Original Article

Continuous Skin-to-skin Care Assists Breastfeeding Mothers to Adapt to Sleep Patterns of Night feeds: A Case–control Follow-up Study

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ABSTRACT

Introduction: Mothers suffer disturbed sleep caused by the nocturnal patterns of breastfeeding. Skin-to-skin care (SSC) between mothers and babies has known comforting effects on mother and baby. **Aim:** The aim of the study was to examine the effect of daily practice of SSC in the 1st weeks after delivery in assisting mothers to adapt to the sleep patterns of her baby. **Materials and Methods:** This is a prospective cohort study of 90 breastfeeding mothers and their infants who were followed up from birth for 6 weeks. They were randomly divided into three groups: 30 performed SSC only at birth, 30 continued SSC on a daily basis, and 30 controls. Child development and weight gain were assessed at 6 weeks using Denver scale and maternal post-partum depression by the Beckwith depression tool. Sleep, activity, fatigue, appetite, health, and sex status were derived from the tool and correlated to parameters under study. **Results:** At 6 weeks, mother's satisfaction with sleep, depression score, child's weight gain, and development were significantly improved in the intervention group. Sleep correlated with activity, less fatigue (r0.5 at p=0.000), appetite (r0.4, p=0.001), and sex (r0.3, p=0.004) but not with maternal weight loss or health (p>0.05). Maternal sleep, activity, less fatigue, and appetite were positively correlated with child development at p=0.000, but not infants' weight gain (p>0.05). **Conclusions:** Daily SSC in the early weeks can support adaptation of mother to her infant's night feeds, promotes child growth and development and maternal well-being.

Key words: Breastfeeding, Child development, Depression, Fatigue, Skin-to-skin care, Sleep

Mothers in the 1st weeks after delivery present with many ailments related to inadequate, interrupted, and disturbed sleep. Literature suggests that one of the most common causes of disturbances in mothers' sleep may be babies' feeding patterns [1-3]. Some studies have reported improved sleep among breastfeeding mothers [4]. While others suggest that breastfeeding may have no effect or a protective effect on maternal sleep [5-8]. Hence, the relationship between breastfeeding and maternal sleep remains controversial for infants over 6 months of age.

It is important to study infants in the first 6–12 weeks of life, as the 1st weeks of life are critical for child development and mother-infant relationships. These infants have significant developmental differences and nutritional needs compared to older infants. It is important for infants to exclusively breastfeed (EBF) in the first 6 months of life and to introduce solid foods thereafter. Six months is a marker for infant sleep consolidation [9]. The first 6 weeks of life are important for establishing EBF and are considered a milestone for enhanced child development.

Skin-to-skin care (SSC) for one hour (h) starting soon after birth has been shown to have many beneficial effects for both mothers and babies [10-12]. The World Health Organization and UNICEF recommend that all newborns be placed on their mother in SSC immediately after birth and be allowed to stay for at least 1 h or up to the first suckle [13]. The development of the child is influenced by the extent of care the mother gives to her child. Bonding during SSC through frequent mother-infant interactions and touch can strengthen this relationship [14], and thereby enhance and caregiving abilities of the mother and consequently child development [15].

The purpose of this study is to examine the maternal sleep patterns in response to an intervention of daily SSC between

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mother and baby, for at least two hours (hs) during the first 6 weeks post-partum and correlate it with maternal depression, maternal well-being with a focus on sleep patterns and maternal fatigue as well as child growth and development at this age.

MATERIALS AND METHODS

This is a prospective observational case-control follow-up/cohort design study. It was conducted in-between the Obstetric and Pediatric Department of Benha University and Ain-Shams University Hospitals in Cairo, Egypt, during the period from June 2019 to March 2020. It included mothers who are expected to deliver full-term normal healthy babies by cesarean section (CSD) or normal vaginal delivery (NVD).

Inclusion criteria were healthy mothers at the childbearing period aged 20–44 years old with their full-term normal healthy babies who were fully breastfeeding. Exclusion criteria for mothers were maternal medical or obstetrical maternal complications. Exclusion criteria for infants were babies who were never breastfed or formula-fed infants. Furthermore, infant exposure to perinatal neonatal complications as asphyxia and trauma, admission to neonatal intensive unit for over 24 h, babies born needing oxygen and ventilator after 6 h of life, and finally those with congenital anomalies, sick or jaundiced infants were all excluded from the study.

