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Research Article

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Effect of Kangaroo Care on Physiological Measurements and Weight in Low Birth Weight Infants

Taghreed K Omar[1]*, Maha I Khalifa[2], Nagwa A Zein[3] and Doaa El-sayed Mohamed[4]

[1]*Emeritus Prof, Assist. Lecturer, Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt*

[2]*Prof. Lecturer, Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt*

[3]*Prof. Lecturer, Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt*

[4]*Assist. Lecturer, Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt*

***Corresponding author**

Taghreed k Omar, Emeritus prof, Assist. Lecturer, Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt. E-mail: taghreedson@yahoo.com

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Abstract

Low birth weight infants are highly vulnerable as they have to make several adjustments to achieve equilibrium in metabolic processes, circulation and breathing. Therefore, the aim of this study was to examine the effect of Kangaroo Care on physiological measurements and weight in Low birth weight infants. The study was conducted at the neonatal Intensive Care Units in Menoufia University hospital (Shebin El-Kom) and Mansheat Sultan village (Menoufia). The study sample was composed of sixty Low birth weight infants. A simple random sample was done to assign them into study and control groups (n=30). A quasi experimental design was used. The results of this study showed that low birth weight infants who attended kangaroo care sessions had better weight gain (2.06±0.21 Vs1.90±0.26), fewer duration of hospitalization (11.33+1.81Vs 15.57+2.81) and better physiological adjustments than low birth weight infants in the control group. Therefore, it was concluded that low birth weight infants who attended kangaroo care sessions had better physiological measurements, weight gain and shorter duration of hospitalization than low birth weight infants in the control group. It was recommended that kangaroo care sessions should be conducted at neonatal intensive care units.

Keywords: Kangaroo Care, Physiological Measurements, Weight, Low Birth Weight Infants.

Introduction

Low Birth Weight (LBW) is a major determinant of neonatal mortality and morbidity due to its long-term adverse consequences on health. Low Birth Weight infants are at greater risk for short and long term complications including disabilities, impairment in growth and mental development, cerebral palsy, sensory deficits, learning disabilities and respiratory illnesses compared with children born with normal birth weight [1]. The birth weight of an infant is the single most important determinant of his/her chance to survival with faster growth and development [2].

Low birth weight is directly associated with perinatal mortality. Therefore, it is essential to identify LBW early and give special attention to them [3]. LBW incidence varies among countries; it ranges from 4% to 6% in Western countries. It is much higher in developing countries. More than 95% of LBW infants are born in developing countries. In Egypt, the estimated percentage of LBW varied from 7% among full term pregnancies to a total estimate of 12% [4]. In 2014, a number of 54 out of 280 cases (18.9%) LBW infants were admitted at Menoufia University NICU at Shebin EL-kom Meanwhile, a number of 70 out of 650 (10.7%) were admitted at Manshiet Sultan NICU that follows Menoufia University hospital.

Low birth weight infants are liable to physiological aberrations. These physiological problems can lead to respiratory distress syndrome (RDS), increased risk of infection, hypoglycemia, problems with feeding, difficulty with keeping warmth and increased risk for major disability such as cerebral palsy and mental retardation [5]. However, they reflect poor adaptation to extra uterine environment and could lead to high mortality.

One of the main objectives of WHO was to reduce the neonatal mortality and incidence of neonatal low birth weight by two- thirds from 1990 to 2015. One of the three proven interventions for the reduction of neonatal mortality rates could be Kangaroo care [6]. Above all, limited research is done in this concern especially Egypt where neonatal deaths related to infection is high. Furthermore, mothers and physicians are reluctant to provide physical contact with neonates outside incubators due to their fear of possible transmission of infections and privacy. Thereby, neonates could be liable to impaired attachment and bonding, unable to benefit from breast feeding, liable to prolonged intervals of colic because of bottle feeding, prolonged hospitalization and higher hospital costs [7].

