

Kangaroo Mother Care Induced Serum Oxytocin Facilitates Prolactin and IL-10 Among Emergency Cesarean Mothers

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Background: The rate of cesarean section is increasing from 15% to 40% in recent years. The type of delivery influences the hormonal, emotional and mental health of the mother, which correlates positively or negatively with the health benefits of the newborn. There have been many published studies on kangaroo mother care for mothers undergoing elective cesarean section, but there is still a lack of understanding about emergency cesarean section.

Objective: This study aimed to evaluate the benefits of KMC practice for mothers undergoing emergency cesarean section in terms of hormone levels such as oxytocin, cortisol, prolactin, interleukin-6 and interleukin-10.

Methods: This retrospective analysis used remnant serum (KMC group = 16; control group = 9), and clinical data such as KMC practice (15–30 minutes three or four times daily until discharge), breastfeeding initiation time, feeding time, crying time and hospital stay were extracted from the electronic database. All hormone and cytokine expressions were quantitatively determined by ELISA. Comparisons within and between groups were performed using appropriate statistical tests.

Results: In the KMC group, increased levels of the hormone oxytocin significantly reduced cortisol and IL-6 and negatively influenced prolactin and IL-10 levels. The elevated prolactin facilitates overall lactation behaviour, of which 64% reported breastfeeding directly at the breast. The cytokine analysis revealed a reduction in pro-inflammatory cytokines and thereby an improved wound healing was seen in the KMC group.

Conclusion: These quantitative results strongly encourage the use of KMC for mothers undergoing emergency cesarean section. These simple yet effective breastfeeding strategies promote maternal and infant health, which can reduce medication use.

Keywords: lactation, KMC, nursing strategy, hormone, cytokine

Introduction

Cesarean Rate Worldwide and in Saudi Arabia

The process of caesarean delivery, also referred to as a C-section or caesarean section, involves the surgical procedure of an open incision made in the mother's abdomen or uterus. The World Health Organization (WHO) reported that the global acceptable rate of caesarean section stands at 10–15% of all births.¹ However, the C-section has surpassed the 15% benchmark in many developed and developing countries, climbing up to 40%.^{2–4} This trend is particularly evident in countries such as Saudi Arabia, where the rate of caesarean deliveries peaked at 26.3% in Jeddah in 2016.⁵ Recent evidence from King Abdulaziz Medical City in Riyadh reveals that elective caesarean deliveries account for at least 13.7% of caesarean deliveries.⁶ Qassim City reported an alarming 55.4% caesarean section rate out of a total of 936 births in 2018.⁷

Stress after Cesarean

The rise in cortisol levels due to post-traumatic stress is a common occurrence in C-sections.⁸ The stress related signalling pathways are controlled by the hypothalamic–pituitary–adrenal (HPA) axis that starts from the paraventricular nucleus (PVN). Corticotrophin releasing hormone (CRH) triggers the anterior pituitary to upregulate the adrenocorticotrophin (ACTH).⁹ The resulting cortisol release causes a reduction in prolactin output.¹⁰ Furthermore, stress can indirectly reduce prolactin levels by stimulating the sympathetic nervous system. This deficiency in prolactin may lead to lactational difficulties in mothers who have undergone C-sections. Besides, hormonal fluctuations following a cesarean section typically occur between the third and fifth day and may even last for six to eight weeks postpartum.¹¹ Anticipate experiencing undulations in oestrogen and progesterone, which may manifest as melancholy, overwhelm, apprehension, and despondency.

KMC: An Introduction

The WHO defined kangaroo mother care (KMC) or skin-to-skin contact (SSC) as “care for a premature baby born skin-to-skin with the mother”. It is a potent, simple yet effective technique to improve the overall health of full-term and preterm infants. KMC between mother and neonate pair should be initiated at early hours after postpartum; however, the duration and method differs with clinical settings. Continuous KMC is the term used for KMC that is administered throughout a 24-hour period in the original approach in low-income settings. The low birth weight infants and/or preterm infants in NICU settings are advised for the intermittent KMC approach; however, in wealthy settings, this strategy is used with brief exposures of one to three hours.

