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The Effect of Kangaroo Mother Care on Neonatal Outcomes in Iranian Hospitals: A Review

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Context: Kangaroo Mother Care (KMC) is a supportive technique that beings at the neonatal period and is one of the skin-to-skin contact methods of holding neonate by mother. This method has an important role in exclusive breastfeeding and thermal care of neonates. This study aimed to investigate the application of KMC and evaluate the effect of this technique in different neonatal outcomes, particularly in Iranian neonates. Moreover, this review can be a tool for formative evaluation for this newly introduced treatment intervention in Iran.
Evidence Acquisition: This review was conducted in national and international databases concerning experience with KMC on term and preterm neonates admitted in Iranian hospitals from 2006 to 2014. The measured outcomes included physiologic, psychologic, and clinical effects of this practice on newborn infants.
Results: In this study, 42 Persian and English language papers were reviewed and finally 26 articles were selected. Various effects of KMC on different factors such as analgesia; physiological effects, breastfeeding, icterus, length of hospitalization, infection, psychologic effects, and weight gain were found.
Conclusions: The results showed that as a simple and suitable strategy for increasing the health status of the mothers and newborns, KMC had an important role in improvement of neonatal outcomes in neonatal wards of Iranian hospitals in recent ten years. Therefore, promoting this technique in all neonatal wards of the country can promote health status of this population.

Keywords: Kangaroo-Mother Care Method; Newborn; Iran

1. Context

Primary phase of the transition from the fetal to postnatal period is the most important, vulnerable, and stressful phase in human life. Hence, care methods that facilitate better adaptation of neonates with early postnatal environment have an important role in nervous development and growth of newborns (1). Attachment is a unique relationship between the parents and their infants that begins during pregnancy when fetus grows in uterus and continues to the postnatal period with the relationship of mother and baby (2, 3). This reciprocal parent-infant relationship is an essential element of the attachment process that helps relaxation of both mother and the infant (2). Kangaroo Mother Care (KMC) facilitates the process (4).

The KMC or skin-to-skin contact (SSC) is used as an alternative to conventional care in low birth weight (LBW) infants. This method was first introduced by Edgar Rey Sanabria and Hector Martinez in 1979 and was conducted at the Maternal and Child Institute of Bogota, Colombia. It was named Kangaroo care for its similarity to marsupial care. Lack of incubators, technologic resources, and equipment and high neonatal mortality rates led to implementation of this technique for earlier hospital discharge of LBW infants (5). KMC includes the following: 1) SSC between the newborn and the mother that may be intermittent or continuous in early or later of neonatal period depending on the level of prematurity and the health condition; 2) exclusive breastfeeding or formula feeding only in conditions that acceptable weight gain is not achieved; and 3) planning early discharge once the infant is appeared well and follow-up is possible (6).

According to the World Health Organization (WHO) guidelines for KMC, the baby is placed in a prone and upright position between mother's breast on the mother's chest and under her suitable clothes (Figure 1). Baby wears only a cap and diaper and mother practices KMC throughout the day and night, sleeps in bed and in a 45-degree position with the baby on the chest during hospital stay. This practice can be supervised by the nursing staff and can be quickly learned by the mothers (7).

Figure 1. Kangaroo Mother Care Technique

Since different studies showed the advantages of this method and it is well understood by clinicians, the use of KMC method is getting popular. KMC is now considered as a convenient, easily available, and preferred method for decreasing neonatal mortality and morbidity in low-income countries (6). The KMC can shorten the infant's length of stay at the neonatal intensive care unit (NICU) and reduces the risk of hypothermia. In addition, this method may have significant correlation with improved head growth and better weight gain, higher breastfeeding rates, more stable heart rate and oxygen saturation, and lower pain scores (8-13). This method has been used by various newborn units around the world since 2003 (14). In Iran, the first report of KMC method application was from 29 Bahman Hospital, Tabriz, in 2004 (15). Authorities decided to promote the KMC through workshops for all nursing personnel who worked there (16). In April 2007, the first workshop of KMC was held at Mashhad University of Medical Science that recommended nurses, midwives, and doctors to encourage the widespread use of this technique in hospitals of the country (17). Different researches investigated different aspects of KMC in infancy in Iran and scattered results have been reported. Therefore, the aim of this study was to analyze the application of KMC, particularly in neonatal population in Iran, and evaluating the effect of this technique on different neonatal outcomes. Indeed, this review can be a tool for formative evaluation of this newly-introduced therapeutic intervention in Iran.

