and thoughts during pregnancy could have more permanent effects on the fetus than any other period of child's life and also since pregnancy is considered a critical period in the development. So, the researcher decides to carry out this study.

Aim of the study:

This study aims to evaluate the effect of training attachment behavior on the relationship between a pregnant woman and her fetus.

Research hypothesis:

Pregnant women who receive training on behavior attachment with their fetus will significantly exhibit higher degree of their maternal fetal attachment.

Subjects and Method

Study design: A quasi-experimental design was used.

Study setting: This study was conducted at Antenatal Clinics of Al-Azhar University Hospital in New Damietta City, Damietta Governorate, Egypt. The setting consists of one flour divided into five parts; reception part, sonar partition, examination section, antenatal care instrument department and room for the nursing staff. The antenatal

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clinic is opened daily from Saturday to Thursday from 9 am to 12 pm, the care was provided by two nurses and 5 obstetricians (consultant, specialist assistant, specialist, and two juniors). There are between 70-50 follow up cases weekly and 5-7 new cases each day.

Sample type: A purposive sample was used in this study.

Study sample: The study sample included 100 pregnant women attended and booked in the previous mentioned setting based on the following criteria: **Inclusion criteria:**

- Women at 30th week gestation.
- Singleton pregnancy.
- Regular follows schedule of antenatal visits.
- Able to read and write.

Exclusion criteria:

- Women with multifetal pregnancy.
- Fetal malformation and history of mental illness.

Sample size calculation:

Based on data from literature **Baghdari et al, (2016)** considering level of significance of 5%, and power of study of 80%, and assuming that the difference of 5 between the mean scores after training is satisfactory, the sample size can be calculated using the following formula:

$n = [(Z\alpha/2 + Z\beta)2 \times \{2(SD)2\}]/ (\text{mean difference between the two groups})2$

where SD = standard deviation

$Z\alpha/2$: This depends on level of significance, for 5% this is 1.96

$Z\beta$: This depends on power, for 80% this is 0.84 Therefore, $n= [(1.96 + 0.84)2 \times \{2(8.12)2\}]/ (3.21)2 =100.3$

Based on the above formula, the sample size required 100 pregnant women.

Tools of data collection: Three tools were used to collect the data

Tool I: A Structure Interview Questionnaire: It was designed by the researcher in Arabic form after reviewing the related literature, it consisted of three parts. **Part I:** It aimed to assess women's demographic characteristics such as age, educational level, occupation…. etc. **Part II:** It aimed to assess women's obstetric history such as, parity, number of abortions or number of baby loss …. etc. **Part III:** It aimed to assess common factors affecting maternal fetal attachment such as health related problems, number of children and desire of pregnancy …. etc.

Tool II: Cranley's Maternal Fetal Attachment Scale (CMFAS): It was adopted from **Cranley (1981)** to measure the extent to which the mother to be is engaged in a behavior which is expressing a sense of belonging and interaction with the development of pregnancy. It is composed of 24 items and each item is scored by a five-point Likert scale ranging from 1 (definitely no) to 5(definitely yes). The total score is between 24 to 120, with the higher scores showing more attachment.

Tool III: The Fetal Position Awareness scale (FPAS): It was adopted from **Nishikawa & Sakakibara (2013)** to measure to what degree expectant mothers perceive the fetus position in the uterus. It is composed of 6 item scale with 5 Likert-type responses, for each item 5 point are given for (always), 4 points for (frequently), 3 points

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for (sometimes), 2 points (occasionally) and 1 point for (almost never). The total score is between 6 and 30, with the higher scores showing more attachment.

Validity of tools:

Tools were revised by a jury of five professors specialized in woman's health and midwifery nursing field to test the validity of the content to ensure that the tools were conveying the intentional meaning and the recommended adjustments and modulation were considered according to their remarks and comments.

Reliability of tools:

The reliability of tool II was adopted from **Cranley (1981)** reliability it was (0.84). Reliability of tool III was adopted from **Nishikawa & Sakakibara (2013)** it was (0.797). Therefore, the tools were reliable.

Pilot study:

A Pilot study was carried out before performing the actual study. The training and the booklet on prenatal attachment were applied on 10 % of the study sample (10 pregnant women). The pilot was done to assess the study tools in terms of clarity and feasibility, and the time required to be applied and to discover possible obstacles that could appear to the researcher and hinder data collection. There was no modification done on the study tool after pilot study, the participants who included in the pilot study were excluded. According to the analysis of the pilot study the time required for each woman was about 25- 35 minutes.

Ethical Considerations:

The study was approved by head of woman's health and midwifery department at faculty of nursing. As well as an informed consent was obtained from the women who participated in the study. The participants were ensured about the privacy and the information's confidentiality. They also informed about their rights to refuse or withdraw at any time from the study and the study maneuvers couldn't entail any harm to the participants.

