The Effect of Mother-Infant Skin to Skin Contact Immediately after Birth on Exclusive Breastfeeding: A Systematic Review and Meta-Analysis

Karimi et al. The Effect of Mother-Infant Skin to Skin Contact on Exclusive Breastfeeding

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Abstract
Objective: In the new millennium, exclusive breastfeeding plays an important role in national and international policies. The effects of mother-infant skin-to-skin contact (SSC) after birth have been investigated in several studies. Given that there has been no overall estimate of this effects, the present study was conducted aimed at investigating the effects of mother-infant SSC on the rate of exclusive breastfeeding by the systematic review and meta-analysis of randomized controlled trials.

Material and Methods: In the present study, the databases of Scopus, PubMed, Cochrane, SID, Magiran, IranDoc and Google Scholar were searched to identify randomized controlled trials that evaluated the effects of mother-infant SSC immediately after birth on the rate of exclusive breastfeeding. The risk of bias and strength of evidence were examined according to the Cochrane Collaboration’s tool and the GRADE approach, respectively. The data analysis was performed using Stata software. To assess the publication bias and heterogeneity, Egger’s and Begg’s tests and I2 were utilized, respectively. In addition, the fixed effects model was employed to perform the meta-analysis.

Results: The heterogeneity of the factor of effects in the studies was determined to be 16.2% (p=0.303). There was no publication bias among the studies included, for the p values of Egger’s and Begg’s tests were 0.168 and 0.386, respectively. The effects of mother-infant SSC on exclusive breastfeeding was statistically significant (OR=2.19; 95% CI: 1.66-2; p=0.000). The subgroup analysis results in the normal vaginal delivery group included OR=2.45 (95% CI: 1.76-3.35; p=0.000), for the cesarean delivery group the results were OR= 1.44 (95% CI: 0.78-2.65; p=0.24), the results for the duration of exclusive breastfeeding as of the discharge time up to 3 months included OR=2.47 (95% CI: 1.76-3.48; p=0.000), and the results for the 3 to 6 months of exclusive breastfeeding were OR=1.71 (95% CI: 1.05-2.78; p=0.030).

Conclusion: The study results showed that mother-infant SSC increased the rate of exclusive breastfeeding. Therefore, this finding could be utilized by maternal and infant health care providers to develop evidence-based intervention programs.

Keywords: Mother-infant skin-to-skin contact, exclusive breastfeeding, systematic review, meta-analysis

Introduction
Infants are quite vulnerable at the early stages of their life, and due to the higher speed of their growth than other life stages, it is important that they are provided with sufficient energy, proteins and other nutrients vital for their future health. Breastfeeding is the most ideal nutrition method at this stage. Hence, breastfeeding plays an important role in formulating national and international policies on general health, child survival, and maternal health, in the new millennium (1-7).

Breastfeeding benefits will be maximized if done exclusively in the first 6 months after birth and then continued with supplementary nutrition up to 2 years. However, the reduction in the rate of exclusive breastfeeding is one of the most prevalent and serious problems at the present time. This rate is low in many world countries, having been declining over the past few years in our country as well. In Iran, according to the Ministry of Health, the breastfeeding rate has been plunging in recent years, with the exclusive breastfeeding rate having reached 56.8% and 27.9% by the end of the 4th month and the 6th month, respectively. This fact required the Office of Research and Technology of the Ministry of Health to develop the breastfeeding promotion program as one of the
country’s research priorities (1, 8, 9); based on this program, it is required that breastfeeding methods be developed and adopted.