2. Evidence Acquisition

We reviewed all Iranian articles related to KMC that were published from 2006 to 2014 and were indexed in Iranian electronic databases including Iran Medex, Scientific Information Database (SID), IranDoc, and Magiran and international databases including PubMed, Google scholar, and chocrane. The Key search terms were: "kangaroo mother care", "kangaroo care", "skin-to-skin contact", "newborn care", "bonding", "conventional methods care", "Incubator Care", "neonate", "infant", "mothers", "nursing", and "midwives", and combination of these with "Iran" or "Iranian". Articles in either English or Persian language were selected for review. We reviewed full texts, abstracts, and poster publications of studies. According to our search protocol, we attempted to include all randomized or crossover clinical trials, semi-experimental, or observational cross-sectional studies. Based on PICO format, the population of interest were neonates (i.e. 0-28 days of life) and the studied intervention was KMC as defined above. The comparison population was conventional care depending on study setting. Evaluated outcomes were mortality and different clinical outcomes of newborns. Studies on the effects of KMC beyond the neonatal period in infancy and non-English or non-Persian language literature were excluded.

The papers were searched based on titles first and then two independent authors reviewed the abstracts of all articles. In the primary search, 93 articles related to KMC were found. After initial screening of titles, posters and abstracts, 42 papers were selected dealing with the population of interest. Finally, we identified 26 related studies of which 21 studies were randomized (18-38) or crossover clinical trial (39), three were semi experimental (40-42) and one was cross-sectional study (43). All the studies were from different provinces of Iran. Seven of the studies were conducted in premature infants (18, 22-25, 37, 43) six cases of which were LBW (22, 24, 25, 27, 39, 43). Other studies (65%) were performed on healthy full-term infants (19-21, 26, 28-36, 38, 40-42). We summarized the overall evidence for each outcome and data such as birth weight, gestational age, KMC duration, and infants' age at the time of beginning the KMC using a table.

3. Results

Table 1 shows the data extracted from the 26 reviewed articles. In addition, baseline characteristics including birth weight, gestational age, KMC duration, and infants' age at the time of beginning the KMC are demonstrated in Table 1.

The results of our review showed various effects of KMC on different factors such as analgesia, physiological effects, breastfeeding, icterus, length of hospitalization, infection, psychological effects, and weight gain (Table 2).

A total of 2495 infants including 796 premature and 1699 term infants were identified. The effect of KMC on analgesia was observed in 540 term (31.78%) and 20 premature infants (2.51%). Physiologic effects of KMC was found in 160 term (9.41%) and 455 premature infants (57.16%). Effects of KMC on breastfeeding was identified in 736 term (43.31%) and 366 premature infants (45.98%). KMC was reported be effective in 230 Icterus term infants (13.38%) receiving this technique. Period of hospitalization was influenced by KMC in 70 term (4.12%) and 401

premature infants (50.38). The effect of KMC on infection was only identified in 215 premature infants (27.01%). The effect of KMC on psychologic aspects was identified in 193 term (11.35%) and 120 premature infant (15.07%). Weight gain was only influenced by KMC in 265 premature infants (32.3%). KMC had the greatest effects on breastfeeding (44.17%), physiologic aspects (24.65%), and analgesia (22.44%), consecutively. The least effect of KMC was observed on infection (8.61%) that only occurred in premature infants. Different outcomes were reported in published article from Iran. Different effects of KMC on neonates are separately discussed below.

3.1. Analgesia

Many researchers have investigated the efficacy of nonpharmacologic interventions in management of procedural pain in preterm and term neonates (18-21, 38, 40, 41, 44-49). However, there are a few reports from Iran investigating the efficacy of KMC on pain intensity in premature infants undergoing painful procedures. Memarizadeh et al. studied the effect of KMC on the pain profile of preterm infants (PIPP) (27-36 weeks of gestational age) after a heel stick procedure (18). KMC was applied 30 minutes before heel stick and continued for ten minutes; KMC was effective in decreasing pain before and after heel stick in premature infants. PIPP was used to evaluate the severity of pain. The mean pain score was 4.9 ± 2.92 and 11 ± 4.22 in the KMC and incubator care (IC), respectively. In comparison to IC, KMC significantly decreased pain score ($P < 0.001$). The results of this study were similar to findings of Stevens and Chidambaram (47, 48).

