

THE POSSIBLE EFFECT OF BREASTFEEDING ON MATERNAL SENSITIVITY DURING
THE FIRST YEAR OF LIFE

by

Sawsan H. Abuhammad

A Dissertation Submitted in
Partial Fulfillment of the
Requirements for the Degree of

Doctor of Philosophy
in Nursing

at

The University of Wisconsin, Milwaukee

December 2016

ABSTRACT

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by

Sawsan H. Abuhammad

The University of Wisconsin-Milwaukee, 2016
Under the Supervision of Professor Teresa Johnson

Poor maternal sensitivity may lead to insecure infant attachment that is associated with consequences in cognitive and mental health in school-aged children and later life. Maternal sensitivity is defined as the mother's ability to recognize and respond to her infant's cues consistently and appropriately. Maternal sensitivity is an indicator of the interactions between mothers and infants that are characterized by mutual and concurrent interchanges, often referred to as the "mother-infant dance." If the mother is able to accurately recognize the infant's cues, then she can provide an appropriate and secure foundation to encourage the infant's exploration, watching over and protecting the infant when necessary (Bowlby, 1969). Literature suggests that maternal sensitivity is enhanced as the oxytocin level of the mother increased in the early postpartum period. One factor that increases the level of oxytocin is breastfeeding. Oxytocin level remains high in a breastfeeding mother compared to a formula feeding mother. It is unknown if breastfeeding is associated with maternal sensitivity or if sensitive mothers during pregnancy will breastfeed her infant

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DEDICATION

With all my love, to my family:

My dad Hammad,

My mom Nawal,

My brothers and sisters,

My Aunt Laila,

My friend in USA, Kimberly

My best friend Tasneem

You have all supported me in my journey during the tough times and the joyous times. I could not have completed this without each and every one of you. Words cannot express the appreciation and love I have for you all. Thank you.

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ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to Dr. Teresa Johnson, my major professor, for guiding me in this journey. I have learned so much in the process about breastfeeding and maternal sensitivity. Your in-depth knowledge and expertise in research have given me the skills and ability to push forward as a nurse leader in this field. I am forever indebted to you as I continue in my career.

My dissertation committee has been a gift from the beginning. I would like to thank Dr. Julia Snethen and Dr. Bonita Klein-Tasman for sharing their expertise and knowledge to develop this dissertation and assist me in improving my ability to present these findings. You have both been active members of my committee from the beginning, providing guidance and constructive criticism to challenge my writing and understanding of these concepts. Dr. Buseh, you have been a wonderful professor, mentor, and role model urging me to pursue my PhD successfully. I am forever grateful for your ability to push me to a level of expertise I would have never envisioned for myself. Thank you, Dr. Clayton-Jones for your critique and suggestions on the final dissertation. It was a privilege and honor to work with each of you. A special thank you goes to Kimberly Howard, Dr. Muntaha, and Dr. Arwa who have urged me forward at times of frustration. I appreciate the patience you all had during this process.

CHAPTER ONE

The Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life

Study Problem and Purpose

The purpose of the current study is to compare maternal sensitivity between breastfeeding and formula-feeding mothers during the first year of an infant's life. The method used to feed an infant is evaluated as one potential indicator of enhancing maternal sensitivity. In this first chapter, the background, problem statement, and purpose are discussed. Maternal sensitivity is considered as one essential component of secure attachment that is required for optimal infant growth and development (Ainsworth, Blehar, Waters, & Wall, 1978; Raval et al., 2001). The concept of maternal sensitivity is derived from classic attachment theory (Ainsworth & Wittig, 1969; Bowlby, 1969). Maternal sensitivity is defined as the ability of the mother to respond to her infant's cues accurately and timely (Shin, 2007). The hypothesis for the current study is that infant feeding, along with other external and internal factors related to the mother and her infant, may impact maternal sensitivity. This current study was developed to further examine whether breast feeding or formula feeding have an effect on the mother's maternal sensitivity during the first year of her infant's life. In addition, the limited evidence reported in the literature on maternal sensitivity and breastfeeding will be discussed. The importance of nurses and other health care professionals, who interact with infants and their mothers, to understand measures available to assess maternal sensitivity during an infant's first year of life will be provided. Also to be covered is how utilizing measures of maternal sensitivity may assist nurses and health care providers to help families with poor attachment and improve an infant's growth and development. Unfortunately, a recent study showed that more than 40% of infants in the US develop insecure attachment (APA, 2014). The prevalence of insecure infant attachment may be

as high as 60-80% in high-risk families such as adolescent and poor families, or with single mothers (CDC, 2014). These early life experiences can negatively affect school achievement and contribute to psychological problems (Alligood, 2013; Axia, Bonichini, & Benini, 2006). For example, a study by Ritcher (2004) suggested that insecure attachment is a significant factor that may lead to an infant having problems with growth and development. The researchers in the current study identified that enhancing maternal sensitivity is one strategy for improving infant growth and development. A mother's responses must be appropriate to the situation and to the infant's communications. Thus, the quality of maternal and infant attachment reflects the expectations of the infant regarding the mother's availability, support at the time of need, and her ability to respond to the infant's cues (Alligood, 2013; Axia, Bonichini, & Benini, 2006; Eisenberg, Cumberland, & Spinrad, 1998).

When an infant has a responsive mother, he/she will rely on her as a source of comfort and a secure base from which to explore their surroundings. Therefore, the study of early mother-infant relationships and the internal working models of attachment that are formed in these interactions have a strong connection in understanding the development of attachment relationships. The mental representations (emotional regulation) women developed during infancy and childhood with their own mothers during times of interactions will influence the way they relate to their infants when they become parents (Britton, 2006). Currently, only paternal teaching, maternal support, and improvement of the maternal working condition have been established as effective methods for increasing maternal sensitivity (Shin, 2006). However, the effectiveness of these methods was not reported to assist low- and high-risk families (Barnard, Morisset, & Spieker, 1993; Marvin, 1993). There are many confounding factors of maternal sensitivity that are still unknown. More research is required to more thoroughly study the effect

of these factors that may affect maternal sensitivity such as support systems, skin-to-skin contact and working support. Moreover, it is also unclear whether feeding style is associated with maternal sensitivity. Few studies have been conducted with Jordanian mothers, which will be the focus of this current study, to address whether breastfeeding is associated with maternal sensitivity. In addition, previous studies failed to control for the potentially confounding variable of the duration of breastfeeding, employment condition, and infant temperament, or to address the context of maternal culture. Presently, there is an increase in the number of new mothers working in Jordan, which makes it an advantageous time to conduct such research. Preliminary evidence suggests that increased levels of oxytocin from breastfeeding in the first few months of childbirth may explain its effect on maternal sensitivity. The oxytocin level remains high in the breastfeeding mothers compared to formula-feeding mothers (Blass, 1994; Nelson & Panksepp, 1998). A study of mothers using different feeding methods, exclusive formula feeding, exclusive breast feeding, or mixed methods feeding, will help to confirm or challenge the existing evidence of effecting of breastfeeding on maternal sensitivity within the Jordanian context.

Eye-to-eye contact and touching during an infant feeding may also enhance maternal sensitivity. While the physical benefits of breastfeeding for the mother are well documented, the psychological benefits are still not understood (Ivarsson, Hemell, Stenlund, & Persson, 2002; Kramer et al., 2001). Breastfeeding mothers reported feeling more enjoyment in their interaction with their infant during breastfeeding, but there is still no empirical evidence available regarding maternal sensitivity enhancement by practicing breastfeeding (Huggins & Hartigan, 1999; Newman & Pitman, 2008)

Significance

This section summarizes some outcomes of insensitive mothers. Research shows that maternal sensitivity and mother interactions with their infants may contribute to either poor or superior developmental outcomes among children later in life, such as poor or high levels of academic achievement. Many researchers have studied this link in relation to maternal sensitivity, as observed behaviors can be specifically defined, reliably measured, and directly linked to child behavior (Alligood, 2013; Lee, Daniels, & Kissinger, 2006). Infants with sensitive mothers are more likely to display secure attachment relationships. If a mother is not accessible to her infant, and sensitive to her infant's needs, then the infant will not be able to form expectations of his or her mother's behavior. When the infant's expectations are met, and the infant feels a consistency in the mother's sensitivity (Bowlby, 1969), the infant is able to find security in the relationship (Alligood, 2013). Infants who do not get appropriate signals from their mothers will form insecure attachments because they are dependent on their mothers for predictable and safe responses. In order for an infant to feel that his or her mother is accessible and responsive, there needs to be a certain amount of interaction between them (Alligood, 2013; Axia, Bonichini, & Benini, 2006).

Maternal sensitivity does not depend on the type of interaction that takes place (often reflecting attachment) but on the way the mother responds to the infant's desires and needs (Bigelow, 1998; Bonichini, & Benini, 2006; Schacter, 2009). Some important interactions exist between the mother and the infant's characteristics such as temperament, health, development, and cognition. Infants with sensitive mothers are generally healthier, happier, and are better adapted to their environment (Bonichini, & Benini, 2006; Schacter, 2009).

For cognition, children with sensitive mothers (from preschool to first grade) are more likely to demonstrate higher achievement in subjects that require high cognitive ability. For instance, researchers reported that children with sensitive mothers scored higher in math knowledge than those who do not have sensitive mothers. Additionally, maternal sensitivity teaches infants about attention skills, which are important later in life for emotional control and other complex cognitive processes (Goldberg, 2008).

There are many explanations that describe how attachment is connected to emotional regulation. According to one perspective, attachment is the safest way for an infant to experience his or her mother's emotions and explore the environment (Alligood, 2013; Keller, 2013; Thompson, 2008). This exploration provides the infant with a way to examine a wider range of emotions than other infants in other attachment styles. Furthermore, the secure mother-infant attachment aids the child in building a healthy relationship with the mother (Keller, 2013).

The emotions of infants are raw materials for interpersonal and cognitive issues in later childhood. Maternal modeling helps the infant by giving them the opportunity to refocus attention and adapt and internalize emotional regulation strategies that may be used in many social and personal situations. Additionally, it's easier for securely attached infants to effectively cope in response to peer conflicts in later childhood by imitating the mothers' attitude. The goal for the child is to be socially accepted and maintain close and healthy peer relationships. Emotional regulation is the most serious component for success in peer relationships (Keller, 2013; Smith et al., 2006, Thompson, 2008). The researchers documented that emotional regulation impacts a child's ability to be socially effective. Greater emotional regulation upgrades social competency. Children who are unable to regulate their emotions undermine their social functioning and are less able to construct a successful strategy to solve problems. The

observers' perception of attachment may be used to successfully predict the quality of cognitive skill that children develop during school. Also, the infant's mood and coping strategies may explain this association of maternal sensitivity (Smith et al., 2006; Thompson, 2008). For example, researchers have reported that maternal sensitivity positively affects children's socialization skills (Smith et al, 2006). Specifically, some research suggests that children with more sensitive mothers have high levels of emotional control and behavioral control. Such control was fostered from the time of birth when a sensitive mother offers appropriate responses to the infant's distress, which teaches infants to adjust their arousal. This speedy regulation of arousal will be continued into childhood, resulting in the ongoing ability to regulate emotions well (Keller, 2013; Thompson, 2008).

The researcher have found that maternal sensitivity have a correlation with empathy in children. Generally, securely attached children have been found to be more empathetic towards other family members and peers compared to insecurely attached children who insecurity was a result of insensitive mother interaction. The reason suggested for this result is that securely attached children receive more empathy from their mothers when they are distressed. This explains that they are more likely to show empathy in a situation where someone else is distressed (Thompson, 2008).

Moreover, a child learns about the reciprocity of relationships through interactions with their mother, such as when the mother soothes him or her when they cry (Dykas & Cassidy, 2011). The reciprocity relationship between mother and her infant develops an infant with fixed attachment because the secure infant experiences an available and sensitive mother. Moreover, infant will come to expect these kinds of positive interactions in their own close relationships with their peers (Thompson, 2008). A secure attachment relationship as an infant provides them

with the confidence required in later childhood to explore their surrounding environment, including new peers and friends. Further, the securely attached infant will enter these new relationships in later childhood by attracting their friends with their exploratory and friendly nature (Keller, 2013; Thompson, 2008; Dykas & Cassidy, 2011). In general, securely attached children will experience fewer problems such as rejection of others, withdrawal from social situations, or acting in an aggressive manner in later childhood (Smith et al., 2008).

Many researchers claim that an association between an infant's attachment (or ability to develop an attachment with a primary caregiver or mother) and a child's ability to develop and maintain peer relationships exists (Britton, 2006; Dykas & Cassidy, 2011; Thompson, 2008). These studies mention that securely attached infants were ranked higher in peer popularity, showed higher levels of cooperation with their peers, displayed less dependent or attention-seeking behaviors, held a greater sense of self-reliance, showed greater competence in their handling of problems with their peers, were more often accepted by their friends, and experienced fewer fights with their friends in later childhood (Smith et al, 2006).

Although researchers have reported that mother-infant attachment security and peer relationships are related, there is no agreement as to which specific mediating mechanism impacts peers' relationships in later childhood. One mechanism that may explain how attachment is associated with peer relationships is emotion regulation (Thompson, 2008). The secure attachment relationship considers the context in which the regulation of emotions developed to support the infant's capacities to regulate their own emotional reactions and behaviors in many situations in later childhood. These skills are learned by observing similar behaviors from their mother. A linkage between security and emotion regulation propensities suggests that there exist

longer-term connections between security and the ability to form peer relationships in later childhood (Dykas & Cassidy, 2011).

For adulthood, the subject of attachment processes possibly playing an important role in adulthood has been studied. For example, Hazan and Shaver (1987) explored Bowlby's theories in the context of romantic relationships. According to Hazan and Shaver, the emotional relationship which develops between two adults is similar to the emotional bond between infants and their mother. Hazan and Shaver noted that the relationship between infants and their mother and the relationship between adult romantic partners share the following features: both feel safe when the other is responsive, both indulge in close bodily contact, both feel insecure when the other is not present, both exhibit a mutual concentration on one another, and both engage in "baby talk." On the basis of these shared features, Hazan and Shaver conclude that adult romantic relationships are like maternal-infant relationships and that romantic love is an extended outcome of attachment processes during the infancy period with sensitive mothers. The quality of this relationship not only affects the romantic relationship between adults, but also their relationship with their children.

Adults' understanding of the meaning of maternal sensitivity impacts their sensitivity towards their children. Specifically, Ainsworth (1969) reported that adults who had insensitive mothers during infancy were unable to remember their infancy and childhood events, or their importance. Furthermore, these adults were unable to present an accurate description of their mothers by using only their memories; in fact, they tended to idealize experiences and were more likely to remember rejection situations from their mothers (Cassidy & Berlin, 2009). Further, adults who experienced greater maternal sensitivity during both infancy and childhood were found to be less negative and more secure than those who did not. Adults who had insensitive

mothers were found to please their mothers when they were young and have a sense of irritation towards their mothers in adulthood. About half of these adults were found to have experienced negative life events, such as their mother's death, accidental deaths, or sexual abuse. These life events are negatively impacted by the security of attachment between infants and their mothers (Cassidy & Berlin, 2009).

Cultural Role

For every culture, the values, beliefs, and motives are different regarding mothering and caretaking for infants to prepare them for physical, social, economic, and psychological life. Culture plays a significant role in determining the physical and social life and influencing infant development outcomes (Bornstein, 1991). There are differences in mothering styles between cultures. In a study of mothering behavior across many cultures around the world, researchers reported that the common style was a warm and controlling style, this style was neither permissive nor restrictive (Rohner & Rohner, 1981). Conduct research on diverse cultures may enhance the researcher's knowledge of the association of different mothering styles and developmental outcomes. Despite the multicultural nature of contemporary society, most information on the infant socio-emotional development of studies has been derived from White, middle-class Americans. In American culture, people usually live in a nuclear family where parents live a separate life far from other relatives such as cousins, uncles, and grandparents (Bornstein, 1991; Rohner & Rohner, 1981). Some American children live a different life than other children who live with their relatives. In the standard American family, the mother is most often the primary caregiver and the first person the infant initially attaches with. Arab culture, such as Jordanian culture, is very different from American culture. Most families in Jordan live in an extended family or around non-immediate family members, which differs from American

culture. It is only recently that Arabic family systems have tended to become nuclear. Cross-cultural studies comparing individuals from Arab countries with those in the United States and American practices documented value and model independence and autonomy in American child-rearing ideology (Lamb & Sternberg, 1992). American culture reflects individuality and independence in rearing their children that is reflected in early weaning from breastfeeding. In contrast, Arab culture values conformity, self-discipline, and family cohesiveness. One characteristic of Arab culture in earlier days, before the country was opened to other cultures, was a strong connection between family members. In other words, the relationship between mother and children overestimated values of Arab culture in caregiving arrangements and in the involvement of the larger community. As a result of this strong connect between mother and infant, differences in the orientation of children toward mothers as primary social partners or toward the large group, would be expected (Super & Harkness, 2002). Close mother-infant interaction may be unusual in most Arab cultural settings where infants are not being brought up as a social partner with their mothers but as members of the community. The American mothers depend on themselves to motivate their children regarding mother-child dyadic role. This is different in Arab communities where the responsibility to learn by many other social partners process. Lamb and Sternberg (1992) suggest that the mother-infant relationship must be evaluated in the context of their cultures. According to Lamb (1992), Arab infants are or become distressed because they have much less experience with separations from their mothers than American infants which causes great distress expression as noted through Strange Situation assessments. Infants from different cultures respond very differently using the Strange Situation assessment. Ladd (1992) suggests that families with different ethnic and cultural traditions may emphasize different aspects of social life as they rear their children, or permit their children to

engage in different types of experiences and relationships. Individual cultures differ in the demands, standards, and values held for children. The researchers propose that some contexts are suitable or unsuitable for the development of children with particular temperaments (Ladd, 1992; Super & Harkness, 1986). Understanding customs, child rearing traditions, and the mother's values in the specific culture will assist researchers in understanding the various cultural elements that play an essential part in the child's developmental environment. For example, a child's temperament in different contexts may be highly related to the cultural demands of a social group and allow the child to become highly adjusted within their own community.

Theory

Infant Temperament

An infant's temperament is a construct that often provides a source of confusion for many researchers. The area of infant temperament has been studied from diverse fields such as nursing, medicine, clinical psychiatry, personality theory, and developmental psychology. Consequently, researchers have had difficulty agreeing on a single definition of infant temperament (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). However, the major theory on infant temperament that is most often used or referred to by clinicians and researchers is provided by Thomas and Chess. These two researchers defined temperament as behavioral characteristics that are exhibited from an infant. Thomas and Chess focused on the interactive process between infants and health care providers, especially in terms of the goodness of fit between the mothering style and infant temperament. In other words, the interaction between the infant and health care provider demonstrates the level of effectiveness of the mothering style and infant temperament. These researchers proposed many dimensions of temperament that include: activity level, rhythmicity, approach-withdrawal, adaptability, intensity of reaction, threshold of

responsiveness, quality of mood, distractibility, and attention span. These dimensions aggregate to form three broad temperament types: easy infant, difficult infant, and slow to warm up. For example, easy infant displays high rhythmicity, high approach, positive mood, and low intensity while difficult infant experiences low rhythmicity, low mood, and high intensity (Thomas & Chess, 1977). To compare, difficult infant experience, low rhythmicity, slow approach, bad mood, and high intensity than easy temperament infant. More information regarding these types of temperament is described in chapter one with the definition of variables).

Breastfeeding, Maternal Sensitivity and Temperament

Researchers in nursing, medicine, psychology, and mental health fields (Bowlby, 1972; Ainsworth, 1972; Klaus & Kennel, 1982; Rubin, 1985) have produced a body of work that focuses on the effect of maternal-infant interactions (especially maternal sensitivity) on all infant life. Several theories and models, such as attachment theory (Bowlby, 1972), maternal role attainment (Rubin, 1982), and PCI model that relate to the maternal role (maternal sensitivity), have been explored in relation to maternal variables to highlight how maternal behavior affects infant development. Each theory plays a role in enhancing our understanding of the maternal effect on infant life. The mother's role (including the emotional feelings of the mother toward her infant) remains an area ripe for additional research based on foundational studies (Rubin, 1982; Fiona, 2006).