Previous studies have shown that the life environment of infants before, during, and immediately after birth, the measures adopted during pregnancy and after birth, and the hospital policy affect the length of the breastfeeding period. These factors can affect the breastfeeding mechanism and the neonate’s primary sucking behaviors, thereby leading to the discontinuation of breastfeeding and a reduction in the exclusive breastfeeding rate (10-12); hence, they are required to be taken into account because the early hours after birth are the most ideal time for a baby to start nutritional behaviors, such as searching and sucking. During this period, most babies respond to the tactile, warm, and olfactory stimuli of their mothers’ body and become capable of sucking, and thus they start getting breastfed. Therefore, the early hours after birth are critical for the establishment and continuation of breastfeeding (1, 10, 13). Research has shown that the separation of the baby from the mother at birth, even in a short time, for the purpose of activities, such as the evaluation of the baby, vitamin K injections, as well as the repairing of an episiotomy and perineal injuries, could exert negative physiological effects on the baby, including creating stress and increasing baby crying. As a result, the consumption of the energy stored reduces the neonate’s success in initiating nutritional behaviors, thereby affecting the stimuli and necessary responses to the development of sucking skills, effective breastfeeding, and the breastfeeding duration (10, 13).

The study by Digirolamo et al. (2001) showed that the delay in starting breastfeeding was the major risk factor in the premature interruption of breastfeeding (14). Hence, skin-to-skin contact between the mother and the infant is recommended at the first moments after birth so as to promote breastfeeding. Skin-to-skin contact between the mother and the infant is a method in which the naked newborn is placed in the prone position on the mother’s bare chest immediately after birth or during the first 24 hours after birth. During mother-infant skin-to-skin contact, the interaction between the mother and the infant enhances, leading to an increase in the neonate’s response to the mother’s body stimulation and the development of nutritional behaviors in the baby (15-17).

Most studies have shown that skin-to-skin contact is beneficial for the mother and the baby. Nevertheless, there are conflicting studies on the relationship between mother-infant skin-to-skin contact and breastfeeding. Mahmood et al. (2011), Gouchon et al. (2010), Marin Gabriel et al. (2009), and Vaidya et al. (2005) have reported that mother-infant skin-to-skin contact immediately after birth increases exclusive breastfeeding significantly (18-21). However, in the studies by Moore & Anderson (2007) and Carfoot et al. (2005), there was no significant relationship observed between mother-infant skin-to-skin contact and the exclusive breastfeeding rate (13, 22).

Systematic reviews and Meta-analyses are essential tools for summarizing the evidence available in a precise, accurate, and reliable manner (23). Despite the fact that several studies have been done on the effects of mother-infant skin-to-skin contact on exclusive breastfeeding, the contradictory findings of these studies necessitate performing a meta-analysis that provides clear and coherent results and a comprehensive guide for policymakers and researchers. Thus, the present meta-analysis was performed aimed at investigating the effects of mother-infant skin-to-skin contact, immediately after birth, on exclusive breastfeeding.

Materials and methods

In the present systematic review and meta-analysis, all studies on the effects of mother-infant skin-to-skin contact, immediately after birth, on exclusive breastfeeding were searched using the keywords of (breastfeeding, breast feeding, lactation, or human milk), (skin-to-skin contact, skin-to-skin mother-infant contact, SSC or Kangaroo Mother Care Methods, Kangaroo Mother Care or KMC), (exclusive breastfeeding, breastfeeding exclusivity, and breastfeeding status), (randomized clinical trials), and their Persian equivalents in the electronic databases of SID, Magiran, IranDoc, Scopus, PubMed, ISI Web of science, Cochrane, and Google Scholar from 2000 up to April 2018. In addition, a manual search was done in the reference section of relevant trials, systematic reviews, and meta-analyses to identify the trials missed by the electronic search.

The search and selection processes of the trials were shown using the PRISMA flowchart (Fig. 1), with the PRISMA checklist used to report the meta-analysis results.

The inclusion criteria were (1) the studies with an RCT design, (2) the interventions that consisted of skin-to-skin contact defined as the placing of the naked neonate in the prone position on the mother’s bare chest within 10 minutes since birth, (3) the participants consisted of mothers and healthy infants between 37 to 42 weeks of pregnancy, and (4) the primary outcome was exclusive breastfeeding up to six months after birth. There was no secondary outcome included.

To study the selection, firstly, the abstracts and keywords of relevant articles and their eligibility criteria were examined. Secondly, the full texts of the articles were reviewed independently by two authors for eligibility and discussed until consensus was reached.

