

**Review Article: Systematic Review, Meta-Analysis, Integrative Review, Scoping Review**

**EFFECT OF KANGAROO MOTHER CARE (KMC) ON THE FORMATION OF MATERNAL-INFANT ATTACHMENT BETWEEN MOTHERS AND PREMATURE BABIES: A LITERATURE REVIEW**

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**Abstract**

**Background:** Nursing care of premature babies in the Neonatal Intensive Care Unit (NICU) setting can inhibit the maternal-infant attachment. One of the evidence-based interventions for premature babies is Kangaroo Mother Care (KMC). KMC needs to be further studied and researched through a review of previous articles to ensure the effectiveness of that implementation. However, there is a very limited review that specifies the effect of KMC on the formation of maternal-infant attachment.

**Objective:** This study was conducted to assess the effect of KMC on maternal-infant attachment between mothers and premature babies.

**Design:** The design of this study uses a literature review.

**Data Sources:** Initial searches of journal articles were performed on the Pubmed, ScienceDirect, and CINAHL search databases. The study found 676 articles but only 7 journal articles that met the search inclusion criteria.

**Review Methods:** A literature review procedures were used to collect library data, reading and taking notes, as well as critical assessment of managing research materials.

**Results:** The results of this review showed that KMC has been shown to have a positive impact on improving attachment status and resulting in a lower risk of bonding failure between mothers and premature babies.

**Conclusion:** It is recommended that health workers can provide treatment using KMC as an intervention to improve the formation of maternal-infant attachment between mothers and premature babies. The policies related to the implementation of KMC as standard operating procedures are also important.

**Keywords:** *Premature Babies, Kangaroo Mother Care (KMC), Maternal-Infant Attachment*

## INTRODUCTION

Premature babies are born at a gestational age of fewer than 37 weeks or 259 days from the first day of the last menstrual period (Vogel et al., 2018). Although care in the Neonatal Intensive Care Unit (NICU) plays role in reducing the risk of premature death, the separation between mother and baby can lead to limited contact with parents, difficulty bonding with the mother, and changing parental interactions. Deficiency of interactions between mother and baby can cause stress, loneliness, fear of loss, and attachment failure (Guillaume et al., 2013; Meijssen et al., 2011). The separation between mother and baby can inhibit early contact and negatively affect the maternal-infant attachment status (Dodwell, 2010; Mehler et al., 2011).

One evidence-based in caring for premature babies is Kangaroo Mother Care (KMC). The World Health Organization (WHO) defines KMC as an intervention for premature infants that use direct touching between mother to baby (WHO, 2003). KMC is a safe, effective, and easy method for premature babies as a comprehensive intervention in the NICU setting (Samra et al., 2013). KMC has several benefits, including increased breastfeeding, maintaining body temperature, prevention of infection, stimulation of nerves, maintaining respiratory regulation, maintaining heart rate and oxygenation status, also reduce energy use (Arya et al., 2021). KMC performed on mothers and babies is useful in reducing postpartum depressive disorders and strengthening the relationship between the two of them (maternal attachment) (Chan et al., 2016; Sahlén Helmer et al., 2020).

Attachment is a bonding that is formed between children and parents (Twohig et al., 2016). Attachment contributes to the physical, psychological, and emotional development of premature birth. Babies who do not get strong attachments with their parents may experience obstacles during their growth (Karakaş & Dağlı, 2019). A previous study by (Kurt et al., 2020) to determine the effect of KMC on

maternal attachment in premature babies in Turkey showed that premature babies who were given KMC had a higher Maternal Attachment Scale (MAS) score than premature babies who were not given KMC as an intervention ( $p < 0.05$ ). A quasi-experimental study designed by (Mehrpisheh et al., 2022) showed that the maternal attachment rate in the KMC group was higher than those in the control group ( $p = 0,003$ ). After the intervention, premature babies in the KMC group had better breastfeeding than in the control group ( $p = 0,000$ ). Furthermore, preterm infants in the KMC group gained better weight ( $p = 0,042$ ).

