



Cross-sectional Study

Breastfeeding and maternal attachment during infancy period among Jordanian mothers: A cross-sectional study

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ABSTRACT

Aims: The aim of the current study was to examine the following hypotheses: 1. Mothers who breastfeed their infants from 2 to 12 months of age or who use a mixed-feeding method after birth will demonstrate greater attachment toward their infants than mothers who only formula-feed their infants, as measured by the Maternal Attachment Inventory (MAI). 2. A difference in maternal attachment levels will be observed between mothers who exclusively formula-feed their infants and those who exclusively breastfeed their infants from 2 to 12 months of age, as measured by the MAI inventory, controlling for infant temperament.

Method: A cross-sectional, descriptive, comparative method was applied in different healthcare centers in Jordan from May 2016 to August 2016 in which the MAI inventory was employed to assess 258 Arabic-speaking mothers. One-way analysis of variance was used to detect the differences in maternal attachment between mothers using different feeding methods.

Results: The findings showed significant differences in maternal attachment between exclusive breastfeeding and exclusive formula-feeding mothers, and mixed-feeding mothers at 2 months ($F = 24.36$, $P < .01$). Moreover, there was a statistically significant difference in maternal attachment between the breastfeeding and the formula-feeding group ($F = 24.358$, $p < .05$) after holding temperament constant.

Conclusion: The results of this current study may help to clarify one role of breastfeeding in shaping a mother's attachment. Healthcare providers need to understand the influences of these variables on maternal attachment and attachment to empower young mothers and counsel them appropriately.

1. Introduction

Poor maternal attachment could lead to insecure infant attachment, which has been shown to have an association with many negative consequences in the mental health of school-aged children that continue into adult life [1,2,3]. Maternal attachment is defined as the mother's ability to understand and respond to her infant's signal and cues consistently and appropriately [4]; it is indicative of the relationship between mothers and their infants, which is characterized by concurrent interchanges, often referred to as the "mother-infant dance." [4,5] If the mother can understand and recognize her infant's cues, then she can provide a secure environment to enhance the infant's exploration and can protect the infant when necessary [2]. The literature mentions that maternal attachment is increased in women with a high level of oxytocin. Oxytocin is naturally increased during the early postpartum period because of breastfeeding [6,7]. Moreover; the oxytocin level

remains high in breastfeeding mothers compared to formula-feeding mothers. However, it is not known whether breastfeeding is linked with increased maternal attachment in the first few months or if mothers who are already attached during pregnancy will choose to breastfeed their infants [5,6]. In other words, it is not clear whether maternal attachment promotes breastfeeding or vice versa.

Attached and responsive infant care in the first year of life is important for the neurophysiological, physical, and emotional growth and development of the child [8]. Maternal attachment appears to be an important factor in child's development, yet, even after many years of research, little evidence is available to assist with the early identification of families at risk of poor maternal attachment, and few interventions are known to be effective in promoting maternal attachment [9]. In other words, it is not clear whether maternal attachment promotes breastfeeding or vice versa [10,11,12].

It has been reported that in developing countries, 25%–35% of

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children enter school with educational and growth problems that are the result of low maternal attachment in the first year of life [12]. Maternal attachment in the first year of life is critical because impaired maternal attachment in infancy can contribute to insecure attachment in children. Insecure attachment impacts a mother's ability to interpret the child's cues [11]. As a result, she cannot provide a safe and secure environment for the infant's exploration in which she watches over, comforts, or protects the infant when needed [1,2,11]. The inability to explore can have a negative impact on the child's ability to learn and subsequently this can cause cognitive and mental health deficiencies during school-age years that continues into adulthood.

Thus far, in Jordan, there is a lack of comprehensive, maternal and pediatric studies that explore and assess the challenges and obstacles that mothers face in improving their relationship with their infant. For instance, previous studies in Jordan have failed to control for factors that may have a negative impact on the duration and exclusivity of breastfeeding, such as infant temperament [9,10]. Therefore, this study attempted to examine whether there is a difference in maternal attachment between exclusive formula-feeding, exclusive breastfeeding, and mixed-feeding mothers. It also sought to ascertain whether there are differences in maternal attachment between these three groups when controlling for infant temperament. Furthermore, the concept of maternal attachment has not clearly been explored or addressed in Jordan. The definition of maternal attachment varies between professions and ranges from defining maternal attachment as a part of attachment process to complete multi-dimensional domains including physical, psychological, and social processes [8,9]. Knowing how these domains interact with each other and impact the life of infants could provide stakeholders in Jordan with information about the relationship between infants and their breastfeeding mothers. Also, the maternal attachment concept may be an indicator of how successful health interventions are in preventing and treating insecure attachment in developing countries such as Jordan. In light of the above, the following hypotheses were formulated:

1.1. Hypotheses

Mothers who breastfeed their infants between from 2 to 12 months of age or who use a mixed-feeding method after birth will demonstrate greater attachment toward their infants than mothers who only formula-feed their infants, as measured by the Maternal Attachment Inventory (MAI).