Subjects and Method

1. **The purpose of the study is:** To examine the effect of kangaroo care on physiological measurements and weight in low birth weight infants.
2. **Research design:** A quasi experimental design was used for this study.
3. **Research hypothesis:** Low birth weight infant who received kangaroo care would have better physiological measurements and increased weight gain than low birth weight infants receiving routine hospital care.
4. **Research settings:** This study was conducted in the NICUs in the following settings:

1. Menoufia University hospital at Shebin El-Kom city included one room. This room was for neonates having different diagnosis and contained eight incubators.
2. Menoufia University hospital at Mansheat Sultan village included three rooms. These three rooms were for neonates having different diagnosis. Each room of them contained four incubators.

Subject: Sixty low birth weight infants were selected. A simple random sample was done to assign neonates into study and control groups. A number of twenty five neonates were obtained from Menoufia University hospital at Shebin El-Kom. A number of thirty five neonates were from Menoufia University hospital at Mansheat Sultan. Their weights ranged from 1450g to 2000g. Their gestational ages were between 33 to 37 weeks.

Inclusion Criteria

Low birth weight infants who are medically stable as indicated by normal respiration, heart rate, temperature and O_2 saturation.

Exclusion Criteria

1. First 5 days of the birth of low birth weight infants who are less than 30 weeks of gestational age.
2. Low birth weights that have congenital heart disease, chromosomal aberrations, lung diseases and neurological abnormalities.
3. Low birth weights with umbilical lines or chest drains.
4. After major procedure or treatment (e.g. extubation, etc.).

6. Instruments of the study:

Three instruments were used for data collection:

Instrument one: Neonatal profile. It was a structured interview questionnaire. It was developed by the researcher after thorough reviewed literature to identify characteristics of low birth weight infant for both groups. It was divided into two parts.

Part one: It included questions about name, age, sex, and gestational age, and diagnosis, date of admission, date of discharge and length of hospital stay.

Part two: Nutrition assessment diary. It included type of feeding, frequency, amount per/hour and per/24 hour, constituents of formula feeding and type of IV fluids.

Instrument two: Physiological and weight assessment diary It was developed by Younis and modified by the researcher to assess respiration, pulse and temperature pre and post kangaroo care sessions [8]. Also, it included daily weight assessment for neonates in the two groups. It was divided into two parts.

Part one: Physiological assessment diary. It included a record for physiological measurements such as respiration, pulse and temperature for ten days.
Part two: Daily records for weight for ten days. It was plotted on percentiles curve.

Instrument three: A physical stability observational sheet. It was developed by Younis and modified by the researcher [8]. It was used to assess the physical stability of low birth weight infants and included three parts.

Part one: Physical stability assessment diary. It was used for low birth weight infants in the kangaroo care and control groups. It included a daily record for heart rate, respiratory rate, and O_2 saturation, apnea, crying and sleeping. Assessment was done during the 1st session up to the10th session.

Part two: Physical stability assessment diary. It was used to assess poor sucking, apnea, cyanosis, heart rate change and activity for both groups. It was daily used on the 1st day up to the10th day.
Part three: Mother's satisfaction of kangaroo care.
Extent of mother's satisfactions

Part three: Mother's satisfaction of kangaroo care.
Extent of mother's satisfactions

Level of mother's satisfaction	Score
Dissatisfied	0
Satisfied	1
Highly satisfied	2

Method:

1 Preparation of the work

A-Written Permission

An official permission to carry out the study was obtained from the director of each setting after submitting an official letter from the Dean of the Faculty of Nursing at EL-Menoufia University explaining the purposes of the study and method of data collection.

2 Instrument Developments

Instruments were developed by the researcher for data collection after a review of past and current literature, local and international related books, articles, periodicals and magazines.

Content validity and reliability

3-Validity: For validity assurance purpose, tools were reviewed by five experts in the field (three pediatric nursing experts and two pediatricians).

4- Reliability: The reliability of the instrument was computed using split-half method (r=0.88). This method was used to assess the homogeneity of the tool.

5- Protection of Human Rights: For ethical considerations, an oral consent was obtained from mothers to share in the study. Therefore, nature of the study, the objectives, its importance, safety

and confidentiality were explained. Mothers were informed about the privacy of their sessions and their right to withdraw at any time.

6- Pilot Study: A Pilot study was carried out on six low birth weight infants (10% of the sample) to test the clarity and applicability of the tools. No modifications were done. The pilot study sample was included in the total sample of the study.