Saeidi et al. Asadi Noghabi et al. and Khodam et al. used KMC to alleviate the pain intensity of vaccination and intramuscular injection in healthy term infants (19, 40, 41). Mean pain intensity during the intervention and mean duration of crying were significantly lower in case group ($P < 0.001$), which was in agreement with the findings by Anderson and Gray et al. (44). Moreover, Azari et al. showed that use of SSC with breastfeeding had positive effects on reducing pain during neonate's injection ($P = 0.04$) (38). Saki et al. reported that in 50 term infants, KMC position seemed to decrease pain score during venipuncture and other painful procedures effectively (20). Grunau et al. also reported the same results (46).

Sajedi et al. evaluated the efficacy of KMC in physiologic responses to the pain created by an intramuscular injection of vitamin K in term neonates (21). The heart rate of neonates that received KMC during and three minutes after injection was significantly lower than that of control group was ($P < 0.001$). The rate of blood oxygen saturation during and three minutes after injection among neonates with KMC were significantly higher than that of the neonates in control group were ($P < 0.001$) while no significant correlation was found between heart rate or O_2 saturation and KMC in Khodam et al. Saeidi et al. and Johnston et al. studies (19, 40, 45).

The KMC is a simple and practical method to reduce injection pain in newborns and is recommended for decreasing pain intensity in neonates undergoing painful procedures.

3.2. Physiologic Effects

The SSC can reduce the psychologic and physical stresses of newborns and decrease neonatal stress, improve the relationship of mother and baby, and create better bonding process. Several studies have investigated the physiologic effects of the KMC on infants (6, 12, 22-26, 39, 50, 51). This method has positive effects on temperature, heart rate, respiratory rate, oxygen saturation, and urine cortisol. Nourian et al. and Salimi et al. evaluated the effects of KMC on cardiopulmonary and thermal response of healthy preterm and LBW infants in randomized controlled trials (22, 23). They observed that SSC between mothers and premature and LBW neonates reduced pulse and respiratory rate and increased oxygen saturation. In contrary to their findings, Khodam et al. and Seyedrasooli et al. reported that these parameters (breathing, temperature, and oxygen saturation) did not have any differences between groups (19, 39). Nourian et al., Jafari et al., and Basiri et al. also showed no significant differences in temperature between the two groups (22, 24, 25). Moreover, Kadam et al. reported the same results (51). On the other hand, Keshavarz et al. found A significant increasing in temperature in half an hour (36.8 vs 36.6 °C, $P < 0.05$) and just before discontinuing KC (an hour after initiating KC) (36.9 vs 36.6 °C, $P < 0.001$). (26). In addition, Chwo et al. reported that infants who had received KMC had higher mean tympanic temperatures (50). Keshavarz et al. reported urine cortisol before discharging were lower had no significance difference between KMC and routine care (RC) (388.4 vs 471.3 μg/24 hours; $P < 0.05$,) (26). Morelius et al. study showed no significant differences in infants' cortisol levels between infants received KMC and control group. However, the SSC decreased salivary cortisol in mothers (12). The physiologic effect of KMC on infant in our review was seen in 24.65% of infants.

3.3. Weight Gain

in their clinical trial study among LBW neonates, Mohammadzadeh et al. found that KMC had better effect on daily weight gaining (18.31 ± 7.57 vs. 4.89 ± 16.57; $P < 0.001$) (27). Jafari et al. reported that the mean weight change in neonates that received KMC and control group were 15 and 4 g, respectively ($P = 0.015$) (24). Gupta et al. reported the same results (29 ± 3.52 g) (52). Similar to other studies, Suman et al. showed that the infants who had received KMC had better mean weight gain per day (KMC, 23.99 g; RC, 15.58 g; $P < 0.0001$) (10). Basiri et al. showed that KMC for more than four hours a day for five days had better effect on daily weight gaining in LBW neonates (37.5 ± 42.8 vs 14.5 ± 25.3 g; $P < 0.007$) (25). KMC method had positive effect on weight gain of preterm neonates. Therefore, it is highly recommended that the health practitioners and