The history of attachment theory development will provide more contexts to this current study. This work starts with Bowlby, (1951) when he initiated research involving the relationship between maternal sensitivity and infants. Some years later, Bowlby (1967) reported that infants became attached to mothers who responded consistently and appropriately to their infant's signals. Bowlby observed a predictable pattern in infants' reaction to the loss of a mother, which

begins with protest, then moves to despair, and finally ends in detachment. Bowlby also established the idea that infants' interactions with their mothers were foundational for later attachment relationships in life. These first interactions with the mother provide a model that is played out throughout a person's life (Bowlby, 1982). Bowlby (1968) defined this first interaction between a mother and infant as the link that develops after six months of life.

The main criticism of researchers about Bowlby is that he did not develop an instrument to measure mother-infant interaction; he relied only on detailed observations of infants by two raters, but his work is still foundational for many studies that relate to development of mother and infant relationships. Moreover, Bowlby's studies in infant development and temperament led him to the conclusion that a strong attachment to a mother provides a necessary sense of security for an infant. Without a secure relationship between the mother and infant, infants are fearful and are less willing to explore their environment and learn from their new experiences. By contrast, an infant with a strong attachment to a mother tends to be more adventurous and able to have new experiences from which to learn and develop.

Maternal sensitivity was first defined by Ainsworth (1968) as a mother's ability to receive and accurately interpret her infant's signals and then respond appropriately. According to Ainsworth, there are four parts of maternal sensitivity, and they are: maternal abilities, reciprocal process with the infant, contingency on the infant's behavior, and quality of maternal response. Ainsworth (1968) developed the first criteria to measure this interactive process of maternal sensitivity and infant attachment, and these criteria are applied through two scales: the Maternal Care Scale and the Strange Situation Procedure. The definition of maternal sensitivity was a result of her work in Uganda. Mother and infant health and well-being in Africa were compared with their counterparts in industrial regions (Ainsworth, 1967). Ainsworth's work focused on the

concept of maternal sensitivity. All Ugandan infants were breastfed through 1 year of life, so Ainsworth's work led to a study of early weaning after the first year of an infant's life. This action of an earlier weaning age and an increase in the use of formula-feeding among Ugandan women more likely occurred due to the loss of confidence in the mother's ability to provide the infant with enough milk and as a result of an improved food product industry (Ainsworth, 1978).

Ainsworth believes that feeding style is critical to the formation of attachment process; she asserted that mother feeding style is indicative of how a mother interacts and responds to her infant (maternal sensitivity). Ainsworth (1967) concluded that the feeding and weaning process was related to the attachment process. Feeding and weaning were considered a communication of the mother's internal feelings for her infant, as well as her attitude about caring for her infant. Mothers of secure infants respond to their emotional needs for closeness and comfort, including their need for nourishment (Ainsworth, 1968). Interestingly, Ainsworth also reported that during weaning the Ugandan infants who weaned after the first year displayed distress behavior, such as clinging and crying, which suggests the infant used the breast for comfort, security, and communication with the mother; it means that children use breastfeeding to send cues to the mother. After that, Ainsworth (1973) observed 26 mother-infant dyads in their homes throughout the infancy period. She hypothesized that maternal response could predict the security of attachment in the first year of life. She started her observation by using the Maternal Care Scale (MCS) to measure mother response (cooperation and acceptance). By the end of the same year, she devised a new procedure, the Strange Situation Procedure (SSP), to measure an infant's attachment during the first year.

Ainsworth identified four types of infant attachment: Anxious-Avoidant, Securely Attached, Anxious-Ambivalent, and Disorganized-Disoriented. Ainsworth's theory suggests that

a mother's sensitivity response to her infant's signals in the first year of life is a predictor of secure infant attachment. Thus, the SSP has been shown to effectively measure infant attachment (Ainsworth, 1968). At the same time as Ainsworth's work, Bowlby (1973) proposed that certain types of maternal responses to their infants help make healthier, more desirable styles of attachment. Infants develop a concept of the self, mother, and mother's situation that guides their expectations about the impact of relationships on daily life and stressful situations. Ainsworth (1973) mentioned that some enduring characteristics, such as temperament of the infant will affect how a mother deals with and responds to her infant. In another way, the temperament of the infant will impede or facilitate the development of secure attachment with the mother. Ainsworth asserted that the interpretation of strange situations depended on the infant's temperament when the researcher observed the infant for a single time. One of the infant responses within strange situation is crying when responding to strangers. The main criticism of Ainsworth work is the dependency on a small size in her studies. Moreover, many replicated studies failed to produce the same results (Goldsmith & Alansky, 1987; Seifer, Schiller, Sameroff, Resnick, & Riordan, 1996).

In the context of responsive and actively supportive mothers, infants are likely to attain advantages regarding their sense of security in the environment. One of the ways to promote this relationship is through breastfeeding. For example, Bowlby (1981) asserted that the way to promote maternal attachment is by facilitating the development of an enduring love relationship between the mother and her infant. However, at that time, the concept of maternal sensitivity had not yet been invented. However, Klaus and Kennell (1982) developed a theory which states that there is a sensitive period during the first few hours of life during in which it is critical that the mother and father have close contact in order to optimal development of their infants. It works to

facilitate early skin to skin contact to support breastfeeding. They asserted that the act of breastfeeding itself promotes attachment by facilitating and enhancing the development of an enduring relationship between the infant and mother. Part of this enhancement can be attributed to the hormonal and other effects of breastfeeding on the physiology and psychology of mothers. Breastfeeding mothers have lower blood pressure and a lower response to stress than non-breastfeeding women. Breastfeeding mothers also exhibit lower brain activity and higher relaxation levels during the act of breastfeeding (Klaus & Kennel, 1985).

Mothers who experience less stress as a result of breastfeeding are able to be more sensitive to their infant's security, safety, and social learning (Klaus & Kennel, 1987). Breastfeeding mothers are more socially interactive and show greater sensitivity and care toward their infants than non-breastfeeding mothers (Drake, 2007; Shin, 2006). The explanation for increased sensitivity of breastfeeding mothers to their infants is perhaps a result of hormonal influences, but it may also be related to the proximity between a mother and her infant during breastfeeding (Wilkinson, 2006). In addition, Britton (2006) reported that the fact that a mother made the choice to breastfeed demonstrates that they had already been seeking greater closeness to their infant. Also noteworthy, breastfeeding involves skin-to-skin contact between a mother and her infant, which may increase a mother's desire to be close to her infant and express a greater sensitivity toward her infant.

Klaus and Kennel (1982) concluded that the more mothers and infants are kept close to each other, the greater the exhibition of maternal sensitivity and security of attachment in the infant. The main criticism of Klaus and Kennel's work is that these researchers pay special attention during the first two hours after child birth without studying other factors that may affect this relationship.

At the same time, Reva Rubin introduced the concept of maternal role attainment (Rubin, 1982). She described the maternal role as a complex cognitive and social process which is earned, reciprocal, and interactive. She described a predictable process of maternal attachment during the post-partum period. Using a nursing observation, she characterized maternal attachment as part of a complex phenomenon of maternal role development. Rubin reported that maternal sensitivity occurs over a much longer period of time, extending over months after the infant's birth. Maternal sensitivity interactions such as daily feedings (breastfeeding) and social-behavioral interactions have been the focus of nurses' observations about responsiveness as an aspect of maternal role attainment (Rubin, 1985). Moreover, Rubin asserted that some pattern of infant behavior (temperament) leads the mother to a certain type of response that facilitate or impede a secure attachment relationship. These behaviors that impede secure attachment may cause the infants to refuse to interact with their mother at observed time of interaction.

Following this line of investigation, Ramona Mercer (1982) defined maternal role attainment as the process in which the mother achieves competence in her role and integrates mothering behaviors into an established role set so that she is comfortable with her identity as a mother (Mercer, 1982). Mothers that are sensitive to the needs and cues of the infant demonstrate evidence of successful maternal role attainment. Mercer's work contributed to the development of attachment theory through several large studies of low-risk families. In a longitudinal study of maternal attachment and maternal role development during the first year after giving birth, she found that maternal characteristics such as self-esteem, depression, and mastery/control of life events (success in breastfeeding) accounted for much of the difference in maternal attachment and sensitivity (Mercer & Fertetich, 1982). Control of life events such as success in breastfeeding appeared to be a consistent major predictor of maternal sensitivity (Mercer &

Ferketich, 1994). The main criticism of Mercer's work is that she did not consider other factors such as infant characteristics, environmental factors, and family support.

Bates and Pettit (1982, 1984) reported that sensitive mothers react to their infant's needs in an affectionate manner. Sensitive mothers generally do not interfere in the ongoing behaviors of their infants but allow infants to have a sense of their own autonomy. In fact, Van Den Boom & Hoeksma (1994) found that infants with difficult infant's temperament were treated differently than their easy infants, and with mothers who reported difficult infants demonstrated being less sensitive to their infants.

At the same time, Barnard (1994) developed a model called the Barnard Model, which depended on Bowlby attachment theory and Ainsworth attachment theory (Bowlby, 1968; Ainsworth, 1968). This model provided a conceptual basis to build an instrument measuring the interaction between mothers and infants during breastfeeding called Nursing Child Assessment Feeding Scale negative to measure effects, child state, child responsiveness, and the clarity of cues. Usually, the main caregiver is the mother. The mother has a huge impact on the child's life, so the mother needs to understand her infant's cues and respond correctly to their cues (maternal sensitivity) (Barnard, 1994)

The mother's characteristics affect the quality of interaction between mother and infant. Barnard (1994) explained the current understanding of attachment theory as believing that nurses and health care providers are still in the process of learning about how infants and mothers connect with one another during the feeding process (breastfeeding), and what happens when that connection is disrupted. It is important for all nurses and health care providers who work with infants and their mothers to be schooled in the historic journey of attachment theory. It is also essential that we understand that this journey has just begun. However, the weaknesses of

this model include the poor definition of health, nursing therapeutics, and infant; and that it is only applicable to a specific population (infants), and that the theory of interaction is considered limited in its ability to meet the needs of a wide range of nurses and their infant patients.

In conclusion, most research on maternal and infant relationship and maternal sensitivity depends extensively on observational methods. It follows that using the observation method along with the maternal report will also enhance our understanding of maternal sensitivity. Researchers need to continue the journey to better understand breastfeeding and maternal sensitivity using well-designed studies and valid instruments.

Study Summary

The purpose of this current study is to answer the following research question: What is the potential effect of breastfeeding on maternal sensitivity during the infant's first year of life? The Maternal Attachment Inventory (MAI) is a tool that measures maternal sensitivity to her infant. In this cross-sectional study, this tool was administered to women who were breastfeeding, not breastfeeding, or who have breastfed and whose infants are between two and 12 months of age. This age was chosen, because the oxytocin level rises to the peak. Maternal sensitivity is defined as the mother's ability to recognize and respond to her infant's cues (crying, smiling, and yawning, etc.). Interactions between mother and infant are characterized by harmonic interchanges, often referred to as the "mother-infant dance." If the mother accurately recognizes her infant's cues, then she can encourage the infant's exploration, helping and protecting the infant when necessary (Bystova, 2009; Shin, 2007). The maternal response to an infant plays an important role in an infant's later growth and development. This information is important because if a mother has difficulty responding to her infant, there are interventions nurses and other health care providers can use with this mother such as role modeling,

counseling, and education. However, even after decades of research, only two articles were identified that provided research findings of how to help women improve maternal sensitivity with breastfeeding (Drake, 2010; Shin, 2007), which demonstrates a gap in the science of maternal sensitivity and breastfeeding. A review of the literature was performed to gain a greater understanding and identification of how breastfeeding may affect maternal sensitivity.

Manuscripts

This dissertation is composed of an introductory chapter, three manuscripts (Chapters 2, 3, 4) and a chapter discussing the implication of the findings (Chapter 5). A review of the literature is provided in chapter two and includes the first manuscript titled “The Potential Effect of Breastfeeding and Maternal Sensitivity during the First Year of Life.” This manuscript synthesizes the possible effect of breastfeeding on maternal sensitivity during the first year of life, the gaps in the literature, and the implications for clinical care. Chapter three is comprised of the second manuscript, titled “Measures of Maternal Sensitivity during the First Year of Life: A Systematic Review.” This manuscript provides a review of measures of maternal sensitivity during the first year of life. Future implications for study and practice are provided in this manuscript also. Third manuscript is located in chapter four, titled, “Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life.” In this manuscript, the methods and results, as well as study limitations, are presented. Chapter five provides an in-depth discussion of the results including implications for practice and policy.

Definition of Variables

Maternal Sensitivity was defined as the mother’s ability to act and respond to infant cues timely and accurately (Britton, 2006; Shin, 2007). Behaviors of sensitive mothers include: talking to, feeding, comforting the infant, responding to distress, encouraging discovery of the

environment and watching. Maternal sensitivity is defined as the mother's ability to recognize when they are successful in interpreting the infant's cues, providing appropriate responses, and recognizing when the infant is responsive to these efforts (Britton et al, 2006). The maternal sensitivity concept has been defined in various terms in the literature; the terms maternal responsiveness, mother-infant interaction, maternal attachment, and maternal bonding are commonly used interchangeably with maternal sensitivity. So maternal sensitivity will be measured with a 26 item self-report instrument called Maternal Attachment Inventory (MAI; Muller, 1994)

Breastfeeding means exclusive breastfeeding directly from the breast without using any type of other supplement. Exclusive breastfeeding was defined as at least two months of breastfeeding with no other supplemental type of feeding, and according to Labbock & Krasovec (1990) as full, almost exclusive breastfeeding or predominant breastfeeding. In this current study, breastfeeding duration will be determined by the mother's report.

Infant Temperament is defined as the way in which an infant approaches and reacts to the world (Thomas & Chess, 1977). There are three types of infant temperament. These descriptions will be given to the mothers who will be asked to indicate how much each description applies to their child; that will allow us to categorize an infant as easy/difficult/shy.

- *Easy or Flexible infant*: this means an infant who is regular in biological rhythms, approachable, adaptable to the environment, and generally positive in mood. Such a child is easy for caregivers. The infant sleeps regularly during the night and day, feeds regularly, adapts to change quickly, is generally cheerful and expresses distress or frustration mildly. In fact, children with easy

temperaments may show very deep feelings with only a single tear rolling down a cheek (Thomas & Chess, 1977, Hall, Wilson & Frankenfield, 2003).

- *Difficult or fussy infant*: those who have an irregular schedule for sleeping, feeding, and bowel movements. The fussy infant slowly adapts to new situations and people and expresses mood. Moreover, if frustrated, the fussy infant may have a temper tantrum. Usually the caregiver for a fussy infant describes the infant as difficult to manage (Bates, 1983; Thomas & Chess, 1977).
- *Slow-to-Warm-Up (shy infant)*: those who feel discomfort with any new situation and adapts slowly to the environment. This infant expresses negative mood slowly and may or may not have an irregular schedule for sleeping and feeding. If this infant is pushed to join the group, the child's shyness immediately becomes worse. This infant can gradually become hyperactive (Thomas & Chess, 1977; Hall, Wilson & Frankenfield, 2003).

Mother's Employment: defined in this current study as unemployed or full time employee outside the home since other types of employment (like part time or remote work) are not offered in Jordan (Alverson, Strickland, Gilboa, & Correa, 2011).

Educational Level: Educational level is the amount of school achieved/ completed by the mother and is described by category: primary, secondary, undergraduate and graduate (Alverson, Strickland, Gilboa, and Correa, 2011).

CHAPTER 2

Chapter Introduction

The purpose of this chapter is to provide review the literature of the potential effect of breastfeeding on maternal sensitivity during the first year of life. This review was conducted to obtain a general understanding of the potential effect of breastfeeding on maternal sensitivity during the first year of life. Using a life course perspective the maternal contexts will be arranged in a biologic, physical and social construct. This chapter is comprised of a systematic review in the format of an article to be submitted for journal submission. The referencing style of this target journal will be applied in this manuscript. **Manuscript 1: The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life: Literature Review**

Abstract

Problem: Poor maternal sensitivity leads to insecure infant attachment, and has been associated with negative cognitive consequences later in life. Maternal sensitivity is an indicator of the interactions between mothers and infants characterized by mutual and concurrent interchanges. If the mother is able to accurately recognize and understand the infant's cues, then she can provide an appropriate and secure foundation to encourage the infant's exploration. Literature suggests that maternal sensitivity is enhanced as the oxytocin level of the mother increases in the early postpartum period. One of the variable factors that increases the level of oxytocin is breastfeeding. Oxytocin level remains high in breastfeeding mothers compared to formula-feeding mothers in the first few months.

Purpose: Review and synthesize all published studies that examine the potential effect of breastfeeding on maternal sensitivity during the first year of life.

Search Strategy: Searches were conducted using the following databases: Medline, CINAHL, and SCOPUS. Inclusion criteria were as follows: published in English, and no limitation on publication date. Articles were excluded if they did not focus on the main concepts of this review, maternal sensitivity, if they focused on the physiological aspects of breastfeeding, or if they included children breastfed after one year of age.

Results of Literature Review: Nineteen out of 60 articles met the inclusion criteria. All of the studies that were identified for this review were quantitative.

Synthesis of Evidence: Four categories emerged from these studies: Potential effects of breastfeeding on maternal sensitivity; Potential effects of *breastfeeding-related environment* on maternal sensitivity; Potential effects of infant's health on maternal sensitivity, and No potential effect of breastfeeding on maternal sensitivity.

Implication for Practice: Identification of breastfeeding as a factor to enhance maternal sensitivity for newly and multi-children mothers will or may assist health care providers and social workers to help mothers improve their interactions with their infants to an optimal level.

Introduction

Breastfeeding is defined as the transfer of human milk from the mothers' breast to the infant. Not only is breast milk an optimal form of infant feeding, but it also supports optimum growth and development for human infants (World Health Organization, 2009). However, many mothers discontinue breastfeeding before their infants are six months of age. In 2013, breastfeeding rates in the United States were reported at the highest levels in US history. According to the Centers for Disease Control and Prevention (2014) more than 75% of new mothers initiated breastfeeding in the hospital, yet only 40% of breastfeeding mothers continued to breastfeed their infants for six months as recommended by the World Health Organization (WHO, 2009). The CDC (2014) reported that if 75% of US. mothers breastfed their children for at least three months after childbirth, it would lead to an average savings of thirteen billion dollars per year in health care costs and prevent 911 infant deaths per year. Despite the positive health impact of breastfeeding for infants and their mothers, the rate of breastfeeding among mothers in the US today remains below global recommendations (World Health Organization, 2012).

Much of the breastfeeding literature focuses on advantages that breastfeeding has for the infant, such as the transfer of nutrients and antibodies that help with immunity (Britton, 2006, Kim, 2011; Tharner, 2011). But there is also evidence that breastfeeding has a significant role in shaping maternal sensitivity (Brandt, 1998). Maternal sensitivity is defined as the mother's ability to recognize and respond to infant cues consistently and is critical to interactions that influence infant development (Shin, Park, & Kim, 2006). Mother-infant interactions are

characterized by mutual and concurrent interchanges, and are often referred to as the “mother-infant dance” (Ainsworth, 1968). If the mother is able to understand and respond appropriately to her infant’s cues, then she can provide an appropriate and secure base for exploration by the infant, watching over and protecting the infant when necessary (Else-Quest, Hyde, & Clark, 2003). The mother’s interactions with her baby during the infancy period have been reported as a predictor of infant mental health, cognitive abilities, and physical health later in life (Tharner et al., 2012). Studies like this suggest that maternal sensitivity plays a key role in their infants’ lifelong development (Else-Quest et al., 2003; Tharner, et al., 2012). However, even after decades of research, there is little evidence available to identify mothers and infants at risk of insecure attachment that cause psychological and physical health problems, mediated and enhanced by maternal sensitivity. Also, few interventions have been identified that improve maternal sensitivity and include support from family and friends and caregiving classes during the prenatal period (Tluczek, Clark, McKechnie, Orland, & Brown, 2010).

