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The Effect of Short Duration Skin to Skin Contact on Premature Infants' Physiological and Behavioral Outcomes: A Quasi-Experimental Study

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ABSTRACT

Purpose: This study aimed at assessing the effect of short duration Skin to skin contact (SSC) (5 days) on premature infants' short-term physiological and behavioral outcomes.
Design and methods: A quasi-experimental control group design was utilized. 89 stable premature infants were allocated to either an interventional or control group.
Results: Results showed that in comparison to the control group, newborns in the SSC group demonstrated higher weight gain (g/day) from day 3–5 of practicing SSC (53.7 g Vs. 32.6 g; $P < .05$), experienced significantly fewer numbers of apneas (48% Vs. 33.3%; $P = .001$), and were less likely to use formula feeding (60% Vs. 90%) and more likely to use mixed feeding (formula and breastfeeding) at discharge (33.3% Vs. 10%). Significant differences were also found in the crying, and sleeping patterns of the infants; infants of mothers who practiced SSC were less likely to cry in a continuous pattern and more likely to experience good sleep than infants in the control group.
Conclusions: The study highlights the importance of the early and short duration of SSC for premature infants.
Practice implications: The initiation of SSC in the first few days of life may have a significant influence on the newborn's short-term outcomes.

Introduction and background

Premature babies (<37 gestational weeks) are the largest group of infants who require admission to neonatal intensive care units (NICU). These neonates are often unable to adapt well physiologically to the stressful environment of the NICU, and they commonly respond to the environmental stressors with an increase in heart rate, a decrease in oxygen saturation (Cardoso, Kozlowski, de Lacerda, Marques, & Ribas, 2015), and poor weight gain (Jarvis & Burnett, 2009). Also, they are at risk for the development of short and long-term outcomes ranging from mild developmental delay to severe disability (Moore et al., 2012). The advancement in modern technology and medicine has allowed for higher rates of survival among this fragile population.

There is growing evidence on how NICU stressors impact premature infants' developmental outcomes. Using a caring approach that aims to minimize NICU stressors and thus enhance neonates' development is important (Altimier & Phillips, 2016). The developmental care approach involves a variety of individualized interventions that are designed to maximize neurological development and to minimize the effect of prematurity and NICU environmental stressors on premature infants (Altimier & Phillips, 2016). Skin-to-skin contact (SSC), as part of the developmental care approach, is a humane and cost-effective method of care for low birth weight (LBW) and preterm infants. Worldwide, SSC is used and practiced as the most feasible and preferred intervention for decreasing neonatal morbidity and mortality (Chan, Bergelson, Smith, Skotnes, & Wall, 2017). SSC has shown to promote exclusive breastfeeding, ensure temperature stability, facilitate physiologic stability, decrease neonatal morbidities, and improve physical and cognitive growth (Boundy et al., 2016; Cho et al., 2016; Feldman, Rosenthal, & Eidelman, 2014). This caring approach also has some behavioral effects on the infant, which include better sleep cycles, decreased crying, and an analgesic effect on the infant during painful procedures (Disher, Benoit, Johnston, & Campbell-Yeo, 2017; Johnston et al., 2017).

Existing literature has studied the effect of SSC on preterm infants' outcomes for relatively long durations. Such studies include, for example, Tully et al.'s (2016) study, which implemented SSC for 3 times a week and until infants reached 2 months of age, Cho et al. (2016) study, for twice a week and for a total of 10 times, (Mishra, Rai, Mishra, & Das, 2017) study, for at least 6 h per day during the entire

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period of hospitalization and then at home, or Feldman et al. (2014) study, for 14 consecutive days. There is limited literature that assessed the effects of providing SSC for preterm infants for short periods and duration. It is this lack of knowledge that has triggered the implementation of this study. The findings of this project will contribute to the discipline of preterm and LBW infant care by providing an awareness of the possibilities of providing SSC even for short duration. This study aimed at assessing the effect of providing short periods and durations of SSC on premature infants' physiological and behavioral outcomes.

Methods

Design and setting

A quasi-experimental control group design was utilized in a large teaching university hospital with a tertiary level NICU in Northern Jordan.