7- Data Collection (assessment phase): Data collection was started on May 1, 2014 and lasted until October 2014. It was conducted daily. Data about characteristics and nutrition were obtained from neonatal records. Data about physiological assessment, weight assessment, physiological and physical stability were collected daily for 10 days.

8- Preparation for kangaroo care session: An appointment for sessions was held with mothers before kangaroo care, each mother was advised to bring a drink, go to the toilet, change top clothes and wear a hospital gown with a front opening. Also, health education was provided about the possibility for changes in neonates vital signs during the transfer and the vital signs will return to normal within 15-20 minutes. If vital signs did not return, this could mean intolerance to kangaroo care. However, this would necessitate the return of newborn to the incubator.

For each neonate, it was necessary to suction mouth or nose if necessary, secure all tubes and lines (e.g. pulse oximetry, IV fluids, etc). Any required care was provided prior kangaroo care sessions to avoid interruption. Also, oxygen saturation, respiratory rate, heart rate and temperature were assessed before and 15 minutes after the transfer of neonate from incubator to mother.

9- Conducting kangaroo care sessions: Each newborn infant received kangaroo care sessions for ten days. Each session lasted from 1-2 hours. They were conducted during the afternoon shifts. Each mother conducted kangaroo care sessions separately. Almost 2- 4 mothers were expected to conduct the sessions daily. During the session, each mother had to use two comfortable chairs to extend her legs and recline her back. Newborns were placed with their skin in touch with mother's chest skin. Neonates were only wearing pampers. They were kept inclined at about 30-50 degrees horizontally. Each neonate was put upright between mother's breasts. Neonates had to be facing their mothers. A blanket was put on the back of neonates to protect them from air drafts. Neonates were carried and received gently.

10- Reassessment phase: After each session, each neonate was reassessed for vital signs, O_2 saturation, physical and physiological stability.

Data analysis

Statistical analysis and data management: The collected data were analyzed using SPSS (Statistical Package of Social Sciences) version 16. Qualitative data were expressed in the form of number and percentage (No & %) and were analyzed using Chi square test ($\chi 2$ test). Quantitative data were expressed in the form of mean and standard deviation (Mean± SD) and were analyzed using student t-test. For comparison of the same group before and after caring, Paired t- test was used. Differences was considered significant at P-value<0.05.

Results

Table 1: showed distribution of infants with low birth weight in the study and control groups according to their sex, Apgar score and diagnosis on admission. The majority of neonates in the two groups had Apgar score 7(50.0% Vs %56.7%) or 8 (30.0% Vs 20.0%). However, there were no statistical significant differences between the study and control groups at 5% level of statistical significance.

Figure 1: illustrated mean and standard deviations of gestational age, neonatal age/day and duration of hospitalization of neonates in the study and control groups. Although there were no statistical significant differences between gestational and neonatal ages of neonates in the study and control groups, there was a highly statistical significant difference between their duration of hospitalization (11.33±1.81 Vs 15.57±2.81) at 1% level of statistical significance.

Table 2: illustrated mean and standard deviation of neonatal weights in the study and control groups on admission and discharge. Although there were no statistical significant differences between weights of neonates on admission, there was a statistical significant difference at 5% between means of their weights in the discharge (2.06±0.21 Vs 1.94±0.26).

Figure 2: showed distribution of neonates in the study and control group according to their weight percentile on the first and last session. Neonates in the study group had higher weight percentiles than neonates in the control group on the last session. Therefore, there was a highly statistical significant difference at 1% level of statistical significance.

Table 3: clarified means of physiological measurements of neonates in the study and control groups before 1st session, after 6th and 10th session. Before 1st session, there were no statistical significant differences between physiological measurements of neonates in the study and control groups at 5% level of statistical significance. After 6 sessions, neonates in the study group had lower heart and respiratory rates (128.2±4.39 Vs 149.5±8.84 and 37.9±4.47 Vs 51.3±8.11). As well, neonates in the study group had lower heart and respiratory rates than neonates in the control group after 10 sessions. For this reason, there were highly statistical significant differences at 1% and 5% levels of statistical significance.