The population under study was subdivided by quasi-randomization into three groups: Group I (15 NVD and 15 CSD): 1st-h skin-to-skin care (FSSC) at birth until the first breastfeeding is completed, but no follow-up for SSC thereafter, they included 15 NVD and 15 CSD. Group II (15 NVD and 15 CSD): FSSC at birth until the first breastfeeding is completed and followed by daily SSC for at least 2 h/day for 6 weeks. Group III (30): (Control group) not exposed to any SSC (only early initiation of breastfeeding within the 1st h of birth).

Mothers underwent a one-to-one interview to collect data related to their age, education, and health, past and present obstetric and breastfeeding practices. The mother-infant pairs intervention group was assessed for maternal well-being, practice of SSC and infant weight, feeding, and health through follow-up at 2, 4, and 6 weeks of age. At the end of the 6 weeks, the depression state of the mothers was assessed and the infant's weight gain and development were also assessed.

Post-partum and postnatal depression (PPD) score assessment was done using the Beckwith Depression score created by Beck, first published in 1961 and later revised in 1978 as the BDI-1A, and the BDI-II, published in 1996. It was used in its Arabic translated edition prepared by Dr. Mohamed M. Elshenawy, the Islamic University of Imam Mohamed Bin-Saud and Dr. Ali Elsaid Khedr, King Saud University in 1991. It consists of 20 questions from which a score is derived and is called PPD score. Focus in this study was done on the questions about how the mothers their sleep, fatigue level, energy, appetite, weight loss, and health in the last week. Each question has a set of at least four possible responses, ranging in intensity each answer being scored on a scale value of 0–3. Higher total scores indicate more severe depressive symptoms as follows: 0–13: Minimal depression; 14–19: Mild depression; 20–28: Moderate depression; 29–63: Severe depression. The score derived from the analysis is used to express the PPD score.

Development assessment was done for babies at 6 weeks of age using Denver developmental scale. The scale is used for children in the first 2 years of life and is based on the milestones of development for motor, fine mother, social, and language development. Gross motor was assessed by equal movements on both sides and ability to lift head upward in ventral suspension. Fine motor (eye to hand coordination) was assessed by ability to follow object to the midline, follow object past midline, social development was assessed by demonstrating social smile spontaneously. Language was assessed by ability to respond to a bell, make wooing and cooing sound. The assessment score given was as follows: 0: Does not initiate; 1: Initiates (<10%); 2: Partially completes (10–100%); 3: Completes (100%).

Ethical Considerations

Informed written consent was obtained from patients before participation; it included data about aim of the work, study design, site, time, subject, tool, and confidentiality. An approval from Research Ethics Committee in Benha University Hospital and Ain Shams University Hospital was obtained.

Statistical Analysis

The collected data were tabulated and analyzed using SPSS version 16 software (SPSS Inc, Chicago, ILL Company). Categorical data were presented as number and percentages, Chi-square (χ^2) and Fisher's exact tests were used to analyze them. Normally distributed variables were expressed as mean ±standard deviation (SD) and analyzed by student "t-test" and one-way analysis of variance (ANOVA) for 2 and 3 independent groups, respectively. ANOVA (F test) was used to compare the continuous variables expressed as mean±SD. "F" is the ratio between variations due to the studied variable to variation due to error. The more the value of "F" the more significant is the result. Non-parametric data were presented as median and range and analyzed by Kruskal–Wallis (KW) test for three independent groups. Matched two non-parametric variables were analyzed by Wilcoxon test. Significant ANOVA or KW was followed by post hoc multiple comparisons using Bonferroni adjusted tests to detect the significant pairs. Correlative studies were done using Pearson correlation for nominal data and Spearman's correlation for categorical variables identifying positive or negative relationships between variables, assuming nominal values. The cutoff of significance used was $p<0.05$.

RESULTS

Table 1 presents the epidemiological data of the population under study. There were no significant differences in the age, residency (urban vs. rural), education level of the mothers under study.