The purpose of this paper is to review and synthesize published literature on breastfeeding and maternal sensitivity and will address the following question: What is the Potential effect of breastfeeding on maternal sensitivity during the first year of life? The first year of life is the foundation that shapes children’s future health, growth, development and achievement at school and in life in general. Moreover, the first year of life is the most critical in shaping the child’s brain architecture. Early experiences provide the foundation for the brain's organizational development and functioning throughout life (American Academy of Pediatrics, 2011).

Methods

The literature search was conducted using the following electronic databases: Medline, CINAHL, and Scopus. The following search terms were used: maternal sensitivity AND breastfeeding, maternal responsiveness AND breastfeeding, mother-infant interaction AND breastfeeding. The scope of the search was later expanded to include a reference list of related articles, including dissertations, theses, conference proceedings, editorials, opinions and theoretical articles (see Figure 1). Articles were screened with the overall goal of identifying data-based studies that focused specifically on the relationship between the two concepts: breastfeeding and maternal sensitivity. Inclusion criteria were as follows: 1) published in English, and 2) no limitation on publication date. Articles were excluded 1) if they did not focus on the main concepts of this review (breastfeeding and maternal sensitivity), 2) if they focused only on the physiological aspects of breastfeeding and maternal sensitivity, or 3) if they included children breastfed after one year of age.

Each abstract was thoroughly evaluated since the title often was insufficient to judge the relevancy of a given study for this review. If the abstract was relevant to the focus of this review, the article was transferred to the data-management software Endnote. Out of 60 articles, 19 met the inclusion criteria. The Prisma table Figure (1) at the end of this paper provides a detailed description of the articles that are included in this literature review. A knowledge-management method using a Word table was created to extract the data from the retrieved articles. The researcher used six categories to organize the data in a summary table (researcher, aim, concept, method, sample and results). Each article was printed, and data were entered according to the variables addressed so that comparing studies across each outcome was feasible. The themes in

the results section were determined according to how the results of the relationship between breastfeeding and maternal sensitivity were categorized.

Results of the Literature Review

The results of the literature review are displayed in Table 1. The four themes are as follows: potential effects of breastfeeding on maternal sensitivity, potential effects of *breastfeeding-related environment* on sensitivity, potential effects of infant health on maternal sensitivity, and no effect of method of infant feeding on maternal sensitivity.

Theme one: Potential effects of breastfeeding on maternal sensitivity.

Among mothers, the physical and psychosocial changes occur during breastfeeding that positively impacts maternal sensitivity. These physical and psychosocial changes that women experience during breastfeeding were identified in over half of the studies displayed in Table 1 (Britton et al., 2006; Danvon, 1978; Kim et al., 2011; Kuzela, Stifter, & Worobey, 1990; Nissen, 1998; Tharner et al., 2012; Wisenefield, 1985). The physiological changes that resulted from breastfeeding and that may impact maternal sensitivity include: maternal changes in the brain, heart rate, response to stimuli, and hormone levels (Kim, 2011). These physiological changes occur as a result of sucking during breastfeeding and influences maternal sensitivity, through secretions in oxytocin hormone and changes in the brain that include increased activity in the frontal lobe and the inferior frontal gyrus that extends to the frontal operculum. For example, Kim (2011) reported that in a subset of 17 dyads from a larger study observing 657 mother and infant dyads, MRIs were used to measure brain changes associated with increased maternal sensitivity. In this current study, The Ainsworth Maternal Sensitivity Scale (AMSS) was also used to measure maternal sensitivity. Mothers who breastfeed show more activity in the brain areas responsible for maternal sensitivity than formula-feeding mothers. In another study, Nissen

et al. (1998) examined whether maternal personality traits like anxiety, fatigue, and sensitivity were correlated with hormone changes that resulted from breastfeeding. Nissen et al.(1998) reported that the oxytocin levels were highly correlated with the level of maternal sensitivity ($r = 0.45$). Furthermore, Danvon (1978) indicated that breastfeeding mothers experience changes that related to enhance maternal sensitivity. For example, breastfeeding mothers may have been more relaxed under laboratory conditions reporting less muscle tension and an increased feeling of calm than formula-feeding mothers did relate to secretion of oxytocin hormone. A breastfeeding mother shows greater cardiac variability responses to their infants' stimulus than a formula-feeding mother.

Only one study evaluated the psychosocial changes associated with breastfeeding: Britton et al., (2006) identified that breastfeeding could be a means of increasing maternal sensitivity and improve the attachment between mother and infant. Britton (2006) study reported that breastfeeding could be a means of increasing maternal sensitivity and improve the attachment between mother and infant. Britton et al. (2006) reported that breastfeeding mothers scored higher on the NCASF than formula-feeding mothers, and demonstrated increased security and decreased disorganization. Boytsov (2009) and Tessier (1998) discuss the relationship between the process in breastfeeding and maternal sensitivity by describing physiological and psychosocial changes without any confounding factors such as the presence of family support and working-related conditions. Both the physiological and psychosocial changes that occurred in the mother during the act of breastfeeding supported the Potential effect of breastfeeding on maternal sensitivity.

Theme two: Potential effects of the *breastfeeding-related environment* on maternal sensitivity.

In this review of the literature, a breastfeeding-related environment is characterized by the following: skin-to-skin contact; support from partner and family members; supportive work environment; and breastfeeding intervention programs (Bystova, 2009; Tessier, 1998; Else-Quest, 2003). Findings from the physical contact studies (skin-to-skin contact) identified overwhelming positive relationships with maternal sensitivity. Encouraging skin-to-skin contact during the first two hours after childbirth affected dyadic reciprocity, mutuality and maternal sensitivity during the infancy period, and enhanced the relationship between the mother and her infant. A lack of physical contact during the first two hours negatively affected mothers and infants in the secretion of breastfeeding hormones (Bystova, 2009; Tessier, 1998; Else-Quest, 2003). Social support includes support from partner and family members, the working environment, and breastfeeding intervention programs during the prenatal period. These same support factors were related to increased maternal ability to recognize infant cues in the early postpartum period (Cooklin, Rowe, & Fisher, 2012; Ekstrom & Nissen, 2006). Mothers who breastfed had significantly higher maternal sensitivity scores than mothers who formula-fed their infants.

Theme three: Potential effects of an infant on maternal sensitivity.

There is a Potential effect of infant physical health and psychological health (temperament) on the mothers' decision to breastfeed and her expression of maternal sensitivity. A study by Tluzek (2010) reported that the health of the infant, such as suffering from health condition, may cause the mother not to breastfeed her infant and be sensitive, suggesting that

maternal sensitivity is not related to breastfeeding. Conversely, another study examined the effects of infant health condition on the quality of maternal sensitivity in the context of feeding using the mixed method design in 17 mother-infant dyads. The psychological status of infants such as infant temperament was reported in three studies that may cause many mothers to be less sensitive to their infant needs and discontinue breastfeeding. Edhbory et al. (2005) mentioned that breastfeeding did not relate significantly to maternal sensitivity and mother attachment to her infant when breastfeeding is known to promote maternal sensitivity through oxytocin release. Tulzek (2010) and Edhbory et al. (2005) both suggest that infant health and infant temperament may cause mothers to be more sensitive. The infant's physical and psychological health (temperament) may be responsible and may cause the mother not to breastfeed the infant (Jonas, 2011)

Theme four: No potential effect of feeding method on maternal sensitivity.

The only two studies that examined differences in maternal sensitivity between breastfeeding mothers and formula-feeding mothers, reported no significant difference (Drake, 2007, Wilkinson & Scherl, 2006). This finding was consistent whether using a large sample or different instruments. Drake et al. (2007) mentioned factors such as the presence of siblings, the mother's self-esteem, and the mother's satisfaction with life as having a significant impact on self-reported maternal sensitivity scores. This limited research suggests there may be an impact on breastfeeding and maternal activity, but more studies are needed to verify this.

Critique

The results of this review demonstrate that there is not, as yet, an agreed definition of maternal sensitivity. The maternal sensitivity concept has been defined in various terms; that include maternal responsiveness, mother-infant interaction, mother-infant attachment, maternal

attachment, and maternal bonding (Eldhbory, 2003). Six of the studies in the literature included some definition of maternal sensitivity using the interchangeable terms as follows: maternal responsiveness, mother-infant interaction, maternal bonding and mother behavior (Britton et al., 2006; Danvon, 1978; Kim et al., 2011; Kuzela, Stifter, & Worobey, 1990; Nissen, 1998 ; Tharner et al., 2012; Wisenefield, 1985). Using a unified and clear definition can provide a context for people unfamiliar with the concept of maternal sensitivity.

Using a well-defined theoretical framework underpinning a study guides the research question and provides an explanation of the relationship between the theoretical concepts of breastfeeding and maternal sensitivity (Duffy & Duffy, 2008). Of the 19 studies included in this paper, only eight studies reported a theoretical framework that was integrated into their literature review of breastfeeding and maternal sensitivity. The predominant theories used to explain the relationship between breastfeeding and maternal sensitivity were Bowlby's attachment theory (n = 3) and Ainsworth's attachment theory (n = 2), since they are focused on mother and infant interaction (Britton et al., 2006; Danvon, 1978; Kim et al., 2011; Kuzela, Stifter, & Worobey, 1990; Nissen, 1998 ; Tharner et al., 2012; Wisenefield, 1985). At this point, inconsistent use of frameworks to develop research studies impedes a thorough comparison of the studies and further development of the phenomena. It is hoped that future work in this area will recognize this need of a unified framework (Shadish, 2001). Using Bowlby attachment theory for future studies would be helpful. Another important issue in the literature is using nine different instruments to measure maternal sensitivity. Using many instruments will impede the ability to compare the studies. However, many of the aforementioned studies used various questionnaires which were not specifically named to measure maternal sensitivity. These studies also failed to report the psychometric properties of the instruments used (Ekstrom & Nissen, 2006; Kuzela et

al., 1990; Pearson, Lightman, & Evans, 2011; Wisenfield, 1985). Therefore, the findings of these studies should be interpreted with caution. However, previous studies suggest that the field is maturing. Self-report (women's perceptions) and observational methods are always going to be part of studying breastfeeding and should be honored for their contributions. Future researchers will improve the scientific understanding of maternal sensitivity through the use of well-validated specialized physiological and reported instrument in measuring the phenomenon of maternal sensitivity, such as MIRI and AMSS, since both have a high rate of reliability (Drake, 2007).

Many studies used small sample sizes due to the financial burden of conducting large studies (Danvon, 1978; Kim et al., 2011; Nissen, 1998; Wisenfield, 1985), which limited the generalization of the results to the larger population. A study that has a small sample size may be inconclusive or have limited application. All of the previous six studies in this review are quasi-experimental that used a subject pool that was 90% white and highly educated. The focus on white and highly educated women may limit the researchers' ability to generalize the findings to other populations and geographic areas. The researcher needs to apply the maternal sensitivity measuring tools to all type of populations to check efficacy.

Discussion and Limitation

The purpose of this review was to evaluate existing evidence on the relationship between breastfeeding and maternal sensitivity during the first year of a child's life. The major findings from the current state of science point out the following types of relationships that exist between breastfeeding and maternal sensitivity. First, it is clear that suckling during breastfeeding improves maternal sensitivity by causing physiological and psychosocial changes in breastfeeding mothers that include increased activity in the emotional area of the brain and

increased heart rate. Which means skin-to-skin contact could increase a woman's oxytocin level? But not to the same degree as breastfeeding(Cong et al, 2015; Drwet, 1982). For example, A Cong et al (2015) reported that maternal oxytocin levels in skin-to-skin contact (SSC) group were significantly increased from baseline (41.25 ± 25.74 pg/mL), to during post skin-to-skin contact (P-SSC) (49.78 ± 25.39 pg/mL), and continued to maintain at a higher level during the post-30 mins of P-SSC (50.10 ± 31.50 pg/mL), $F_{(2, 36)} = 4.52$, $p < 0.05$. In contrast, Drwett (1982) report that the breastfeeding mothers' plasma *oxytocin* rose from 54 pg/ml before breastfeeding to 130 pg/ml during breastfeeding and *oxytocin levels* changed rapidly from minute to minute. This means that suckling raises oxytocin levels more than skin-to-skin contact, which may explain why breastfeeding has the potential to be more effective in increasing maternal sensitivity levels. Increased breastfeeding education in the peri-natal postnatal period and social support after childbirth may improve maternal sensitivity by encouraging mothers to breastfeed.

Another finding is that infant health status impacts the mother's decision to breastfeed. If the infant experiences any metabolic disease, and the mother discovers this during pregnancy or after delivery that would negatively impact her decision to breastfeed and this may positively impact her sensitivity to her child's cues (Drake, 2007). Finally, one study found that there is no relationship between the method of feeding and maternal sensitivity, as the literature showed that the mother who formula-feeds is just as sensitive to her infant's needs as the breastfeeding mother.

The search was limited to the English language and research that took place in Europe, Australia, and the USA. Another limitation was the limited number of RCT in these areas. These articles focused on *breastfeeding-related environments* and not on the breastfeeding process. The general limitations include the risk of confounding (history and number of previous children)

small participant size, and the retrospective design of the examined studies. Furthermore, the studies in this review used different analytical procedures, which limit the synthesis of the studies. Moreover, the inconsistency of definitions and measurement tools limited the researcher's ability to compare the findings and applications to practice.

Implications

Research can strengthen the scientific understanding of the potential effect of breastfeeding on maternal sensitivity by focusing on breastfeeding holistically instead of just the related factors of the mother and infant. Further investigation should explore maternal sensitivity in single women, women of color, and women with less education and fewer economic resources.

Further research is needed that applies a specific and explicit theoretical framework using one defined concept of maternal sensitivity. A unified and clear definition of maternal sensitivity with an explicit theory of the relationship between breastfeeding and maternal sensitivity could provide context for people unfamiliar with the concept. Researchers need to conduct more quasi-experimental and randomized, controlled trials with comparison group, rather than descriptive trials such as research studies which contain two subject groups. The researchers can thus compare the difference between breastfeeding mothers and formula-feeding mothers that result in significant differences between these mothers.

Conclusion

There is strong evidence that a relationship exists between breastfeeding and maternal sensitivity. However, that relationship is not well-defined. The potential effect of breastfeeding on maternal sensitivity is likely not directional, and it is probably not exclusive (i.e. there is also a relationship between formula-feeding and maternal sensitivity). This synthesis also supported

that the effect of breastfeeding on maternal sensitivity is clinically significant for the health and well-being of infants so we better understand the breastfeeding maternal sensitivity relationship. There were several gaps in the literature review that merit further exploration. Firstly, several different instruments were used. Secondly, definitions of maternal sensitivity were not always included in the reports. Thirdly, definitions that were sometimes included differed significantly across studies. Fourthly and finally, only a few studies focused exclusively on maternal sensitivity. Knowledge in the field will develop if researchers in the future replicate or closely approximate the most promising and best-designed studies.

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Figure 1

PRISMA for Breastfeeding and Maternal Sensitivity

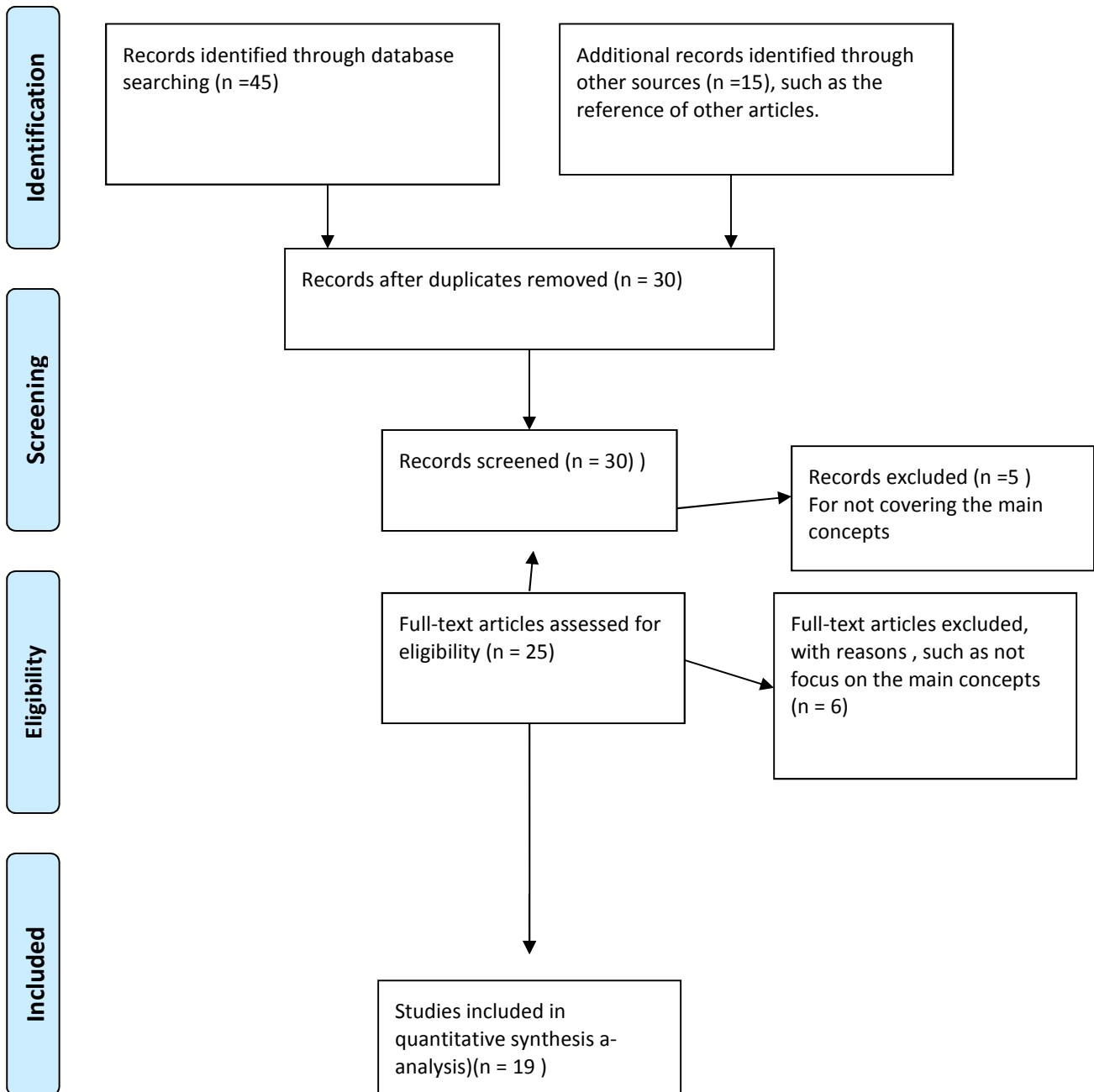


Table 1
Literature Review

Table 1
Breastfeeding and Maternal Sensitivity

Study	Aim	Concept/ Theory	Methods	Sample	Results
Level of study			Instrument		
Britton et al, 2006 USA II-1 BF-MS	Examine RT of BF intent, Attachment & MS.	Attachment Bowlby's Attachment Theory ^a	Longitudinal, prospective & non-randomized study NCAST-F ^f AMSS ^g	152 mothers with healthy singleton infants, uncomplicated VD	Prenatal BF intent related to attachment security that resulted from maternal sensitivity ($r=0.24$). Early maternal sensitivity in BF mothers was not a predictor of the duration of exclusive BF during the infant's first year of life.
Bystrova et al, 2009 Russia I BFE-MS	Examine the impact of mother-infant interaction practices on maternal sensitivity	Concept: Mother & infant interaction. No theory	Prospective, cross sectional RCT PCERA ^h	176 MI-dyad, FT healthy baby without complications.	Women that BF demonstrated greater infant sensitivity than those who do not F(1481)=53.71 at the first few months. There is NS relationship between the duration of BF & maternal sensitivity (PCERA) at 4 months of age.