The implementation of KMC needs to be further studied and researched through a review of previous articles to ensure the effectiveness of that implementation. A review of previous articles was conducted to prove relevant theories to the implementation of KMC in preterm birth. However, a literature review study design about the effect of KMC on maternal-infant attachment has not been widely carried out.

This study aimed to explore previous research about the effect of KMC on maternal-infant attachment status between mothers and premature babies. KMC provides various benefits, including increasing attachment status.

## METHODS

### *Design*

This study was conducted using the literature review method. A literature review is a scientific approach that aims to analyze, evaluate, synthesize, and criticize research finding on a particular topic or topic published online and in print. A comprehensive review of several research studies is determined based on the theme of effectiveness KMC on improving the quality of bonding attachment between mother and premature babies.

### *Search Methods*

Literature search in this literature review used the PubMed, ScienceDirect, and

CINAHL databases. Combination searches were completed using Boolean Operators and the Medical Subject Headings (MeSH) term. The following keywords are used in this study: ‘Kangaroo Care’ OR ‘Skin to Skin Contact’ AND ‘maternal-infant attachment’ OR ‘bonding’ AND ‘premature infant.’ Literature searches based on the last ten years (2012-2022) and articles that will be used in this literature review must meet the full text requirements. After that, the selected articles will be reviewed.

The researchers utilized the inclusion and exclusion criteria to ensure that all relevant articles were included. The inclusion and exclusion criteria in the selection of the articles is following the PICOS framework and are based on the article’s characteristics, including publication year, language, and access status. Articles selection in this study was carried out based on inclusion and exclusion criteria as shown in Table 1.

**Table 1. Inclusion and Exclusion Criteria**

No.	Criteria	Inclusion	Exclusion
1	Population	Mother and premature baby (<37 weeks)	-
2	Intervention	KMC	-
3	Comparison	Attachment between mother and premature baby who obtained KMC intervention	-
4	Outcome	Attachment between mother and premature baby	-
5	Study type	Original article without limitation of research design (experiment or observation) as	Conference proceeding abstracts, review articles, letters to the editor or

No.	Criteria	Inclusion	Exclusion
		well as data analysis method (quantitative, qualitative, or mixed method)	case report, unpublished manuscripts
6	Publication years	Range 2012-2022	-
7	Languages	English	-
8	Access status	Open access	-

*Search Outcome*

This study follows Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines by an applying purposive sampling technique. The flow diagram illustrating the search process of relevant articles by following the PRISMA 2020 term is presented in Figure 1.

*Quality Appraisal*

The author carries out careful and precise evaluations by using an assessment of the quality of research studies that have been found using the Critical Appraisal Skills Program (CASP). Assessment considerations are given a value of yes, no, or unclear. Each score with the value "yes" is given one point and the others are given a score of zero, then each score is calculated and summed up. If the overall result is less than 50% then it does not pass the critical assessment test and more than 50% then it passes the critical assessment test. Journal quality reviewed are those that pass critical appraisal as many as 7 articles.

*Data Abstraction*

A total of 676 articles were found through Boolean Operators and MeSH term search. The screening process through duplication selection found 279 similar articles exclude and the remaining 397 articles. After reading each title and abstract, 47 articles were included in the study. Then, after reading the complete text articles versions and following to PICOS framework, a total of 6 articles were

judged to meet the inclusion criteria. References from the included studies were manually searched for additional articles that met the inclusion criteria, adding one article. Finally, a total of 7 articles were included in this review.