The risk of bias was examined for each study by two independent evaluators, using the Cochrane Collaboration’s tool. In case of a disagreement between the two evaluators, the issue would be resolved by a third researcher. Using the mentioned tool, 6 types of biases were assessed, including the selection bias (random sequence generation and allocation concealment), the performance bias (examining the blinding of participants.
and personnel), the detection bias (the blinding of outcome assessors), the attrition bias (incomplete outcome data), the reporting bias (selective reporting), and other sources of biases. Based on the degree of each type of bias, the studies were assessed and reported with low, high, and uncertain risks (24, 25).

To assess the overall strength of the evidence, the GRADE approach (Grading of recommendation, assessment, development, and evaluation) was adopted.

The extracted data was registered on relevant forms. The two authors extracted data from the full text of the articles independently, based on the data collection form.

The collected data included authors’ names, publication years, study designs, sample sizes, tools, outcomes, and the risks of bias assessment. After data collection, the extracted data were assessed. The data analysis was performed using STATA 14.1. The effect level was calculated as the odds ratio, with the odds of exclusive breastfeeding in the intervention group divided by that of the control group. Next, the subgroup analysis was performed based on the type of delivery and duration of exclusive breastfeeding to assess heterogeneity among the studies.

I² and its \( P \)-value were utilized to assess heterogeneity among the studies; in addition, a fixed effects model was applied to pool data and perform the meta-analysis. The publication bias among the studies was assessed statistically using Egger’s and Begg’s tests, and visually using the funnel plot.

### Results

In the primary search, 326 articles were obtained, with a total of 12 trials of which having met the inclusion criteria of the study. Out of the 12 studies, 5 studies were conducted in Iran, 3 studies in India, and the other 4 ones were conducted in Pakistan, Italy, the United States, and Spain. Exclusive breastfeeding was assessed by asking questions from mothers on the phone or via face-to-face interviews in most studies (n=9). The language of 6 studies was English, and that of 3 studies was Persian. The data extracted from the studies included in the meta-analysis are presented in Table 1. The results of assessing the risk of bias in the studies, using the Cochrane Collaboration’s tool, are shown in Figs. 2 and 3.

The publication bias was assessed statistically using Egger’s and Begg’s tests. The \( P \)-values of Egger’s and Begg’s tests were 0.168 and 0.386, respectively, indicating that no publication bias existed among the studies included. The symmetric pattern of the funnel plot could also confirm the preceding statistical tests visually (Fig. 4).

The heterogeneity of the measure of effects among the studies was assessed based on I², which was 16.2% (\( p<0.303 \)). However, a random effects model was applied to all calculations because it was assumed that some of the differences among the studies could be factual.

All studies were included in the meta-analysis, which resulted in the OR of 2.19 with the 95% CI (1.66-2.89), implying that the effects of mother-infant skin-to-skin contact on exclusive breastfeeding were statistically significant (\( p<0.000 \)). The forest plot, the odds ratio, its confidence interval, the corresponding weight of each individual study, the pooled odds ratio (OR), its confidence interval, and the I² index are shown in Fig. 5.

Next, the subgroup analysis was performed based on the type of delivery and periods of exclusive breastfeeding to examine the impact of these two variables on the results (Figs. 5 and 6). The subgroup analysis, based on the type of delivery, resulted in lower heterogeneity among the studies in the normal vaginal delivery group (I²=14.9%, \( p=0.319 \)), yet lower heterogeneity in the cesarean delivery group (I²=0.0%, \( p=0.682 \)). However, the measure of the effects (odds ratio) was 2.45 with a 95% CI (1.76-3.35) for the normal vaginal delivery group and 1.44 with a 95% CI (0.78-2.65) for the cesarean delivery group (Fig. 6).

The same pattern was observed when the subgroup analysis was performed based on the duration of exclusive breastfeeding (from the discharge date up to 3 months as well as 3 to 6 months). In addition, heterogeneity increased in one group (I² = 58.1%, \( p = 0.26 \)) and decreased in the other one (I² = 0.0%, \( p = 0.745 \)). Similarly, the subgroup analysis did not change the measure of the effects significantly. OR values were 2.47 with a 95% CI (1.76-3.48) in the first group and 1.71 with a 95% CI (1.05-2.78) in the second one (Fig. 7).