Table 4: Clarified comparison between mean and standard deviations of heart rate, respiratory rate and O_2 saturation of neonates with low birth weight in the study and control groups during first, six and ten sessions. Neonates in the study group showed lower heart (137.17±6.73 Vs 152.2±9.00, 128.7±5.11 Vs 150.5±9.78 and 127.8±3.29 Vs 147.11±8.23) and respiratory rates than neonates in the control group. Meanwhile, they had higher O_2 saturation than neonates in the control group (99.4±0.77 Vs 96.17±1.99, 99.96±0.18 Vs 96.17±247 and 100±0.0 Vs 96.48±2.47). Therefore, there were statistical significant differences at 1% level of statistical significance.

Table 5: represented Physical stability of neonates in the study and control groups during the 1st, 6th and 10th sessions. In the study group, apnea was absent, crying stopped and neonates had deep sleeping. While in the control group, 3.3%

Of neonates had apnea, 96.7% had usual day crying and 93.4% had light sleep during the 1st session. Also, 13.3% of neonates had apnea, 93.4% had usual day crying and 93.4% had light sleep

during the 6th session. While 7.1% of neonates had apnea, 96.4% had usual day crying and 92.9 had light sleep during the 10th Session. Therefore, there were statistical significant differences between study and control groups for crying and sleeping at 1% level of statistical significance.

Table 6: Clarified clinical manifestations of distress in the study and control groups within the 1st, 6th and10th sessions. In the study group, poor suckling was in 50% of neonates, apnea was absent and change of heart rate was present in 20% in the 1st session. In other words, there were no statistical significant differences between study and control groups. Regards 6th session, poor suckling, apnea and change of heart rate were almost absent and 100% of neonates had active movement. While in the 10th session, poor suckling, apnea, and change of heart rate were absent and 100% of neonates had active movement. On the other hand, 73.3% of neonates had some flexion in the control group, more than half of neonates had poor suckling, and apnea changes in heart rate were in 3.3% and 16.7% respectively within the 1st session. While in the 6th session, neonates showed more manifestations of distress and in the 10th session, 7.2% of neonates had poor suckling, 3.6% had apnea and changes of heart rate while 53.6% had some flexion. Therefore, there were statistical significant differences between study and control groups at 1% level of statistical significance.

Figure 3: showed that the majority of mothers (93.3%) were satisfied with this experience of kangaroo care.

Table 1: Distribution of low birth weight infants in the study and control groups according to their sex, Apgar score and diagnosis on admission

Variables		Study group N=30		Control group N=30		P-value	X2
		No	%	No	%		
Sex	Male	15	50.0	17	56.7	o.27	0.61
	Female	15	50.0	13	43.3		
Apgar score	6	6	20.0	7	23	0.67	0.80
	7	15	50.0	17	56.7		
	8	9	30.0	6	20.0		
Diagnosis on admission	Low birth weight and RDS	17	56.7	12	40.0	0.19	1.67
	Low birth weight, RDS and jaundice	13	43.3	18	60.0		

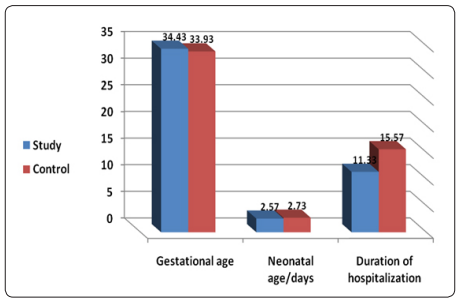

Figure 1: Mean and standard deviations of gestational age, neonatal age/day and duration of hospitalization of neonates in the study and control groups.