Table 1. Assessment of Kangaroo Mother Care Outcome in Different Hospitals of Iran [a]

Author, y	City Center	Study Type	Sample Size	GA	BW, g	Neonatal Age at Beginning of KMC, day	KMC Duration	Starting of KMC	Outcome Measure	Measured Parameters	P Value
Memarizadeh A. 2011 (18)	Shiraz	RCT	20	Premature, 27-36 wk	-	3-28	40 min	-	Analgesia (Heel stick)	Pain score: KC, 4.9 ± 2.92; CC, 11 ± 4.22	< 0.001
Saeidi R. 2006(40)	Lahijan	Semi-Experimental	60	Term	2500-4000	-	30 min	First 24 h of birth	Analgesia (vaccination)	$SatO_2$, HR, pain intensity, duration of crying	0.1, NS, 0.1, NS, < 0.006, < 0.001
Asadi Noghabi F. 2006-2007 (41)	Bandar Abbas	Semi-Experimental	100	Term	2500-3500	-	-	At least 2 h after birth	Analgesia (IM injection of Vit k)	Pain intensity	< 0.001
Azari M. 2011 (38)	Ardabil	RCT	200	Term	-	-	2 min; 45 Sec	2 h after birth	Analgesia (IM injection of Vit k)	Behavioral state	0.04
Khodam H. 2001 (19)	Gorgan	RCT	30	Term	-	-		At least 2 h after birth	Analgesia (vaccination)	$SatO_2$, HR, duration of crying	> 0.05, > 0.05, 0.02
Saki M. 2005 (20)	Khorramabad	RCT	50	Term	2200-4000	3-9	-	-	Analgesia (venous puncturing supine, prone, and KC)	Pain score: supine, 7; prone, 6.8; KC, 6	< 0.001
Sajedi F. 2007 (21)	Bandar abbas	RCT	100	Term	2500-4000				Analgesia (IM injection of Vit k)	$SatO_2$, HR	< 0.001
Nourian M. 2008 (22)	Tabriz	RCT	80	Premature, 26-36 wk	LBW, 1297 ± 304.50		60 min	-	Physiologic effects	$SatO_2$, HR, RR, temperature	0.02, 0.01, 0.03, NS
Salimi T. 2008 (23)	Yazd	RCT	50	Premature, 32-36 wk	3481 ± 396		5 min, three times a day	At least 24 h after birth	Physiologic effects and behavioral state of infant	HR, RR, temperature, behavioral state (+ effect)	0.04, 0.02, 0.03, < 0.001
Seyedrasooli E. 2007-2008 (39)	Tabriz	Cross over Clinical trial	60	Premature, 32-36 wk	1500-2500		30		Physiologic effects	$SatO_2$, HR, RR, temperature (5th and 30th min before removing from incubator and 5 min after returning back)	NS, NS, NS, 0.001, 0.02, 0.03
Jafari M 2010 (24)	Mashhad	RCT	50	34-37 wk	LBW < 2500	-	60 min until discharge from NICU	-	Physiologic effects, period of hospitalization, weight gain	Temperature, weight change, duration of hospitalization	NS, 0.015, 0.030
Basiri B. 2012 (25)	Hamadan	RCT	115	31.7 ± 2.2 wk	LBW < 2500	-	Group1, 4 h; Group 2, > 4 h	Until 5 days of hospitalization	Physiologic effects, BF, infection, weight gain	Weight change, $SatO_2$, frequency of feeding, infection, temperature	< 0.05, not observed, NS
Keshavarz M. 2007-2008 (26)	Shahrood	RCT	160	Term	2500-4000		60 min three times a day for two consecutive days	2 h after birth	Physiologic effects and Icterus	Temperature, infant's reflex, jaundice, urine cortisol; frequency of sever crying: KC, 5.6 vs CC, 12.3	< 0.001, NS, NS, < 0.05, < 0.05