Procedure of data collection:

The study conducted for 10 months period started on October 2018 till end of July 2019.The data were collected through four phases:

1) **Preparatory phase:** In the preparatory phase, the relevant literature related to the study was collected, the tools were designed, Official permissions to carry out the study was obtained from the head of Obstetrics and Gynecology Department as well as the director of the antenatal clinics of Al-Azhar University Hospital (appendix) and finally the pilot study was conducted to assess applicability of the study tools.

2) **Planning and designing phase**: Training protocol (appendix II): The consistency of implementing the training was assured by the training protocol designed by the researcher as guiding to the content and process of the training. This protocol outlined the duration, the training behaviors, and objectives from this training.

- Development of training on maternal fetal attachment behavior: Practical and educational intervention regarding active communication to the fetus e.g. listening to Quran, counting fetal movement, palpating the abdomen and positive imagination to the fetus was prepared based on the review of literature.
- Designing Maternal Fetal Attachment behavior booklet (appendix III): A colored booklet of MFA behavior was prepared by the researcher in a simple Arabic language after extensive reviewing of textbooks and

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validated international websites to obtain the knowledge about behaviors affecting attachment between the pregnant woman and her fetus.

3) **Implementation phase:** First (Initial baseline assessment):

❖ The researcher attended the antenatal clinic at Al-Azhar University Hospital three days /week from 9 Am to 12 Pm until the sample size was completed and checked the registered book to identify the pregnant women who met the inclusion criteria.

❖ Then the researcher met the potential participants individually after receiving their routine antenatal care and invited them to participate the study and informed them about the purpose of the study and the time required for participation.

❖ After their agreements to participate, the researcher explained and provided the tools which include the interview questionnaire (tool I and the (CMFAS (II,) FPAS (III they were asked to answer the tools and the researcher filled in and completed them, as an initial baseline assessment.

❖ Then the researcher asked woman to take a break 30 m for toilet, rest, drinking some juice.

• Second, they are asked woman to Join M FAB Training: The researcher provided the MFAB booklet (the supportive material) to the participants and discussed the booklet content and answered the questions individually. After that the participants trained and practiced those behaviors:

• Listening to Quran sound (recited by abdulbasit through mobile phone)

• Practicing the abdominal palpation to perceive fetal position

• Practicing imagining breastfeeding the baby, caring, positive imaging of fetus appearance.

• Counting fetal movement. Immediately after that, the women' attachment regarding their fetuses was reassessed via CMFAS and FPAS (post intervention1). Then the researcher provided the participants her contact information and asked them for their phone number. The researcher informed the participants that contact information would be used to contact with her on a private group at what's up application to remind them of date, place, and time of antenatal visit for collecting follow up post intervention data and for sending videos materials translated into Arabic related to behaviors and benefits of maternal fetal attachment.

• Follow up phase: At the next antenatal visits, after two weeks from enrolment in the study, according to the participant schedule. The researcher reassessed the women' attachment to their fetuses was reassessed via CMFAS and FPAS (post intervention 2) the objective of that re-assessment was to follow up the relationship between the pregnant women and their fetus based on the conducted training behaviors.

• The post intervention 3 conducted after 4 weeks from the enrollment to the study scheduled at the time of the participant's routine antenatal visit. The objective of this was to reassess women's attachment to their fetuses by using the same tools used pre the training intervention.

Statistical Analysis

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). All continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in number and percentage. The comparisons were determined using Student's t test for two

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variables with continuous data and ANOVA test for more than two variables with continuous data. Chi-square test was used for comparison of variables with categorical data. Cronbach's alpha test was performed to test for the internal consistency of the tools used in the study. Statistical significance was set at $p<0.05$.

Result

Table 1: Distribution of the studied sample according to their Socio-Demographic Characteristics(n=100).

Variables	No.	%
Age		
18 < 23	29	29.0
24 < 30	46	46.0
30 < 35	22	22.0
<=35	3	3.0
Mean ±SD	26.4 ±4.8	
Duration of marriage		
<1 year	25	25.0
1 – 5 years	52	52.0
6 – 10 years	17	17.0
>10 years	6	6.0
Educational level		
Read and write	9	9.0
Primary education	14	14.0
Secondary education	23	23.0
University education	49	49.0
Postgraduate education	5	5.0
Work status		
Housewife	71	71.0
Professional	11	11.0
Managerial and Semi-Professional	16	16.0
Skilled (technician)	2	2.0
Residence		
Rural	46	46.0
Urban	54	54.0
Income		
Not enough	29	29.0
Enough	67	67.0
Enough and saves	4	4.0

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Table 1 shows distribution of studied sample according to socio-demographic characteristics. It was shown that less than half (46%) of them aged between 24 <30 years old; with a mean age 26.4 ±4.8. More than half (52%) of them got married for 1 to 5 years. About (49%) of them graduated from universities. More than two thirds (71%) of the studied sample were housewives, more than half (54%) of them were residents from urban areas and more than two thirds (67%) of them had enough income.