Study Level of study	Aim	Concept/ Theory	Methods Instrument	Sample	Results
Cooklin et al, 2012 Australia III BFE-MS	Investigate the association between the M-I relationship, including maternal sensitivity, duration of BF, & maternal employment status, at 10 months after childbirth.	No definition No theory.	Longitudinal & descriptive study PAQ ^j	165 employed, pregnant women >18 years of age, English speaking	There were no significant differences in maternal sensitivity between employed and non-employed women $\chi^2=3.45$
Danvon et al, 1978 USA II-1 BF-MS	Examine that infant cognitive development is a function of maternal sensitivity to infant during BF.	Maternal responsiveness Ainsworth Attachment Theory ^b	Prospective, nonrandomized & longitudinal study AMSS ^a DVP ^k HR ^l	22 mother-infant dyads.	Maternal sensitivity during BF was related to subsequent infant performance in cognitive tasks compared to formula-feeding mothers $\chi^2=3.21$ The mother who have high score in Development of Visual Pursuit are more sensitive

than mother with low scoring infants.

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Study Level of study	Aim	Concept/ Theory	Methods Instrument	Sample	Results
Drake et al , 2007 USA III NFBF	Examine potential predictors on maternal sensitivity, including infant feeding.	Maternal responsiveness Care-giving Theory ^c	Cross-sectional survey design MIRI ^m RSE ⁿ SWLS ^o	177 M-I dyads in the first 2 to 4 months after child birth.	Other factor such as satisfaction with life, self-esteem, & many children cause more maternal sensitivity scores F = 4.176 not BF.
Edhborg et al, 2005 Sweden II-2 I-MS	investigate associations between blues, bonding, perception of the child's temperament and depressive symptoms two months postpartum in both parents	bonding	Cross-sectional correlational (PBQ) ^w	, 106 couples(dads and moms) returned all questionnaires	N/S maternal sensitivity (MIRI) in BF mothers Fathers scored significantly higher on PBQ and its subscales two months postpartum than did mothers indicating that at this time the fathers had more difficulties than mothers with the emotional

Ekstrom &Nissen, 2006 Swedian I BFE-MS	Examine the relationship between program in BF counseling during prenatal & maternal sensitivity	No definition No theory	Longitudinal, prospective & RCT	540 first-time mothers	relationship with the child. 92% of the mothers reported that they breastfed their children at 2 months. Breastfeeding did not significantly relate to postpartum bonding in the regression equation for the mothers, breastfeeding is known to promote maternal bonding through Oxytocin release. Those who received BF counseling expressed more maternal sensitivity to their infants ($\chi^2=15.45$). The mothers in the intervention group were more confident with their infant.
Else-Quest et al, 2003 USA II-1 BFE-MS	Investigate the role of early BF in the development of maternal sensitivity.	Bonding Bonding Theory ^d	Longitudinal study & non- randomized study. PCERA ^h	570 mother-infant pairs > 18, between weeks 12 &21 of pregnancy, student	BF mothers tended to demonstrate higher levels of sensitivity than formula-feeding mothers.

or unemployed, had a telephone.

BF mothers felt more positively reinforced by their infants. $F(1, 495) = 3.07$
 At 4 months, these results support the effect of breastfeeding on maternal sensitivity, but not at 12 months $F(2, 489) = .74$

Study	Aim	Concept/ Theory	Methods	Sample	Results
Level of study			Instrument		
Kim et al, 2011 USA II-1 BF-MS	Investigate the relationship between BF, Maternal brain response to her infant stimuli, & maternal sensitivity after child birth.	No definition No theory.	Prospective, longitudinal & non randomized study. CIB ^P	17 healthy Caucasian biological mothers of healthy baby.	BF mothers showed greater activations in the areas responsible for maternal sensitivity (Amyglada and hypothalamus) while listening to their baby crying than formula-feeding mothers ($r = .62$).
Kivurji, 2005 Finland II-1 I-MS	Examine hypothesis that infant temperament associated with maternal sensitivity and continuity of breastfeeding.	Maternal sensitivity No theory	Cross-sectional-correlational study PCERA	65 low-risk mothers and their full-term and healthy infants	Infant temperament was related to maternal sensitivity and continuation of breastfeeding at 3, 6 and 12 months of age ($\chi^2 = 5.85, DF = 1, p = 0.016$).

	Examine the hypothesis that boys and girls would differ in their temperament characteristics in the first year of life.				Gender differences in temperament were evident already at 6 and 12 months of age
Kuzela et al, 1990 USA III BF-MS	Examine the relationship of maternal sensitivity to BF outcomes at six weeks postpartum.	No definition. No theory.	Prospective, comparative descriptive Study NCAST-F ^f	42 Latina mothers in 3rd trimester of pregnancy. Primiparous, antepartum desire to BF > 8 weeks	Continuing BF > 6 weeks postpartum increases maternal sensitivity (NCAFS scores) more than dyads who had stopped BF by 6 weeks.
Study Level of study	Aim	Concept/ Theory	Methods Instrument	Sample	Results
Tester-jones, 2015 UK II I-MS	Examine the hypothesis that maternal rumination would mediate the relationship between social support and maternal attunement when infant negative temperament was high, but not low	Maternal attunement	Descriptive correlational study (MIRI)	203 mothers with infants aged between nine and 14 months. Period.	Direct relationships between negative temperament, maternal depressive symptoms, lower maternal self-reported responsiveness to the infant and continue of breastfeeding
Nissen et al, 1998 Sweden II-1 BF-MS	Determine whether maternal sensitivity was correlated with hormone changes relate BF.	No definition No theory.	Longitudinal, prospective & non randomized KSP ^q	37 healthy mother dyads FT infants.	The amount of milk the infant took in during feeding increased the oxytocin level in the mothers' blood.

The amount of oxytocin level correlated with the level of maternal sensitivity ($r = 0.45$)
N/S relationship between duration of BF & maternal sensitivity.

Study Level of study	Aim	Concept/ Theory	Methods Instrument	Sample	Results
Tessier et al.(1998) Colombia I BFE-MS	To compare the maternal sensitivity of mothers who had skin-to-skin contact with early baby suckling with a more traditional care group to compare maternal sensitivity and early infant suckling between mother who did and did not have skin-to-skin contact	Concept: Bonding is the relationship between mother and her infant. Bonding Theory ^d	Prospective, longitudinal & RCT NCAST-F ^f	488 healthy M-I dyads	The mothers in the skin-to-skin were more sensitive to their infants. Mothers in skin to skin group more sensitive to time spent (less than 10 days) in the hospital for their infants than formula-feeding mothers.
Tharner et. al, 2012 Netherland III BF-MS	Examine the relationship of BF with maternal sensitivity & M-I attachment	Attachment Ainsworth Attachment Theory ^b	Longitudinal, prospective & cohort study AMSS ^g	675 M-I dyads. with 2 parents & 4 grandparents	Longer duration of BF was associated with higher maternal sensitivity ($r=0.24$)

Study Level of study	Aim	Concept/ Theory	Methods Instrument	Sample	Results
Tluczek, 2010 USA II-2 IH-MS	Examine effects of neonatal diagnosis on the quality of maternal sensitivity in the context of feeding.	No definition. No theory.	Longitudinal &mixed- method PCERA ^h STAI ^m	17 mother &infant dyads 1of 4 have conditions including cystic fibrosis, congenital hypothyroidism	Duration of BF was not related to attachment problems, but longer BF predicted a lower risk of problem in sensitivity. Maternal oxytocin receptor genotype was not a significant moderator of maternal Mothers of infants with metabolic disease formula fed. Mothers (normal baby) with low task-oriented behavior (showed more sensitivity to their infants' cues ($\chi^2=137$). Mothers of infants with metabolic disease had significantly more anxiety &depression. Breastfeeding mothers at 3 months postpartum were more sensitive in their interactions with their infants at 6 months
Jones, 2015 Canada II-2	examined the association between breastfeeding at three months postpartum and infant	No definition No theory	Longitudinal Correlational study AMSS	170 breastfeeding mothers for breastfeeding postpartum.	

B-Ms temperament at 18 months postpartum and whether this link was affected her sensitivity postpartum, and elevated sensitivity, in turn, predicted reduced levels of negative affectivity in infant temperament at 18 months postpartum. After controlling for confounders (effect $ab = -0.0312$ [0.0208], 95% CI = -0.0884 to -0.0031).

Study	Aim	Concept/ Theory	Methods	Sample	Results
Level of study			Instrument		
Wilkinson & Scherl, 2006 Australia II-2 NEBF	Test psychological health & maternal attachment in an sample of BF & formula-feeding mothers	Attachment is the child's need to seek proximity to and comfort from his mother at times of stress. No theory	Longitudinal & mixed method EPSD [†] MRI ^u	36 BF & 24 formula-feeding women with a child between 4& 6.	No differences in sensitivity between BF & formula-feeding mothers The secure attachment styles were related to change the feeding method to BF(F(5, 54=52.41).
Wisenefield et al, 1985 UK II-2 BF-MS	Examine the relationship between infant feeding method & maternal sensitivity	Concept: Maternal responsiveness is responding of mother to her infant's signals which have been accorded a central	Nonrandomized & cross sectional study SCR	48 healthy mothers w/o receding or following menstrual cycle.	Response of BF& formula-feeding mothers across response measures is different. Skin conductance measures using Galvanic skin response indicated

role in affected by a
host.

No theory

that breast-feeders may
have been more relaxed.
cardiac response of BF
mother compare to
formula-feedings
different,
BF mothers were more
sensitive & they also
expressed greater
satisfaction with the
feeding experience
($r=.28$)

NOTE: All results are significant at $P=.05$ except with when indicated by N/S (not significant)

^a(Bowlby attachment theory)(Bowlby,1978)

^m(Maternal Infant Responsiveness Instrument=MIRI) (Amankwaa, 2002)

^b(Ainsworth's Attachment Theory)(Ainsworth,1972)

ⁿ (Rosenberg Self-Esteem Scale =RSE) (Rosenberg, 1965).

^c(Care-giving Theory)(Erel,2000)

^o(Satisfaction with Life Scale =SWLS) (Diener et al, 1985)

^d(Bonding Thoery)(Klaus,1972)

^p(Coding Interactive Behavior=CIB) (Feldman, 1998).

^e(Roy Adaption Theory)(Roy & Andrew,1999)

^q(Karolinska Scales of Personality=KSP)((Klinterberg,1986).

^f(Nursing Child Assessment Satellite Training Feeding=NCAST)(Banard,1994)

^r (Extension of Stimuli)(Bindemann, 2005)

^g(Ainsworth Maternal Sensitivity Scale)(Ainsworth,1978)

^s(Maternal Sensitivity Scaler = MSS) (Han, 2002)

^h(Parent-Child Early Relational Assessment=PCERA)(Clark,1994)

^t (Edinburgh Postnatal Depression Scale =EPDS)(Cox et al., 1987).

^l(Postnatal Attachment Questionnaire =PAQ) (Condon,1998)

^u(Maternal Attachment Inventory =MAI)(Muller, 1994).

^j(Development of Visual Pursuit &the Permanence of Objects=DVT) (Uzgisir& Hunt, 1975).

^l(Recording heart-rate of mothers)(Graham & Clifton, 1966).

^v (Postpartum Bonding Questionnaire=PBQ) (Brockington et al,2006)

Duration of breastfeeding is the time mother continue breastfeeding in weeks

Themes of the relationship between breastfeeding and maternal sensitivity

BF-MS= Potential effect of maternal sensitivity on breastfeeding

NEFB= No effect of breastfeeding on maternal sensitivity

BFE-MS= Potential effect of maternal sensitivity environment on breastfeeding

I-MS= Potential effect of infant on maternal sensitivity.

CHAPTER 3

Chapter Introduction

The purpose of this chapter is to provide a review of the literature related to the instruments used to measure maternal sensitivity during the first year of life. The objective of this chapter is to develop a publishable manuscript that assesses and critiques the existing literature. The reference style of the target journal will be applied in this manuscript.

Manuscript 2: Measures of Maternal Sensitivity during the First Year of Life: A Systematic Review

Abstract

Problem: Maternal sensitivity is one of the key elements of an infant's secure attachment. Mothers that are unable to read and respond to infant cues put their infants at high risk for delayed development and their school-aged children at high risk for negative cognitive and mental health outcomes. It is important for nurses and other health care professionals that interact with infants and their mothers to understand what measures are available to assess maternal sensitivity. Utilizing measures of maternal sensitivity may assist nurses and health care providers in helping families with poor attachment and improve an infant's growth and development.

Purpose: Assess the extant literature on instruments used to measure maternal sensitivity during the first year of life and theoretically evaluate these measurements.

Methods: An integrative review (1978-2015) was conducted by searching the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Pub-Med databases. Key words included: *maternal sensitivity*, *attachment*, and *bonding*. Inclusion criteria were: (a) a sample of women who had given birth to an infant within the past year; (b) a description of maternal sensitivity as a primary research outcome or measurement; and (c) studies that reported results using an instrument measuring maternal sensitivity.

Results of Search: Of the 55 articles reviewed, 17 met the inclusion criteria, and eight instruments were reviewed that measured maternal sensitivity.

Synthesis of Evidence: Instruments were evaluated for reliability, validity, and feasibility of their use. The instruments with the greatest reliability: NCASF, MAI, and PCERA, were included in this review.

Implications for Practice: Reliable and valid instruments are necessary for researchers and clinicians to accurately measure maternal sensitivity in order to conduct quality research and provide quality clinical care. Many maternal sensitivity instruments are reliable and valid, and include NCASF, MAI, and PCERA. MAI takes 10 minutes to administer, and PAQ can feasibly be implemented in practice. NCASF and PCERA need a health care provider that completed special training to administer them. The MAI can be administered in 10 minutes, and the PAQ can be feasibly implemented into practice. A professional with special training must administer the NCASF and PCERA.

Introduction

Sensitivity is one of the key elements of secure attachment (Bowlby, 1978). Maternal sensitivity is defined as the mother's ability to recognize and respond to her infant's cues consistently and appropriately (Shin, 2006). The way to assess the mothers' level of sensitivity and the appropriateness of those interventions are the most important (Bowlby, 1973; Britton et al., 2006). The first year of an infant's development is critical because how a mother responds to her child during the first year of life, impacts how she is able to relate to her child throughout its life. This first year of life provides an important opportunity to establish a sensitive and reciprocal relationship between the mother and her infant (Kim, 2011). For example, Britton, Britton & Grownwaldt (2006) reported relationships between maternal sensitivity and the cognitive and mental health of an infant. Additionally, Bowlby and Ainsworth reported from their research that one of the principal antecedents of secure attachment in children was the attachment figure's responsiveness to a child's distress. Other researchers have reported that enhanced maternal sensitivity is linked to the improvement of a child's cognitive abilities, psychological health, and academic achievement (Britton, Britton, & Gronwaldt, 2006; Shin, 2006). Therefore, it is important for all healthcare professionals who work with children to understand the concept of maternal sensitivity, what measures are available to assess it, and how to provide culturally sensitive interventions during the child's first year of life (Han, 2002). For example, both pediatric nurses and health care providers need to mother anticipatory guideline based on a mother's sensitivity to her child. The purpose of this paper is to evaluate the reliability and validity of the instruments used to measure maternal sensitivity, and to synthesize the literature on maternal sensitivity. The information from the review and analysis of these

instruments is vital to researchers and clinicians who help mothers' respond to their infants in a sensitive manner during the first year of life. It's important to analyze these instruments, since they directly inform the care and education provided to new mothers. The effectiveness and applicability of the care can impact how the mother establishes and maintains a sensitive and reciprocal relationship with her infant. Ultimately, these efforts can influence the mother's ability to develop secure attachment with her infant and eventually her child throughout its entire lifetime.

Definition of Maternal Sensitivity

A theoretical and operational definition allows researchers and clinicians a means to measure maternal sensitivity. Maternal sensitivity is the mother's response to infant actions which is general across caregiving contexts (Kim et al., 2011). The operational definition of maternal sensitivity is gauged by observation of patterns from data collected and reported that assesses a mother's reactions and responses to her infant (Shin, 2006). Maternal sensitivity is important during the first year because higher levels may result in an infants' increased awareness of the mother's availability and reliability, thereby promoting a sense of security for infant, behavioral independence, social interaction, symbolic competence, verbal fluency, and intellectual achievement (Ainsworth, Bell, & Stayton, 1974; Bus & van IJzendoorn, 1992; De Wolff & van IJzendoorn, 1997; MacDonald, 1992). Therefore, ongoing work by researchers and clinicians to measure and optimize maternal sensitivity during that critical phase can help improve infant socialization and academic achievement outcomes.

Method

The purpose of this article to assess the extant literature on instruments used to measure maternal sensitivity during the first year of life and theoretically evaluate these measurements.

The following data bases were searched: PsycINFO, CINAHL, Pub-Med, and SCOPUS; literature from the health sciences, psychology, and social sciences were where the majority of the papers were obtained. The search was conducted using the following key search terms: *mother-infant relations, maternal sensitivity, maternal responsiveness, maternal-infant attachment, and mother and infant interaction*. Moreover, a review of the reference lists for each of these articles was conducted to identify any other relevant articles that were not identified in the search. This search yielded a total of 55 articles. These articles were further sorted by two conditions, 1) age of infant from birth to 24 months; 2) English language, which yielded 20 articles. Seventeen articles met the inclusion criteria, and these articles examined the science behind relationships and maternal sensitivity. The initial literature search did not reveal all of the original studies that described all characteristics of the instruments published between 1978 and 2015 and reference lists, which generated 10 more studies. The reliability and validity were extracted from original studies. Studies that summarized the reliability of maternal sensitivity measures are displayed in Table 2, and are organized into the following categories: maternal sensitivity instruments, reliability, and findings that constituted the validity of the measures.

Results

Studies that reported the reliability and validity were extracted from original papers that were published prior to 1980. The results of this search are reported in Table 1, where instruments are summarized with the theory, instrument used, description of the sample, and the reliability for each instrument. Studies that reported the reliability of measures of maternal sensitivity are summarized in Table (2). Data were extracted and organized by use of maternal sensitivity instruments, reliability, and findings that constituted the validity of the measures.

This integrative review identified eight instruments that measured maternal sensitivity during an infants' first year of life and are as follows: Seventeen articles were identified with eight different instruments that measured maternal sensitivity: (1) Ainsworth Maternal Sensitivity Scale (AMSS) (N =1) ; (2) Maternal Sensitivity Scale (MSS) (N =1) ; (3) Nursing Child Assessment Satellite Training Feeding (NCASF) (N =3); (4) Maternal Infant Responsiveness Instrument (MIRI) (N =1); (5) Parent-Child Early Relational Assessment (PCERA) (N =3); (6) Postnatal Attachment Questionnaire (PAQ) (N =2); (7) Maternal Attachment Inventory (MAI) (N =1); and (8) Karolinska Scales of Personality (KSP) (N =1). In the 17 articles, three used NCASF and four used specialized instruments, such as AMSS, to measure maternal sensitivity (Danvon, 1978; Kim et al., 2011; Shin, Park, & Kim, 2006; Tharner et al., 2012). MIRI was used in one study (Drake, Humenick, Amankwaa, Younger, & Roux, 2007). Three studies used PCERA (Bystrova et al., 2009; Else-Quest, Hyde, & Clark, 2003; Tluczek, 2010). Lastly, five studies used attachment instruments (PAQ and MAI) to measure maternal sensitivity (Britton, Britton, & Gronwaldt, 2006; Cooklin, Rowe, & Fisher, 2012; Danvon, 1978; Kim et al., 2011; Wilkinson & Scherl, 2006). For example, Cooklin et al. (2012) used PAQ and MAI, while three studies used Ainsworth's Strange Situation to measure maternal sensitivity. Finally, one study used KSP, and another study used an unnamed questionnaire.

Instrument Description

All instruments used an observational or self-report format with a Likert-like scale or a semantic differential scale to collect data collection to measure maternal sensitivity during the first year of life. The number of items varied from 16 to 102.

AMSS

The AMSS is a written record of videotaped home observation for 15 minutes during cooking and 15 minutes during bathing. In order for the AMSS measurement to be defined as accurate, it is important that accurate observations are done by two trained observers who can provide insights into the caregiver's behavior. For one of the studies, conducted in the United States of America, interpreter reliabilities used (Pearson correlation=0.87). Ainsworth and colleagues reported a high correlation between infant and maternal sensitivity. For example, Tharner et al. (2012) reported when using AMSS that breastfeeding was associated with greater maternal sensitivity, better attachment security, and a decrease in attachment disorganization in breastfeeding mothers compared to formula-feeding mothers.