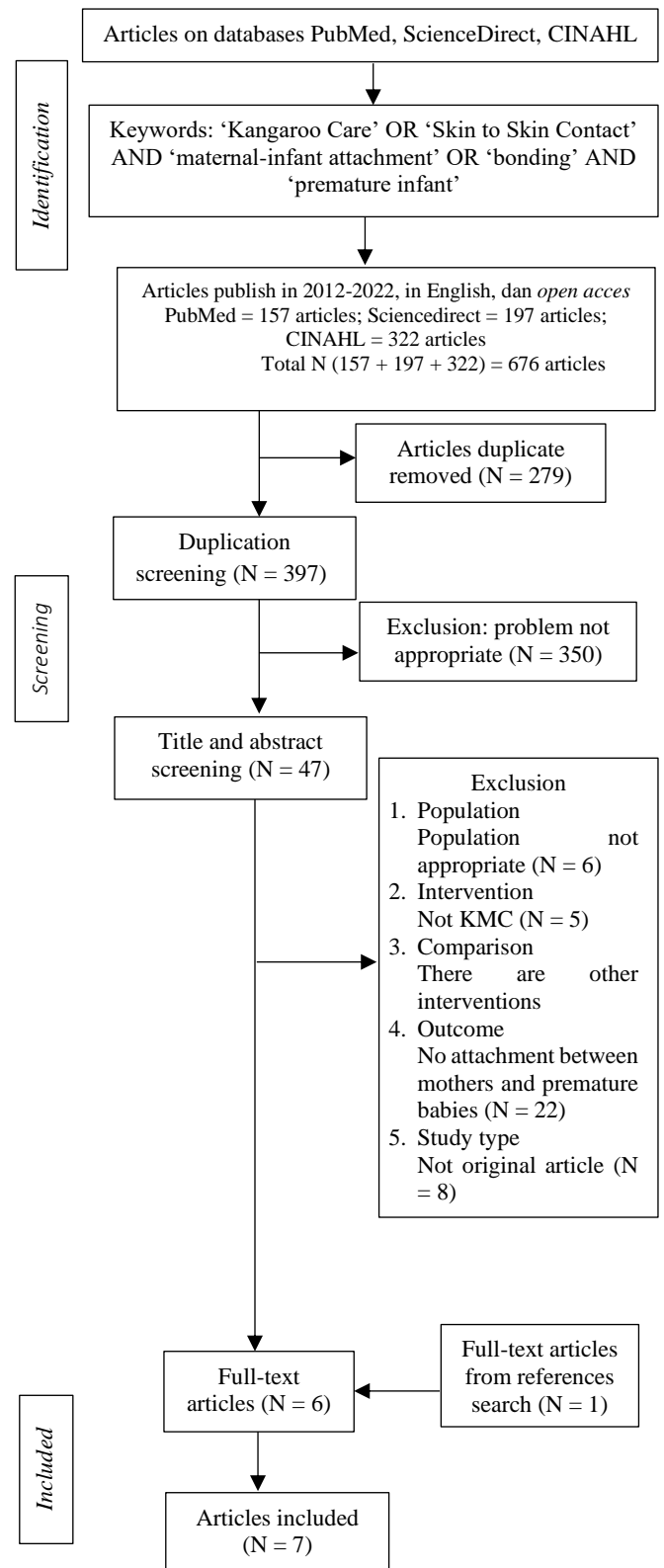
*Data Analysis/ Synthesis*

Researchers synthesize articles by analyzing the findings of each article. We synthesize articles using a synthesis matrix that demonstrates the features of the studies (author and year, aim, design, variable, instrument, analysis, sample, and key findings) to make sense of the reviewed evidence.

**RESULTS**

Based on the synthesis matrix, seven articles reviewed were international journal articles with experimental research designs indexed by Scopus. Those articles use quantitative, qualitative, and mixed method (quantitative-qualitative) data analysis methods. The research was conducted in Iran, Turkey, South Korea, Germany, China, and Norway. Respondents in the reviewed articles were mothers and babies born prematurely. Respondents of mothers had ages ranging from 24 years old to more than 36 years old, while the babies were born at 28 weeks to 36 weeks of gestational age. Most babies are born with a weight of fewer than 2500 grams (Table 2).

KMC makes mothers feel closer to their babies so the maternal-infant attachment status can improve (Mehrpisheh et al., 2022). Attachment is induced biochemically by oxytocin secreted when skin contact, breastfeeding, as well as closeness between mother and baby. Increments in oxytocin are associated with the improvement of maternal mental health (Galbally et al., 2011). Believed that skin-to-skin contact makes parents more responsive and provides better care to babies (Charpak et al., 2001).