Table 2: Distribution of the studied sample according to their reproductive history (n=100).

Variables	No.	%
Gravida		
Primi	26	26.0
Multi	74	74.0
Mode of conception		
Natural	80	80.0
Assisted	20	20.0
Cause of infertility in assisted pregnancy (n=20)		
Male	5	25.0
Female	9	45.0
Both	3	15.0
Unexplained	3	15.0
Birth before 7th month		
No	97	97.0
Yes	3	3.0
Previous Fetal loss		
No	78	78.0
Yes	22	22.0
Causes of fetal loss (n=22)		
Abortion	18	81.8
Intrauterine death	2	9.1
Neonatal death (still birth)	2	9.1
History of low birth weight		
Never	97	97.0
Once	3	3.0

Table 2 shows distribution of the studied sample according to their reproductive history. It was found that (74.0%) of them had multi-gravid, (80%) of them use natural mode of conception. Additionally, (45%) of causes of infertility in assisted pregnancy were related to females, (97%) of those sample never had birth before 7th month and never had history of low birth weight.

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Table 3: Comparison of the Cranley's Maternal-Fetal Attachment (CMFA) Scale Domains of studied sample along the study (n=100).

Variables	30 weeks Pre-training	30 weeks Immediately post-training	32th week post-training	34th week post-training	ANOVA test	
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	F	P value
Differentiation self from the fetus	16.26 ±2.36	16.94 ±2.01	17.48 ±1.69	17.52 ±1.55	9.326	<0.001**
Role taking	13.96 ±3.14	16.82 ±1.89	18.34 ±1.72	18.53 ±1.61	93.846	<0.001**
Interaction with fetus	12.48 ±4.05	16.21 ±2.74	18.01 ±2.53	18.39 ±2.65	78.128	<0.001**
Attributing characteristics with fetus	17.12 ±4.37	20.91 ±3.03	23.49 ±2.56	23.69 ±2.58	90.284	<0.001**
Giving of self	19.77 ±2.18	20.33 ±2.05	20.94 ±1.60	21.09 ±1.72	10.135	<0.001**
Total score	79.6 ±11.9	91.2 ±8.4	98.3 ±7.5	99.2 ±7.3	101.747	<0.001**

Table 3 shows comparison of the Canley's Maternal-Fetal Attachment (CMFA) scale domains along the studied sample. It was found that there was a highly statistically significant differences regarding differentiation self from the fetus, role taking, interaction with fetus, attributing characteristics with fetus, giving of self, and their total score (P <0.001**). The highest Means ±SDs were found in the 34th week post-training.

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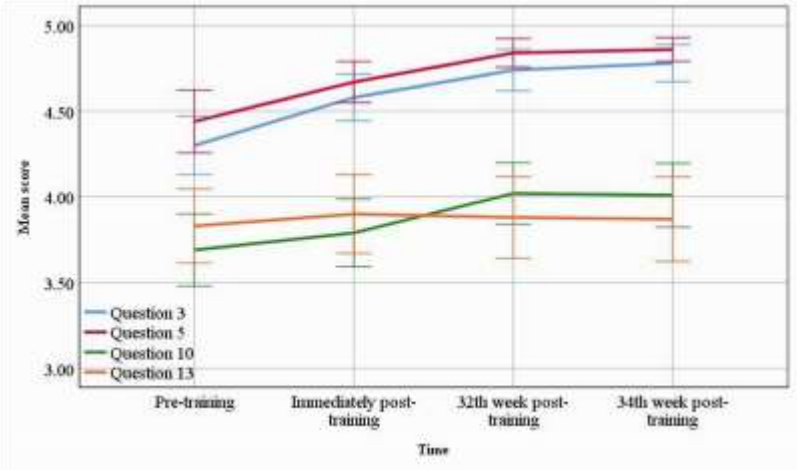

Figure 1 Comparison between Means of the Cranley's Maternal-Fetal Attachment (CMFA) Scale regarding Differentiation of self Domains from the fetus along the study (n=100).

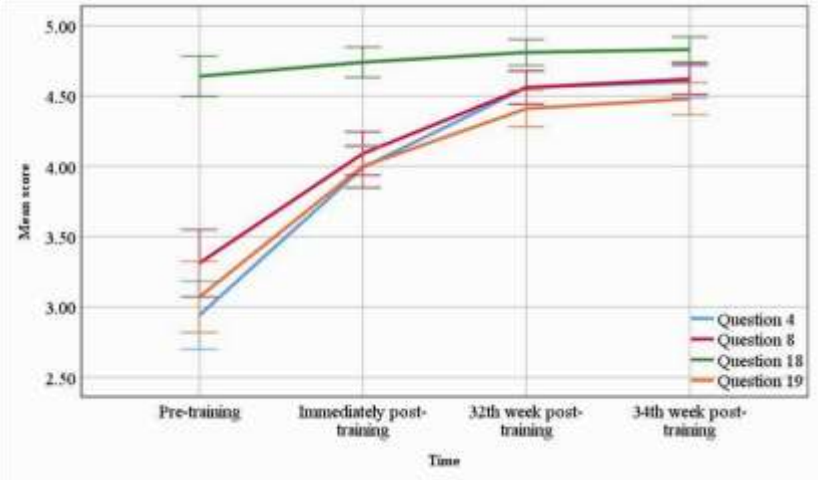

Figure 2 Comparison between Means of the Cranley's Maternal-Fetal Attachment (CMFA) Scale regarding Role taking Domain along the study (n=100).