MSS

Another tool for measuring maternal sensitivity is the MSS (Han, 2002). This instrument is a self-report questionnaire consisting of 36 items. Responses were measured on a five-point Likert scale ranging from 5 (most likely) to 1 (most unlikely). (Cronbach's 'alpha coefficient'=0.90) (Shin et al , 2006). The reported reliabilities are high and demonstrate that the measures are consistent in measuring maternal sensitivity. Reporting reliability adds strength to the previous studies described. However, validity was not reported in the Shin et al. (2006) to demonstrate that the content was adequately measuring maternal sensitivity. The findings of the Shin et al. (2006) should be cautiously analyzed, taking consideration of not reporting validity.

NCASF

Another instrument used to measure maternal sensitivity is NCASF (Barnard, 1994). Three studies used the NCASF to measure maternal sensitivity (Britton et al., 2006; Kristie 1998; Tessier, 1998). NCASF has one to six sub scales to measure maternal and infant interaction, which include: (a) responsiveness to cues, (b) response to distress, (c) emotional and social

growth fostering, (d) cognitive development fostering, (e) clarity of signal, and (f) infant to parent response. The studies reported in Table 2 only used a few selected items from this instrument to measure maternal sensitivity. The NCASF has been widely used, and varies in the concepts being measured, from general measurement for mother and infant interaction including maternal sensitivity as part of the mother-infant attachment. Unlike other instruments of maternal sensitivity, this one narrowly measures maternal sensitivity. Reliability is controlled by requiring that professionals using the tool to complete a standardized videotaped course on the use of the tool. Field users must achieve 85% accuracy and researchers 90% standardized reliability (Britton et al., 2006).

MIRI

The MIRI instrument is a self-report questionnaire used to measure maternal sensitivity and consists of 22-items, measuring maternal sensitivity to infant cues. Maternal response to infant behaviors consists of six categories, including smile, eye contact, touch, an auditory signal, eye contact, and offering food. Infant behaviors include: gazing toward the mother, away from the mother, and facial expression to mother's gaze. The frequency of maternal signals for each of the three infant categories was determined using a Likert scale ranging from point five (strongly disagree) to point one (strongly agree) for each of the 22 criterion with an internal consistency=0.86 (Drake, 2007). Maternal self-report has the advantage of giving the researchers the mother's perspective, which is significant in this area of study and unobtainable by observers. MIRI measured the mother's recognition of her sensitivity to the infant and any obstacles identified in expressing her sensitivity. However, depending on self-report only, has the possibility of introducing bias to the findings. Integrating observational measures with self-report measures will decrease the possibility of bias by improving the objectivity of findings.

PCERA

The PCERA (Clark, 1985) evaluates maternal sensitivity based on three factors related to mother and infant interactions, and was reported in four studies (Bystrova et al., 2009; Else-Quest et al., 2003; Tluczek et al., 2010). Mother-infant pairs were videotaped in their homes for three five-minute sessions. The sessions included free play, feeding (pairs breastfed or formula-fed at four months) and a structured task (reading a story at twelve months and diapering at four months). Each session of the PCERA was rated on a five-point scale by trained raters (Clark, 1985). This instrument is used to reflect the infant's or child's experience of the mother, the mother's experience of the infant or child, the behavioral and affective characteristics that each bring to the dual interaction, and the quality of the relationship. Three studies failed to report the validity of PCERA (Bystova et al., 2003; Else-Quest et al., 2003; Tluczek et al., 2010), and validity and reliability were not reported in their previous studies to demonstrate the content was adequately measuring maternal sensitivity. In conclusion, the findings of the previous studies should be analyzed with the limitation of the lack of reporting reliability and validity.

PAQ

Two additional studies used attachment instruments to measure maternal sensitivity (Cooklin et al., 2012; Wilkinson & Scherl, 2006). Cooklin et al. (2012) used the (PAQ) (Condon, 1998) to measure maternal sensitivity. This instrument is a self-report scale consisting of 19 items measuring the strength of affection relationship using the five-point Likert scale: Very frequently (5) to Almost never (1). The PAQ has psychometric properties including internal consistency (Cronbach's Alpha=0.68), and low validity (test-retest reliability=0.60) (Cooklin et al., 2012). In contrast, Wilkinson & Scherl (2006) used Maternal Attachment Inventory (MAI) (Muller, 1994) to measure maternal sensitivity. MAI is a 26-item scale asking mothers to

determine how they generally feel in relation to thoughts, feelings and situations. Responses to this questionnaire are scored on a fourpoint scale ranging from 4 (Almost always) to 1 (Almost never). The total score ranges from 26 to 104 with internal consistency (Cronbach's Alpha = 0.50) (Wilkinson & Scherl, 2006). It should be noted that these studies used only a few selected items from each instrument. Using selected items will limit measuring and assessing all of the components and related items of maternal sensitivity.

KSP

The KSP described affiliation and psychological characteristics consisting of three main groups, as follows. Firstly, anxiety scales consist of psychic anxiety, somatic anxiety, and muscular tension. Secondly, impulsiveness-related scales include the detachment and monotony avoidance scales. Thirdly, are the aggression and hostility-related scales. These scales consist of verbal aggression, indirect aggression, suspicion, and irritability. Nissen (1998) used KSP to measure maternal psychological characteristics, but he failed to report the validity and reliability of this instrument. The KSP has interesting possibilities, but future work with psychometric data (reliability and validity) would strengthen confidence in KSP use.

Questionnaires Were Not Named

The remaining studies used various questionnaires which were not specifically named to measure maternal sensitivity. These studies also failed to report the psychometric properties of the questionnaire used. (Ekstrom & Nissen, 2006; Wisenefield, 1985). Therefore, the findings should be interpreted with caution.

In conclusion, it seems that previous studies suggest the area is maturing (Britton, 2006). Self-report and observational methods are always going to be part of studying breastfeeding and should be honored for their contributions. Future researchers will improve the scientific

understanding of maternal sensitivity with the well-validated instruments that are more specialized in measuring the phenomenon of maternal sensitivity.

Samples and Subjects

All studies displayed in Table 2 included samples of women aged 18 to 45 years old with a child in the first year of life. The majority of participants from the samples in Table 2, were homogenous and included white and/or middle-class participants. Additionally, ten studies took place outside of the United States, in Colombia, Australia, the Netherlands, and Germany.

Reliability

Most studies that used NCASF, PCERA, or an adapted version of these scales reported internal consistency for the maternal sensitivity subscale, a specific subscale, or a total score with values ranging from 0.86 to 0.99, indicating high internal consistency. This was the case for all the studies except for the study conducted by Tharner et al. (2012), who used AMSS and reported a moderate internal consistency of 0.68. Four studies did not report any information regarding reliability (Britton, 2006; Danvon, 1978; Nissen, 1978; Esktrom & Nissen, 2006). Studies using the MSS revealed high alpha coefficients ranging from 0.86 to 0.96.

Validity

Factor analysis addressing construct validity was reported in five studies using the maternal sensitivity instruments. In each, researchers performed a confirmatory factor analysis to confirm the factors. In the original publication of maternal sensitivity, the authors reported extensive validity metrics, including factor analysis and predictive validity. They identified significant validity, although correlations between the *Maternal Sensitivity Scale* and *How to Receive the Baby* were not established. Other articles described construct, convergent, and concurrent validity. One study used this instrument to establish convergent validity for another

measure, and another study used the Q-sort to establish concurrent validity with NCASF. To identify other validity assessments, one must evaluate the original articles describing the maternal sensitivity instruments (Barnard, 1994; Clark, 1985; Han, 2002; Shin, 1994). The first evaluated article, which used NCASF, reported evidence for criterion and construct validity for this measure. The article describing PCERA also reported a sufficient establishment of construct validity (Kim, 2011). The original MSS article did not describe a validity assessment. Criterion-related validity of the AMSS was supported by a high correlation between the AMSS and breastfeeding practice (0.90) in a sample of breastfeeding adult mothers (Clark, 1985). Construct validity is shown through the statistically significant correlations between scores on the scale and scores on the *How I Feel about the Baby Now* scale (Kim & Shin, 2007). The PAQ was translated Dutch and Italian and reported reliability; this version is appropriate for infants between the ages of four and five months. PAQ showed higher internal consistency than that found in the mentioned versions to Dutch and Italian ($\alpha=0.78$ - 4-week and 8-month infants, and $\alpha=0.79$, 4-month infants (Scapesi, Viterbori, Sponza, Zuchinetti, 2004). MAI has been translated into Korean, Brazilian, and Arabic. The internal consistency of the translated versions from Brazillian and Arabic was ($\alpha=0.85$ - 4-week infants, $\alpha=0.76$ - 4-month infants, and $\alpha=0.85$ - 8-month infants)(Van Bussel, Spitz, Demyttenare, 2010; Gharaibeh & Halman, 2011). The KSP is originally in Swedish, but has been translated to English ($\alpha=0.65$ – 4 months infants, and $\alpha=0.76$ - 8-month infants). AMSS has been translated to Japanese and Korean language and the interrater reliability was high ($\alpha=.90$ at 8-months).

Appropriateness of Instrument

An important issue for implementation of these instruments in research and clinical practice is the length of time, complexity, or feasibility of applying the instrument. The identified

studies did not discuss the feasibility of the implementation of the instruments. In some cases, authors identified the time required for completion; however, the time reported often involved completion of multiple questionnaires, not just the maternal sensitivity instrument. As a result, none of these researchers reported length of time required to measure maternal sensitivity.

Access to the instrument is another feasibility consideration. Initial search results show that most instruments do not seem readily available within the public domain and often require identifying the original article describing the instrument. The MIRI is accessible only through a website.

Additionally, instruments such as NCASF and PCERA require a qualified researcher to use them. Many of these instruments are translated to other languages, while other instruments such as NCASF, PCERA, MIRI and MSS still do not have non-English translations.

Critique

Theoretical Issues

Despite the importance of theory-driven research, fewer than half of the articles in this integrative review identified a theoretical framework (Britton et al., 2006; Danvon, 1978; Shin et al., 2006; Tharner et al., 2012). Only four studies used Ainsworth's attachment theory and Bowlby's attachment theory (Britton et al., 2006; Danvon, 1978; Else-Quest et al., 2003; Shin et al., 2006; Tessier, 1998, 2006; Tharner et al., 2012). Both theories include a normative theory of how the inner "attachment system" functions in all humans and as a theory which highlights human differences in the attachment style that is used in different life experiences (Ainsworth, 1972; Bowlby, 1970). Researchers should also consider *Bonding Theory* when measuring maternal sensitivity during the first year of life (Shin, 2006), as this review identified two studies in which bonding has been used to explain that the optimal sensitivity of a mother and her infant occurs when the mother practices physical contact such as breastfeeding in the early hours after

her child's birth (Else-Quest et al., 2003; Tessier, 1998). Maternal sensitivity was attributed to the immediate release of maternal oxytocin at the highest level during the first few months (Klaus & Kennel, 1972). Clark (1985) reported that this widely used framework highlights the potential for dynamic interactions between the mother and her infant during the first hours of interaction.

Sampling Issues

Most studies in this search included white, non-Hispanic mother and infant dyads as is reflected in the homogenous participant pool of predominately white females. Thus, the results of this integrative review will most likely not be generalizable to other ethnic groups (Bystrova et al., 2009; Cooklin et al., 2012; Ekstrom & Nissen, 2006; Kim et al., 2011; E. Nissen, Gustavsson, VVidstrom, & Uvniis-Moberg, 1998; Pearson et al., 2011; Tluczek et al., 2010; Wilkinson & Scherl, 2006; Wisenfield, 1985). Future research should include a purposeful sampling of minority and low-income mother and infant dyads. Focusing on families in higher socioeconomic populations further limits the generalizability of the current assessments of maternal sensitivity instruments to populations with limited resources (Bystrova et al., 2009; Cooklin et al., 2012). Mothers and infants from lower socioeconomic backgrounds may inherently face more environmental, personal, or financial challenges, which may negatively influence maternal sensitivity (Gharaibeh & Halman, 2011). Identifying and testing appropriate measurement instruments to evaluate maternal sensitivity in these vulnerable populations and populations from various ethnic groups may be increasingly important in helping nurses and other healthcare professionals work with mothers from many backgrounds to optimize their use of maternal sensitivity with their infants (Ainsworth, 1972, Bowlby, 1969). For example, AMSS is not be acceptable to use with Muslim women, since many female Muslims refuse to expose

any part of their body in front of strangers for religious and traditional reasons (Gharaibeh & Halman, 2011).

Definition Issues

The maternal sensitivity concept has been defined in various terms; the terms maternal responsiveness, mother-infant interaction, maternal attachment, and maternal bonding are commonly used interchangeably with maternal sensitivity. Only six of the studies in the literature included some definition of maternal sensitivity using these interchangeable terms. Britton et al. (2006) defined maternal bonding as the connection between a mother and an infant. This connection is unique to the mother-infant relationship and generally has a long-lasting effect. In another study, Tharner et al. (2012) defined maternal sensitivity as the mother's ability to respond appropriately and opportunely to the infant's attachment signals. In the first months of life, infants develop expectations of the availability of the mother when she is needed. Wisenfield (1985) defined mother-infant interaction as the way in which a mother responds to her internal feeling of responsibility to the infant, which is essential to the formation of attachment. In another study, Drake et al. (2007) defined maternal responsiveness as the mother's ability to understand the infant's cues and act consistently according to those cues. According to Evan et al. (2003), attachment is a sequence of synchronous, mutual expressions or exchanges between the mother and her infant. Shin (2006) defined maternal sensitivity as a mother's ability to interpret and perceive her infant's communication and cues accurately, and then respond appropriately to these cues. The remainder of the papers included in this review did not provide an explicit definition of maternal sensitivity. Unfortunately, there is no consensus in the literature regarding the definition of maternal sensitivity.

Feasibility Issues

The main feasibility issues in the various studies are access to the instruments and the time of completion. For example, the researcher reports that “time” often involved the completion of multiple questionnaires, not just the maternal sensitivity instrument. Therefore, it is difficult to measure how many minutes it takes to complete the assessment of maternal sensitivity alone. The research team should consider the need to search for and possibly utilize the instrument when developing a study budget. Moreover, they need also to consider the time needed to complete the maternal sensitivity tool or questionnaire specifically.

Reliability and Validity Issues

Most instruments measuring maternal sensitivity demonstrated high internal consistency, indicating that individuals completing the instrument respond in a consistent way or that items conceptually fit with one another within the instrument (DeVon, Block, & Moyle-Wright, 2007). However, it is important to note that two of the studies did not mention any information regarding reliability. One needs to consider that internal consistency may vary based on the number of response options used on the Likert scale, with a higher number of responses resulting in higher internal consistency (0.76) and that the alpha value may also vary based on the number of survey items (DeVon et al., 2007; Waltz, 2010).

The validity of all of the instruments in Table 2 was not described by any of the researchers. As a result other researchers or practitioners who want to use the instrument have to return back to the original article describing the psychometrics of the maternal sensitivity instrument to obtain evidence of validity, it is time consuming to return back to original studies (Nissen, 1998 ; Pearson et al, 2011; Shin et al., 2006; Wilkinson & Scherl, 2006; Wisenefield, 1985). This is will be very time consuming for many researchers and not feasible. The lack of

valid data reported in the identified articles is a limitation of contemporary literature. Validity information for many articles in this review was considered as a barrier to evaluating an instrument's ability to measure maternal sensitivity within an infant population (DeVon et al., 2007; Sousa & Rojjanasrirat, 2011).

Implications

Reliable and valid instruments are necessary for researchers and clinicians to accurately measure maternal sensitivity in order to conduct quality research and provide quality clinical care. The use of well-constructed measurements will facilitate investigation of the expected results and increase opportunities to generalize findings to larger and different populations (DeVon, 2007; Sousa & Rojjanasrirat, 2011)

This review is relevant to research and clinical practice as it identified several reliable and valid instruments to evaluate maternal sensitivity. The available instruments vary in length with respect to the targeted participant age group. The length affects the respondents' attitudes and behavior so the increased length adds to the burden on respondents and pushes more of them beyond a threshold from which they will no longer cooperate or participate in the study (Sousa & Rojjanasrirat, 2011). The researcher needs to use these tools with caution if applying these psychometrics to different groups over a period of time since the psychometrics were identified in articles published prior to more than a decade timeframe; however, caution is warranted if applying these psychometric properties across time and in different groups. So the researcher should be certain about the rigor or pilot results in order for an instrument to be used in a different way (Sousa & Rojjanasrirat, 2011; Streiner, 2003).

Future studies are needed to implement maternal sensitivity measurements in other ethnic groups, as well as samples from other countries, to further assess the psychometric properties of

these instruments and to broaden their application to mothers globally (Sousa & Rojjanasrirat, 2011). The researchers need to check the rigor of the study and the applicability of the instrument for other countries by applying the step listed above on translating an instrument to another language. Bias results from inaccurately measuring or classifying outcomes among subject groups. Inaccurate data influences results, invalidates study effectiveness, and misleads the investigation and research (Sousa & Rojjanasrirat, 2011; Striener, 2003). The lack of psychometric data for these measures in adolescent mothers is also an issue. One must consider the cultural issues, the length of the scale, available psychometric data, and availability of the measure. Having specific criteria will guide the instrument selection.

Conclusion

In conclusion, when selecting an instrument to measure maternal sensitivity during the infancy period, the clinical or research team must consider various factors that include population, length of the scale, psychometric data of the instrument, access and price of the measure, and cultural issues. Furthermore, future studies are needed to implement maternal sensitivity measures in minority populations and adolescent mothers to make sure they are relevant and acceptable. It is important to select an instrument that is appropriate, feasible, and responsive to the needs of the mother, the researcher or clinician, as well as, valid, reliable, and precise to maintain the clinical and research integrity. Many maternal sensitivity instruments are reliable and valid and include NCASF, MAI, and PCERA. MAI may only take 10 minutes to administer MAI and PAQ can feasibly be implemented in practice. NCASF and PCERA need a professional with special training to administer them.