Sample and sampling procedure

A convenience sample of 89 stable preterm infants was included in this study. G*Power 3.0.10 was used to calculate sample size. The following options were used: *t*-test, means differences between two independent means (two groups), a priori, and two-tailed. An effect size of 0.8 (i.e. large), alpha error 0.05, power 0.95. Based on the previous values, the total sample size needed was 84 participants (group 1 = 42, group 2 = 42). Additional participants were recruited to allow for subject withdrawals. Inclusion criteria for the research participants included infants who were stable preterm with gestational age between 26 to <37 weeks (stable infants are those who can breathe unassisted and have no major health problems (WHO, 2003)), weighed >1800 g, were transferred from the hospital's delivery room to the NICU at the time of study, and whose mothers consented to participating and were willing to practice SSC with their infants. Exclusion criteria included preterm infants with high-risk conditions, receiving respiratory therapy with ventilator and/or on medication that may alter sleep pattern. Maternal inclusion criteria were mothers with no critical illnesses and who were able to comply with the SSC guidelines.

Data collection procedure

Data were collected over six months from March–August 2017. Infants whose mothers agreed to come to the NICU to provide SSC for their infants for five consecutive days and a minimum of 60 min each time were allocated to the intervention group ($n = 48$). The remaining 41 infants were assigned to the comparison group and received only standard care.

The intervention

As an intervention, intermittent SSC was initiated immediately after NICU admission and the stabilization of newborn infants (within an average of 12 hour postnatal age). Intermittent SSC was implemented in our study because of its convenience to the mothers and the research setting, and because it has been proven to be effective for improving weight gain in LBW infants (Samra, El Taweel, & Cadwell, 2013). Mothers were given full details about the SSC method by the principal investigator following the WHO (2003) guidelines. Mothers in the intervention group practiced SSC for five consecutive days after admission to the NICU. The data were collected every day by a trained nurse research assistant who was also responsible for supporting mothers during SSC. Mothers were seated in a comfortable recliner chair and were encouraged to carry out SSC as long as possible. Infants were connected to the bedside cardio-respiratory monitors to assess for apnea occurrence and were cared for by SSC wearing only a diaper and a head cap and resting on the mother's bare chest. The mother-baby dyad was covered with a warm blanket with the infant's head exposed. The mothers were encouraged to talk to the infant softly. SSC was provided for 60–120 min each day depending on the tolerance of the newborn.

The standard care

Infants who received the standard care were monitored inside their incubators and received routine medical and nursing NICU care. At the time of commencing this study, the SSC was not practiced as part of the standard care in the NICU. According to the hospital policy, parents were allowed to hold their infant wrapped in blanket once they were physiologically stable.

Outcome measures

The primary outcome variable of this study was weight gain. Secondary variables included feeding, sleeping, and crying patterns and the occurrence of apneas. Data collected from both the intervention and comparison groups included the following:

Premature infants' characteristics. Premature infants' characteristics obtained from the infants' hospital records. These included the date of admission, gestational and chronological age, birth weight, diagnosis, previous admission, and active resuscitation.

Mothers' characteristics. Mothers' characteristics included age, number of pregnancies, number of children, complications in pregnancy, and type of delivery.

Physiological outcomes. Physiological outcomes included observation of infants' weight and the occurrence of apneic episodes. Weight (g/day), length (cm/day), and HC (cm/day) were assessed on the day of enrollment and once a day until discharge. Weight was measured before feeding using a calibrated electronic scale for both groups and with babies wearing only a dry diaper of the same weight for all. The length was measured with an infantometer. HC was measured with a non-stretchable tape. Apnea was defined as the pause of breathing for >20 s in the presence of oxygen desaturation and bradycardia (Zhao, Gonzalez, & Mu, 2011), and was monitored through the bedside cardio-respiratory monitors.

Behavioral outcomes. Behavioral outcomes included observation of crying and sleeping patterns. A daily diary for sleeping and crying patterns were recorded during the day shift for the five consecutive days by research assistant nurses. Research assistants recorded the crying and sleeping time at 10 minute intervals for the entire day shift. The crying pattern was recorded as either continuous (extended periods of inconsolability for >10 min), only with painful stimuli, or no cry. The sleeping pattern was recorded depending on the time infants spent in longer consolidated periods of sleep during the day shift and was described as either “good” or “poor.” Good sleep, as described by Schwichtenberg, Shah, and Poehlmann (2013), is characterized by independent sleep onset, longer consolidated sleep periods, and more sleep per sleep-wake cycle. For the current study, the research assistants were instructed to complete a sleep log for each infant, which included the number and duration of daytime naps. As preterm infants may sleep for 22 h per day, but only for around an hour at a time (Llaguno et al., 2015), the sleeping pattern was described as “good” if infants had longer episodes of quiet sleep (longer than an hour) during the day shift.