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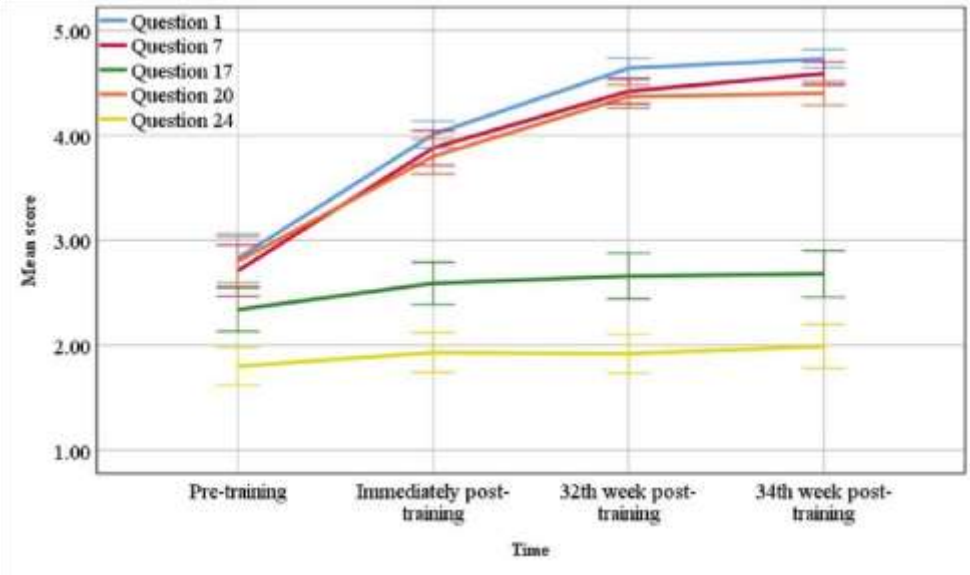

Figure 3 Comparison between Means of the Cranley's Maternal-Fetal Attachment (CMFA) Scale regarding the interaction with fetus Domain along the study (n=100).

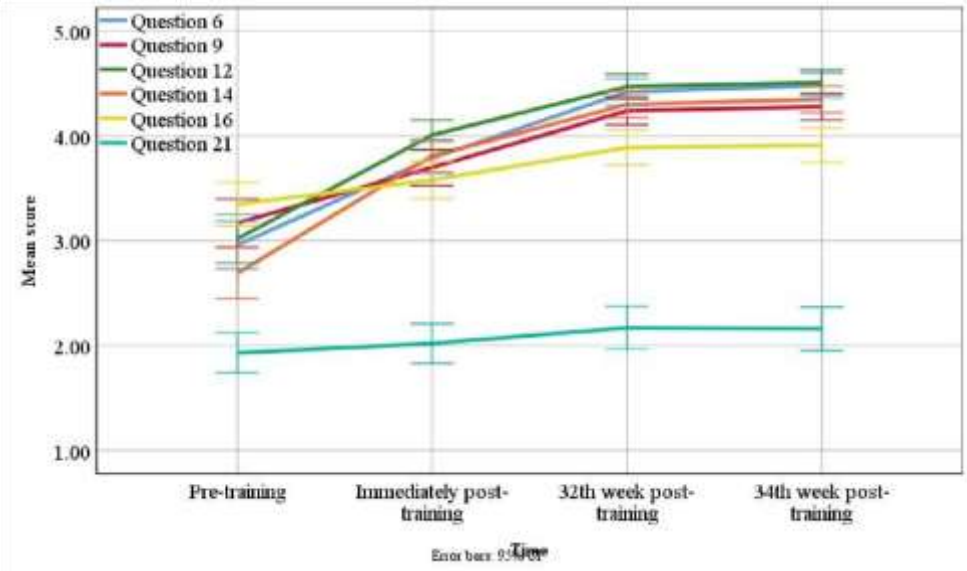

Figure 4 Comparison between Means of the Cranley's Maternal-Fetal Attachment (CMFA) Scale regarding the Attributing characteristics with fetus Domain along the study (n=100).