A difference in maternal attachment levels will be observed between mothers who exclusively formula-feed their infants and those who exclusively and mixed breastfeed their infants for 2–12 months of age, as measured by the MAI inventory, controlling for infant temperament.

2. Materials and method

A cross-sectional, descriptive, comparative study was used to collect data from a convenience sample of mothers in Jordan. In this design, one group of infants or mothers (breastfeeding) was compared with a second contrasting group (formula-feeding), and a third group (mixed breastfeeding and formula-feeding method).

2.1. Setting

Women were recruited from three maternal and child health (MCH) centers located in various different areas of Irbid city in Jordan. Around 1.5 million people live in Irbid city and each MCH serves around 30,000 women who are either Jordanian citizens or Syrian refugees and provides services including prenatal care, postpartum care, family planning and immunization. A total of 258 mothers who met the inclusion criteria of being able to read and write Arabic (sixth-grade level), which was recorded in the patient's health record, and who visited the health center for immunizations and infant care were included in the study.

The current study was approved by the Institution Review Board (IRB) of the University of Wisconsin Milwaukee and by the Ministry of Health in Jordan. Participants who met the inclusion criteria were approached by the researchers and given a letter that explained the purpose of the study in detail. The letter stated that researchers would use the information to help practitioners and people in the community and that the researchers would maintain the privacy of the participants' information. To protect the privacy and confidentiality of the mothers, there were no names and/or other identifying information on the survey forms, and therefore no way to directly link back to the individuals completing the survey. This study had registered to research registry website researchregistry 6742 <https://www.researchregistry.com/registry-ter-now#user-researchregistry/registerresearchdetails/607642472950ad001b5ea51d/>.

The first page of the distributed survey stated the purpose of the survey, its voluntary nature, and that completion of the survey meant that they had given their consent to participate in the study. It also stated that the researcher would not use any information in presentations or publications in a way that could identify the participants. In addition, it stated that the principal investigator and agents of the Office for Human Research Protection and the Ministry of Health in Jordan would have appropriate regulatory oversight.

To facilitate recruitment, informational brochures describing the purpose of the study were made available to potential study participants at the three selected MCH centers. The staff members of the centers asked patients if they were interested in hearing about the study. The study instrument consisted of three forms: 1) a form consisting of three sections containing questions to obtain: a) demographic data, b) current antenatal data, and c) data on past breastfeeding experiences; 2) the MAI form; and 3) a form on infant temperament. Research assistants were available to provide information about the study. The study packet contained information about the study, the responsibilities of the study participants, and the benefits and risks of being in the study. Furthermore, the primary investigator or research assistant provided each of the mothers with an opportunity to ask questions, and offered assistance in completing the data collection forms as necessary.

The first form consisted of 10 questions to obtain demographic data, current antenatal data, and data on past breastfeeding experiences. The demographic data section included questions about maternal age, educational status, employment status, marital status, number of children, and family annual income and size. The antenatal section included questions on the mother's total number of pregnancies and most recent type of delivery, and the third section included questions regarding current feeding methods. This study followed the STROSS checklist [12]

The second form was the MAI form, which was a self-report form aimed at measuring the maternal attachment level. This form consists of 26 items that are used to measure maternal attachment to infant cues [15]. Specifically, the MAI form measures a woman's recognition of her attachment toward her infant and any perceived obstacles to expressing her attachment or responding appropriately to her infant. The form covers three dimensions of maternal attachment: pleasure of proximity, tolerance, and acceptance/competence. The maternal response to infant behaviors consists of six categories: smile, eye contact, touch, auditory signal, eye directions, and offering food. Infant behaviors included gazing toward and/or away from the mother as well as facial expressions in response to the mother's gaze. [13,15] The frequency of maternal signals for each of the three infant categories was determined by using items answered by maternal responses on the questionnaire on a four-point Likert scale ranging from almost never (1) to almost always (4). Hence the total score ranges from 26 to 104; a high score (>75) indicate a high level of maternal attachment [4].