Mohamadzadeh A. 2009 (27)	Mashhad	RCT	100	-	LBW, < 2000	3-10	16.52 ± 8.32 d	-	Physiologic effects, infection, period of hospitalization, weight gain	Nosocomial infection, weight gain, duration of hospitalization	NS, NS, < 0.001, < 0.001
Godarzvand L. 2010 (28)	Tehran	RCT	70	Term		-	60 min three times a day for 3 consecutive days	-	Icterus and period of hospitalization	Duration of hospitalization, bile change	< 0.001, NS
Keshavarz M. 2008 (29)	Shahrod	RCT	160	Term	-	-	60 min three times a day for two consecutive days	-	BF	Frequency of BF, exclusive BF for 6 month, initiated BF; frequency of severe crying: KC, 5.6 vs CC, 12.3	< 0.05, < 0.05, NS, < 0.001
Kamalifard M. 2009 (42)	Tabriz	Semi-experimental	80	Term	-	-	60 min	Earliest after birth for 4 months	BF	Mean duration of exclusive BF	0.04
Safarabadi Farahani T. 2008 (30)	Tehran	RCT	100	Term	≥ 2500	-	12-47 min	Earliest after birth for 4 months	BF	Success of first BF and duration of exclusive BF at 4 months F/U	0.00, NS
Karimi A. 2012 (31)	Mashhad	RCT	114	Term	2500-4000	-	2 h	Earliest after birth and continuous (28 day)	BF	Successful BF and time to initiate first feed	0.02 < 0.001
Khadivzadeh T. 2007 (32)	Mashhad	RCT	92	Term	2500 ≤	-		-	BF	Frequency of infants initiated BF and interval from birth to first BF	0.000, < 0.001
Beiranvand Sh. 2011 (33)	Khorramabad	RCT	90	Term 38-42w	3312.4 ± 302.5	-	60 min		BF	BF Status: readiness to feed, suckling pattern, mean score of BF (KC, 8.76 ± 3.63 vs CC, 7.25 ± 3.5)	0.021, 0.030, 0.048
Ali-Akbar M. 2007 (34)	Tehran	RCT	100	Term	2500-4000	-	12-47 min	At least 60 min after birth	BF	Sucking reflex, rooting reflex, wakefulness	≤ 0.001, ≤ 0.001, ≤ 0.001
Heidarzadeh M. 2008-2009 (43)	Tabriz	Cross-sectional study	251	Premature ≥ 28 wk	< 1000, 1000-1500, > 1500	7	1-3 h, three times day	-	BF and period of hospitalization	Exclusive BF	0.00
Karimi A. 2008 (35)	Mashhad	RCT	114	Term	2500 < g	-	2 h	-	Psychologic effects	Infant stress	0.03
Nematbakhsh F. 2001 (36)	Esfahan	RCT	79	Term	-	-	20-30 min	Earliest after birth and continuous 28 day	Psychologic effects	Anxiety in children	0.004
Rajai N.2011 (37)	Tehran	RCT	70	Preterm 32-37 wk	-	-	70 min	-	Psychologic effects (behavioral state of infant)	Quiet sleep, alert awake, drowsiness, active awake, crying status	< 0.001, < 0.001, < 0.001, < 0.002, < 0.002

[a] Abbreviations: GA, Gestational Age; BW, Birth Weight; KMC, Kangaroo Mother Care; RCT, Randomized Clinical Trial; $SatO_2$, Oxygen Saturation; HR, Heart Rate; IM, Intramuscular; KC, Kangaroo Care; RR, Respiratory Rate; CC, Conventional Care; NS, Not Significant; LBW, Low Birth Weight; and NICU, Neonatal Intensive Care Unit.

Table 2. Various Factors Influenced by Kangaroo Mother Care in Term and Premature Infants [a]

Variables	Term Infants (No. = 1699)	Premature Infants (No. = 796)	Total 2495 (100%)
Analgesia	540 (31.78)	20 (2.51)	560 (22.44)
Physiologic effects	160 (9.41)	455 (57.16)	615 (24.65)
Breastfeeding	736 (43.31)	366 (45.98)	1102 (44.17)
Icterus	230 (13.38)	-	230 (9.21)
Decreased Length of hospitalization	70 (4.12)	401 (50.38)	471 (18.88)
Infection	-	215 (27.01)	215 (8.61)
Psychological effects	193 (11.35)	120 (15.07)	313 (12.54)
Weight gain	-	265 (32.3)	265 (10.62)

[a] Data are Presented as No. (%).

policymakers consider the benefits, effects, and strategies of KMC to increase the duration of this method. The positive effect of KMC on weight gain of preterm infants was obtained in 10.62%of infants in our review.