Feeding method. Feeding at discharge was documented either as exclusive breastfeeding, mixed (defined as both breastfeeding and formula), or formula only.

Ethical approval

IRB approval was obtained from the involved parties. Mothers of infants who met the inclusion criteria were informed about the study purposes and the SSC method and consented to participate.

Table 1
Maternal characteristics.

Variables	Categories	SSC N = 48	Comparison group N = 41	P-values*
Mother age, mean ± SD		30.04 (6.706)	30.34 (5.351)	*.818*
Number of pregnancies, mean ± SD		3.17 (3.408)	3.39 (2.333)	*.734*
Number of children, mean ± SD		2.71 (1.458)	2.71 (1.792)	*.998*
Level of education, N (%)	Higher education	5 (10.4)	5 (12.5%)	*.888*
	Bachelor degree	21 (43.8%)	20 (50.0%)	
	Diploma	7 (14.6%)	5 (12.5%)	
	High school or lower	15 (31.3%)	10 (25.0%)	
Pregnancy complication, N (%)	No	29 (63.0%)	27 (65.9%)	*.785*
	Yes	17 (37.0%)	14 (34.1%)	
Type of delivery, N (%)	Vaginal	8 (17.0%)	3 (8.1%)	*.229*
	C/S	39 (83.0%)	34 (91.9%)	

* P value of <.05 is statistically significant.

Data analysis

Statistical Package for Social Science (SPSS) SPSS®-PC version 22 for Windows was used to analyze the data. Chi-Square (χ^2) tests and Mann-Whitney test were used to compare the intervention group to the comparison group in the sociodemographic variables and the outcome variables of the study. Means were used for normally distributed data; medians were used for non-normally distributed data. The value of P < .05 was accepted as the statistical significance limit.

Results

Demographic characteristics of study participants

A total of 89 mothers and their preterm infants participated in this study and were allocated to either the intervention group ($n = 48$) or the comparison group ($n = 41$). Table 1 shows the characteristics of mothers. Mean mother age, average numbers of pregnancies, number of children, complications in pregnancy, and type of delivery were similar in the two groups (P > .05). Gestational age for all infants ranged from 26 to 36 weeks ($Mdn = 33$, $SD = 2.43$), and the birth weight ranged from 0.640 to 2.900 g/kg ($Mdn = 1.850$, $SD = 0.489$). The length of stay in the hospital for all infants ranged from 5 to 66 days ($Mdn = 17$, $SD = 13.98$), with no significant differences between the two groups. Infants' characteristics were comparable between the two groups (P > .05), with no significant differences in infant's weight, length, and head circumferences between the two groups at admission and the time of enrollment (Table 2).

A Mann-Whitney *U* test showed that there was a significant difference on weight gain on day 3 (U = 592.00, P = .003), day 4 (U = 570.50, P = .027), and day 5 (U = 421.00, P = .001) between infants in the intervention group and those in the comparison group. The median weight gain for the intervention group on days 3, 4 and 5 were higher compared to the median weight gain of infants receiving the standard care (Table 3).

Type of feeding was also significantly different among the two groups at the time of infant discharge. A low rate of exclusive breastfeeding was detected in both groups (6.3% in SSC Vs. 0.0% in the comparison group). However, mothers in the intervention group were less likely to use formula feeding (60% Vs. 90%) and more likely to use mixed feeding (33.3% Vs. 10%) at discharge than mothers in the comparison group. There was a significant decrease in the incidence of apnea among infants in the intervention group (P = .001) compared to those in the comparison group (48% Vs. 33.3%) (Table 4).

The results of the Chi-Square tests revealed that the infants' cry-sleep patterns varied between the two groups. Significant differences in the crying pattern for infants in the intervention group were found compared to infants in the comparison group on all five days. Infants of mothers who practiced SSC were less likely to cry in a continuous pattern than infants in the comparison group. Also, infants in the intervention group were more likely to have good quality sleep all five days than infants in the comparison group (Table 5).

Discussion

The results of this study showed a higher weight gain among the intervention group, which started to be manifest on days 3 to 5 of providing SSC. Newborns in the intervention group were less likely to use formula feeding and more likely to use mixed feeding at discharge. The incidence of apnea significantly decreased among newborns in the intervention group. Infants in the intervention group were less likely to cry in a continuous pattern and more likely to sleep better than

Table 2
Infants' characteristics.