KMC Benefits

KMC has been reported to decrease the incidence of neonatal mortality from 53% to 36% by the following ways.¹² The practice of SSC has greatly improved the health and mental status of mother and infant. Research suggests that SSC can improve blood oxygenation, maintain the blood glucose level, encourage longer duration of breastfeeding, reduce apnoea during sleep, reduce stress of birth, decrease the risk of jaundice, strengthen the immune system and aid in pain management for infants.^{12,13} KMC also benefits mothers who have undergone C-section as it helps to strengthen the mother–baby bond and helps them to cope with anxiety and postpartum depression. The growing evidence augmented that the surge of oxytocin, a neuropeptide hormone during or after KMC, plays a paramount role in the aforementioned health benefits.

SSC provides immediate and long-term benefits that include improved recognition and attachment between mother and newborn infant,¹⁴ faster expulsion of the placenta, lowered primary postpartum haemorrhage condition,¹⁵ improved maternal self-efficacy toward breastfeeding,¹⁶ facilitation of breastfeeding initiation,¹⁶ increased exclusive breastfeeding duration,^{16,17} frequency of breastfeeding per day increases,¹⁸ and reduced maternal post-traumatic stress and depression.^{19,20} From the infant point of view, SSC stabilizes thermoregulation¹⁸ and cardiopulmonary dynamics, helps to maintain the blood glucose level¹⁴ and reduces pain during intramuscular injections. KMC have found to reduce infant’s stress and crying duration and frequency during the early period post birth.

KMC and Hormone Study

During KMC, skin-to-skin contact causes the release of oxytocin, which can alleviate the mother’s discomfort. When oxytocin released in the brain enters the amygdala during KMC, it functions to deactivate the stress mechanisms via decreased secretion of cortisol, and other metabolites that are harmful to the mother and the baby. Moreover, apart from encouraging maternal conduct like bonding, oxytocin also possesses tranquilizing, anxiolytic and analgesic properties. Furthermore, oxytocin also encompasses qualities that are similar to those of antidepressants. A positive consequence of the hormone oxytocin is that it can aid in reducing the mother’s circulation of catecholamines, which subsequently diminishes maternal stress.²¹

The aforementioned hormonal axis facilitates parent–infant interactions by means of a bio-socio-behavioural feedback loop that involves the hormone oxytocin. Subsequently, the release of oxytocin promotes increased maternal–infant proximity. Previous studies have correlated the peripheral oxytocin levels during KMC practice with maternal behaviours. Besides,

engaging in KMC enhances the production of maternal prolactin. Such oxytocin release may help enhance maternal responses to the baby and bonding, while simultaneously reducing maternal stress levels.

KMC could be considered as an alternative for post-operative analgesia since both interventions have resulted in similar outcome. The recovery rate of surgical wound made during C-section is another contributing factor for mother's stress response. The pro-inflammatory cytokines such as IL-6 is a well-known biomarker for surgical tissue damage and nowadays can be used in the prognosis of severity of operative wound. Therefore, inhibition of these kinds of cytokines is beneficial to post-operative recovery.^{22,23}

IL-10, an anti-inflammatory cytokine, activates and promotes infiltration of immune cells and non-immune cells at the wound site.²⁴ Studies have highlighted that the overexpression of IL-10 markedly reduces the plasma IL-6 level during skin damage. Both these actions promote faster post-surgical wound healing, including cesarean delivery.^{25,26} Despite copious studies focused on the effects of KMC on maternal and neonatal health, few studies determine the involvement of hormones and its effects on stress management in the early postpartum period after cesarean section.

Aim/Objective

Even though the WHO recommends KMC for at least 80% of all births,¹ the prevalence of KMC varies greatly across different parts of the world.² The role of KMC in vaginal as well as elective C-section delivery was well studied. In C-section cases, immediate SSC is achievable using spinal or epidural anaesthetics (WHO & UNICEF 2009)²⁷. Growing trends on emergency C-section cases were documented in recent years, and to date there is limited research on the benefits of KMC reported in these cases, particularly in the province of Saudi Arabia. Thus, our objective was to scrutinize how hormonal fluctuations during KMC practice to mothers who underwent emergency cesarean delivery alters maternal and neonatal behaviour relevant to stress, wound healing and feeding aspects.