3.4. Icterus

A few numbers of studies examined the effect of KMC on neonatal icterus in Iran. Keshavarz et al. reported no significant differences in jaundice between KMC and RC group (26). Godarzvand et al. evaluated the safety and efficacy of one hour per day KMC during the course of phototherapy using a fiber optic phototherapy panel in infants who had physiologic jaundice (28). They reported that KMC with cutaneous neonatal phototherapy could not significantly decreased mean bilirubin than the control group and no significant differences was observed after treatment (P = 0.236). Ludington-Hoe and Swinth found no significant differences in the number of days of phototherapy or in daily mean bilirubin decrease in premature infants (30-35 weeks gestation and < 2500 g) who required phototherapy, between those who received KMC and those who did not. The total serum level of bilirubin in the KMC group revealed a more slight decrease than the profiles for the other groups; on the other hand, a significant difference in decline was detected only on treatment day four (P = 0.05) (53). Hence, Godarzvand et al. study's duration of KMC was not enough and longer duration of KMC are recommended (28). We found the effect of KMC on icterus in 9.21% of term infant.

3.5. Infection

A few numbers of researches have investigated the effect of KMC on neonatal infection in Iran. Mohammadzadeh et al. and Basiri et al. showed that there was no significant differences between the two groups in nosocomial infection (P > 0.05) (25, 27). These findings were similar to the Kadam et al. report that observed no significant differences in the incidence of sepsis (51). on the other hand, Charpak reported that infection was milder in children receiving the KMC (8). Results of randomized controlled trial done by Sloan et al. showed a significant decrease in severe infections such as sepsis and pneumonia in infants who received KMC during the first six months of follow-up compared with infants received only RC (54).

3.6. Breastfeeding

An important main stay of KMC is breastfeeding encouragement. Iranian researchers showed that early SSC has a significant and positive effect on early breastfeeding and its duration (25, 29-34, 43)Keshavarz et al. reported that duration of exclusive breast feeding at six month of life was higher than that of RCs was (P < 0.05) (29). Kamalifard et al. also showed that SSC has a significant positive effect on mean exclusive breastfeeding duration in infants receiving KMC (119.8 ± 13.2 vs 110.7 ± 24 days; P < 0.04) (42). however, Safarabadi Farahani et al. did not find any significant differences in duration of exclusive breastfeeding between infants receiving KMC services and conventional care group during four-month follow-up (101.2 ± 27.84 vs 88.7 ± 4.47 days; P < 0.85) (30) that was similar to the results by Carfoot et al. (55).

Karimi et al. and Khadivzadeh et al. showed that the time to initiate first feed was also shorter in SSC group (31, 32), which was similar to the findings of Mahmood Iqbal et al. (56). in contrary, there was no difference between groups in that regard in Moore et al. study (57). Safarabadi Farahani et al. Khadivzadeh et al. and Karimi et al. reported that SSC had a great positive effect on success rate of the first breastfeeding (100% vs 74%, 89.4% vs 2.2%, and 56.6% vs 35.6%, respectively) (30-32). These results were almost comparable with the results of studies by Moore et al. and Walter et al. (57, 58). Basiri et al. showed that frequency of feeding in the group receiving KMC for > 4 hours was higher than the frequency in the group receiving KMC for < 4 hours was (P < 0.05) (25). Similar to the study of Moore and Anderson (59). Beiranvand et al. and Ali-Akbar et al. observed that early SSC after delivery had positive effects on full-term infant's pre-feeding behaviors (33, 34). These behaviors have been considered effective on breast-feeding. however, no positive effect was observed in Erlandsson et al. study (60).