Furthermore, there were no differences in the gravidity or parity of the mothers (p>0.05). Table 2 describes the epidemiological data of the infants with regards the sex, birth order, gestational age, mode of delivery, and birth weight. There were no statistically significant differences between the groups (p>0.05).

The mean score for dissatisfaction with sleep among the breastfeeding mothers who continued to nurture their baby through early and daily SSC for the first 6-week post-delivery was significantly lower, as compared to the other groups who practiced initially after birth or who did not practice SSC at birth or thereafter (0.7±0.53 vs. 1.07±0.56 and 1.2±0.7 at p=0.007, respectively) as shown in Table 3. The mean score for fatigue was significantly better in mothers doing SSC with their babies compared to the other groups (0.3±0.48, p=0.006). The mean score for the developmental milestones was significantly higher in babies on SSC (p=0.000); however, mean appetite and depression scores were not different between groups (p>0.05).

Sleep was positively associated with Less fatigue (r0.5 at p=0.000), appetite (r0.4, p=0.001), and sex (r0.3, p=0.004) but not with weight loss or health (p>0.05). Weight loss was positively correlated with fatigue, poor appetite, poor satisfaction with health status, and poor desire for sex (p<0.05). Sex correlated positively with all variables under study (p<0.05), as presented in Table 4. Sleep was also positively correlated with improved maternal PPD and child development, activity, fatigue, and appetite states of mother at p=0.000. Weight gain in infants correlated only with

Table 1: Demographic description of the mothers included in the study

Variable	Group I (n=30)		Group II (n=30)		Group III (n=30)		Test of significance	p
Age (years)								
Mean±SD	27.4±6.3		28.5±5.3		27.9±5.7		ANOVA=0.30	0.74
Range	19-38		20-38		20-39			
Residency								
Urban	13	43.3	19	63.3	13	43.3	χ^2=3.2	0.20
Rural	17	56.7	11	36.7	17	56.7		
Education								
Nil	3	10.0	5	16.7	4	13.3	FET=3.02	0.82
Basic	5	16.7	4	13.3	5	16.7		
Secondary	12	40.0	14	46.7	16	53.3		
University	10	33.3	7	23.3	5	16.7		
Gravidity								
Median (Range)	3.0 (1–6)		2.5 (1–5)		2.0 (1–5)		KW=1.12	0.57
Parity								
Median (Range)	1.5 (0–3)		1.0 (0–3)		1.0 (0–2)		KW=1.75	0.41

p>0.05 – not significant, χ^2= Chi-square test, FET=Fisher's test, ANOVA – Analysis of Variance, KW =Kruskal–Wallis test

Table 2: Demographic details of the infants' population

Variable	Group I (n=30)		Group II (n=30)		Group III (n=30)		Test of significance	p-value
	No.	%	No.	%	No.	%		
Baby gender								
Male	16	53.3	13	43.3	16	53.3	χ^2=0.8	0.67
Female	14	46.7	17	56.7	14	46.7		
Mode of delivery								
Vaginal	15	50.0	15	50.0	15	50.0	χ^2=0.0	1.0
Cesarean	15	50.0	15	50.0	15	50.0		
Gestational age (weeks)								
Mean±SD	38.3±1.39		38.1±1.26		38.2±1.35		ANOVA=0.074	0.93
Range	36-40		36-41		36-41			
Order in family								
1st	8	26.7	9	30	9	30	FET=5.92	0.43
2nd	7	23.3	9	30	11	36.7		
3rd	10	33.3	8	26.7	10	33.3		
>3	5	16.7	4	13.3	0	0.0		
Weight at birth								
Non	3.26±0.39		3.19±0.20		3.2±0.21		ANOVA=0.51	0.60
Median (range)	2.75–4.5		2.8–3.6		2.8–3.6			

p>0.05 – not significant, χ^2= Chi-square test, FET=Fisher's test, ANOVA – Analysis of variance

Table 3: Sleep patterns and fatigue in mothers who practiced continuous skin-to-skin care with their babies, compared to other groups