The validity and reliability of the MAI form used in the current study has been proved in a previous study [13] in which the MAI form was translated into the Arabic language according to World Health Organization recommendations. The previous study used the MAI form to measure maternal attachment of a sample of 200 participants to assess

its suitability for use in a conservative country such as Jordan and found that the MAI is more appropriate than observational measures in gaining an understanding of maternal attachment [13]. The previous study reported that the Cronbach's alpha coefficient for the MAI in Jordanian mothers is 0.91, thus demonstrating its high reliability and suitability for the context of the current study.

3. Results

The demographic information about the study sample is displayed in Table 1 and Table 2. The results of the differential statistics include the following hypotheses:

Hypothesis One: Mothers who breastfeed their infants from 2 to 12 months of age or who use a mixed-feeding method after birth will demonstrate greater attachment toward their infants than mothers who only formula-feed their infants, as measured by the MAI inventory.

One-way analysis of variance (ANOVA) showed significant differences in maternal attachment between breastfeeding and formula-feeding mothers at 2 months after birth ($F = 24.365, P < .01$). The breastfeeding mothers were also higher in maternal attachment than the formula-feeding mothers at 3 months after birth. Furthermore, the results of a one-way ANOVA at 12 months revealed significant differences in maternal attachment between breastfeeding and formula-feeding mothers ($F = 15.68, P < .01$), which means that breastfeeding mothers were higher in maternal attachment than formula-feeding mothers.

A post hoc analysis of the ANOVA test (Tukey's HSD test) was used to identify the difference in maternal attachment between the three groups (breastfeeding, formula-feeding, mixed). The results of Tukey's test shown in Table 3 revealed a significant difference in maternal attachment between formula-feeding mothers and breastfeeding mothers, and a difference in maternal attachment between mixed-method and formula-feeding mothers (mean difference = 5.53 (1.17), $P = .01$). The breastfeeding mothers and mixed-feeding mothers scored higher in maternal attachment than the formula-feeding mothers. However, there was no significant difference in maternal attachment between the mixed-method and exclusive breastfeeding mothers during the first year of the infants' life (mean difference = -0.70 (1.11), $P = .8$). Multiple regression analysis was used to develop a model to predict the factors that affect maternal attachment. Each of the predictor variables had a significant ($p < .01$) zero-order correlation with maternal attachment, but only breastfeeding and having an easy infant had a significant partial effect in the full model ($p < .05$). The predictor model was able to account for 45% of the variance in maternal attachment, $F(3, 25) = 8.45$,

Table 1
Comparison between the Three Groups based on the feeding method.

	%	Combined	Breast Feeding Only	Formula Feeding Only	Mixed Methods Feeding
Demographic Information	100.00%	258	90	75	93
Infant Gender		258	90	75	93
Male	58.53%	151	43	54	54
Female	41.47%	107	47	21	39
Education		258	90	75	93
Illiterate	2.33%	6	2	1	3
Primary	55.04%	142	56	36	50
Secondary	16.28%	42	14	13	15
Bachelors	26.36%	68	18	25	25
Employment		258	90	75	93
Employed	77.91%	201	77	56	68
Unemployed	22.09%	57	13	19	25
Unknown	0.00%	0	0	0	0
Experience		258	90	75	93
Yes	27.13%	70	21	26	23
No	72.48%	187	69	49	69
Unknown	0.39%	1	0	0	1
T1(Temperament)		258	90	75	93
Easy Baby	96.12%	248	87	70	91
Difficult Baby	3.88%	10	3	5	2

Table 2
The Descriptive statistics for the Subject(N = 258).

Variable	Mean	Std. Deviation	Variance
Age (in years)	27.48	5.88	34.53
Education	2.67	0.89	0.80
Employment	0.22	0.42	0.17
Income	463.09	320.22	102540.83
Delivery Method	1.33	0.47	0.22
Receive Prenatal Information	0.74	0.44	0.19
Feeding Method	2.01	0.84	0.71
Current Feeding	2.20	0.79	0.62

Note: Age in years, education 1 = illiterate, 2 = primary. 3 = secondary, 4 = Bachelor or more, Employment 1 = Non Employed, 2 = Employed, Delivery Method 1 = NVD, 2 = C/S, Feeding 1 = Breastfeeding, 2 = Formula Feeding, 3 = Mixed Method.