The sensitivity analysis showed that the restriction of the meta-analysis did not change the results significantly but improved the quality of the body of evidence evaluated based on the GRADE approach (Table 2).

### Discussion

In this systematic review and meta-analysis, 12 RCTs were reviewed, which had investigated the effects of mother-infant skin-to-skin contact on exclusive breastfeeding. The results of this meta-analysis indicated that the mother-infant skin-to-skin contact had more statistically significant effects on exclusive breastfeeding than the routine care. In the analysis of the subgroups performed based on the type of delivery and duration of exclusive breastfeeding, it was determined that mother-infant skin-to-skin contact had a statistically significant effect on exclusive breastfeeding.

Past research has shown that the life environment of the baby before, during, and immediately after birth, the measures adopted during pregnancy and after birth, and the hospital policy affect the breastfeeding of neonates and are strong predictive factors of the duration of exclusive breastfeeding (26-28). One of the midwifery interventions in hospitals is the separation of the mother from the baby for medical reasons, immediately after birth. The reasons cited by hospitals for isolating the mother from the baby include monitoring the baby quickly
after birth to stabilize his/her physical and medical conditions, preventing mother-to-baby infection transmission, providing more time for the mother’s sleep and comfort, and assessing the baby medically (26). Research in this field showed that the separation of the mother from the neonate after birth could exert adverse effects on the mother and the baby; this could result in reducing the interaction between the mother and the baby, making the baby fail to display nutritional behaviors, causing delays in lactation, reducing the mother’s self-esteem and self-efficacy in relation to breastfeeding, impairing breastfeeding, reducing the breastfeeding duration, and finally leading to the use of other foods (1, 27, 29, 30).

To solve the problem, skin contact between the mother and the neonate was introduced, in which the baby was placed on his abdomen in chest-to-chest contact with the mother. The principle of skin contact between the mother and the baby is derived from studies on animals. In studies on animals, it has been demonstrated that some of instinctive behaviors seen in neonates are essential for their survival, with the neonates’ survival being dependent on close contact with the mother. From the standpoint of ethologists, the early postnatal hours when the fetus is transmitted to the ectopic, undergoing rapid and profound physiological changes, are critical in the neonate’s adaptation in a short time so as to survive. Ethologists believe that the early hours after birth are ideal for starting baby’s nutritional behaviors, such as searching and sucking, and are sensitive and critical times for breastfeeding because most babies respond to tactile, warm, and olfactory stimuli of the mother’s body. Hence, the separation of the mother and the baby immediately after birth could lead to the discontinuation of such instinctive behaviors (31). During skin-to-skin contact, the interaction between the mother and the baby increases, thereby leading to the development of nutritional behaviors that result in the baby’s sucking on the mother’s breasts and being nourished. It has been reported in relevant research that breastfeeding started immediately after birth ensures greater continuity. Because of the importance of this issue and based on the existing evidence, postnatal skin contact between the mother and the baby is one of the measures recommended by the World Health Organization and UNICEF to increase the rate of breastfeeding (1,13, 26, 31).

In the same vein, the Moore’s study (2016) showed that postnatal skin contact between the mother and the neonate exerted beneficial effects on exclusive breastfeeding. Although this study confirmed the beneficial effects of skin contact between the mother and the neonate, it had some limitations that justified the need for the current study. Some of the limitations included the examining of several different variables in the study that reduced the accuracy of the search and the non-inclusion of all eligible studies by the data extracted especially the ones published in Persian, which resulted in a decrease in the input of the final sample size into the meta-analysis and the affect analysis (32).

Forster (2007), in a narrative review, state that skin contact between the mother and the neonate is one of the ways of boosting breastfeeding. In fact, the study by Foster was merely a literature review, yet the present study is a systematic and meta-analytic review, with this type of study providing the best evidence for judging the impact of interventions in medicine and their use in clinical settings (29).