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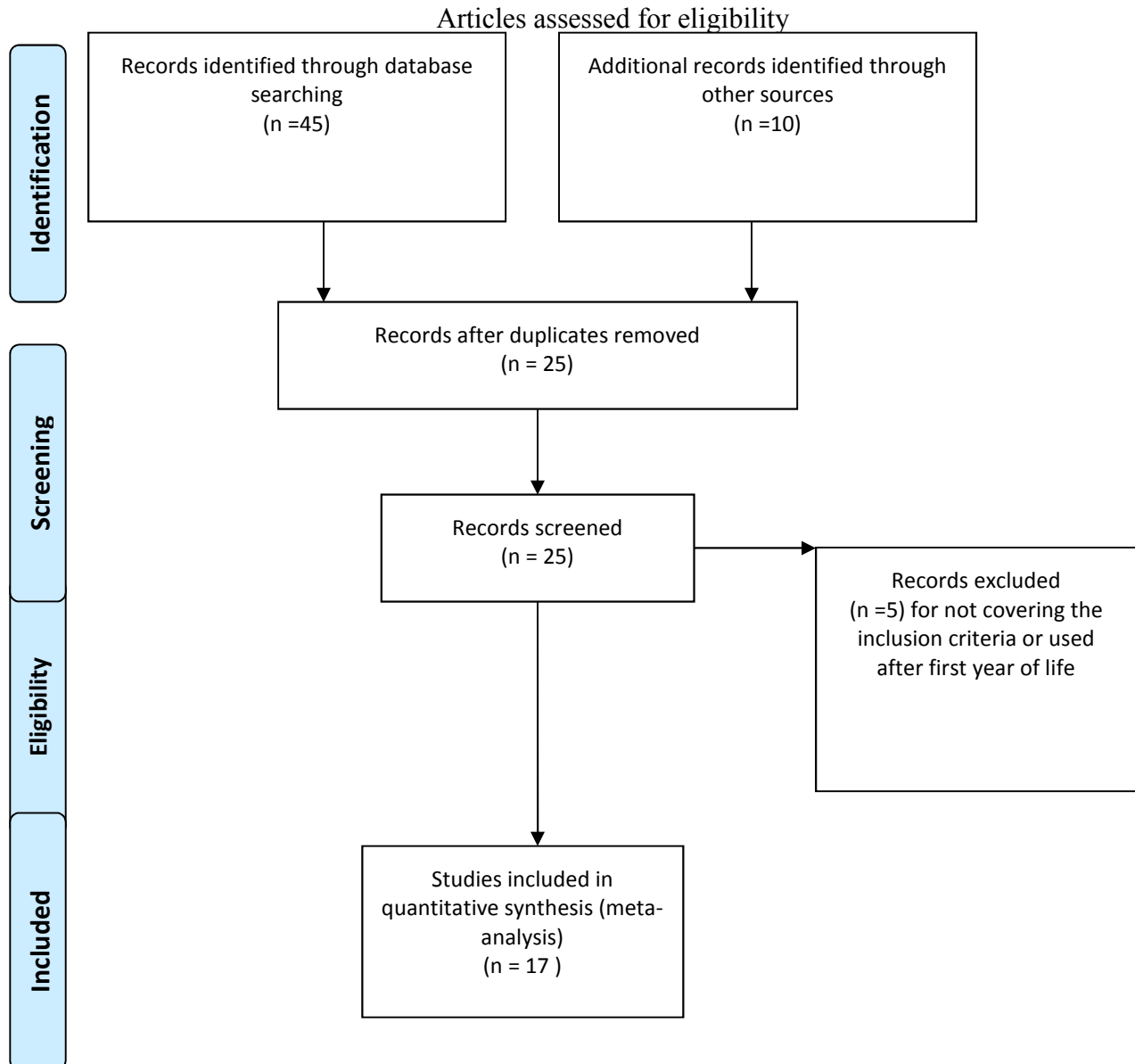
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Figure 1

PRISMA 2009 for Literature Review



NOTE: All results are significant at $P=.05$ except with when indicated by N/S (not significant)

^a(Bowlby attachment theory)(Bowlby,1978)

^m(Maternal Infant Responsiveness Instrument=MIRI) (Amankwaa, 2002)

^b(Ainsworth's Attachment Theory)(Ainsworth,1972)

ⁿ (Rosenberg Self-Esteem Scale =RSE) (Rosenberg, 1965).

^c(Care-giving Theory)(Erel,2000)

^o(Satisfaction with Life Scale =SWLS) (Diener et al, 1985)

^d(Bonding Thoery)(Klaus,1972)

^p(Coding Interactive Behavior=CIB) (Feldman, 1998).

^e(Roy Adaption Theory)(Roy & Andrew,1999)

^q(Karolinska Scales of Personality=KSP)((Klinterberg,1986).

^f(Nursing Child Assessment Satellite Training Feeding=NCAST)(Banard,1994)

^r (Extension of Stimuli)(Bindemann, 2005)

^g(Ainsworth Maternal Sensitivity Scale)(Ainsworth,1978)

^s(Maternal Sensitivity Scaler = MSS) (Han, 2002)

^h(Parent-Child Early Relational Assessment=PCERA)(Clark,1994)

^t (Edinburgh Postnatal Depression Scale =EPDS)(Cox et al., 1987).

^l(Postnatal Attachment Questionnaire =PAQ) (Condon,1998)

^u(Maternal Attachment Inventory =MAI)(Muller, 1994).

^j(Development of Visual Pursuit &the Permanence of Objects=DVT) (Uzgiris& Hunt, 1975).

^l(Recording heart-rate of mothers)(Graham & Clifton, 1966).

Table 1
Original Maternal Sensitivity Instrument

Instrument	Objective	Participant	Method/ You are	Reliability	Validity
Nursing Child Assessment Satellite Training Feeding(NCASF)(Barnard,1994)	Examine psychometric properties of NCASF	1500 infants in the first year of life recruited in HC and tested for three times	Longitudinal Factor analysis	Maternal sensitivity to cues .60, response to distress .69, social-emotional growth fostering .63,cognitive growth fostering .69, infant clarity of cues .56,responsiveness to mother.58. Pearson reliability sensitivity to cues .41; response to distress .40; social-emotional growth fostering .75; cognitive growth fostering .86; clarity of cues .16;	Correlations between the feeding scores and IQ scores at three months of age were high.

	Parent-Child Early Relational Assessment(PCERA) (Clark, 1985)	determine the factorial validity of scores	570 pregnant women and 550 husbands/partners of the women .The women recruited during pregnancy	Factor analysis	and responsiveness to mother .31 high levels of internal consistency, with coefficients ranging from .75 to .96	relationship between the first ERA parent subscale, Parental Positive Affective Involvement and Verbalization, with the subscales of Attachment
79	Ainsworth Maternal Sensitivity Scale(AMSS) (Ainsworth, 1972)	Examine the factorial validity of infant-mother score	180 mother-infant dyads recruited after birth and examined at 4 and 12 months	Factor analysis	High level of internal consistency with coefficients ranging from 0.80 - 0.87	Construct validity with significant correlates between breastfeeding initiation and maternal attachment(r =.52).
	Maternal Attachment Inventory (MAI) (Shin, 1994)	Determine psychometric properties of instrument	200 mother-infant dyads were recruited after birth and MS measured at 4 and 12 months	Factor analysis	The Cronbach's alpha coefficient 0.85	construct validity through the statistical significant correlates between scores on the scale and these on How I Feel About the Baby Now Scale (r = 0.45, P < 0.01)

this test is indicator
of maternal
relationship to her
infant

Table 2
The Using of Maternal Sensitivity Instrument

Author	Theory	Instrument	Description Provided	Sample	Reliability	Results
Using AMSS						
Britton et al, 2006 USA	Bowlby's Attachment Theory ^a	NCAST-F ^f AMSS ^g	Brief description	152	NR	Prenatal BF intent related to maternal sensitivity ((r=0.24). Early maternal sensitivity in BF mothers is not a predictor of the duration of exclusive BF during the first year after child birth.
Tharner et. al, 2012 Netherland	Ainsworth Attachment Theory ^b	AMSS ^g	Brief description	675	Intrater reliability=.68	Longer duration of BF was associated with more maternal sensitivity (r=0.24) Duration of BF was not related to attachment problems, but longer BF predicted a lower risk of problem in sensitivity.
Using Maternal Attachment Instrument						
Cooklin et al, 2012 Australia	No theory	PAQ ^j	Brief Description	165	Cronbach alpha=.86	Employed mothers were less likely to be BF at 10 months postpartum. However, this does not impact her sensitivity.

Drake et al , 2007 USA	Care-giving Theory ^c	MIRI ^m	Brief description	17	Internal consistency=.86	Mother satisfaction with life, self-esteem, & many children cause more maternal sensitivity scores F = 4.176 not BF. Maternal sensitivity NS related to BF
Ekstrom &Nissen, 2006 Swedian	No theory	Three questionnaires	Brief description	540	NR	Those who received BF counseling after childbirth expressed more maternal sensitivity to their infants ($\chi^2=15.45$).
Using PCERA						
Else-Quest et al, 2003 USA	Bonding Theory ^d	PCERA ^h	Detailed description	570	Intrarater reliability=.87	BF mothers tended to feel more sensitive than formula-feeding mothers at one year after childbirth. BF mothers felt more reinforced by their infants .F {1, 495) =3.07 At 4 months, these results support the bonding hypothesis, but not at 12 months F(2, 489) = .74. The mothers that BF are more sensitive than those who do not BF at 6 months after delivery. F(1481)=53.71There is NS relationship between the duration of BF&
Bystrova et al, 2009 Russia	No theory	PCERA ^h	Detailed description	176.	Interrater reliability=.99	

<p>Tluczek, 2010 USA</p>	<p>No theory.</p>	<p>PCERA^h STAIⁿ</p>	<p>Detailed description</p>	<p>17</p>	<p>Intrarater reliability=.94</p>	<p>maternal sensitivity at 4 months of age. Mothers of infants with metabolic disease formula fed. Mothers (healthy baby) with low task-oriented behavior showed more sensitivity to their infants' cues ($\chi^2=137$).</p>
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Using NCASF

<p>Kuzela et al, 1990 USA</p>	<p>No theory.</p>	<p>NCASF-F^f</p>	<p>Not complete description</p>	<p>42</p>	<p>Intrarater reliability=.86</p>	<p>Women who BF > 6 weeks postpartum had higher maternal sensitivity scores than women who stop BF by 6 weeks of age.</p>
<p>Tessier et al.(1998) Colombia</p>	<p>Bonding Theory^d</p>	<p>NCASF-F^f</p>	<p>Brief description</p>	<p>488</p>	<p>Intrarater reliability=.85</p>	<p>Maternal sensitivity was higher in the skin to skin contact group after birth ($\chi^2=15.45$). The mothers in the skin-to-skin were more sensitive to their infants. Mothers in skin to skin group more sensitive to time spent (less than 10 days) in the hospital for their infants than formula-feeding mothers.</p>

Other Questionnaires

Nissen et al, 1998 Sweden	No theory.	KSP ^q	Detailed description	37	NR	The amount of milk the infant took in during feeding increased the blood oxytocin level and the amount of oxytocin level correlated with the level of maternal sensitivity (r = 0.45) N/S relationship between duration of BF & maternal sensitivity.
Pearson et.al, 2011 UK	No theory.	PA ^r	Detailed description	51	Crnobach alpha=.95	Attentional sensitivity bias towards infant distress was higher in BF mothers than formula-feeding mothers(r = .52) . Mothers who planned to BF during pregnancy did not show more sensitivity response towards infant during distress already during late pregnancy.
Shin, 2006 Korea	Roy Adaption Model ^e	MSS ^s	Brief description	196	Crnobach alpha=.96	The main predictor of maternal sensitivity was maternal-fetal attachment (r =.56) which lead mother to BF.
Physiological Instrument						
Kim et al, 2011 USA	No theory.	CIB ^p	Detailed description	17	.91	BF mothers showed greater activations in the areas responsible for maternal sensitivity while

Wisenefield et al, 1985 UK	No theory	SCR	Brief description	48.	Internal consistency.85- .95	listening to their baby crying than formula- feeding mothers (r = .62) Response of BF& formula-feeding mothers across response measures is different. Skin conductance measures using Galvanic skin response indicated that breast-feeders might have been more relaxed. cardiac response of BF compare to formula- feeding is different, BF mothers were more sensitive & they also expressed greater satisfaction with the feeding experience (r=.28)
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NOTE: All results are significant at P=.05 except with when indicated by N/S (not significant)

NR: not reported.

^a(Bowlby attachment theory)(Bowlby,1978)

^b(Ainsworth's Attachment Theory)(Ainsworth,1972)

^c(Care-giving Theory)(Erel,2000)

^d(Bonding Thoery)(Klaus,1972)

^e(Roy Adaption Theory)(Roy & Andrew,1999)

^f(Nursing Child Assessment Satellite Training Feeding=NCAST)(Banard,1994)

^g(Ainsworth Maternal Sensitivity Scale)(Ainsworth,1978)

^h(Parent-Child Early Relational Assessment=PCERA)(Clark,1994)

^l(Recording heart-rate of mothers)(Graham & Clifton, 1966).

^j(Postnatal Attachment Questionnaire) (Uzgis& Hunt, 1975).

^m(Maternal Infant Responsiveness Instrument=MIRI) (Amankwaa, 2002)

ⁿ (Rosenberg Self-Esteem Scale =RSE) (Rosenberg, 1965).

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^o(Satisfaction with Life Scale =SWLS) (Diener et al, 1985)

^p(Coding Interactive Behavior=CIB) (Feldman, 1998).

^q(Karolinska Scales of Personality=KSP)(Klinteberg,1986).

^r (Extension of Stimuli)(Bindemann, 2005)

^s(Maternal Sensitivity Scale = MSS) (Han, 2002)

^t (Edinburgh Postnatal Depression Scale =EPDS)(Cox et al., 1987).

^u(Maternal Attachment Inventory =MAI)(Muller, 1994).

Duration of breastfeeding is defined as the time mother continues to breastfeed in week

Chapter 4

Chapter Introduction

The purpose of this chapter is to provide a presentation and discussion of the results from this dissertation study. The focus of this chapter will be on the findings from the study, which include the relationship between breastfeeding and maternal sensitivity during the infants' first year of life, and how that affects child growth and development. This chapter presents the outcomes of the study in the form of a manuscript that will be submitted for consideration. The referencing style of this targeted journal will be applied throughout this manuscript.

Manuscript 3: The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life

Purpose: This current study examined the following hypotheses: (a) Mothers who breastfeed their infants between two to 12 months after birth will demonstrate greater sensitivity with their infants than mothers who only formula-feed their infants as measured by MAI. (b) Mother's employment can affect the mother's choice of feeding her infant (c) A difference in maternal sensitivity levels using MAI parameters will be observed between mothers who never breastfed their infants and those who breastfed their infants for two to 12 months of age, controlling for infant temperament.

Study Design: Cross-sectional quasi experimental design was employed.

Participants: Participants included Arabic speaking mothers (N = 258) from three different healthcare centers in Irbid, Jordan. Participants ranged in age (18 years-43 years; mean age = 20.8 years; SD = 2.20). Mothers from all educational levels were represented in the study. Participants predominantly reported being married (99%). Data were collected from participants on (a) Maternal Sensitivity (b) Infant Temperament (c) Sociodemographical Information, and (D) Antenatal Information.

Data Collection and Analysis: Informational brochures describing the purpose of the study and the benefits and risks were made available to potential study participants at these centers to facilitate recruitment. In each healthcare center, staff members asked patients if they were interested in hearing about the study. The data was analyzed using the Statistical Package for the Social Sciences (SPSS, version 24).

Results: The mothers in the study had different maternal sensitivity level toward their infants. The following findings are summarized from the study: (a) The results of a one-way analysis of variance (ANOVA) revealed significant differences in maternal sensitivity between breastfeeding and formula feeding mothers at two months ($F=24.365$, $P < .001$). (b) Crosstab techniques were used to determine that no effect of the mother's employment status on breastfeeding her infant ($\chi^2 = 2.58$, $DF = 2$, $P= 0.095$). (c) Using analysis of the covariance to statistically control for the infant temperament status, there was a statistically significant difference in maternal sensitivity between the breastfeeding and formula feeding group ($F=24.358$, $p < .05$) when keeping temperament constant. The partial Eta squared of the groups indicates the effect was small (.12). Additionally, at 12 months, there was a statistically significant difference in maternal sensitivity between the breastfeeding and formula feeding group ($F=3.98$, $p < 0.05$) keeping temperament constant.

Conclusion: Identifying the maternal sensitivity level for breastfeeding mothers towards their infants is an appropriate first step in developing appropriate data-driven educational programs that help train future nurses to interact sensitively and appropriately with new mothers. Case studies that incorporate information and data from those mothers could be used to help provide both better perspectives on and understanding of maternal sensitivity.

Introduction

Poor maternal sensitivity leads to insecure infant attachment, which has been associated with negative consequences in cognitive and mental health in school-aged children that continue into adulthood (Bowlby, 1972; Britton, 2006; Thompson, 2008). *Maternal sensitivity* is defined as the mother's ability to recognize and respond to her infant's cues consistently and appropriately (Shin, 2006); it is indicative of the interactions between mothers and their infants, which is characterized by mutual and concurrent interchanges, often referred to as the "mother-infant dance" (Cooklin, 2012; Shin, 2006). If the mother is able to accurately recognize her infant's cues, then she can provide an appropriate and secure foundation to encourage the infant's exploration, watching over and protecting the infant when necessary (Bowlby, 1969). Literature suggests that maternal sensitivity is enhanced for women with high levels of oxytocin. Oxytocin is naturally increased during the early postpartum period, as a result of breastfeeding (Strathearn, Iyengar, Fonagy, & Kim, 2012; Swain, Kim, Spicer, Ho, Dayton, & Elmadih, 2014). Oxytocin levels remain high in breastfeeding mothers compared to formula feeding mothers. It is unknown if breastfeeding is associated with increased maternal sensitivity in the first few months or if mothers who are already sensitive during pregnancy will choose to breastfeed their infants (Schacter, 2009; Strathearn, 2012). Moreover, sensitive and responsive caregiving to infants in the first year of life is important for the neurophysiological, physical, and emotional development of the child (Thompson, 2009).

Maternal sensitivity appears to be key in the child's development, yet, even after decades of research, little evidence is available to assist with early identification of families at risk for poor maternal attachment, and few interventions are known to be effective in promoting maternal sensitivity (Thompson, 2008). In another words maternal sensitivity promotes maternal attachment. A potential method to improve the development of a sensitive mother-infant relationship appears to be via breastfeeding (Britton, 2006, Kim, 2011; Schacter,

2009). Thompson (2008) reported that in developing countries 25-35% of children enter school with educational and growth problems that are as a result of low maternal sensitivity in the first year of life (Thompson, 2008). Maternal sensitivity in the first year of life is a critical because impaired maternal sensitivity in infancy can contribute to insecure attachment in children. Insecure attachment impacts a mother's ability to interpret the child's cues. As a result, she will not be able to provide a safe and secure base for exploration and watch over, comfort, or protect the infant when needed (Ainsworth et al., 1978; APA, 2014). This inability to explore can have a negative impact on the child's ability to learn, and subsequently causes cognitive and mental health deficiencies during school-age that continues into adulthood.

Comprehensive, scholarly maternal and pediatric studies to explore and assess the challenges and obstacles that mothers facing in improving their relationship with their infant have not been widely conducted in Jordan. There is an increase in the number of new mothers working in Jordan after since the 1990s (Gharaibeh & Halman, 2011). Previous studies have failed to control factors that may have negatively impacted duration and exclusivity of breastfeeding such as mothers' employment positions and infant temperament (Cooklin, 2012). The current study will examine whether there is a difference in maternal sensitivity between exclusive formula feeding, exclusive breastfeeding, and mixed feeding by the mother's employment status. Furthermore, the concept of maternal sensitivity has never been explored or addressed in Jordan. The definition of maternal sensitivity varies between professions and ranges from defining of maternal sensitivity as a part of attachment process to multi-dimensional domains include physical, psychological, and social processes. Knowing how these domains interact with each other and impact the life of infants could inform stakeholders in Jordan with information about the relationship between infants and their breastfeeding mothers. The maternal sensitivity concept may be an indicator of how successful health interventions are in preventing and treating insecure attachment in developing countries like Jordan. Jordan is an Arab Muslim developing society with a population of around 10 million including

approximately three million refugees from Syria, Iraq, Libya, and other countries which have a total fertility rate of five children per woman. Women in Jordan are having children at an older age and returning to work after the birth of their children. The median age of Jordanian mothers at the time of their first marriage has significantly increased between 1990 and 2012, from 19.6 to 27 years (Department of Statistics and Macro International Inc., 2014).

Conceptual Framework

The mother or attachment figure functions as a secure base from which the infant explores the world and retreats to as a safe place in times of distress (Bowlby, 1969/1982). Bowlby (1973) suggested that experiences with separation and attachment create sets of expectations or “internal working models” of the self, others, and the interpersonal environment. Thus, through repeated experiences with mothers, infants develop sets of cognitive-affective constructs about the self, the mother, and the caregiving situation (Bowlby, 2006; Shin, 2006). These constructs guide expectations and perceptions about how close relationships operate and how they are used in daily life and in stressful situations. Working models also affect the infant’s behavior in a caregiving situation (Thompson, 2008). When an infant has an available, sensitive, and actively-supportive mother, they are more likely to explore the environment, with the knowledge and confidence that the mother is there, should a need arise. Ainsworth asserted that secure infants had their mother’s continued attention, both to their emotional needs for contact and comfort, as well as their needs for physical nourishment (Thompson, 2008). Ainsworth (1977) concluded that the process of feeding and weaning were related to attachment in so far as feeding/weaning interactions were considered a communication of the mother’s feelings for, and comfort with, her infant, as well as her attitude about taking care of her infant (Wilkins, 2005). Ainsworth asserted that how a mother fed her infant provided a good sample of how likely she interacted with the infant. The purpose of this current study was to answer what is the potential effect of breastfeeding on maternal sensitivity during the first year of life (Mercer, 2004; Wilkins, 2005).