Variables	Categories	SSC N = 48	Comparison group N = 41	P-values*
Gender of infant	Male	23 (47.9%)	19 (46.3%)	*.882*
	Female	25 (52.1%)	22 (53.7%)	
Active resuscitation at birth	No	5 (10.4%)	7 (17.5%)	*.335*
	Yes	43 (89.6%)	33 (82.5%)	
Gestational age of infant (in weeks), Mdn (±SD)		32 (2.48)	33 (2.41)	*.993*
Apgar score at birth		8 (2.06)	8 (2.06)	*.894*
Length of stay (in days), Mdn (± SD)		17.5 (15.44)	17.06 (12.12)	*.830*
Growth measurements:				
At enrolment, Mdn (±SD)	Weight (g/kg)	1.860 (0.506)	1.870 (0.344)	*.517*
	Length (cm)	44 (3.762)	44 (3.47)	*.727*
	Head circumference (cm)	30 (2.069)	31 (1.79)	*.395*

Mdn (SD): median (standards deviations).
* P value of <.05 is statistically significant.

Table 3
Infants' weight gains for 5 consecutive days compared to control group.

Variables	SSC Mdn (±SD)	Comparison group Mdn (±SD)	P-values*
Day 1	1.830 (0.409)	1.792 (0.328)	*.645*
Day 2	1.900 (0.415)	1.807 (0.372)	*.270*
Day 3	1.990 (0.471)	1.692 (0.293)	*.003*
Day 4	2.00 (0.438)	1.815 (0.350)	*.027*
Day 5	2.03 (0.430)	1.825 (0.363)	*.001*

Mdn (SD): median (standards deviations).
* P value of <.05 is statistically significant.

Table 5
Behavioral outcomes include observation of crying and sleeping patterns.

Variables	Categories	SSC	Comparison group	P-values*
Crying pattern				
Day 1	None	37 (77.1%)	20 (48.8%)	*.002*
	With painful stimuli	10 (20.8%)	11 (26.8%)	
	Continuous	1 (2.1%)	10 (24.4%)	
Day 2	None	24 (50.0%)	17 (41.5%)	*.005*
	With painful stimuli	22 (45.8%)	12 (29.3%)	
	Continuous	2 (4.2%)	12 (29.3%)	
Day 3	None	38 (79.2%)	18 (43.9%)	*.000*
	With painful stimuli	10 (20.8%)	15 (36.6%)	
	Continuous	0 (0.0%)	8 (19.5%)	
Day 4	None	39 (81.3%)	21 (51.2%)	*.007*
	With painful stimuli	9 (18.8%)	18 (43.9%)	
	Continuous	0 (0.0%)	2 (4.9%)	
Day 5	None	33 (68.8%)	19 (46.3%)	*.010*
	With painful stimuli	15 (31.3%)	16 (39.0%)	
	Continuous	0 (0.0%)	6 (14.6%)	
Sleeping pattern				
Day 1	Good	46 (95.8%)	30 (73.2%)	*.003*
	Poor	2 (4.2%)	11 (26.8%)	
Day 2	Good	46 (95.8%)	28 (68.3%)	*.001*
	Poor	2 (4.2%)	13 (31.7%)	
Day 3	Good	48 (100%)	29 (70.7%)	*.000*
	Poor	0 (0.0%)	12 (29.3%)	
Day 4	Good	48 (100%)	37 (90.2%)	*.027*
	Poor	0 (0.0%)	4 (9.8%)	
Day 5	Good	48 (100%)	37 (90.2%)	*.027*
	Poor	0 (0.0%)	4 (9.8%)	

* P value of <.05 is statistically significant.

infants in the comparison group. Since there were no significant differences between the two groups in relation to any variable before research enrollment, the application of the SSC method may have influenced these variables.