Variables	Statistical data	Group I (30)	Group II (30)	Group III (30)	F ratio	p-value
Maternal sleep	Range	0.0–3.0	0.0–2.0	0.0–3.0	5.307	0.007
	Mean±SD	1.07±0.58	0.7±0.53	1.2±0.71		
Maternal fatigue	Range	0.0–2.0	0.0–1.0	0.0–1.0	5.5	0.006
	Mean±SD	0.77±0.57	0.33±0.48	0.47±0.51		
Mother loss of appetite	Range	0.0–1.0	0.0–2.0	0.0–1.0	0.17	0.84
	Mean±SD	0.33±0.48	0.33±0.54	0.4±0.5		
Maternal depression	Range	2–19	0.0–28	0.0–21	0.4	0.66
	Mean±SD	8.4±4.4	8.0±6.4	9.3±6.2		
Child's development	Range	2–9	9–9	2–9	46.3	0.000
	Mean±SD	6.3±1.8	9.0±0.0	5.7±1.6		
Baby's weight gain	Range	3.5–5	4.0–4.9	3.5–4.4	6.9	0.002
	Mean±SD	4.1±0.35	4.3±0.39	3.9±0.25		

p-value – two-tailed significance

Table 4: Correlative studies between maternal sleep and levels of fatigue, appetite, weight loss, health, and sex in the mother

Characteristics	Active	Sleeping well	Fatigue	Appetite	Weight loss	Health	Sex
Maternal sleep (90)							
Correlation	r0.3	1	r0.5**	r0.4**	r0.2	r0.2	r0.3**
Sig. (2-tailed)	0.01		0.000	0.001	0.076	0.086	0.004
Maternal fatigue (90)							
Correlation	r0.5	r0.5**	1	r0.3**	r0.2*	r0.4**	r0.4**
Sig. (2-tailed)	0.00	0.000		0.004	0.032	0.000	0.000
Mother's appetite (90)							
Correlation	r0.17	r0.36**	r0.3**	1	r0.4**	r0.3**	r0.45**
Sig. (2-tailed)	0.1	0.001	0.004		0.000	0.003	0.000
Mother's weight loss (90)							
Correlation	r0.3	r0.2	r0.2*	r0.4**	1	r0.36**	r0.38**
Sig. (2-tailed)	0.005	0.08	0.032	0.000		.001	0.000
Mother's health (90)							
Correlation	r0.4	r0.2	r0.4**	r0.3**	r0.4**	1	r0.4**
Sig. (2-tailed)	0.001	0.09	0.000	0.003	0.001		0000
Desire for sex (90)							
Correlation	r0.4	r0.3**	r0.4**	r0.45**	r0.4**	r0.4**	1
Sig. (2-tailed)	0.000	0.004	0.000	0.000	0.000	0.000	

****Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed)**

mother's appetite (p=0.04) but not with sleep, activity, or fatigue (p>0.05), as shown in Table 5.

DISCUSSION

The study showed that mothers who practiced daily SSC for at least 2 h a day with their baby had significantly improved sleep patterns, less fatigue, and more energy status. Although daily SSC resulted in more improved sleep patterns, yet the depression scores were not different between the groups of breastfeeding mothers under study (Fig. 1). There are limited studies on the effect of continuing daily SSC in the first weeks after delivery on mother's sleep patterns. One study reported that after controlling for variables including breastfeeding status, only infant nighttime

Table 5: Correlative studies between sleep, fatigue, appetite in relation to maternal depression scores, child development, and weight gain at 6 weeks

Characteristics	Activity	Sleep	Fatigue	Appetite
Post-partum depression (90)				
Correlation	r0.4**	r0.6**	r0.5**	r0.6**
Sig. (2-tailed)	0.000	0.000	0.000	0.000
Development (90)				
Correlation	r0.3**	r0.4**	r0.5**	r0.5**
Sig. (2-tailed)	0.009	0.000	0.000	0.000
Weight gain in infants (90)				
Correlation	r0.004	r-0.135	r-0.05	r0.2*
Sig. (2-tailed)	0.974	0.205	0.617	0.041

****Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed)**

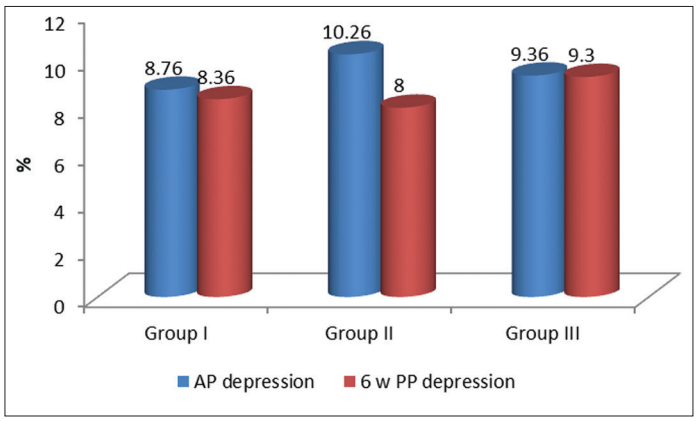

Figure 1: Bar chart comparing the depression scores of women in the antepartum period (AP) versus at 6 weeks post-partum (PP) by study group

sleep duration was significant in predicting maternal short sleep duration [16].

Most of the studies focus on SSC in preterm babies and its effect on improving mother's well-being and preventing or alleviating their depressive status. In preterm infants, SSC has been shown to be beneficial for the mother and the infant interactions and in reducing maternal post-partum depressive symptoms [17]. In addition, preterm infants exposed to SSC grow quicker and are healthier, cry less, and sleep better, while mothers are less anxious and stressed, invest more in breastfeeding, and feel more bonded to their infant [18,19].

In our study, continued SSC supported mothers to continue EBF. However, a study that examined breastfeeding and sleeps in 77 dyads of mothers and infants 6–11 months old revealed no significant difference in sleep patterns between breastfed and non-breastfed infants. Another study in Egypt conducted for 100 mothers, including 50 NVD and 50 CSD who were supported to practice early SSC immediately after delivery and followed-up for 1 month for health and feeding outcome. At 1 month after delivery, follow-up revealed that 76% of NVD and 82% of CS mothers were EBF; the workers concluded that early SSC and post-partum support supported these mothers to EBF their infants [11].

Other studies reported that mothers with post-partum depression exposed to SSC with breastfeeding had synergistic effects on sedating and calming both mother and baby and empowering the mother to care and feed her baby [20]. From such findings, it is clear that early breastfeeding through early SSC and continuing SSC on a daily basis can play an important role in enhancing mother-infant interactions which can boost their intellectual and psychological status. The mechanism whereby early SSC can reduce depression could be related to its effect on diminishing the stress hormones as cortisol [20] and the stimulation of the oxytocin which blocks the stress response promotes calmness and socialization processes [21].

A systemic review showed that higher oxytocin was associated with lowered depression states [22]. Maternal touch influences infant neural and behavioral development, it supports learned odor associations necessary for the infant to identify mother's nipple for latching onto the breast during the first breastfeed and consequent attachment. This requires an intact endogenous opioid well-functioning system for mediating the calming and analgesic properties of maternal touch [23].

All the mothers in our study were breastfeeding. This can explain the lower depression scores and improved sleep and fatigue levels in our study as compared to other studies. A study of 6410 mothers of babies 0–12 months old about their sleep patterns, infant sleep location, the mothers' physical and emotional health found that on all measures, breastfeeding mothers reported significantly better functioning. They were getting more sleep, felt better during the day, and were less depressed. There was no significant difference between the mothers who were either mixed- or formula-feeding on any measure [4].

This suggests a threshold effect for breastfeeding that mothers who supplemented did not have the same physiological benefits as mothers who only breastfed [24]. The babies, obviously, benefit from receiving their mothers' milk. However, the mothers get more physiological benefits if they can breastfeed exclusively. Other previous studies reported breastfeeding mothers were sleeping significantly more hours. They suggested that the mothers' reported hours of sleep may be a better predictor of lowered depression risk than measures of mothers' "actual" hours of sleep recorded through polysomnograph [1,6].