Hypotheses

1. Mothers who breastfeed their infants between two to 12 months or using mixed feeding method after birth will demonstrate greater sensitivity with their infants than mothers who only formula-feed their infants, as measured by MAI.
2. Mother's employment can affect the mother's choice of feeding her infant
3. A difference in maternal sensitivity levels using MAI measure will be observed between mothers who never breastfed their infants and those who breastfed their infants for two to 12 months of age, controlling for infant temperament.

Methods

Design

A cross-sectional, *Quasi-experimental Design* was used to collect data from a convenience sample of mothers in Jordan. In this design, one group of infants or mothers (breastfeeding) compared to a second contrast group (Formula feeding) and a third group (mixed method). A cross-sectional, *Quasi-experimental Design* is very suitable for this type of study because, in this current study design comprised of three groups (breastfeeding, mixed feeding, and formula feeding) which may not be equivalent. The group assignment was self selected not randomized based on the maternal choice for feeding. Confounding factors such as duration of breastfeeding support from family and employment breastfeeding atmosphere were not measured.

Recruitment Plan and Procedure

Women were recruited for the study from three healthcare centers in Irbid city, Jordan, Informational brochures describing the purpose of the study and the benefits and risks were made available to potential study participants at these centers to facilitate recruitment. In each healthcare center, staff members asked patients if they were interested in hearing about the study. The study packet consisted of three forms: 1) A form consisting of three sections: a)

demographic data b) current antenatal data c) past breastfeeding experiences: 2) The MAI Form and 3) Temperament Questions Form. The research assistants were available to provide information about the study, obtain the mother's written informed consent. They explained the purpose of the study, the benefits, and risks to study participants, and provided enrollment materials to mothers interested in participating. The study packet contained information about the study, the responsibilities of study participants, and the benefits and risks of being in the study. Furthermore, the primary investigator or research assistant provided each of the mothers an opportunity to ask questions, and offered assistance completing the data collection forms as necessary. Moreover, the research assistant was available at the centers to answer any questions that nursing staff or management had during the study.

Instrument

The data was collected using 1) The first form which consists of three sections: a) demographic data b) current antenatal data c) past breastfeeding experiences: 2) The MAI Form and 3) Temperament Questions Form convenience sample of mothers. The first form consisted of 10 questions regarding a) demographic data; b) current antenatal data; and c) past breastfeeding experiences. The demographic data section included information about maternal age, educational status, employment status, marital status, the number of children, and the family's annual income and size. The antenatal section included the mother's total number of pregnancies, most recent type of delivery; and the third section included questions regarding current feeding methods.

MAI

The second form was a self-report form entitled Maternal Attachment Inventory (MAI), which aimed to measure maternal sensitivity levels. This form consisted of 26 items to measure maternal sensitivity to infant cues (Muller, 1994). Specifically, MAI measures the woman's recognition of her sensitivity to her infant and any perceived obstacles to expressing her sensitivity or responding sensitively to her infant. This form included three dimensions of

maternal sensitivity: pleasure of proximity, tolerance, and acceptance/competence. Maternal response to infant behaviors consisted of six categories that include: smile, eye contact, touch, auditory signal, eye directions, and offering food. Infant behaviors include: gazing toward and /or away from the mother as well as facial expressions in response to the mother's gaze (Gharaibeh & Halman, 2011; Muller, 1994). 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 almost never (1) to almost always (4). The total score varied from 26 to 104; a high score of > 75 indicated a high level of maternal sensitivity (Shin et al., 2006).

The MAI form used in this current study has substantial validity and reliability testing reported (Gharaibeh & Helman, 2011). The MAI form was translated into the Arabic language and used for a sample consisting of 200 participants to measure maternal sensitivity to use in a conservative country such as Jordan and was more appropriate to understand maternal sensitivity phenomena than observational measures (Halman, 2014). The Cronbach's alpha coefficient for the MAI in Jordanian mothers 0.91 (Gharaibeh & Halman, 2011).

Inclusion and exclusion criteria

Inclusion criteria for this current study were as following: Jordanian women aged 18 to 43 who had given birth to a healthy full-term infant that was two to 12 months in age. Only Jordanian women were included in this current study because Syrian refugees negatively impacted by what might be described as emergency immigration or displacement may have other distinct factors such as a lack of shelter and nutrition that may influence their psychological statuses. These events could distort results for this current study. Jordanian mothers who were able to read and write in Arabic (this information was self-reported) and who had visited one of the three MCH centers for immunizations and infant care services were recruited for this current study. Women with an infant who had experienced serious illnesses, such as metabolic disease or cancer were also excluded from this current study.

Results

The demographic information from the 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 between two to 12 months or using mixed feeding method after birth will demonstrate greater sensitivity with their infants than mothers who only formula-feed their infants, as measured by MAI.

The results of a one-way analysis of variance (ANOVA) revealed significant differences in maternal sensitivity between breastfeeding and formula feeding mothers at two months ($F=24.365$, $P<0.001$). In comparison, the results of a one-way analysis of variance (ANOVA) at 12 months revealed significant differences in maternal sensitivity between breastfeeding and formula feeding mothers ($F=15.685$, $P < .001$). Post Hoc of the ANOVA revealed a significant difference in maternal sensitivity between formula feeding mothers and breastfeeding mothers and a difference in maternal sensitivity between mixed method and formula feeding. However, there is no significant difference in maternal sensitivity between mixed method and exclusive breastfeeding during the first year of life. For more information regarding Post Hoc results, see *Table 3*

Hypothesis two: Mother's employment can affect the mother's choice of method for feeding her infant.

Crosstab techniques were used to determine the contribution of the mother's employment status on breastfeeding her infant ($\chi^2 = 2.58$, $DF = 2$, $P= 0.095$). The probability of obtaining this chi-square statistic is (2.58) if there is, in fact, no effect from the independent variables (employment status), on the dependent variable (breastfeeding). The model is not statistically significant because the P-value (0.095) is more than 0.05.

Hypothesis Three: A difference in maternal sensitivity levels will be observed between mothers who never breastfed their infants and those who breastfed their infants for two to 12 months of age, controlling for infant temperament.

Using analysis of covariance (ANCOVA) to statistically control for the infant temperament status, there was a statistically significant difference in maternal sensitivity between the breastfeeding group and the formula feeding group ($F=24.358$, $p < .05$) when holding temperament constant. The partial Eta squared of the groups indicates the effect was large (.101). Using ANCOVA and controlling for confounding variables in this assignment can help increase statistical power. For more information regarding ANCOVA, see *Table 5*

Discussion

This current study revealed that mothers who breastfed at least two months after delivery were generally more sensitive in their interactions with their infants. This set of relationships persisted after controlling for confounding variables that related to the mothers themselves, such as their infant's temperament, employment status, and level of income. However, when we considered the relationship between breastfeeding, sensitivity, and temperament as a function, the infant's temperament did not alter. Breastfeeding and the mother-infant at two to 12 months postpartum did not alter later temperament. Our present findings are in line with previous studies that showed that breastfeeding mothers exhibit different patterns of maternal sensitivity, as measured by the Maternal Attachment Inventory. For example, higher scores on this scale were associated with the practice of breastfeeding. Thus, breastfeeding may contribute to enhancing maternal sensitivity. The findings of this 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 in response to suckling. Moreover, the increases in oxytocin levels in breastfeeding mothers correlate to anxiety reduction and higher interaction. This physical contact between mothers and their infants during the breastfeeding process may enhance the mother's abilities to read their infants and respond to their infants' cues. Further, Kim's (2012) study showed greater activation in the brain of a breastfeeding mother when compared with formula feeding mothers. In other words, it is possible that differences in

regional brain activation, as seen in this current study, are due to the act of breastfeeding and the increased release of oxytocin. Moreover, the studies also show that skin-to-skin contact between mothers and preterm infants can cause an increase in oxytocin levels that affect the mother's ability to read infant's cues. Oxytocin also facilitates other maternal behaviors in human and animal studies (Febo, Numan, & Ferris, 2005). Higher levels of peripheral oxytocin have been associated with sensitive and synchronous maternal behaviors (Feldman, Weller, Zagoory-Sharon, & Levine, 2007).

The findings of the current study support the existing literature examining the effect of maternal employment on the mother's choice of infant feeding. In the literature, maternal employment was not associated with choosing or discontinuing breastfeeding as a feeding method. Zaslow et al (1985) reported that the mother's employment status does not have a significant effect on the mother's choice to breastfeed her infant. The differences between working and nonworking mothers choosing to breastfeed or formula feed depends on several factors including satisfaction with the motherhood role, presence of someone to help, and quality of available infant care (e.g., Belsky, 1988; McKim et al., 1999, NICHD, 1997a). Perhaps, a potential explanation is that more mothers are working while rearing their children, and mothers have more work options available to them.

Another finding from this current study is that infant temperament was a predictor of maternal sensitivity toward the infant; this is also consistent with the literature. This means having an easy infant may cause the mother to be more sensitive to her infant's needs. Jonas (2015) reported that infant temperament affects maternal sensitivity and increased maternal sensitivity mediated infant temperament. This indirect mediation persisted after controlling for confounders (effect $ab = 0.0312$ [0.0208], 95% CI = 0.0884 to 0.0031). The Jonas (2015) study supports the conclusion that breastfeeding mothers display greater maternal sensitivity than formula feeding mothers while controlling for infant temperament. On the other hand, the current study did not support literature findings that concluded that having a difficult infant

might cause the mother to be less sensitive. A potential explanation for this result is that the reliability and validity of the tool used to measure infant temperament in this current study were not previously assessed. As such, the researchers need to treat these results with caution. The limitations of the study are important to consider in the interpretation of the findings and for guiding future research. The major limitation that affected this current study was the use of a convenience sample. The criticism about convenience sampling is “sampling bias” and that the sample is not representative of the entire population. Another disadvantage of using a convenience sample is the limitation in generalization and inference making about the entire population. Moreover, there is no psychometric information regarding the temperament questions. Thus, future studies comparing maternal sensitivity need to focus on using random sampling and including a more heterogeneous sample focus on other cities and populations. Second, the researchers recommend considering other temperament instruments with measured reliability and validity information. Third, the cross-sectional design only allows for data collection at a single point in time, and thus changes over time cannot be detected. In future studies, it will be important to include measures of oxytocin and other related neuro-hormones and utilize more reliable tools to measure temperament. Another potentially confounding issue concerns the factors which influence a mother’s decision to breastfeed before the child is born: the relationship between breastfeeding and maternal sensitivity with maternal characteristics such as education level, age, and race. Moreover, the choice of feeding method can also be affected by environmental factors such as culture.

Implication for Practice and Research

Nurses, obstetricians, mothers' healthcare providers, and many people, who have direct and indirect contact with mothers have a responsibility to assess, intervene, educate and make a referral to specialized persons to help. Mothers will benefit from screening opportunities that are offered using MAI instruments. Nurses 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, and breastfeeding as part of that. Nurses could or can also provide education regarding healthy mother and infant interaction and support.

Many focus groups may examine various interventions to increase maternal sensitivity. Some clinical research may find the MAI a useful tool for pre- and post-test measurements to assess the success of new programs and interventions. Effective assessment and interventions are needed to promote growth as well as to prevent problems. Working with mothers, assisting them in determining their strengths and weaknesses, supporting the mother, increasing their awareness of the importance of breastfeeding, could increase resilience for the mother and her infant.

More qualitative/research is required to understand its unique and salient role in child rearing practices. Instead of looking for breastfeeding to have a direct association in 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 were touched on in this current study and may lend themselves to more comprehensive exploration. Additionally, further examination of attitudes towards weaning and the experience of weaning for mother and infant may be fertile ground for further research. Maternal expectations of self and of infant were found to be significant predictors of the assessment of self as mother and of infant at 12 months. These findings may give clinicians clues as to when it would be best to intervene to help identify at-risk mothers.

Conclusion

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

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Table 1
Comparison between the Three Groups

	<i>%</i>	<i>Combined</i>	<i>Breast Feeding Only</i>	<i>Formula Feeding Only</i>	<i>Mixed Methods Feeding</i>
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

Table

Post s

Table 3
Post Hoc two months

Feeding Method	<i>Feeding Method</i>	<i>Mean Difference</i>	<i>Sig.</i>
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*

<i>Source</i>	<i>Type III Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Partial Eta Squared</i>
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)

Chapter 5

Introduction

The purpose of this dissertation is to provide a synthesis of the manuscripts including a review of the literature related to the potential effect of breastfeeding on maternal sensitivity during the first year of life, and of the instruments used to measure maternal sensitivity during the first year of life. A discussion of the dissertation study findings which showed that breastfeeding had a significant impact on maternal sensitivity is also included. This chapter begins with a synthesis of the manuscripts and concludes with a discussion, a section on limitations, and a section on future implications in theory, practice, education, research and policy.

Synthesis of Manuscripts

A review of the literature on the potential effect of breastfeeding on maternal sensitivity during the first year of life provides a greater understanding of how breastfeeding affects maternal sensitivity as the focus of the dissertation and the hypothesis. The exploratory research question concerns the potential effect of breastfeeding on maternal sensitivity during

the first twelve months of life. The first manuscript entitled, “The Potential effect of breastfeeding on maternal sensitivity during the first year of life” provides an examination of the current state of the science of breastfeeding and maternal sensitivity. In this manuscript, the results were broken down into four major areas related to the potential effect of breastfeeding on maternal sensitivity including: potential effects of breastfeeding on maternal sensitivity, potential effects of the breastfeeding–related environment on sensitivity, potential effects of infant health on maternal sensitivity, and no effect from the method of infant feeding on maternal sensitivity. A great quantity of literature was discovered initially and was narrowed down to the most recent research. The majority of the literature was written by those in psychological and nursing disciplines. In this review, the studies consisted of population based, correlational studies, and a few quasi- experimental or experimental studies; the research was international in reach.

The literature review in the first manuscript of the most current studies “The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life” revealed a lack of consensus amongst researchers regarding the definition of “maternal sensitivity”. The maternal sensitivity concept has been defined in various terms: these include maternal responsiveness, mother- infant interaction, mother- infant attachment, maternal attachment, and maternal bonding (Eldhbory, 2003). For example, only six of the studies reviewed included a definition of maternal sensitivity. Maternal sensitivity was defined using the interchangeable terms as follows: maternal responsiveness, mother infant interaction, maternal bonding and mother behavior. The weaknesses of these studies included small samples, methodological flaws, and an inability to accurately measure the variables confounding maternal sensitivity. Another an important gap in the literature was that at least nine different instruments were used to measure maternal sensitivity. Thus it was very difficult to impossible to compare studies using nine different instruments to measure maternal sensitivity. Moreover, many studies used various questionnaires which were not specifically named to measure

maternal sensitivity. The second manuscript will provide a review of instruments used to measure maternal sensitivity during the first year of life.

The second manuscript is titled, “Measures of Maternal Sensitivity during the First Year of Life: A Systematic Review”. The objectives of this manuscript were to evaluate the instruments used to measure maternal sensitivity during the first year of life and to synthesize the literature using these measures. This manuscript provided an overview of instruments that measured maternal sensitivity for a target group, a detailed description of each instrument, feasibility of the instrument(s), and an overview of the reliability, validity. During the construction of this manuscript, seventeen articles met the inclusion criteria, and these articles examined the science behind relationships between breastfeeding and maternal sensitivity. The literature review in the second manuscript revealed that reliable and valid instruments are necessary for researchers and clinicians to accurately measure maternal sensitivity in order to conduct quality research and provide quality clinical care. Many maternal sensitivity instruments were reliable and valid, and these include MSS, AMSS, MIRI, NCASF, MAI, and PCERA. MAI may only take 10 minutes to administer; MAI and PAQ can feasibly be implemented in practice. NCASF and PCERA need a professional administrator who has received special training to administer them. However, the development of reliable and valid instruments for measuring maternal sensitivity that are sensitive to change in mothers of different backgrounds over time is still an important need for health care providers and researchers.

Despite the importance of theory-driven research, less than half of the articles in this integrative review of studies using measures of maternal sensitivity identified a theoretical framework (Britton et al., 2006; Danvon, 1978; Shin et al., 2006; Tharner et al., 2012). Also problematic, is that most studies included white, non-Hispanic mothers-infant dyads as is reflected in the homogenous participant pool of predominately white mother individuals. Thus, the results of this integrative review will most likely not be generalizable to other ethnic

groups (Bystrova et al., 2009; Cooklin et al., 2012; Ekstrom & Nissen, 2006; Kim et al., 2011; E. Nissen, Gustavsson, VVidstrom, & Uvniis-Moberg, 1998; Pearson et al., 2011; Tluczek et al., 2010; Wilkinson & Scherl, 2006; Wisenefield, 1985). Although the results may not be fully generalizable, the second manuscript is one of the few works that examines and assesses maternal sensitivity measures that are used in different studies during the first year of life.

The dissertation study was conducted using an attachment theory. This model acknowledges the effect of maternal sensitivity on infant health outcomes. Using data gathered from Jordan to identify the potential effect of breast feeding on maternal sensitivity and infant health outcomes, three hypotheses were generated.

Hypotheses

- Mothers who breastfeed their infants between two to twelve months after birth will demonstrate greater sensitivity than mothers who only formula-feed their infants, as measured by MAI.
- Mother's employment can affect the mother's choice of method for feeding her infant.
- A difference in maternal sensitivity levels in MAI measure will be observed between mothers who never breastfed their infants and those who breastfed their infants from two to twelve months of age, controlling for infant temperament.

The third manuscript is entitled, "The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life". This manuscript includes a study design, methodology and results section. Altogether, 258 mothers with infant dyads completed questionnaires. The breastfeeding history and maternal sensitivity assessment sections were both self-reported by participants. Descriptive analysis was conducted using the self-report information provided by the mothers; the responses provided rich demographic antennal

information for this population. The resulting variables were then analyzed to determine if a relationship exists between breastfeeding and maternal sensitivity; correlated variables such as infant temperament and mother's employment were also analyzed to determine if there was any effect on maternal sensitivity. Breastfeeding was used as an independent variable to compare differences in maternal sensitivity in this population. Ultimately, all variables for the final analysis were considered either continuous or categorical variables.

The principal findings of this current study were that mothers who breastfed their infants or provided mixed feedings “were more likely to express greater maternal sensitivity” than mothers who fed their infants formula alone. However, since this current study was conducted in Jordan, we cannot infer generalization of the findings to infants in other countries. Furthermore, only the significantly correlated variables in this current study were retained for ANOVA. The analysis revealed a significant correlation between breastfeeding and mixed methods feeding, and maternal sensitivity. As such, the findings from the current study support the previous conclusions in the literature that breastfeeding may enhance maternal sensitivity. The third manuscript also provides a discussion as well as graphic presentations of the study results. The main findings were that one factor effected maternal sensitivity and two factors do not affect maternal sensitivity. The factor that effected maternal sensitivity is breastfeeding ($F=24.358, p < .05$). On the other hand, the factors that do not affect maternal sensitivity are infant temperament and maternal employment. In short, women whom breastfeed their infants are more likely to express greater maternal sensitivity than women who formula feed. Once more, since this current study was not a case control, generalizations to infants from other cultures and ethnic backgrounds cannot be made.

Multiple Regressions

Multiple regression analysis was used to develop a model for predicting factors that affect maternal sensitivity. Each of the predictor variables had a significant ($p < .01$) zero-order correlation with maternal sensitivity, 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 sensitivity, $F(3, 25) = 8.45$, $p < .01$, $R^2 = .65$, 95% CI [.35, .72]. Based on this analysis, we have recommended that health care providers, especially nurses, who work with infants, reconsider the importance of assessing the feeding method and infant's comportment when assessing and teaching mothers about maternal sensitivity. In fact, based on the research results we recommend making assessments of the previously mentioned variables a requirement.

The Finding of Hypotheses

The study findings were consistent with a large number of the prior investigations, which determined that mothers who do any breastfeeding expressed greater maternal sensitivity than exclusively formula-feeding mothers (Britton, 2006; Shin et al., 2007). However, in at least one study, Drake (2007), mothers who exclusively breastfed for at least two months did not report any more maternal sensitivity than mothers who formula fed for the same amount of time. Instead, hierarchical multiple regression analysis in the study revealed that mother life satisfaction, parity, but not breastfeeding, had a more significant impact on self-reported maternal sensitivity scores.