**Figure 1. Flowchart PRISMA 2020**

Those are a trigger for increasing attachment between baby and their family. Attachment can change the mother's behavior which results in increasing self-confidence and reducing anxiety (Mehrpišeh et al., 2022).

## DISCUSSION

KMC is an intervention that initiates primer attachment, maintains the long-term attachment, and facilitates adaptation between mother and baby (Ahn et al., 2010; Cho et al., 2016a; Vahdati et al., 2017). KMC as an important intervention to strengthen the interaction between mother and baby, reduce the mother's stress and anxiety, increase attachment, as well as maintain attachment status in the long term (Kurt et al., 2020). In the study also believed that KMC are useful for strengthening the relationship and initiating breastfeeding in the postnatal period (Çelik & Çiğdem, 2022). This is in line with the study by (Mehler et al., 2020) which states that skin-to-skin contact can reduce the risk of maternal depression and bonding failure.

KMC allows premature babies to lie on the mother's abdomen which causes increasing negative pressure on the diaphragm and facilitates respiratory function. KMC has a positive impact on a baby's oxygen needs because its position can promote cardiorespiratory stabilization which is affected by increasing oxygen saturation (Cho et al., 2016a). KMC has a positive impact on reducing the intensity of a baby's crying, accelerating the baby's growth, increasing the frequency of breastfeeding, reducing the intensity of the mother's pain, and making the parents happier (Føreland et al., 2022; Zhang et al., 2021). Thus, KMC is effective in reducing complications in premature birth (Cho et al., 2016b).

In the study defines maternal-infant attachment as a unique relationship that is formed over time and is one of the important factors that support a child to grow healthily (Kurt et al., 2020). The study (Cho et al., 2016) also stated that maternal-infant attachment is

the earliest social-emotional relationship between mother and baby consistently built from child to adult. The relationship between mother and baby highly affects physical, psychological, and intellectual development and continues to influence throughout life (Güleç & Kavlak, 2013). The earlier mothers build attachment and interact with their babies, the healthier those relationships and the stronger in mother's role. Low maternal-infant attachment can be associated with the baby's life in a long time, as well as retardation in social-emotional development (Mason et al., 2011), deviated behavior (Fuchs et al., 2016), malfunction delay (de Cock et al., 2016), and cholic (Yalçın et al., 2010). Therefore, the mother and baby should be together immediately after birth to initiate the interaction between mother and baby (Kurt et al., 2020).

KMC can initiate primer attachment and adaptation between mothers and premature babies (Ahn et al., 2010; Cho et al., 2016b). This is supported by the study conducted by (Mehrpišeh et al., 2022) using the Maternal Attachment Scale (MAS) instrument on 100 pairs of mothers and babies born prematurely in Iran which showed that the attachment status of mothers in the experimental group significantly increased than the control group ( $47.7 \pm 2.9$  vs  $40.4 \pm 5.4$ ,  $p = 0.003$ ). In that study, babies in the intervention group had better breastfeeding than the control group ( $10.6 \pm 1.8$  vs  $8.2 \pm 1.6$ ,  $p = 0.000$ ). Furthermore, babies in the intervention group significantly had better weight gain than the control group ( $2164.6 \pm 481.1$  vs  $1965.2 \pm 372$ ,  $p = 0.042$ ).

The study (Kurt et al., 2020) that determine the effect of KMC on attachment in premature infants in Turkey showed the mother's attachment score in the experimental group ( $35.03 \pm 5.54$ ) was significantly ( $p < 0.001$ ) higher than in the control group ( $29.87 \pm 4.66$ ). That study was conducted using MAS questionnaire with the Alpha Cronbach equal to 0,83. The result study (Kurt et al., 2020) is in line with the study by (Çelik & Çiğdem, 2022)



in Turkey which indicates that the MAS score in the control group was  $90.85 \pm 8.26$  while in the experimental group was  $99.19 \pm 9.26$ , so there was a statistically significant difference between those two groups ( $p < 0.01$ ).