The present study showed that sleep patterns improved by SSC in all mothers irrespective of mode of delivery, that is, whether delivered by NVD or CSD. Another study conducted for the analysis of outcome of CSD on child survival and early breastfeeding practices showed that unnecessary CSD and cumulative cost of CSD were significantly correlated with infant mortality rates [25]. A prospective cross-sectional observational study including 200 women (100 with NVD and 100 CSD) using spinal anesthesia by heavy bupivacaine showed that early initiation of breastfeeding immediately after birth and neonatal feeding reflexes were significantly delayed in CSD compared to NVD. However, mothers supported in the postnatal period were more likely to continue EBF and there were no differences between NVD and CSD [12]. Hence, although CSD is associated with poor feeding and child survival outcomes, yet daily SSC as a supportive intervention in the postnatal period could improve breastfeeding outcomes irrespective of the mode of delivery and can probably heal what the invasive mode of delivery has disrupted.

In our study, fatigue was closely correlated with sleep disturbances. In Turkey, a study of 194 mothers was done to investigate the relationship between the insomnia-fatigue levels of mothers with infants and their depression and maternal attachment status. There was a significant weak relationship in the positive direction between maternal fatigue and insomnia levels and depression status. They recommend that social support provided by health professionals may contribute to alleviating fatigue and insomnia and thereby preventing maternal depression and strengthening maternal attachment of the mothers with their infants [26]. Other workers reported that sleep quality can reduce mother self-efficacy in breastfeeding because of increased tiredness [27]. Such findings indicate that SSC can reduce the

negative effect of fatigue and improve sleep quality and thereby improve mother's self-efficacy in breastfeeding. In our study, mothers who began supplementing with breastfeeding at 2 weeks stopped supplements as they practiced more SCC and were EBF by 6 weeks, indicating an increase in their self-efficacy in breastfeeding.

In this study daily, SSC was found to enhance child development. This could be explained by the enhanced mother-infant interactions. Other studies have shown that child development was enhanced was enhanced by child care and child stimulation [28]. Hence, mothers who have improved sleep patterns are more active and report less fatigue, are more likely to provide better care for their babies and thereby stimulate their child development as shown by the higher developmental scores in the group of mothers who practiced daily SSC with their babies.

In this study, the developmental scores of babies exposed to daily SSC were significantly higher at six weeks than other mother groups. The mechanism whereby daily SSC can enhance development could be due to the improved oxygenation of blood flowing to the brain. A study that examined the effects of SSC for 55 babies <1 year of age with congestive heart failure showed that breastfed babies exhibited significantly higher levels of oxygen saturation (PaO_2) at start of the feed than the formula fed ones and P02 continued to rise, decreasing at about 8 min then rising again at the end of the feed. The PaO_2 of formula-fed did not rise during a feed and fell at 6 min. The PaO_2 patterns improved with SSC and remained stable and high in both breastfed and formula-fed, but remained statistically significantly higher in the breastfed [29].

The current study also showed that full-term babies exposed to daily SSC had higher weight gain compared to the control groups. Other studies for Egyptian mothers with babies in the neonatal unit showed that babies given SSC doubled their weight gain in a shorter period and this correlated with improved depression score in their mothers [30].

Study Limitations

The sample size was limited, as there are many barriers to SSC in our culture. SSC is culturally very difficult to apply in conservative cultures. Furthermore, it takes a great effort to convince such mothers to practice SSC as they expressed fear of their baby catching a cold, etc. The information from mother was subjective as we were unable to see the mothers conduct the practice, but mothers who practiced it expressed extreme satisfaction with it and admitted that they were happy to continue doing it. The period of six weeks was short and needed to be extended to 12 weeks or even longer. We expect that a longer study may give even more findings that can be useful in understanding the mother and infant's lifestyle and sleep patterns.

CONCLUSIONS

Mothers who practice daily SSC report improved sleep patterns and breastfeeding practices. Babies show higher scores of development and better weight gain when exposed to daily SSC. It also promotes bonding and child care skills of mothers and their tolerance to the needs of their newcomers. It improves mothers' mood and satisfaction as they were in a heightened state of affection and gratification with this new relationship. Hence, daily SSC is recommended to be used as an intervention for assisting mothers to transition into the interrupted sleep patterns of their babies who need to breastfeed frequently in the evening and nighttime due to the rapid growth and developmental needs of babies in this critical period of their life.

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