It should be noted that Drake (2007) is one of few maternal sensitivity studies that used both a self-report instrument and Internet data collection. Conversely, Shin et al (2011) reported that in the first postpartum month, mothers who breastfed their infants displayed greater activations in the superior frontal gyrus, insula, precuneus, striatum, and amygdala while listening to their own baby-cry as compared to mothers who formula fed their infants. Greater activations in the brain regions were associated with higher maternal sensitivity postpartum. Thus, these results suggest links between breastfeeding and greater maternal infant bonding. Such brain region activations may enhance greater maternal sensitivity.

In the current study, the second hypothesis tested the effect of maternal employment on the mother's choice of infant feeding method. The current study's findings support the existing

literature that explores the effect of maternal employment on the mother's choice of method for infant feeding. In the literature, maternal employment was not associated with choosing or discontinuing breastfeeding as a feeding method. Research related to the impact of maternal employment on the mother's choice of infant feeding is limited. Only a few studies examined the impact of maternal employment on the mother's choice for infant feeding and no association was reported. Zaslow et al (1985) reported that the mother's employment status does not have a significant effect on the mother's choice to breastfeed her infant. The differences between working and nonworking mothers choosing to breastfeed or formula feed depends on several factors including satisfaction with the motherhood role, presence of someone to help, and quality of infant care (e.g., Belsky, 1988; McKim et al., 1999, NICHD, 1997a). Perhaps, a potential explanation is that more mothers are working while rearing their children, and mothers also have more work options available to them. In addition, research currently pays more attention to including the covariables of maternal employment to examine their association with choice of infant feeding method.

Crosstab techniques were used in the current study to determine the contribution of the mother's employment status on breastfeeding her infant. The probability of obtaining this chi-square statistic is (2.58), which means the independent variable (employment status) has no effect on the dependent variable (breastfeeding). The model is not statistically significant because the P-value (0.095) is more than 0.05. In this current study, maternal employment was not found to influence maternal sensitivity.

In the current study, the third hypothesis tested for infant temperament and showed that infant temperament was a significant predictor of maternal sensitivity toward the infant. This finding is consistent with the literature. In Tester- Jones (2015), infants whose mothers had a negative temperament displayed lower sensitivity towards them. However, this current study is limited by its cross-sectional design and the use of self-report measures to assess a mother's sensitivity to infant needs and behaviors, rather than observational measures of maternal

sensitivity. Moreover, Kivijuri (2005) reported that Infant temperament was related to maternal sensitivity and sustained breastfeeding at 3, 6 and 12 months of age ($\chi^2 = 5.85$, $DF = 1$, $p = 0.016$).

Jonas (2015) reported that mothers who breastfed for three months postpartum were more sensitive in their interactions with their infants at six months postpartum, and had more elevated maternal sensitivity than formula feeding mothers. Infant temperament affects maternal sensitivity and increased maternal sensitivity mediated infant temperament. This indirect mediation persisted after controlling for confounders (effect $ab = 0.0312$ [0.0208], 95% $CI = 0.0884$ to 0.0031). This current study supports the conclusion that breastfeeding mothers display greater maternal sensitivity than formula feeding mothers while controlling for infant temperament.

Limitations

The major factor affecting this current study is using a convenience sample. The major criticism of convenience sampling is sampling bias, and that the sample may not be representative of the entire population. Another considerable disadvantage of using a convenience sample is the limitation in generalization and inference making about the entire population. Since the sample is not representative of the population, the results of the study cannot speak for the entire population. This results in the low external validity of the study. Moreover, an important limitation of this current study is its focus on a fairly homogenous group, who were almost exclusively Caucasian, middle to low class, educated, Jordanian women. As such, these findings are not representative of findings that can occur across cultures and are thus not generalizable. This is a particularly important limitation in a study on breastfeeding because we know it is highly influenced by cultural norms. In addition, this current study was not designed to assess objective differences in maternal sensitivity. Since this current study is quasi experimental and comparative in nature, threats to internal validity are present (Rhode et al, 2003). Bias is prevented through operational definitions of variables, large

sample size, valid and reliable research tools, and formal data collection methods. Another threat is lack of randomization, manipulation, and control factors which make it difficult to establish any cause-effect relationships with any degree of confidence. However, reversed causality is more plausible and should be investigated (Kong et al, 2012; Rutherford, 2011). The possibility of a third, common explanation in causal-comparative research is plausible in many situations. One way to control for a potential common cause is to compare groups on that variable (Creswell, 2008; Shadish et al, 2002).

Another area of concern regarding this current study is the nature of self-report measures and the accompanying risk of response bias. Participation was entirely voluntary; it is Potential that mothers who felt uneasy in their feelings of attachment toward their babies may have excluded themselves from this current study. It is Potential that those who chose to participate were overly positive in rating themselves as warm and loving mothers. It would, in fact, be difficult to find a mother who does not feel that she does all she can for her baby. Mothers may also be reluctant to acknowledge feelings (or actions) of hostility, aggression, neglect, or rejection toward their infants, for a variety of reasons. Although the instructions specified that participation was entirely voluntary and anonymous, mothers may have been wary of revealing any information that might have been cause to notify infant welfare agencies.

Implication for theory

The findings of this current study support Bowlby and Ainsworth's attachment theory. Ainsworth (1972) proposed that certain types of maternal responses to their infants help make healthier, more desirable styles of attachment. Infants develop a concept of the self, mother, and mother's situation that guides their expectations about the impact of relationships on daily life and stressful situations. Ainsworth mentioned that some enduring characteristics, such as the temperament of the infant will affect how a mother deals with and responds to her infant. Put differently, the temperament of the infant will either hamper or facilitate the development

of secure attachment with the mother. Ainsworth asserted that the interpretation of strange situations depended on the infant's temperament when the researcher observed the infant for a single time. It is hoped that the present study provides some added information about using breastfeeding in improving maternal sensitivity since it has many physiological and psychological benefits.

Implications for Clinical Area

Nurses, obstetricians, women's' health professionals, and many other people who have direct and indirect contact with mothers have a responsibility to assess, intervene, educate and make referrals to specialized persons to help mothers with motherhood. Mothers will benefit from screening opportunities that are offered using MAI instruments. Nurses play a big role in assisting mothers through their life changes especially with the maternal role. For many years, nurses have dedicated their time to teach mothers about many aspects related to the mothering role starting from skin to skin contact, and breastfeeding. Nurses could also provide education regarding healthy mother and infant interaction and support. This should be part of their routine assessment & care. Some clinical researchers may find the MAI to be a useful tool for pre- and post-test measurements to assess the success of new programs and interventions. Effective assessment and interventions are needed to promote growth as well as to prevent problems. Working with mothers, assisting them in determining their strengths and weaknesses, supporting them, and increasing their awareness of breastfeeding importance, are could all increase resilience for the mother and her infant. There are many resources that suggest that formula feeding does not provide the same benefits of breastfeeding. Moreover, pediatric health nurses, and community health nurses should provide health education to both the homemaking and working mother about how to sensitively interact with their infants because the employment status of Jordanian mothers appears not to be associated with the prediction of maternal sensitivity. Moreover, maternal sensitivity has a substantial impact on infant attachment. The teaching about maternal sensitivity will help Jordanian mothers know and

respond to the infant's behaviors more sensitively and appropriately. It will improve their relationship. Jordanian mothers should be provided with information on how to be sensitive or arrange high quality care for their infant. Providing sensitive care is required not only in a normal situation, but also when an infant is hospitalized. When infants get sick and have to be hospitalized, pediatric nurses should interact with them with warmth, sensitivity, and intuition, and also assist their mothers to interact with them in the same manner. Because in that situation the infant requires more care and attention, all caregivers especially mothers in such special situations will need to be understanding and patient with the infant. These are all important skill sets that require emphasis and instruction.

Policy

Research attempting to link breastfeeding and infant temperament to maternal sensitivity is extremely limited. In particular, this research project is unique and as such contributes to the advancement of understanding of breastfeeding on maternal sensitivity. The potential policy implications regarding breastfeeding are numerous, especially when simultaneously considering the impact that income has on decreasing breastfeeding rates. Moreover, the breastfeeding policy highlights the importance of breastfeeding on infant health outcomes (APA, 2012). The federal United States government and Jordanian government both published recommendations for improving breastfeeding and friendliness at infant hospitals. These recommendations provide structured guidelines for nurses, health care providers and employers to increase the rate of breastfeeding. This current study and these guidelines may assist nurses and health care providers in helping families affected by low maternal sensitivity and give extra preventative support to the families at risk.

Future Research

An interesting direction for research to take would be to explore qualitatively what benefits women expected to attain for themselves in the mothering relationship via

breastfeeding. Studies indicate that women expect breastfeeding to afford them a unique type of intimacy with their infant. It would be interesting to learn if breastfeeding mothers actually experience that intimacy in practice to enhance maternal sensitivity. Moreover, it would be interesting to compare maternal sensitivity in mother's who did not breastfeed after planning to do so with mothers who did. In addition, it would be also be of interest to make a more general comparison of breast feeders with non-breast feeders without the caveat of having planned to breastfeed, in terms of their perceptions of their mother-infant relationship, to determine if any differences existed between them. It may also be beneficial for future research to consider the duration of breastfeeding, as current studies do not. Perhaps maternal sensitivity toward their infants varies depending on the infant's age or based on factors related to the infant itself. In addition, differences may be found amongst different socioeconomic groups. The potential effect of socioeconomic status should be investigated more closely to see what aspects are directly related to reports of maternal sensitivity. Breastfeeding is important; it can have a profound effect on families, mothers, and infants whether one chooses this method or not. It will always be a part of the culture of parenting and so its exploration will always be meaningful. This current study did not establish some of the ideas it set out to establish. However, the findings were interesting and some may be a good starting point for further research. Because the sample in this current study was at very low risk for encountering difficulties in maternal sensitivity with breastfeeding their infants, further studies with other groups of mother-infant dyads who are at high risk for encountering difficulties in maternal sensitivity and breastfeeding, such as premature infants admitted in a NICU unit, and mothers who are divorced or separated from their husband, for example, could be helpful. It would be a challenge to interrogate the impact of different cultural or regional factors that influence the effect of breastfeeding on maternal sensitivity in mothers using the results from this current study alone, since it was conducted exclusively in Jordan. However, future studies are required

to reveal more information in this area, and could examine cultural, national, regional and/or religious influences on the effect of breastfeeding on maternal sensitivity.

Becoming a mother is a complex, multifactorial, fluctuating, nonlinear process that may vary across time. Maternal characteristics, infant characteristics, and outside factors may also influence the process of maternal sensitivity and infant attachment (Ainsworth, 1972; Bowlby, 1980, Shin et al, 2006). Social support and adult attachment patterns are two additional areas that could be explored. Social support has been identified as a factor in maternal role development in several other studies (Barclay, Everitt, Rogan, Schmied, & Wyllie, 1997; Goldstein, Diener, & Mangelsdorf, 1996). Also, memories of maternal acceptance and the mother's own adult attachment patterns have been identified as a predictor of maternal sensitivity (Crockenberg & Leerkes, 2003, van Ijzendoorn, 1995). For researchers exploring maternal sensitivity, the MAI may become a useful instrument. This was the first large study of healthy mother-infant dyads using the MAI in Jordan, using a questionnaire to measure maternal sensitivity. Researchers in this area have generally relied heavily on observational measures and not self-reported instruments. Finally, despite the findings of the current study, it is essential to explore more on breastfeeding and its relationship with maternal sensitivity and infant temperament. We need to continue to document the psychological benefits of breastfeeding. Future researchers should collect data about infant feeding patterns and infant temperament routinely as a part of mother and infant clinical studies in order to track breastfeeding initiation and duration rates. Recent experimental studies highlight the critical role of Oxytocin, one of the hormones associated with breastfeeding, in the development of trust in human relationships (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005). Future methodology may benefit from restricting participants to those who are exclusively breastfeeding or exclusively formula-feeding instead of also including a mixed group. It might provide for interesting research to examine why it is that the age of a mother is negatively

correlated with her maternal sensitivity toward her infant. Perhaps certain factors that plays a role in an older woman's life conflict with certain motherly roles.

Conclusion

This research study has revealed some important effects of breastfeeding on maternal sensitivity. Specifically, maternal affection has been shown to be significantly affected by breastfeeding. Additionally, the employment status does not affect the level of maternal sensitivity. These results may be used to support interventions designed to foster maternal-infant attachment among mothers and their infants. A mother's status may be identified by an assessment of her attachment style and maternal sensitivity while her infant is healthy. An understanding of the conditions necessary for improving maternal sensitivity and maternal-infant attachment may be beneficial in helping secure attachment relationships.

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APPENDICES

Appendix A

Department of University Safety & Assurances

New Study - Notice of IRB Exempt Status

Melissa Spadanuda
IRB Manager
Institutional Review Board
Engelmann 270
P. O. Box 413
Milwaukee, WI 53201-0413
(414) 229-3173 phone
(414) 229-6729 fax

Date: February 23, 2015

To: Teresa Johnson, PhD

Dept: College of Nursing

Cc: Sawsan Abuhammad

IRB#: 15.247

Title: The Relationship between Breastfeeding and Maternal Sensitivity during the First year

<http://www.irb.uwm.edu>
spadanud@uwm.edu

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has been granted Exempt Status under **Category 2** as governed by 45 CFR 46.101(b).

This protocol has been approved as exempt for three years and IRB approval will expire on **February 22, 2018**. If you plan to continue any research related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, please respond to the IRB's status request that will be sent by email approximately two weeks before the expiration date. If the study is closed or completed before the IRB expiration date, you may notify the IRB by sending an email to irbinfo@uwm.edu with the study number and the status, so we can keep our study records accurate.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., [FERPA](#), [Radiation Safety](#), [UWM Data Security](#), [UW System policy on Prizes, Awards and Gifts](#), state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation and best wishes for a successful project

Respectfully,

Melissa C. Spadanuda

Melissa C. Spadanuda

IRB Manager

Appendix B

Dear Mother,

Peace, mercy and blessings of God:

⌘ The purpose of this current study is to identify the level of maternal responsiveness to her infant's needs.

Information will be collected by the researcher only. Non-identified names or any code refers to the identity will be used. Note that the information will be kept confidentially and will be used for the purposes of scientific research only from me, my professor and statistician.

⌘ You have a right to withdraw at any time, and refused to answer any questions. This will not affect your present or future health care

⌘ The results of this research will enable mothers to see how to improve her responsiveness to her child. This current study will enable staff to learn how breastfeeding strengthen the link between mothers and their infants, which resulting in enhancing the optimal physical and emotional health for their infants.

⌘ If you would like to receive the results of this current study, you can contact the researcher at: Phone number: 07962312342 or email: Sawsan@uwm.edu.

⌘ This questionnaire consists of two parts and each part consists of several questions.

⌘ Remember dear mother that there was no right or wrong answer.

Thank you for your kind cooperation

Sociodemographical and Antenatal –Perinatal Variables of mothers and infants

English version

1- Sociodemographical Variables:

1- Mother age: ()

2- Educational Level: illiterate Primary Secondary Bachelor or more

3- Employed status: Employed None employed

The number of employment hours for employed one: ()

4- Receiving assistance in infant care: Yes No

Who give you this assistance: Child grandparents husband others

5- Have previous experience in infant care: Yes No

6- Living in Independent house: Yes No

7- How you perceive your marital relationship after childbirth:

Very good Good Fair Bad

8- Family Income Level: () JD

9- Infant age: () months

10- Infant Gender: male Female

2-Antenatal – Perinatal Variables:

1- Planning of Pregnancy: Yes No

2- Mode of delivery: Normal Vaginal Delivery Cesarean section

3- Receiving prenatal information regarding the infant care: Yes No

Identify the source of information: health center mass media

Family and friends others

4- The type of infant feeding in the first two month : Breastfeeding formula-feeding together

5-The current infant feeding: : Breastfeeding formula-feeding together

6- How you perceive your experience during pregnancy and childbirth:

Very good Good Fair Bad

The Postnatal Attachment Inventory

English version

The following sentences describe thoughts, feelings, and situations new mothers may experience. Circle the letter under the word that applies to you.

Item	Almost Never	Sometimes	Often	Almost always
1. I feel love for my baby.				
2. I feel warm and happy with my baby.				
3. I want to spend special time with my baby.				
4. I look forward to being with my baby.				
5. Just seeing my baby makes me feel good.				
6. I know my baby needs me.				
7. I think my baby is cute.				
8. I'm glad this baby is mine.				
9. I feel special when my baby smiles.				
10. I like to look into my baby's eyes.				
11. I enjoy holding my baby.				
12. I watch my baby sleep.				
13. I want my baby near me.				
14. I tell others about my baby.				
15. Its fun being with my baby.				
16. I enjoy having my baby cuddle with me.				
17. I'm proud of my baby.				
18. I like to see my baby do new things.				
19. My thoughts are full of my baby.				
20. I know my baby's personality.				

Item	Almost Never	Sometimes	Often	Almost always
21. I want my baby to trust me.				
22. I know I am important to my baby.				
23. I understand my baby's signals.				
24. I give my baby special attention.				
25. I comfort my baby when he/she is crying.				
26. Loving my baby is easy.				

The Temperament Instrument

English version

The following sentences describe thoughts, feelings, and situations new mothers may experience. Circle the letter under the word that applies to you.

Item	Strongly agree	agree	disagree	Strongly disagree
1. My baby is an easy baby.				
2. My baby is sensitive to noise.				
3. My baby gets upset easily.				
4. My baby has a regular sleep cycle.				
5. My baby has a regular eating cycle.				
6. My baby is a difficult baby				

VITA
 Sawsan H, Abuhammad,
 MSN, R.N.
 PhD candidate
 College of Nursing
 University of Wisconsin-Milwaukee
 P.O. Box 413
 Milwaukee, WI 53201
 (414)229-6548
 email
 sawsan@uwm.edu

EDUCATIONAL PREPARATION:

University of Wisconsin Milwaukee, WI Oregon Health and Science University Portland, OR	Ph.D. M.SN. B.S.N.	Major: Philosophy of Science of Nursing Major: Nursing Child, health Major: Nursing	Anticipated 2016 2013 2008
Jordan University of Science and Technology Irbid, Jordan			

EDUCATIONAL HONORS AND AWARDS:

Eta Nu Chapter of Sigma Theta Tau International <i>Doctoral Student Poster Award</i> Annual Conference submission for 2016, UW-Milwaukee	2016
Pioneer student in Nursing, Jordan University of Science and Technology	2005

EDUCATIONAL EXPERIENCE

Teaching Assistant (Genetics and Genomics, Community Health, Growth & Development, Cultural Diversity, Professional Health Role)	University of Wisconsin Milwaukee	8/14--Now
Teaching Assistant (Nursing Skills, Physical Health Medical & Surgical, Maternal and Neonatal Health, Special cases, Community Health, Child health, Postpartum for Midwives)	Jordan University of Science Technology	10/08 – 8/11

PROFESSIONAL MEMBERSHIPS AND ACTIVITIES:

Honor Society Org member Society
 Sigma Theta Tau International

Jordan Nursing Council
Jordan Nursing and Midwife Association

POSTERS

- Abuhammad, S. & Johnson, T. S. (2016). Measures of maternal sensitivity during the First year of life: A systematic review. Peer reviewed, Poster for the Children's Pediatric Fall Conference, Children's Hospital of Wisconsin, Milwaukee, WI
- Abuhammad, S. & Johnson, T. S. (2016). The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life. Peer reviewed, Poster for the Second Nursing Symposium, University of Wisconsin Milwaukee, Milwaukee,
- Abuhammad, S. & Johnson, T. S. (2015). The Potential Effect of Breastfeeding on Maternal Sensitivity during the First Year of Life. Peer reviewed, Poster for the Children's Pediatric Fall Conference, Children's Hospital of Wisconsin, Milwaukee, WI
- Abuhammad, S. & Johnson, T. S. (2015). Measures of maternal sensitivity during the first year of life: A systematic review. Peer reviewed Poster for the Nursing Education Research Conference. Sigma Theta Tau, Washington DC.