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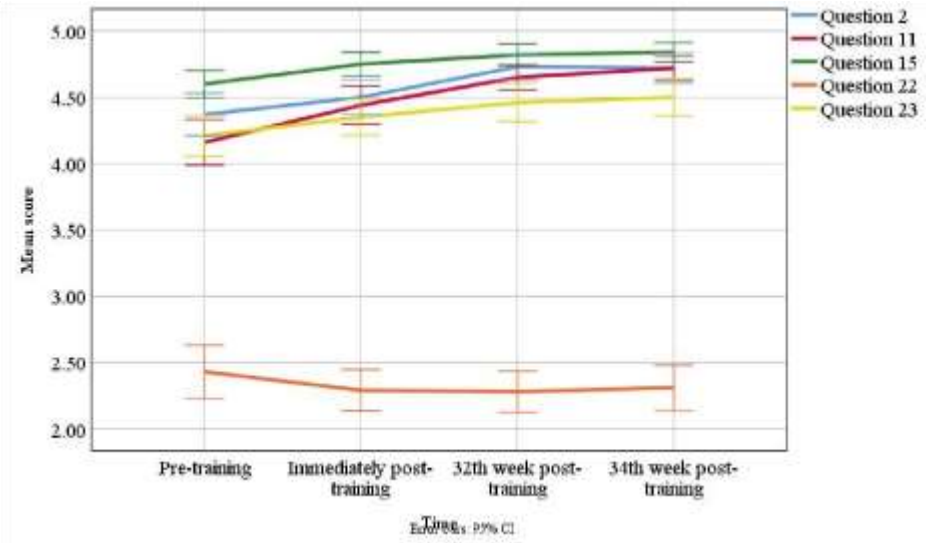

Figure 5 Comparison between Means of the Cranley's Maternal-Fetal Attachment (CMFA) Scale regarding the Giving of self-Domain along the study (n=100).

Table 4 Comparison of the Fetal Position Awareness Score (FPAS) of the studied sample along the study (n=100).

Variables	Pretraining	Immediately post training	32th week post training	34th week post training	One-way ANOVA test	
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	F	P value
I perceive that the fetus is moving his\her legs.	1.8 ±1.2	2.8 ±1.0	3.1 ±0.9	3.2 ±0.9	28.595	<0.001**
I perceive that the fetus is moving his\her hands.	2.0 ±1.2	2.8 ±1.0	3.1 ±0.9	3.2 ±0.9	28.595	<0.001**
When I touch the abdomen with my hands, I perceive the position of the back of the fetus.	1.8 ±1.1	2.5 ±1.1	2.7 ±1.1	2.8 ±1.1	15.734	<0.001**
When the fetus moves, I softly touch my abdomen.	3.6 ±1.0	4.0 ±0.7	4.1 ±0.6	4.1 ±0.6	12.698	<0.001**
I imagine the fetus' character from his/her movement	2.5 ±1.4	3.2 ±1.0	3.3 ±0.9	3.4 ±0.9	14.078	<0.001**

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I can depict the appearance of the fetus	1.6 ±1.1	2.7±1.0	2.8 ±1.0	2.8 ±1.0	35.353	<0.001**
Total FPAS score	13.4 ±4.7	18.1 ±3.5	19.0 ±3.7	19.4±3.8	48.958	<0.001**

Table 4 reveals that there was a highly statistically significant differences were found among all its items and their total score (P<0.001**). The highest Mean ±SD for all domains' items was found in the 34th week post training period.

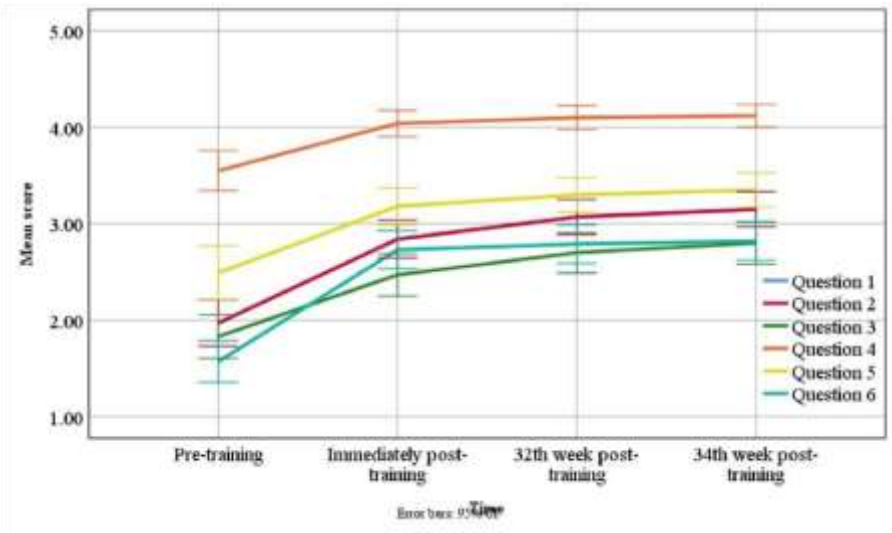

Figure (6) Comparison of the Fetal Position Awareness Score (FPAS) of the studied sample along the study (n=100).