Table 3
Post-Hoc for the differences between groups in attachment based on feeding method.

Feeding Method	Feeding Method	Mean Difference	Sig.
Breastfeeding	Formula Feeding	5.5377(1.177)	.01
	Mixed	-.70394(1.1135)	.80
Formula Feeding	Breastfeeding	-5.53778(1.177)*	.01
	Mixed	-6.24172(1.168)*	.01
Mixed	Breastfeeding	.70394(1.113)	.80
	Formula Feeding	6.24172(1.168)*	.01

Table 4
ANCOVA Model regarding the confounding factors for maternal attachment.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2067.821 ^a	4	516.96	10.00	.00	.14
Intercept	21289.76	1	21289.76	411.97	.00	.62
T1	293.92	1	293.91	5.68	.02	.02
T6r	126.44	1	126.43	2.44	.12	.01
FEED	1720.04	2	860.02	16.642	.00	.12
Error	13074.26	253	51.677			
Total	2372944.00	258				
Corrected Total	15142.08	257				

^a R Squared = .137 (Adjusted R Squared = .123).

$p < .01$, $R^2 = 0.65$, 95% CI [0.35, 0.72]. For more information, please refer to [Table 4](#).

Hypothesis Two: A difference in maternal attachment levels will be observed between mothers who exclusively formula-feed their infants and those who exclusively or mixed breastfeed their infants from 2 to 12 months of age, as measured by the MAI inventory, controlling for infant temperament.

The researchers used analysis of covariance (ANCOVA) to control for the influence of infant temperament status on maternal attachment. The results of the ANCOVA showed a significant difference in maternal attachment between the exclusive breastfeeding group and the exclusive formula-feeding group ($F = 24.35$, $p < .05$) when holding temperament constant.

The results of this part of the analysis showed that having an easy baby is associated with a mother greater attachment toward her infant ($P = .01$). Controlling for the effect of temperament gave greater clarity on the effect of breastfeeding on maternal attachment, as shown in [Table 4](#). The breastfeeding mothers were higher in maternal attachment than formula-feeding mothers regardless of temperament of the infant. The partial Eta squared of the three groups indicated that the effect was large (0.10). However, it should be noted that the temperament scale used in the current study has not used before. Therefore, using a proven, reliable temperament instrument may enhance or change the results of this study. The current study also shows that using ANCOVA and controlling for confounding variables can help increase the statistical power of the findings.

4. Discussion

The current study revealed that mothers who breastfed at least 2 months after delivery were generally more attached in their interactions with their infants. This relationship persisted after controlling for confounding variables that were related to the mothers themselves, such as employment status, and level of income. However, when we considered the relationship between breastfeeding, attachment, and infant temperament as a function, the infant's temperament did not alter the results for each of the three groups with respect to the level of their attachment.

Our present findings are in line with those of previous studies that show that breastfeeding mothers exhibit different patterns of maternal attachment, as measured by the MAI [16,17]. For example, higher scores on this scale are associated with the practice of breastfeeding. Thus, breastfeeding may contribute to enhancing maternal attachment [13, 14]. The findings of our research may support the conclusion that breastfeeding causes parasympathetic changes that do not occur with formula-feeding. These parasympathetic changes cause a decrease in blood pressure and increase the skin temperature of mothers in response to suckling [23]. Moreover, the increase in the oxytocin level in breastfeeding mothers correlates with anxiety reduction and higher interaction. This physical contact between mothers and their infants during the breastfeeding process may enhance the mother's ability to read her infant and respond to her infant's cues [15,16,17]. Furthermore, a previous study showed greater activation in the brain of a breastfeeding mother when compared with formula-feeding mothers. [12] In other words, it may show that differences in many brain areas, as seen in other studies, maybe the increase of attachment is to the act of practicing breastfeeding and the increased release of oxytocin. Moreover, previous studies have also shown that skin-to-skin contact between mothers and preterm infants can cause an increase in the oxytocin level that affects the mother's ability to read her infant's cues. Also, Oxytocin may cause many maternal behaviors in humans and animals [16–18]. Furthermore, a higher level of oxytocin has been linked with more attached maternal behaviors [16,19–21].

The current study also found that infant temperament was a predictor of maternal attachment toward the infant; this is also consistent with the literature. This means that an easy infant may cause the mother

to be more attached to her infant's needs. A previous study has reported that infant temperament affects maternal attachment and increased maternal attachment mediates infant temperament. [19] This is in line with the finding of the current study that breastfeeding mothers display greater maternal attachment than formula-feeding mothers when controlling for infant temperament. On the other hand, the current study does not support a finding in the literature that having a difficult infant might cause the mother to be less attached [21].