Materials and Methods

Study Design

This present retrospective study was carried out on leftover stored samples (secondary use). The de-coded patient material was used in accordance with the Institutional Ethics Committee. Data pertaining to mothers who delivered a baby via emergency C-section delivery between January 2022 and December 2022 and those who met the inclusion criteria were identified through the available electronic database.

Study Sample

Inclusion

The eligibility criteria were women who delivered via emergency C-section and were exposed to KMC at different time points during hospitalization. All pregnancies were primiparous and delivery took place between 34 and 40 weeks of gestation. Samples collected before and after KMC were included.

Exclusion

Samples were excluded who had a pregnancy with HIV/HBV/HCV, history of confirmed COVID-19, pregnancy with chronic diseases, received steroid therapy in the last 72 hours, twin pregnancy, fetal death and congenital abnormalities of the fetus.

KMC Procedure

Briefly, intermittent KMC was routinely practised for approximately 15–30 minutes in a day for three to four times at intervals until discharge, mainly before breastfeeding.

Sample Collection

Step-down thawing of stored remnant serum was followed, mixed well and aliquoted before use. Convenience sampling was adopted.

Variables and Measurements

Maternal hormones including oxytocin, cortisol, prolactin, IL-6 and IL-10 were analysed. Data on other parameters such as baby-crying time, feeding frequency and feeding duration were retrieved.

Quantification of Serum Hormones

Oxytocin (OXT): the serum concentration of OXT was analysed using Enzyme Linked Immunosorbent Assay kit (EIAab). This quantitative sandwich immunoassay detects OXT in the range between 15.6 and 1000 pg/mL with a limit of detection at <11.7 pg/mL. The concentration was determined as per the manufacturer's protocol and by measuring the end-point colour intensity using a spectrophotometer at 450 nm.²⁶

Cortisol and prolactin (PRL): the maternal cortisol and prolactin in serum were determined by competitive ELISA kits, DiaMetra ELISA²⁸ and EIA kit respectively.²⁹

Serum Inflammatory Markers

IL-6 and IL-10: IL-6 and IL-10 in maternal serum samples collected at different time points were measured by ELISA (eBioscience, San Diego, CA). The sensitivity of each assay kit was 2 pg/mL; the samples were assayed in triplicate for determining the intra- or inter-assay coefficient variations (CV). Each run was considered valid only when the results of CV were 14.0% and 3%, respectively.

Other Neonatal Parameters

Variables for breastfeeding outcomes and infant-related parameters were adapted from Abdulghani et al's study³⁰ with modifications: (1) breastfeeding initiation time in hours (h) and (2) feeding duration was measured in average min/day. Infant's crying time (h/day) and duration of hospital stay (days) were also assessed from clinical data.

Statistical Analysis

Data were extracted from the database, converted into an Excel sheet and analysed using the Statistical Package for the Social Sciences (SPSS), version 21. All statistical tests were performed with a two-sided significance level of 5%. Results were presented as mean \pm standard deviation (SD) and the range were determined for each data set by descriptive statistics. The distribution of data for each variable at different intervals under two groups was presented in box and whisker plot. Within and between-group variance were measured by one-way ANOVA, followed by a Tukey Post-hoc test. The Pearson correlation matrix among the KMC group was constructed to identify the relationship within and between the study variables.³¹

Ethics

This study protocol was in accordance with the Research Ethics Committee of King Khalid University, Kingdom of Saudi Arabia (ECM#2023-1702). All data were de-identified, provided a unique study code and conserved using a password-protected archive.

Results

There were no adverse events or wound or infections reported during the study period. There were no reports of delayed surgical healing or wound infection. A total of 25 mothers' serum who underwent cesarean was included in the study. Of which, 16 serum were from mothers who practised KMC (KMC group) while nine did not practise KMC (control group). This study focused on the variations in serum hormonal and cytokine levels observed after KMC practice in emergency C-section mothers. [Figure 1A–E](#) depicts the change in serum hormonal and cytokine profile between and within groups at different time intervals.