Table 5: Relationship between Means of CMFAS and FPAS Scores of the studied sample regarding previous fetal loss

Variables	**Fetal loss**		**Student's t test**	
	No	**Yes**	**t**	**P**
	Pre-training			
Total CMFAS score (Mean ±SD)	76.64 ±10.17	90.05 ±11.46	5.309	<0.001**
Total FPAS score (Mean ±SD)	12.73 ±3.95	15.68 ±5.01	2.913	0.004**
	Immediately post-t raining			
Total CMFAS score (Mean ±SD)	89.08 ±7.33	98.77 ±7.58	5.441	<0.001**

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Total FPAS score (Mean ±SD)	17.63 ±2.85	19.77 ±3.72	2.906	0.005**
32th week post-training				
Total CMFAS score (Mean ±SD)	96.58 ±6.96	104.23 ±6.30	4.643	<0.001**
Total FPAS score (Mean ±SD)	18.42 ±2.99	21.18 ±2.97	3.826	<0.001**
34th week post-training				
Total CMFAS score (Mean ±SD)	97.72 ±6.32	104.55 ±5.89	4.542	<0.001**
Total FPAS score (Mean ±SD)	18.78 ±3.34	21.55 ±3.65	3.355	<0.001**

Table 5illustrates a relationship between means of CMFAS and FPAS scores of the studied sample regarding previous fetal loss. Statistically significant differences were found between the two variables (P< 0.005). The highest mean of CMFAS was during the 34th week post-training and scored 104.55 ±5.89. Similarly, was the FPAS score during this period, as it scored; 21.55 ±3.65 for the previous fetal loss.

Table 6 Relation between Means of CMFAS and FPAS Scores of the studied sample regarding Support Provider (n=100).

Variables	**Support provider**					**ANOVA test**	
	None	**Parents**	**Husband**	**Friends**	**All of the above**	**F**	**P value**
	(Mean ±SD)	**(Mean ±SD)**	**(Mean ±SD)**	**(Mean ±SD)**	**(Mean ±SD)**		
P re-training							
Total CMFAS score (Mean ±SD)	77.75 ±10.72	74.97 ±9.65	84.00±11.53	74.00 ±4.24	79.79 ±13.27	2.918	0.025*
Total FPAS score	11.75 ±1.26	11.90 ±3.89	14.50 ±4.47	8.50 ±0.70	14.04 ±4.51	2.594	0.041*
(Mean ±SD)							
Immediate post-training							
Total CMFAS score (Mean ±SD)	90.50 ±9.88	88.80 ±7.27	94.53 ±8.49	86.50 ±6.36	89.20 ±8.12	2.899	0.026*
Total FPAS score (Mean ±SD)	15.25 ±2.63	16.97 ±3.10	19.25 ±2.95	17.00 ±2.83	18.17 ±3.10	3.458	0.011*
32w post-training							

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Total CMFAS score (Mean ±SD)	96.75 ±9.36	95.83 ±7.12	101.43±6.97	94.50 ±2.12	96.58 ±7.39	3.315	0.014*
Total FPAS score (Mean ±SD)	19.75 ±2.22	17.50 ±3.07	20.20 ±3.03	18.50 ±0.71	18.92 ±3.16	3.464	0.011*
34w post-training							
Total CMFAS score (Mean ±SD)	99.50 ±4.93	96.70 ±6.40	102.13±6.45	95.50±0.70	97.79 ±6.95	3.598	0.009*
Total FPAS score (Mean ±SD)	19.75 ±2.22	18.37 ±3.41	20.73 ±3.74	19.50 ±0.71	18.38 ±3.27	2.657	0.038*

Table 6 shows a relation between means of CMFAS and FPAS scores of the studied sample regarding support provider. It's determined that there are statistically significant differences between the two variables regarding the support provider either the women's parents, husbands, or their friends (P> 0.041*) along the study

Table 7 Relation between Means of CMFAS Score and FPAS Score of the studied sample regarding Strong Attachment to Mother (n=100).

Variables	**Strong attachment to mother**		**Student's t test**	
	No	**Yes**	**t**	**P value**
Pre-training				
Total CMFAS score (Mean ±SD)	75.10 ±10.79	81.51 ±11.77	2.558	0.012*
Total FPAS score (Mean ±SD)	11.90 ±4.04	14.01 ±4.36	2.272	0.025*
Immediately pos t-training				
Total CMFAS score (Mean ±SD)	88.30 ±8.43	92.46 ±8.10	2.323	0.022*
Total FPAS score (Mean ±SD)	17.20 ±3.13	18.49 ±3.13	1.882	0.063
32w post-training				
Total CMFAS score (Mean ±SD)	95.23 ±7.52	99.56 ±7.16	2.726	0.008*
Total FPAS score (Mean ±SD)	18.10 ±2.06	19.43 ±3.50	1.937	0.056
34w post-training				
Total CMFAS score (Mean ±SD)	96.97 ±5.48	100.19 ±7.13	2.206	0.030*

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Total FPAS score (Mean ±SD)	18.17 ±2.70	19.91 ±3.80	2.281	0.025*

Table 7 clarifies a relation between means of CMFAS and FPAS scores of the studied sample regarding strong attachment to mother. Statistically significant differences were found concerning the two variables except in the FPAS score in the immediate post-training and the 32th week post-training periods (P= 0.063 & 0.056 respectively).