Table 2: Mean and standard deviation of neonatal weights in the study and control groups on admission and discharge

Weighing Time	Study group (X± SD)	Control group (X± SD)	t-test	P- value
Admission	1.93±0.23	1.91±0.27	0.21	0.84 ns
Discharge	2.06±0.21	1.94±0.26	2.09	0.04*

Ns **P > 0.05 * P<.05**

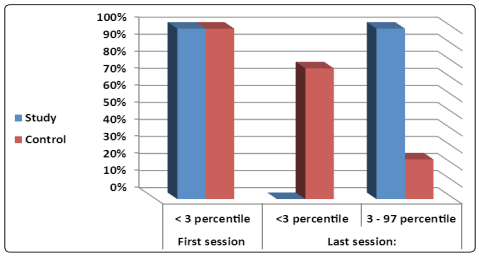

Table 3: Means and standard deviations of physiological measurements of neonates in the study and control groups before 1st session, after 6th and 10th sessions

Physiological measurements	Study X± SD	Control (X± SD)	t-test	P-value
Before 1st session				
• Temperature	36.88± 0.72	36.57± 0.63	1.77	0.08 ns
• Heart rate	150.4± 6.25	151.9± 9.67	0.73	0.47 ns
• Respiratory	55.9± 6.7	56.23±10.84	0.13	0.90 ns
After 6th session				
• Temperature	37.03± 0.36	36.84± 0.47	1.75	0.96 ns
• Heart rate	128.2± 4.39	149.5± 8.84	7.93	<0.001
• Respiratory rate	37.9± 4.47	51.3± 8.11	11.82	<0.001
After 10 session				
• Temperature	37.23± 0.07	37.02± 0.57	2.09	0.07 ns
• Heart rate	127.8± 3.29	147.04± 8.13	7.47	<0.001
• Respiratory rate	32.1± 10.38	49.46± 13.83	3.97	0.003

Ns **P > 0.05**

Table 4: mean and standard deviations of heart rate, respiratory rate and O_2 saturation of neonates with low birth weight in the study and control groups during 1st, 6th and 10th sessions

Physiological signs	Study (X± SD)	Control (X± SD)	t-test	P value
During 1st session				
• Heart rate	137.17± 6.73	152.2± 9.00	7.38	<0.001
• Respiratory rate	42.5± 5.54	54.75± 9.8	5.91	<0.001
• O_2 saturation	99.4± 0.77	96.17±1.99	8.33	<0.001
During 6th session				
• Heart rate	128.7± 5.11	150.5± 9.78	10.32	<0.001
• Respiratory rate	37.03± 3.33	50.61± 7.33	6.67	<0.001
• O_2 saturation	99.96± 0.18	96.17± 247	7.54	<0.001
During 10th session				
• Heart rate	127.8± 3.29	147.11± 8.23	10.32	<0.001
• Heart rate	35± 1.49	46.78± 9.02	6.67	0.001
• Respiratory rate	100± 0.0	96.48± 2.47	7.54	<0.001

Table 5: Physical stability of neonates in the study and control groups during the 1st, 6th and 10th sessions

		Study group N=30		Control group N=30		X2	Study group N=30		Control Group N=30		X2	Study Group N=10		Control Group N=28		X2
		1st session					6th session					10th session				
		No	%	No	%		No	%	No	%		No	%	No	%	
Apnea	Absent	30	100	29	96.7	1.02	30	100	26	86.7	1.02	10	100	26	92.9	0.75
	Present	0	0	1	3.3		0	0	4	13.3		0	0	2	7.1	
Crying	Stop crying	30	100	0	0	60.0	30	100	0	0	60.0	10	100	1	3.6	33.31
	Usual day crying	0	0	29	96.7		0	0	28	93.4		0	0	27	96.4	
	No response	0	0	1	3.3		0	0	2	6.6		0	0	0	0	
Sleeping	Drowsiness	0	0	2	6.6	60.0	0	0	2	6.6	40.0	0	0	0	0	29.41
	Light sleep	0	0	28	93.4		0	0	28	93.4		0	0	26	92.9	
	Deep sleep	30	100	0	0		30	100	0	0		10	100	2	7.1	

ns P > 0.05

Table 6: Clinical manifestations of distress in the study and control groups within the 1st, 6th and 10th sessions