Given that exclusive breastfeeding can provide specific nutrients, both in quality and quantity for the neonate by the end of the 6th month after birth, it will provide all neonate’s nutritional needs necessary for the normal development. In addition, given that the reduction in the exclusive breastfeeding rate is one of the major public health problems (33), the need for identifying the ways of establishing and maintaining exclusive breastfeeding is evident. In this regard, according to the results of the present study, the postnatal skin contact of the mother and the neonate could increase the exclusive breastfeeding rate. It is suggested that contact between the mother and the baby be adopted as a care method by maternal and child health care providers, such as midwives, doctors, and students responsible in childbirth. One of the strengths of the present study was that it was the first systematic and meta-analytic review study in Iran to have investigated the effects of postnatal mother-neonate skin contact on exclusive breastfeeding. One of the limitations of this study was the quality of the studies included in terms of their methodologies. Thus, it is recommended that clinical trials be performed using more qualitative methodologies to obtain more positive evidence.

**Conclusion**

The articles reviewed in this systematic review and meta-analysis showed that mother-infant skin-to-skin contact increased the exclusive breastfeeding rate. Thus, the contact provides the best postnatal care for neonates. In spite of the evidence provided and the benefits of close postnatal contact between the mother and the baby, this is not practiced satisfactorily in Iran; in addition, in many cases, the mother and the neonate are separated after birth to perform conventional hospital practices, which seems to play an important role in causing lactation disorders. Perhaps this is the reason why despite the benefits of exclusive breastfeeding in the first 6 months after birth, exclusive breastfeeding rates have declined in our country over the past few years. Thus, the results of the present study could be utilized in evidence-based decision making by policy makers and service providers in the field of maternal and child health care as a guide for increasing the exclusive breastfeeding rate.

**Declaration of interest:** There is no conflict of interest or funding support (sources of funding) in this study.
References

9. Ministry of Health and Medical Education, Dean of Research and Technology: The priority of breastfeeding research. [Correspondence]
Figure 1. The PRISMA flowchart of the study’s selection process

Records identified through database searching (n = 325)

Additional records identified through other sources (n = 1)

Records after duplicate and irrelevant data removed (n = 85)

Records screened (n = 85)

Records excluded (n = 54)

Full-text articles reviewed by inclusion criteria (n = 31)

Full-text articles excluded (n = 19)

Articles included in the qualitative review (n = 12)

Articles excluded because of the poor quality

Articles included in the quantitative synthesis (Meta-analysis) (n = 8)
Figure 2. Author’s judgments of risk of bias items for each study included
Figure 3. Authors’ judgments of risk of bias presented as percentages across all included studies.

![Funnel plot with pseudo 95% confidence limits](image)

Figure 4: The funnel plot for the publication bias x-axis is the natural logarithm of the Odds Ratio and the y-axis is the standard error of the natural logarithm of Odds Ratio.
Figure 5: The effects of mother-infant skin-to-skin contact on exclusive breastfeeding based on the odds ratio. The horizontal lines denote the 95% CI, the Square (■) shows the point estimate (the size of the square corresponds to its weight); the diamond shows (◇) the combined overall effects of treatments.
Figure 6: The effects of mother-infant skin-to-skin contact on exclusive breastfeeding based on the type of delivery. The horizontal lines denote the 95% CI, the Square shows (■) the point estimate (the size of the square corresponds to its weight); the diamond shows (◇) the combined overall effects of treatments.
Figure 7: The effects of mother-infant skin-to-skin contact on exclusive breastfeeding based on the periods of exclusive breastfeeding. The horizontal lines denote the 95% CI, the Square (■) shows the point estimate (the size of the square corresponds to its weight); the diamond shows (◇) the combined overall effects of treatment.