Discussion

The aim of the present study was to evaluate the effect of training attachment behavior on the relationship between pregnant woman and fetus. Findings of the current study revealed that presence of statistically significant differences between the studied group as, the level of maternal fetal attachment parameters in each time point (first, second & third assessment) post intervention during their third trimester were higher in favor of practicing the training behaviors compared to the pre assessment. Also, there was a statistically significant difference along the group as fetal awareness position was improved in favor of practicing the training behaviors. Results of the present study support the research hypothesis pregnant women who receive training on behavior attachment with their fetus would significantly exhibit higher degree of their maternal fetal attachment. It has been assumed that engagement in attachment behaviors raises maternal awareness toward the health of the unborn baby, and therefore influences bonding positively.

Regarding attachment behaviors, the present study showed that engagement with active communication to the fetus e.g. listening to Quran, counting fetal movement, palpating the abdomen and positive imagination to the fetus were protective factor for bonding during pregnancy. A plausible explanation for this finding is that while focusing on these behaviors, the baby becomes more real and maternal awareness of the baby's health is raised, which is thought to positively influence bonding.

The current study findings were similar to previous studies done by **Ekrami et al., (2020)** who study effect of counseling on maternal fetal attachment in women with unplanned pregnancy and **Kordi et al., (2016)** who study effect of guided imagery on maternal fetal attachment in nulliparous women with unplanned pregnancy, as they revealed that the maternal fetal attachment score of pregnant women who had low initial MFA increased significantly after weeks following the training intervention.

Moreover, the present study findings were in agreement with **KIRCA (2017)** who study maternal attachment during antenatal and postpartum period and reported that the pregnant women trained during antenatal period got closer to their infant and had more positive behaviors towards them in the birth and postpartum period. Also, a study done by **Suciati (2015)** about the impact of prenatal education through stimulating Quran' s recitation on child's growth in Indonesia showed that pregnant women who read, recite or listen to the Quran can give good impact to the fetus or baby in their wombs. It does not just influence the baby's Intelligence Quotient (IQ) and Emotional Quotient (EQ), but it also gives Spiritual Quotient (SQ) to the baby.

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Furthermore, the current study results were supported by **Güney &Uçar (2019)** they study the effect of the fetal movement count on maternal fetal attachment in the east of Turkey and reported that fetal movement counting positively affected maternal fetal attachment. Since the fetal movements are regularly counted, they might provide pregnant women with an opportunity to extend the amount of time spent thinking about their fetus and talking and touching it.

Moreover, in another study conducted by **Mehran et al. (2013)** on history of perinatal loss and maternal fetal attachment behaviors reported the fact that pregnant women touch their abdomen while counting fetal movements might increase their sensitivity and sensibility toward the fetus and develop intimacy with the fetus. Therefore, fetal movement counting might enhance the quality of attachment. It was stated that the pregnant women with a high level of maternal fetal attachment were sensitive to the fetal movements and used the movements to communicate with their baby.

While the present study findings were in disagreement with **Saastad et al., (2011)** who study fetal movement counting effects on maternal fetal attachment they found no effects on prenatal bonding. Also, another study done by (**Saastad & Froen, 2012)** they reported that the women who counted the fetal movements in the third trimester have fewer concerns than the control group. The disagreement between study's findings may be due to differences in demographic characteristics, timing of measurements, and the health care settings

Regard to the pregnant mothers' reproductive history, it was found that about three quarters of sample had multi-gravid, the majority of them use natural mode of conception and never had birth before 7th month and never had history of low birth weight. Similarly, a study by **Mobarak, & Sultan, (2019)** studying the prevalence, indications and determinants of caesarean delivery in Alexandria, Egypt, found that the most of their participants use natural modes of conception. The World Health Organization estimates the prevalence of preterm birth to be 5–18% across 184 countries of the world. And this was assured by **Wagura et al., (2018)** they were found to be 18.3% in their study prevalence and factors associated with preterm birth at kenyatta national hospital.

Regarding the Cranley s maternal fetal attachment scale along the study. It was found that there were highly statistically significant differences regarding all its domains with the best mean scores achieved at the 34th week post-training and the highest was obtained in the 'attributing characteristics with fetus' domain, and the lowest in 'differentiation self from the fetus' domain. Definitely, more than half of the participants graded fair during the pre-training period, and their grades became higher and scored more than 75% during the whole post training periods.