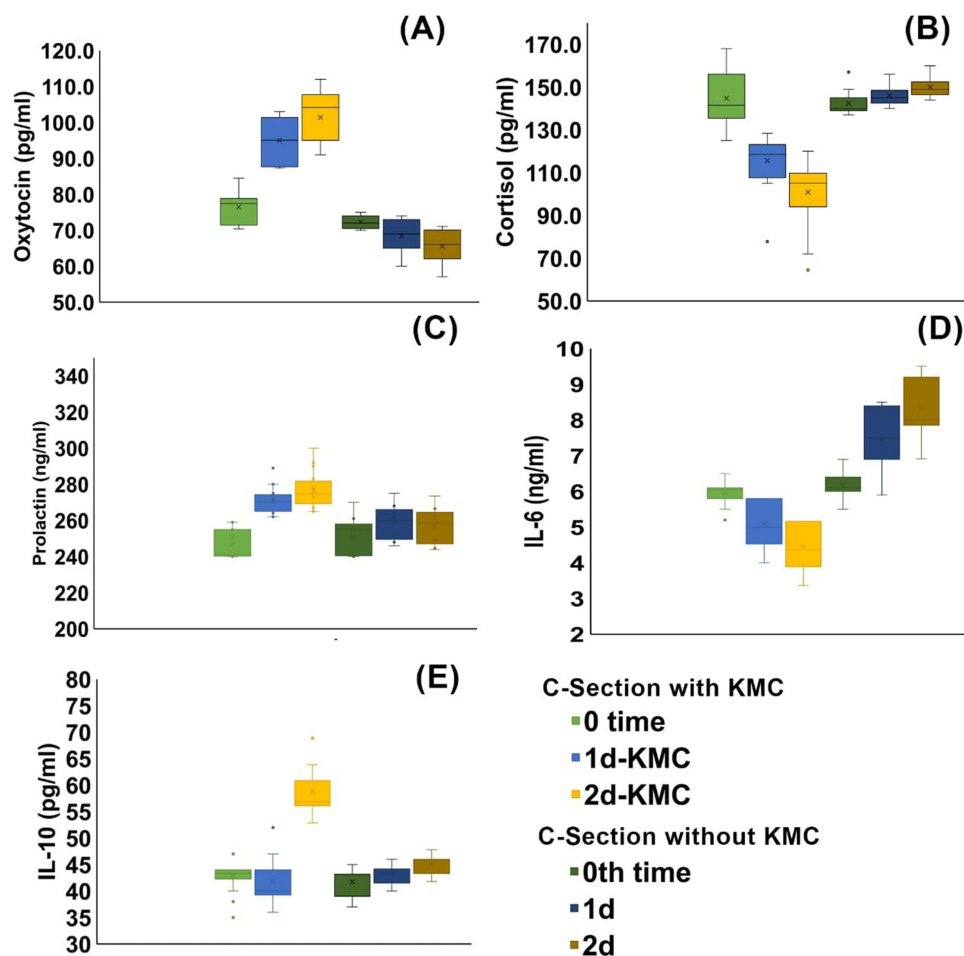


Figure 1 Changes in hormonal levels (A) oxytocin, (B) cortisol and (C) prolactin and cytokine levels (D) interleukin-6 and (E) interleukin-10 among the KMC group. Data represented in a box and whisker plot in which distribution of data are depicted as percentiles. The minimum value on the Y axis (pg/mL) of each graph is adjusted to the nearest low level of each parameter studied. KMC, kangaroo mother care; d, day(s).

Serum OXT Quantification

Basal quantity of OXT did not differ significantly between with and without KMC practice among emergency C-section mothers (70.4 vs 70.0 pg/mL). KMC positively influenced the oxytocin level with an increase from basal line over three days postpartum from 70.4 to 112.0 pg/mL. Mothers who delivered via emergency cesarean but did not undergo KMC showed decreased OXT concentration (~16 pg/mL) in the following 2nd day postpartum. The net difference between the last day OXT quantities between two groups was 36 pg/mL (112.0 vs 65.5 pg/mL). In the KMC group, the minimum was 70.4 pg/mL and a maximum level was 112.0 pg/mL. The data range differs from 14.1, 15.7 and 21.0 in the KMC group whereas control samples showed 5.0, 14.0 and 14.0 pg/mL, respectively. The increase in OXT level was significantly evidenced in the KMC group as compared to control serum (Figure 1A).