		Study group N=30		Control group N=30		X2	Study group N=30		Control Group N=30		X2	Study Group N=10		Control Group N=28		X2
		1st session					6th session					10th session				
		No	%	No	%		No	%	No	%		No	%	No	%	
Poor suckling	Present	15	50	16	53.3	0.07	0	0	6	20	6.67	0	0	2	7.2	0.75
	Absent	15	50	14	46.7		30	100	24	80		10	100	26	92.8	
Apnea	Yes	0	0	1	3.3	1.02	30	100	0	0	3.16	0	0	1	3.6	0.36
	No	0	0	29	96.7		0	0	28	93.4		10	100	27	96.4	
Changes of HR	Present	6	20	5	16.7	0.11	0	0	2	6.7	2.07	0	0	1	3.6	0.36
	Absent	0	0	2	6.6		30	100	28	93.3		10	100	27	96.4	
Activity	Limp	6	20	5	16.7	0.29	0	0	2	6.7	37.29	0	0	0	0	8.85
	Some flexion	22	73.3	22	73.3		0	0	21	70		0	0	15	53.6	
	Active movement	2	6.7	3	10		30	100	7	23.3		10	100	13	46.4	

Ns P > 0.05

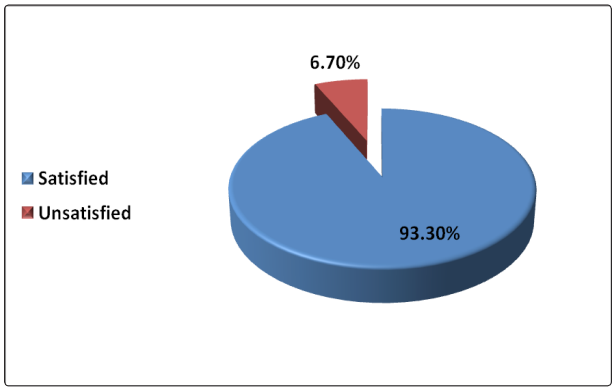

Figure 3: Number and Percentage distribution of mothers' response regarding Kangaroo care sessions.

Discussion

This study is a quasi experimental study, which hypothesized that if low birth weight infant received Kangaroo care they would have better physiological measurements and increased weight gain than Low birth weight infants receiving routine hospital care. In the context of promotion of neonatal care that is provided at NICUs. This study examined the influence on providing kangaroo care on neonates' weights, duration of hospitalization, physiological measurements (temperature, heart and respiratory rates), O_2 saturation, apnea, crying, sleeping, suckling, activity and maternal satisfaction.

Accordingly, the significant findings of this study will be discussed. Therefore, the relationships between kangaroo care and previously mentioned dependent variables will be the basis of discussion.

Regarding characteristics of neonates, the present study revealed that there were no statistical significant differences between the study and control groups at 5% level of statistical significance. This could reveal the homogeneity of neonates in the study and control groups. Thereby, there was lack of bias due to the control of differences in unwanted variables (different Apgar score on admission and diagnosis).

Concerning hospitalization of low birth weight infants, low birth weights in the study group had fewer durations of hospitalization compared to control group. These results were consistent with Nagai et al., Who conducted a study about "The Newborn Individualized Developmental Care and Assessment Program (NIDCAP) With Kangaroo Mother Care (KMC): Comprehensive Care for Preterm Infants" [9]. Also, Ramanthan et al., in their study about "Kangaroo Mother Care in Very Low Birth infants" found that neonates who received kangaroo care were discharged earlier than neonates who did not [10].

According to weights of neonates in the study and control groups, although there was no statistical significant difference between them on admission, neonates in the study group had better weight gains afterwards. Therefore, there were statistical significant differences between weights of neonates in the study and control groups upon discharge. This could be attributed to better emotional satisfaction, prolonged periods of deep sleeping and health promotion as evidenced by higher and more stable body temperature, lower heart and respiratory rates.

In other words, reduced basal metabolic rate could have promoted the secretion of growth hormone, which consequently might cause weight gain. This result came in agreement with Juan et al., in a study about "kangaroo mother care initiative" and Ramanthan et al., who found that neonates in the study group had significant increase in weight than neonates in the control group [10, 11].

Regarding physiological measurements (temperature, heart and respiratory rates) of neonates in the study group, before and after ten kangaroo care sessions, the present study showed that after ten kangaroo care sessions, there was an obvious increase in mean temperature and decline in means of heart and respiratory rates. This could be attributed to neurophysiologic organization and an indirect effect by improving parental mood, perception and interactive behavior.