In Heidarzadeh et al. study, the exclusive breastfeed-

ing was compared in newborns that were divided into three groups according to their weight. In the first group with neonates' weight < 1000 g, the rate of exclusive breastfeeding was significantly higher in KMC group in comparison to RC (72.4% vs 53%; P < 0.01). In the second group with neonates' weight of 1000 to1500 g, the rate of exclusive breastfeeding was significantly higher in KMC group in comparison to RC (42.8% vs 24.4%; P < 0.01). In the third group with neonates' weight of > 1500 g, no significant difference existed between two groups in rate of breastfeeding (3.7% vs 3%; P = 0.63), respectively. This study revealed a 4.1-fold increase in exclusive breastfeeding rate by KMC at the time of discharge from hospital (43). Almeida reported that the success rate of exclusive breastfeeding at the time of hospital discharge was 2.34-times more in infants who received KMC than in control group (61). Venancio showed that KMC is an important factor for continuity of breastfeeding at discharge. It seems that KMC can be a useful tool in increasing exclusive breastfeeding (62).

On the other hand, there were several studies on the breastfeeding period at the time of discharge or during the hospitalization. In an observational cross sectional study, Heidarzadeh et al. assessed the effect of KMC technique on exclusive breastfeeding of premature neonates at the time of hospital discharge (43). Based on their results, the mothers who performed KMC had more success in exclusive breastfeeding at the time of discharge than the mothers who did not perform this method had (62.5% vs 37.5%; P < 0.01), which was similar to the results of Suman et al. study that reported mothers who had more KMC had higher rates of exclusive breastfeeding (98% vs 79%) (10). We also found the effect of KMC on breastfeeding in 44.17% of term infants.

3.7. Length of Hospitalization

Jafari et al. showed that there was a statically significant difference in the mean days of staying in hospital between the KMC and RC group (7.9 and 10.6 days, respectively; P = 0.03) (24). Mohammadzadeh et al. and Godarzvand et al. also found longer duration of hospital stay in RC group (27.18 ± 12.07 vs 16.24 ± 10.04 day; P < 0.001) (27, 28) that was similar to the study of Gathwala (6.8 ± 1.3 vs 3.56 ± 5.5 day) (4) while, both Suman et al. and Nagai et al. did not show any significant differences in duration of hospitalization between CC and KMC groups (10, 63).

3.8. Psychologic Effects

Separation from the parents, especially from the mother, following admission at NICUs and based on clinical conditions of the neonates have negative effects on mother and infants attachment; this can affect the long-term emotional development of the child. There are some evidences that a close relationship between the mother and premature infant may have positive effect on the adaptation of the baby with the world. The KMC is a health care method, especially for LBW infants, in which mothers play an important role, but father may involve directly or indirectly based on their interest (43, 64).

Karimi et al. and Nematbakhsh et al. in their studies on term infant showed that KMC decreases mothers and infants stress. Mother's attachment tool was used to define attachment and anxiety regarding children (35, 36). The mean scores at the end of neonatal period in KMC and CMC were respectively 28.42 ± 3.32 and 26.07 ± 4.16 in Karimi et al. study (P = 0.02) and respectively -3.07 ± 3.05 and -1.71 ±2.91 in Nematbakhsh et al. study (P < 0.01), which were similar to the results of Ludington-Hoe et al. study (65).

Rajai et al. showed the effect of two care methods on the sleep and waking states of preterm neonates (37). In compare to CC group, the KMC group had significantly more quiet sleep and alert awake and less drowsiness (P < 0.001), active awake, and crying states (P = 0.002). They demonstrated that neonates had more beneficial and less undesirable states of sleep and waking during KMC. Therefore, KMC may be helpful in improving sleep and waking states of preterm neonates in NICU.

Basiri et al. found that receiving > 4 hours a day KMC was more beneficial than receiving < 4 hours a day in terms of developmental and psychologic measures in LBW infants (25).

Our review has some limitations. First, most of the studies were performed on term and healthy neonates and studies on the effect of KMC in preterm and LBW infants were infrequent in our country. Second, studies and outcome assessments had large scattering in Iran and we did not have information about this technique in all hospitals of Iran.

4. Conclusions

The KMC is one of the most important methods that improve the newborns health and has an important effect on saving preterm and LBW infants, especially in Iran. Several benefits for KMC have been reported in studies and implementation of this technique, as an effective intervention, is recommended for all mothers and neonates in hospitals. However, further studies to assess other aspects of this technique such as economic evaluations are needed to clarify the cost-effectiveness of KMC in our country.

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