Serum Cortisol Quantification

Higher cortisol levels were observed in the control serum of the women who underwent C-section labour: 146.1 ± 4.8 ng/mL and 150.0 ± 5.4 ng/mL for 1st and 2nd day after delivery, respectively. The minimum and maximum values in that group of serum samples were 156 ng/mL and 140 ng/mL. The peak cortisol peptide of 144.7 ± 14.0 ng/mL was controlled in the KMC serum group to 100.9 ± 15.0 ng/mL. In addition, a significant falling trend (Figure 1B) in the cortisol concentration due to repeated sessions of KMC practice was evidenced in these two days (144.7 vs 115.6 ng/mL).

Prolactin Level

The mean PRL level of 2nd day in the KMC mothers (276.6 ± 10.0 mg/dL) was significantly higher than that in the control group (256.6 ± 13.4 mg/dL) ($p=0.001$). The maximum and minimum values observed in this study were 240.0 mg/dL (baseline in both groups) and 300.0 mg/dL (2nd day KMC group).

Serum Inflammatory Markers

Figure 1D and E clearly shows the positive effect of KMC practice among cesarean mothers. On day 1 and 2, the mean baseline IL-6 serum levels in non-KMC mothers were 7.4 ± 0.9 and 8.3 ± 0.8 pg/mL, while after KMC they were significantly reduced to 5.1 ± 0.7 and 4.5 ± 0.8 pg/mL ($P=0.001$).

The mean serum level of IL-10 on day 2 in the control group was 45.1 ± 2.9 pg/mL, whereas in the KMC group it was significantly higher up to 58.7 ± 4.1 pg/mL ($P=0.05$).³² These levels differ with the mean baseline levels (41.7 ± 2.7 and 43.0 ± 3.2 pg/mL) in the control and 0th day KMC groups, respectively.

Other Neonatal Parameters

Breastfeeding and other neonatal outcomes are presented in Table 1. Mothers in the KMC group have started their lactation in 39.3 ± 2.59 h, while it was 49.3 ± 2.65 h in the control group. None started their first breastfeeding within 24 h. The average feeding time per lactation was higher in the KMC group (10.00 ± 3.0 average min/day) as compared to the non-KMC group (15.31 ± 1.2 average min/day). During the first two to three days after birth, about two-thirds of mothers in the KMC group exclusively breastfed directly at the breast ($n = 16$, 64%). In control infants, the mean crying time was 2.26 ± 1.38 h/day but got reduced to 1.50 ± 0.25 h/day in KMC infants ($P=0.001$). Due to the hormonal changes induced as a result of KMC practice, the hospital stay for mothers in emergency C-section was reduced to 3.69 from 4.81 days.

Correlation Matrix

A detailed relationship matrix within (at different time points) and between quantitative variables in KMC group is tabulated as Table 2. As the frequency of KMC practice increased, a strong positive correlation was observed across two days in all parameters studied. IL-6 showed a high r value ($r=0.946$, IL-6 (2) vs IL-6 (3)), followed by IL-10 ($r=0.886$, IL-10 (2) vs IL-10 (3)) and OXT ($r=0.877$, OXT2 vs OXT3). As OXT gradually increased from day 0 to day 2, prolactin ($r=0.477$, OXT1 vs PRL1) and IL-10 ($r=0.63$, OXT3 vs IL-10 (3)) also increased. A negative correlation was evidenced in all the other molecules such as cortisol and IL-6. Highest was between OXT and IL-6 on day 2 ($r=-0.800$).