The first hour after birth is a sensitive period to strengthen the bonding between mother and baby (Føreland et al., 2022). Closeness through touching and visual contact in sensitive periods is important to strengthen the relationship between mother and baby (Maastrup et al., 2018). The study that conducted in China to determine the experiences of mothers after implementing KMC (Zhang et al., 2021). As many as 89% of mothers who participated in that study believed that KMC can improve the premature baby's ability to breastfeed, strengthen bonding, and speed up postpartum recovery. Mothers who have skin-to-skin contact with their babies argued that it was a good intervention to know the baby's well-being and vital status, could strengthen bonding, and make the mothers feel calmer (Føreland et al., 2022).

A study in Turkey (Çelik & Çiğdem, 2022) to identify the effect of KMC on mothers with Vulnerable Infant Syndrome (VIS) showed that the Vulnerable Baby Scale (VBS) score in the control group was  $43.66 \pm 4.63$ , while the VBS score in the experimental group was  $17.22 \pm 5.39$ , so there were significant differences in these two groups ( $p < 0.001$ ). The Edinburgh Postpartum Depression Scale (EPDS) score in the control group was  $17.22 \pm 7.95$ , while in the experimental group was  $4.48 \pm 5.38$ , so there was a significant difference in EPDS score between these two groups ( $p < 0.001$ ). The results showed that KMC can reduce in mother's vulnerability and depression.

Mothers have the opportunity to direct skin-to-skin contact when doing KMC with their babies. Contact and attention given by the mother to the baby can bring up feelings of happiness in the mother so it has the potential to reduce maternal stress (Cho et al., 2016a). It can trigger a positive response and strengthens

the attachment between mother and baby (Karakaş & Dağlı, 2019). The study in South Korea by (Cho et al., 2016) showed that the experimental group that provided KMC has a higher maternal-infant attachment score ( $F = 25.881$ ,  $p < 0.001$ ) and lower maternal stress score ( $F = 47.320$ ,  $p < 0.001$ ) than the control group.

KMC positively affects the interaction quality between mother and baby as well as reduces the risk of postpartum depression and bonding failure without causing any complications in premature infants. Through KMC, mothers can provide a comfortable environment for premature babies so the feelings that appeared can reduce the mother's anxiety (Mehler et al., 2020). It was approved by (Mehler et al., 2020) which suggests that mothers and babies in the skin-to-skin contact group have better responsive behavior (motoric and vocal) ( $p = 0.41$ ). Skin-to-skin contact led to lower risks associated with postpartum depression ( $p = 0.003$ ) and bonding failure ( $p = 0.031$ ). The stress level in the skin-to-skin contact group was lower than the visual contact group ( $p = 0.559$ ).

A good attachment between mother and baby has the benefits to reduce the crying intensity and lowering the impact of stressful experiences due to hospitalization for both mother and baby (Miller & Commons, 2010). This can build secure attachment which is shown by the comfortable feelings when making some interactions. This type of attachment will babies get when the mothers respond to their needs full of affection. This attachment is considered to be safe because the babies will try to interact with their mothers when they feel stressed. Babies will look for mothers to express their emotions. The feeling of safety between mother and baby shows that the mother can be fully present, consistently, and responsively to the baby's emotions and behaviors (Frazier & Scharf, 2015).