Table 2. The GRADE evidence profile for the effects of mother-infant skin-to-skin contact immediately after birth on exclusive breastfeeding for the type of delivery and duration of exclusive breastfeeding

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>Study results Odds Ratio (95% CI)</th>
<th>Heterogeneity (I²)</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>2.19 (1.66-2)</td>
<td>16.20</td>
<td>Moderate: downgraded by one level due to the lack of blinding in most of studies</td>
</tr>
<tr>
<td>Normal vaginal delivery</td>
<td>2.45 (1.76-3.35)</td>
<td>14.90</td>
<td>Moderate: downgraded by one level due to the lack of blinding in most of studies</td>
</tr>
<tr>
<td>Cesarean</td>
<td>1.44 (0.78-2.65)</td>
<td>0.00</td>
<td>Low: downgraded by one level due to the lack of blinding in most of studies; downgraded by one level due to imprecision</td>
</tr>
<tr>
<td>Discharge up to 3 months</td>
<td>2.47 (1.76-3.48)</td>
<td>58.10</td>
<td>Low: downgraded by one level due to the lack of blinding in most of studies; downgraded by one level due to unexplained heterogeneity</td>
</tr>
<tr>
<td>No.</td>
<td>Author Year</td>
<td>Location of the study</td>
<td>Design</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>1</td>
<td>Sharma 2016</td>
<td>India</td>
<td>RCT</td>
</tr>
<tr>
<td>2</td>
<td>Khadivzadeh et al. 2016</td>
<td>Iran</td>
<td>RCT</td>
</tr>
<tr>
<td>3</td>
<td>Srivastava et al. 2014</td>
<td>India</td>
<td>RCT</td>
</tr>
<tr>
<td>4</td>
<td>Nasehi et al. 2012</td>
<td>Iran</td>
<td>RCT</td>
</tr>
<tr>
<td>5</td>
<td>Thukral et al. 2012</td>
<td>India</td>
<td>RCT</td>
</tr>
<tr>
<td>6</td>
<td>Mahmood et al. 2011</td>
<td>Pakistan</td>
<td>RCT</td>
</tr>
</tbody>
</table>

¹Exclusive breastfeeding
²Infant breastfeeding status
<table>
<thead>
<tr>
<th>7</th>
<th>Gabriel et al. 2010 Spain</th>
<th>RCT</th>
<th>350 healthy mothers with term babies</th>
<th>Mother-infant SSC n = 117</th>
<th>Routine care n = 113</th>
<th>34</th>
<th>Telephone calls</th>
<th>Mothers in the SSC group upon discharge, but not ( b = 0.05 ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Gouchon et al. 2010 Italy</td>
<td>RCT</td>
<td>96 mother-child pairs</td>
<td>Mother-infant SSC N=17</td>
<td>Routine care N=17</td>
<td>64</td>
<td>Phone follow-ups</td>
<td>The SSC newborns did not differ from controls.</td>
</tr>
<tr>
<td>9</td>
<td>Kamalifard et al. 2010 Iran</td>
<td>RCT</td>
<td>80 primipara mothers</td>
<td>Mother-infant SSC N=40</td>
<td>Routine care N=40</td>
<td>0</td>
<td>Telephone interviews</td>
<td>The mean of the duration was 119.8±13.2 days, and the difference was statistically significant.</td>
</tr>
<tr>
<td>10</td>
<td>Keshavarz, Bolbol Haghighi 2010 Iran</td>
<td>RCT</td>
<td>160 mother-infant pairs</td>
<td>Mother-infant SSC N=80</td>
<td>Routine care N=80</td>
<td>0</td>
<td>Telephone interviews</td>
<td>In the SSC group, exclusive breastfeeding was greater than RC (( b = 0.04 )).</td>
</tr>
<tr>
<td>11</td>
<td>Safarabadi Farahani et al. 2009 Iran</td>
<td>RCT</td>
<td>100 mother-infant pairs</td>
<td>Mother-infant SSC N=50</td>
<td>Routine care N=50</td>
<td>0</td>
<td>Face-to-face interviews</td>
<td>No statistically significant difference was found in exclusive breastfeeding for the first 4 months.</td>
</tr>
<tr>
<td>12</td>
<td>Moore, Anderson 2007 U.S</td>
<td>RCT</td>
<td>23 mother-infant pairs</td>
<td>Mother-infant SSC N=12</td>
<td>Routine care N=10</td>
<td>17</td>
<td>IBS</td>
<td>No significant difference in breastfeeding exclusivity in one month (1.50 ± 1.1 vs 2.10 ± 2.2, ( P = 0.45 )).</td>
</tr>
</tbody>
</table>