Discussion

Many studies have documented data on attitude, knowledge and implementation of KMC among nurses in Saudi Arabia.^{33–35} In the study region, it was found that KMC was less often in practice due to newborn infants often being separated from their mothers and hence delayed breastfeeding initiation for hours or days was observed.¹⁷ The present study's aim was to determine the hormonal levels after intermittent KMC practice in mothers who had emergency C-section and compare them with the non-KMC C-section group. To our knowledge, this is the first report on intermittent KMC that improves oxytocin level in emergency cesarean delivery. The outcome was justified quantitatively using

Table 1 Evaluation of KMC on Other Maternal and Neonatal Parameters

Variables	C-Section	C-Section + KMC
Hospital discharge (days)	4.8±0.98	3.7±0.70
Lactation starting time (h)	49.3±2.65	39.3±2.59
Feeding time (average min/day)	10.9±3.30	15.3±1.25
Crying time (h/day)	2.3±0.38	1.5±0.38

Note: Data are given as mean±SD.

Table 2 Pearson's Correlation Matrix Within and Between the KMC Group

Parameter in KMC group	Interval	Oxytocin			Cortisol			Prolactin			IL-6			IL-10		
		0 Time	1d-KMC	2d-KMC	0 Time	1d-KMC	2d-KMC	0 Time	1d-KMC	2d-KMC	0 Time	1d-KMC	2d-KMC	0 Time	1d-KMC	2d-KMC
Oxytocin	0 time	1.000														
	1d-KMC	0.868	1.000													
	2d-KMC	0.733	0.878	1.000												
Cortisol	0 time	-0.713	-0.690	-0.759	1.000											
	1d-KMC	-0.616	-0.521	-0.459	0.472	1.000										
	2d-KMC	-0.784	-0.773	-0.676	0.639	0.756	1.000									
Prolactin	0 time	0.478	0.501	0.499	-0.661	-0.529	-0.678	1.000								
	1d-KMC	-0.014	0.301	0.238	-0.158	-0.005	-0.140	0.361	1.000							
	2d-KMC	0.423	0.548	0.439	-0.374	-0.770	-0.746	0.572	0.545	1.000						
IL-6	0 time	-0.056	0.018	-0.078	0.029	0.081	0.033	-0.210	-0.081	-0.111	1.000					
	1d-KMC	-0.811	-0.801	-0.694	0.495	0.617	0.780	-0.669	-0.256	-0.568	0.157	1.000				
	2d-KMC	-0.754	-0.737	-0.693	0.489	0.611	0.760	-0.707	-0.261	-0.568	0.344	0.947	1.000			
IL-10	0 time	0.421	0.421	0.259	-0.219	0.154	-0.375	0.021	0.179	0.038	0.203	-0.312	-0.262	1.000		
	1d-KMC	0.358	0.246	0.294	0.073	0.220	0.325	-0.211	0.087	-0.183	-0.138	0.120	0.140	-0.071	1.000	
	2d-KMC	0.166	0.247	0.630	0.045	0.216	0.145	-0.107	0.054	-0.132	-0.173	-0.037	0.022	-0.018	0.886	1.000

Notes: Negative integer indicates negative correlation; positive integer denotes positive correlation; and value close to or equal to "0" denotes no correlation. Values "between -1 and 0", of "0" and "from 0 to 1" are shaded by red, white and blue colours, respectively.

immunoassays and behavioural neonatal parameters. Due to practical difficulties, remnant serum samples were obtained at relatively long intervals.

KMC is devoted to mothers who had preterm deliveries or with infants less than 2000 g birth weight. Few studies have compared the benefits of KMC practice on elective C-section and vaginal deliveries. Among cesarean deliveries, there are different modes such as elective (personal decision) and emergency (medical need) becoming routine in these days. Hence, it is important to reveal the health benefits of KMC on emergency C-section mothers. Results showed overall pros of SSC practice with respect to the hormonal levels.

Oxytocin

The OXT concentration found in the study sample is comparable (32.3 to 2297.6 pg/mL) with the previous data. The author reported a two-fold difference among individuals in OXT levels (57 to 108 pg/mL).³⁶ However, peripheral OXT levels in women documented by other studies was much lower than this.³⁷ Thus determined OXT values in this study using stored serum samples differ with the previous findings in terms of sample processing and assay methods. Previously, the maternal OXT levels among mothers who had spontaneous delivery were mentioned as higher but not significantly than those at elective C-section. The maternal–fetal attachment scale resulted in higher OXT in women during the third trimester.³⁸ Another study concluded that mothers with lower level of OXT had experienced postpartum depression in mid-pregnancy.³⁹

Cortisol

An earlier study has noted that the range of serum cortisol was from 831 ± 257 nmol/L to 906 ± 243 nmol/L in pre- and post-operative cesarean delivery, respectively. S-cortisol was significantly higher among spontaneous delivery women as compared to the preoperative cesarean section mothers.⁴⁰ Many have worked in elective C-section, but there is still lacunae on S-cortisol levels at emergency C-section in this study region. The present data on KMC practice have also shown a reduction in S-cortisol level in the KMC group as compared to the non-KMC group.