**Table 2. Synthesis of Result**

No.	Author and Year	Method	Sample	Key Findings
1.	Mehrpisheh et al., 2022	<p><b>Design:</b> A Quasi-experimental study with pre-test and post-test.</p> <p><b>Variable:</b> KMC and attachment between mothers and premature babies.</p> <p><b>Instrument:</b> A demographic questionnaire and Maternal Attachment Scale (MAS).</p> <p><b>Analysis:</b> The t-test, Chi-Square test, and Mann-Whitney test.</p>	The sample of this study was 100 pairs of mothers and premature babies (50 pairs in the experimental group and 50 pairs in the control group) who were admitted to the NICU in Iran from March 2019 until February 2020.	After the implementation of KMC, maternal attachment status in the experimental group was significantly higher than the control group ( $47.7 \pm 2.9$ vs $40.4 \pm 5.4$ , $p = 0.003$ ).
2.	Kurt et al., 2020	<p><b>Design:</b> Quasi experimental.</p> <p><b>Variable:</b> KMC and maternal attachment status.</p> <p><b>Instrument:</b> A demographic questionnaire and Maternal Attachment Scale (MAS).</p> <p><b>Analysis:</b> The t test, Chi-Square test, Kruskal-Wallis test.</p>	The sample in this study was 60 pairs of mothers and premature babies (30 pairs in the experimental group and 30 pairs in the control group) in the NICU setting in Turkey.	The maternal attachment score in the experimental group ( $35.03 \pm 5.54$ ) was significantly higher ( $p < 0.001$ ) than in the control group ( $29.87 \pm 4.66$ ).
3.	Cho et al., 2016	<p><b>Design:</b> Quasi-experimental with non-equivalent control groups and pre-test post-test.</p> <p><b>Variable:</b> KMC, physiological functions, maternal-infant attachment status, and maternal stress.</p> <p><b>Instrument:</b> Observation sheet of physiological functions (body weight, heart rate, respiratory frequency, oxygen saturation, and body temperature), modified Maternal Attachment Inventory (MAI), and modified Parental Stress Scale (PSS).</p> <p><b>Analysis:</b></p>	The sample in this study was 40 pairs of mothers and premature babies (20 pairs in the experimental group and 20 pairs in the control group) born at $\geq 33$ weeks of gestation in Seoul, South Korea.	The breathing pattern of premature infants in the experimental group decreased significantly than the control group ( $F = 5.70$ , $p = 0.020$ ). The experimental group had a higher score in maternal-infant attachment ( $F = 25.881$ , $p < 0.001$ ) and a lower score in maternal stress ( $F = 47.320$ , $p < 0.001$ ) than the control group.

No.	Author and Year	Method	Sample	Key Findings
4.	Mehler et al., 2019	<p>The t test, ANOVA and ANCOVA test.</p> <p><b>Design:</b> Single-centre randomized controlled trial.</p> <p><b>Variable:</b> DR-SSC, VC, response to the interactions between mother and baby, cortisol hormone levels, maternal depression levels, stress levels, and bonding status.</p> <p><b>Instrument:</b> <i>Mannheim Rating Scale</i>, laboratory analysis to measure the hormone cortisol levels, Center for Epidemiological Studies Depression Scale, Parenting Stress Index (PSI), and <i>Parental Bonding Questionnaire</i> (PBQ).</p> <p><b>Analysis:</b> The t-test, Wilcoxon-Mann-Whitney test, and Fisher test.</p>	<p>The sample in this study was 77 pairs of mothers and premature babies (39 pairs in the DR-SSC group and 30 pairs in the VC group).</p>	<p>The positive response between mothers and premature infants was significantly higher in the DR-SSC group than in the VC group (<math>86 \pm 26</math> vs <math>71 \pm 32</math>, <math>p = 0.41</math>).</p> <p>There were increasing cortisol levels in the VC group than in the DR-SSC group (76% vs 52%, <math>p = 0.071</math>) but the difference was not statistically significant.</p> <p>DR-SSC leads to a lower risk of postpartum depression (15% vs 45%, <math>p = 0.003</math>) and impaired bonding (3 vs 5, <math>p = 0.031</math>) than VC.</p> <p>The stress levels in the DR-SSC group were lower than in the VC group (49 vs 51, <math>p = 0.559</math>).</p>
5.	Zhang et al., 2021	<p><b>Design:</b> A mixed method.</p> <p><b>Variable:</b> KMC; mother's experiences during the hospitalization; and mother's perception of KMC, its processes, benefits, and challenges.</p> <p><b>Instrument:</b> A maternal-infant demographic questionnaire and interview guideline.</p> <p><b>Analysis:</b> Descriptive analysis using percentage table (quantitative) and transcription of qualitative data audio recordings on KMC experiences and processes in the postnatal ward.</p>	<p>The sample in this study was 752 pairs of mothers and premature babies (born between 34-36 weeks of gestational age) in four postnatal wards.</p>	<p>55.5% of mothers want the duration for KMC to be about 1 until 2 hours, while 26.7% of others want the implementation of KMC in less than 1 hour. Most mothers (89.0%) not having difficulty when doing KMC and argue that KMC can improve the ability of premature babies for breastfeeding, strong bonding, and better postpartum recovery.</p>
6.	Foreland et al., 2022	<p><b>Design:</b> A qualitative randomized controlled trial using semi-structured interviews.</p> <p><b>Variable:</b></p>	<p>The sample in this study was 10 pairs of mothers and premature babies (5 pairs in the SSC group and 5 pairs in the TC group).</p>	<p>Mothers in the SSC group recognized that SSC is a good intervention to know the baby's well-being and vital status, can strengthen bonding, and make mothers calm. In the TC group,</p>