The initiation of SSC depends mainly on the infant's medical condition and the degree of prematurity; however, many studies showed that even extremely preterm infants could tolerate SSC during the first weeks of life with several advantages (Flacking et al., 2012; Ludington-Hoe, 2013; Maastrup et al., 2014). Our results documented a significant weight gain in the intervention group which started around the third day of providing intermittent SSC. This is consistent with many other studies that documented a better average daily weight gain for preterm infants in SSC groups compared to comparison groups (Acharya, Singh, Bhatta, & Poudel, 2014; Ludington-Hoe, 2013; Samra et al., 2013). However, our results added to the limited literature by testing short periods and durations of SSC, as it demonstrated that as little as 1 h for a few days could improve the infants' conditions. The literature suggests that there are sensitive periods during the maturation process of certain skills, in which even slight input has a great effect (Knudsen, 2004). The initiation of SSC in the first few days of life may have a major influence on the newborn's outcomes. Besides the short-term effects of this intervention, recent research provides evidence of the long-term effects of providing SSC for preterm infants, even if for short periods (Feldman et al., 2014).

Additionally, similar to others (Baley, 2015; Samra et al., 2013), our results support the positive effect of SSC on cry and sleep patterns and on decreasing the incidence of apnea. The SSC between infants and their mothers provides multisensory stimulation (Samra et al., 2013), which may explain our findings about these variables. The short and long-term consequences of crying on infants are well established in the literature (Ludington-Hoe, Cong, & Hashemi, 2002), which warrant the utilization of interventions that decrease infants' stress and crying, such as the SSC method. A previous study by Feldman et al. (2014) showed that providing SSC for an average of 1 h for two weeks resulted in a more organized long-term sleep-wake cycle.

Although our results documented a low rate of exclusive breastfeeding at discharge (6.3%), infants in the intervention group were more likely to be discharged with mixed feeding methods. The low rates of exclusive breastfeeding could be explained in light of a previous project that documented various inhibitive practices in supporting exclusive breastfeeding in some Jordanian NICUs (Shattnawi, 2015). While neonatal nurses recognized the importance of promoting exclusive breastfeeding for preterm infants, they reported barriers to do so, including heavy workload, time constraints, and staff shortage (Shattnawi, 2017). The institutional model of care observed at some NICUs generated task-oriented activities that hindered the support mothers could need to breastfeed or to express breast milk for their babies (Shattnawi, 2017). Also, the small number of SSC sessions provided for our sample may have limited the effect that this method could have had on breastfeeding promotion.

Implications for practice

The results of this study show that five days of at least 1 h of SSC were effective in improving weight, feeding, crying, and sleeping patterns of preterm infants. Therefore, mothers need to be encouraged and supported to provide SSC, along with the development of effective strategies for consistent and early implementation of SSC in NICUs.

Limitations

Despite the shortcomings of the quasi-experimental design used in this study, a quasi-experimental design is useful when randomization is not possible. In this study, we chose to use a quasi-experimental design because of the ethical implications of randomizing infants to receive or not receive an intervention shown in multiple studies (Chan et al., 2017; Disher et al., 2017; Johnston et al., 2017) to be beneficial

Table 4
Differences in the incidence of apnea and type of feeding between intervention and control group.

Variables	Categories	SSC	Comparison group	P values*
Incidence of apnea	No	48 (100.0%)	33 (80.5%)	*.001*
	Yes	0 (0.0%)	8 (19.5%)	
Feeding at discharge	Exclusive breastfeeding	3 (6.3%)	0 (0%)	*.006*
	Formula	29 (60.4%)	36 (90.0%)	
	Mixed	16 (33.3%)	4 (10%)	

* P value of <.05 is statistically significant.

to this population. Allowing mothers to self-select into group may have biased the results. However, it should be noted that at the time of commencing this study, the SSC was not practiced as part of the standard care in the NICU. Future research using true experimental design would be more rigorous and assist in controlling confounding variables.

Conclusion

While it is evident that SSC has numerous benefits for positive neonatal outcomes, findings also highlight the importance of the early initiation and short-term duration of this practice for preterm infants. This safe, low-cost intervention can prevent many complications accompanied by preterm birth and has the potential to provide benefits for both preterm and full-term newborns (Chan et al., 2017). The consistency of these findings across study settings and infant populations provides support for the widespread implementation of SSC as the standard of care for preterm and healthy newborns. For as little as an hour a day, which may have impacted weight gain, feeding, crying, and sleeping patterns of infants in this study. However, more research is needed to determine the ideal duration and frequency of this method, especially for preterm infants. Successful strategies based on evidence for SSC implementation should be designed and implemented in clinical practice.

Conflict of interest

Authors have no competing interests to declare.

Ethical approval

Both ethical approvals (reference number 6860 and IRB (reference number 26/94/2016) were obtained from Ministry of Health and Jordan University of Science and Technology respectively.

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CRediT authorship contribution statement

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