Prolactin

The present study observed that the mothers in the KMC group had less anxiety which contributed to more active breastfeeding resulting in generous milk production. The increased prolactin level in the KMC group further validated the copious milk secretion. This facilitates the milk production, initiation of breast feed, prolongation of feeding time and frequency of feed per day. High prolactin levels support exclusive breastfeeding which indirectly reduces mortality in low birth weight infant. The present result suggests that there is no need for drugs for prolactin secretion. KMC makes patients more relaxed that reduces trauma after C-section delivery.

Feeding Behaviour

Studies conducted in Saudi Arabia mostly compared elective C-section with vaginal delivery.⁴¹ In this study, the intermittent KMC among cesarean delivery revealed a minor proportion of mothers breastfeed on the day of delivery. This is contrary to what has been previously reported (ranged from 76% to 98%). This because of mother–infant separation was unknowingly practised during the initial hour after birth in emergency C-section. A growing body of evidence supports the association between KMC during the first hour postpartum with successful breastfeeding. This study revealed breastfeeding directly at the breast observed during the postpartum stay was 62% and is associated well with increased breastfeeding even at six months postpartum.⁴¹

Crying Time

As seen in infants of the KMC group, the decrease in crying time and restlessness, and an increase in the duration of deep sleep and relaxation were documented in colicky infants.⁴²

Colicky infants responded well to KMC practice as it significantly reduced the symptoms of irritability and crying in comparison with the control group.⁴³

Cytokines

The clinical consequences of modulating wound cytokine concentrations and anti-inflammatory strategies are incompletely understood among emergency C-section deliveries and hence require detailed studies. The postoperative pain can be mediated by the release of various kinds of inflammatory cytokines from the wound itself.

Generally, analgesia can inhibit or reduce the release and movement of pro-inflammatory cytokines to wound tissue, thereby accelerating the wound's recovery.⁴⁴

The IL-6 concentration decreased in this study rather than elevated as previously reported, most likely reflecting the effect by KMC practice that significantly reduced the levels of both. The IL-6 level in the control group began to increase postoperatively at day 1 and maintained at day 2. This pain-induced higher level of IL-6 level in this group was brought down effectively by analgesia in postoperative care.⁴⁵

The present study justified the changes in serum IL-10 levels were indirectly proportional in the study groups; its level began to rise postoperatively at day 1 and peaked at day 2. A study has found that the pre-operative levels of IL-6 was higher but IL-10 was relatively unchanged.⁴⁴ This explains the relationship between the two different effects of cytokines during post-operation and from the surgical wound site.

The overall comparison revealed that KMC might have control on the hypothalamic–pituitary–adrenal axis which was evidenced by the correlation matrix. Once OXT secretion is triggered by KMC on day 1, cortisol and IL-6 levels were in a down trend that resulted in the surge of prolactin hormone and upregulation of IL-10. This rise in OXT and PRL are known to facilitate lactation in cesarean mothers. The pro-inflammatory cytokine decreased with an increase in OXT may reduce postoperative trauma. Hence, the mothers in the intervention group showed a reduction in hospital stay with earlier discharge as compared to the control group. KMC, a simple, effective and easy to perform nursing strategy, has shown several health benefits for both cesarean mothers and their infants.

Limitations of the Study

Only samples with data for all study parameters were included. Due to practical difficulties, remnant serum samples were obtained at relatively long intervals. Further subgrouping that comprises preterm and term deliveries was not focused. A prospective-based cohort study with a large sample size will substantiate the findings of the present study.

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Disclosure

The authors report no conflicts of interest in this work.

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