The current study results were in the same line with, **Ekrami et al., (2020)** they found that significant differences were seen after the intervention in the two groups in relation to 'attributing characteristics to fetus'. Moreover, the present study findings were in agreement with a study done by **Delavari, et al., (2018)** they study the relationship between maternal fetal attachment and maternal self-efficacy in Iranian women and reported that the highest mean score was obtained in the 'role taking' domain and the lowest in the 'interaction with the fetus' domain.

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Also, the present study findings were in agreement with **Sajjadi et al. (2016)** who study efficacy of maternal fetal attachment techniques on enhancing mother's attachment to the fetus and showed that training of attachment program increases MFA. Additionally, a randomized clinical trial by **Parsa, et al., (2016)** about the effect of training on maternal-fetal attachment (MFA) in nulliparous women**,** they found that there was a significant difference between the intervention and control groups on the mean of MFA scores. The mean of MFA significantly increased in the intervention group after training. However, no significant change was observed in the control group. Depending on a nursing intervention program and testing its effect on MFA, **Nishikawa & Sakakibara (2013)** found that FPAS in the 32nd, the 34th and the 36th weeks were higher in the intervention group than in the control group. Also, they have suggested that maternal-fetal attachment develops especially after quickening of the fetus.

Furthermore, **Rowe et al., (2013)** who study the growth of maternal fetal emotional attachment in pregnant adolescents: A prospective cohort study concluded that fetal position awareness helps mothers to exhibit behaviors that increase the emotional attachment to their fetus, communicating with their unborn baby and trying to discover the extremity and position of their fetus by caressing their belly indicates that the emotional attachment of pregnant women to the fetus has increased.

Moreover, **Salehi et al., (2017)** who study maternal fetal attachment: What we know and what we need to know reported that having more information about fetal activity in prenatal care, especially about fetal positioning, will probably help pregnant women to build a stronger emotional attachment to the fetus. From the researcher's point of view, it is essential that pregnant women access antenatal care services and structured antenatal training programs to improve the maternal-fetal attachment and bound a good relationship with her coming newborn.

Regarding attributing factors affecting maternal-fetal attachment and fetal position awareness. The present study results shows that previous fetal loss, social support, and strong attachment to mother were the most apparent factors. The current study results were in the same line with **Sadeghi & Kheirkhah (2014)** who study the relationship between marital satisfaction and social support with maternal fetal attachment in pregnant women with a history of baby loss, they stated that there was a positive and significant relationship between the mean of MFA in mothers with the history of fetal loss and social support and MFA.

Furthermore, the current study finding was supported by the Egyptian study done by **Hassan & Hassan, (2017)** predictors of maternal fetal attachment among pregnant women they reported that a statistically significant positive correlation was noticed between subjects' level of overall maternal-fetal attachment and their level of perceived social support, and the attachment to their mothers.

Moreover, **Metin (2014)** who exam the relationship between perceived social support and prenatal self-assessment in pregnant reported that there was a statistically significant correlation between pregnant women's prenatal attachment mean scores, and the number of stillbirths and abortion. However, **Baghdari et al., (2016)** found that the pregnant women who had stillbirth and history of abortion have lower prenatal attachment mean scores.

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This may be due to psychological and mental changes results from history of fetal or infant death so the application of similar prenatal educational interventions is recommended for these mothers.

Conclusion

The present study concluded that pregnant women who receive training on behavior attachment with their fetus would significantly exhibit higher degree of their maternal fetal attachment. It has been assumed that engagement in attachment behaviors raises maternal awareness toward the health of the unborn baby, and therefore influences bonding positively. Regarding attachment behaviors, the present study showed that engagement with active communication to the fetus e.g. listening to Quran, counting fetal movement, palpating the abdomen and positive imagination to the fetus were protective factor for bonding during pregnancy.

Recommendations

- Designing and applying MFA training programs in the second trimester of pregnancy particularly for primigravida.
- Integrating active communication to fetus (e.g. fetal movement counting, positive imagination to fetus, listening to

Quran and palpating the abdomen) into prenatal education programs and adding them to the curriculum of pregnancy education classes

- Comprehensive updated booklet and brochures about types of MFA behaviors should be distributed to pregnant women in antenatal clinics.

Further studies are recommended to:

- Carry out prospective longitudinal designs researches that span the full pregnancy and postpartum period to obtain comprehensive information about the effect of MFA training on maternal infant attachment.
- Explore the perceptions and attitudes of pregnant women toward practicing prenatal attachment behaviors and attending antenatal educational classes.
- Investigate barriers against the utilization of MFA behaviors among high-risk women.

Acknowledgment:

Researchers make a grateful offer to all women participated in the study for their cooperation during the research process and all appreciation to the health care provider for their invaluable assistance during the study.

Conflict of Interest Disclosure: Researchers declare that there is no conflict of interest in research.

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