Nurses, obstetricians, healthcare providers, and many other people who have direct and indirect contact with mothers have a responsibility to assess, intervene, educate and make a referral to specialized persons if a mother is exhibiting signs of needing help. Nurses in particular play an important part in educating mothers about the importance of their role in their child's development. Nurses dedicate their time to teaching mothers about numerous aspects related to the mothering role starting from skin-to-skin contact to breastfeeding. Nurses could or can also provide education on healthy mother-infant interaction and support to achieve that.

Based on the results of the current study, mothers will benefit from screening opportunities that are offered that use MAI instruments. Many focus groups may examine various interventions to increase maternal attachment. Some clinical research studies may find the MAI a useful tool to use in assessing the success of new programs and interventions. Effective assessment, early detection, and appropriate interventions are needed to promote growth and prevent developmental problems in children. Assisting mothers in determining their strengths and weaknesses, supporting them to address their weaknesses, and increasing their awareness of the importance of breastfeeding, could increase the resilience of both the mother and her infant.

The United States federal government and the Jordanian government have both published recommendations for improving breastfeeding and friendliness at pediatric hospitals. These recommendations provide structured guidelines for nurses, healthcare providers and employers to increase the rate of breastfeeding. The results of the current study together with these guidelines may assist nurses and healthcare providers in helping families affected by low maternal attachment and in giving extra preventative support to those families at risk.

Nevertheless, more qualitative/research is still required to understand the unique and salient role of breastfeeding in childrearing practices. Instead of investigating breastfeeding in terms of its direct association with the relationship between mother and infant, it should be considered, together with other variables, in terms of the manner in which it is manifested in the mother-infant relationship. Some interesting ideas have been touched on in the current study that may lend themselves to more comprehensive exploration, such as environment. Additionally, examination of attitudes toward weaning and the experience of weaning for the mother and infant may be fertile ground for further research. In the current study, maternal expectations of the self and of the infant were found to be significant predictors of the assessment of the self as a mother and of the infant at 12 months. These findings may give clinicians an indication as to when it would be best to intervene to help identify at-risk mothers. However, when interpreting the findings of the current study and how they may guide future research, it is important to consider the study's limitations. The major limitation that affected the study was the use of a convenience sample. This type of sampling has been criticized for "sampling bias" and producing samples that are not representative of the entire population [19, 22]. Thus the use a convenience sample can limit generalization and did not alter the results for each of the three groups with respect to the level of their attachment making of inferences about the entire population. Thus, future studies that seek to compare maternal attachment among mothers need to focus on using random sampling and including a more heterogeneous sample from a range of cities and populations. Second, the study did not collect any psychometric information regarding the temperament questions. Therefore, the researchers recommend that future studies in this area consider employing other

temperament instruments that have been shown to have reliability and validity. Third, the design of the current study only allowed for data collection at one time point, and thus changes over time cannot be detected. Furthermore, in future studies, it will be important to include measures of oxytocin and other related neuro-hormones. Another issue to address in future studies is the presence of confounding factors that may impact a mother's decision to breastfeed her child before birth as well as the relationship between breastfeeding and maternal attachment, such as education level, age, and race. Moreover, the choice of feeding method may also be affected by environmental factors such as culture [10,11,24].

5. Conclusion

In conclusion, findings from this research show that breastfeeding does have an effect on the mother and that breastfeeding does enhance maternal attachment emotion. Employment and temperament do not affect maternal attachment. It should be noted that this is one of the few studies of maternal attachment using a self-report instrument, and may also be the first study of maternal attachment in Jordan. The results of this current study may help to clarify one role of breastfeeding in shaping a mother's attachment. Healthcare providers need to understand the influences of these variables on maternal attachment and attachment to empower young mothers and counsel them appropriately.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

No conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.amsu.2021.102395>.

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Ethical approval

University of Wisconsin Milwaukee was given IRB of this study.

Consent

Consent was received from all participants.

Author contribution

All authors were participated in all steps of the study.

Registration of Research Studies

1. Name of the registry: Research registry.
2. Unique identifying number or registration ID: researchregistry6742.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.researchregistry.com/browse-the-registry#user-researchregistry/editregisterresearch/607642472950ad001b5ea51d/>

Guarantor

Sawsan Abuhammad

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