No.	Author and Year	Method	Sample	Key Findings
7.	Celik et al., 2021	<p>Mother's experiences, SSC, and TC.</p> <p><b>Instrument:</b> Interview guideline.</p> <p><b>Analysis:</b> Qualitative content analysis.</p> <p><b>Design:</b> An experimental study in the NICU setting with pre-test and post-test.</p> <p><b>Variable:</b> KMC, mother's perception of vulnerability, postpartum depression levels, and attachment status between mother and baby.</p> <p><b>Instrument:</b> Mother and baby demographic questionnaire, Vulnerable Baby Scale (VBS), Edinburgh Postpartum Depression Scale (EPDS), dan Maternal Attachment Scale (MAS).</p> <p><b>Analysis:</b> The independent t-test and dependent t-test.</p>	<p>The sample in this study was 58 pairs of mothers and premature babies (31 pairs in the experimental group and 27 pairs in the control group).</p>	<p>mothers feel fear, worry, and feeling of separation so the bonding process between mother and baby becomes inadequate.</p> <p>The average VBS score in the control group was <math>43.66 \pm 4.63</math>, while the average VBS score in the experimental group was <math>17.22 \pm 5.39</math>, so there was a statistically significant difference in these two groups (<math>p &lt; 0.001</math>). Based on this information, it is shown that KMC positively affects a mother's perception of vulnerability. The average EPDS score in the control group was <math>17.22 \pm 7.95</math>, while in the experimental group was <math>4.48 \pm 5.38</math>, so there was a statistically significant difference in average EPDS scores between the two groups (<math>P &lt; 0.001</math>).</p> <p>The average MAS score in the control group was <math>90.85 \pm 8.26</math>, while the average MAS score in the experimental group was <math>99.19 \pm 9.26</math>, so there was a statistically significant difference in average MAS scores between the two groups (<math>P &lt; 0.01</math>).</p> <p>These results showed that KMC effectively can reduce a mother's perception of vulnerability, reduce maternal depression levels, and increase attachment between mothers and premature babies.</p>

## CONCLUSION

This literature review study design analyzed the previous articles that identified the effect of KMC on maternal-infant attachment between mothers and premature babies. Based on that analysis, it can be concluded that there is an effect of KMC implementation on the maternal-infant attachment between mothers and premature babies. KMC conducted in the NICU setting has been shown in improving maternal-infant attachment status and reducing the risk of bonding failure between mothers and premature babies. Therefore, health workers can provide KMC as an intervention to increase the maternal-infant attachment between mothers and premature babies.

There are few studies focused on the effect of KMC on maternal-infant attachment, especially in Indonesia. Therefore, the authors suggest that further researchers can conduct research on this topic in the experimental study design using various instruments. The authors also suggest that hospitals make policies related to the implementation of KMC as standard operating procedures for premature babies.

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## DECLARATION OF CONFLICTING INTEREST

The authors stated that they did not competing interests in producing this manuscript.

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## AUTHOR CONTRIBUTION

**Zubaidah:** made substantial contributions to the conception of the study and approved the final manuscript.

**Ayu Diah Safitri:** took responsibility for data analysis, interpretation, discussion of results, also writing and editing manuscript.

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