This finding was consistent with Benoit et al., in their study about "Trial of Repeated Analgesia with Kangaroo Mother Care (TRAKC Trial)" [12]. The study revealed that the heart rate, respiratory rate and pain scores (behavior and facial) were significantly lower after conducting kangaroo care session than before sessions. Consistently Windstorm et al., in a study done about ''Towards Universal Kangaroo Mother Care: Recommendations and Report from the First European Conference and Seventh International Workshop on Kangaroo Mother Care'' concluded that kangaroo care enhanced the physiological stability of neonates (temperature, pulse and respiration) and reduced pain sensation during and after kangaroo care sessions [13].

Concerning physiological measurements (temperature, heart and respiratory rates) of neonates in the study group, before and after six kangaroo care sessions, the present study showed that after six kangaroo care sessions, there was an obvious increase in mean temperature and decline in means of heart and respiratory rates. Therefore, many neonates had early discharge from the hospital after conducting six sessions. This could be attributed to kangaroo care that has a positive effect on the development of the immune system, on temperature regulation and on the stability of heart and breathing rates.

Another positive effect is the impact of kangaroo care on sleeping without breathing apnea interruptions. These results were in agreement Anne et al., in the study about ''Measuring Implementation Progress in Kangaroo Mother Care'' [14].The study concluded that the heart and respiratory rates were significantly decreased and body temperature was significantly elevated during and after kangaroo care sessions. In the same line Vivian et al., in their study " Safety of Kangaroo Mother Care in Intubated Neonates Under 1500g " concluded that the dependent variables'' heart rate and respiratory rate'' were statistically significantly decreased between the kangaroo care group ($P<.05$) whereas, there was no statistical significant elevation in mean temperature [15].

Furthermore Kadam et al., in a study about " Feasibility of Kangaroo Mother Care in Mumbai" reported that there was a significant reduction in episodes of hypothermia between neonates who had kangaroo care sessions than neonates who did not receive these sessions [16]. Also, they noticed a significant reduction in rates of heart and respiration compared to neonates in the control group Arzani et al., Clarified that the infants in the control group were usually separated from their mothers immediately and were transferred to neonatal intensive care unit [17]. This separation could affect their respiratory, heart rate and body temperature as it prevented them from the benefits of skin-to-skin contact.

Regarding Means and standard deviations of heart rate, respiratory rate and O_2 saturation of neonates with low birth weight in the study group during the 1st, 6th and 10th sessions, and the present study illustrated that during the 6th and 10th session neonates had lower heart and respiratory rates and higher O_2 saturation than during the 1st session. This finding was similar to Davanzo & Bedri who found that levels of O_2 saturation increased significantly after conducting kangaroo care sessions [18]. Besides Rozin &Weller Mentioned that kangaroo care was beneficial in stabilizing cardio-respiratory system, thermoregulation and improving infants' oxygen saturation and significantly reducing their oxygen requirements during the skin-to-skin contact [19].

In addition, the present study showed that neonates in the study group had lower heart and respiratory rates than neonates in the control group. Meanwhile, they had higher O_2 saturation than neonates in the control group. This was attributed to kangaroo care could have provided warmth which decreased the need for energy and oxygen. Thus, it caused improvement in temperature, respiration, heart rate and O_2 saturation.

However, this finding was similar to Palaez who conducted a study about" State of the Art and Recommendations Kangaroo Mother Care: Application in a High Tech Environment" [20]. The study identified that skin-to-skin contact on mother's chest promoted thermal regulation, heart and respiratory rate and elevated O_2 saturation. Tessier & Cristo reported that the kangaroo mother care enhanced bonding and attachment, infants' physiological stability

and increased O_2 saturation during sessions. Perhaps, this was due to minimizing the separation between the infant and parents [21].

On the other hand, this finding was inconsistent with a study done by Phatak Who found that there was no statistical significant difference in oxygen saturation between kangaroo care and control group [22]. This could be attributed to the fewer sessions of kangaroo care.

Also, it was noted that neonates in the study group had fewer apnea episodes, fewer crying and more prolonged deep sleeping during sessions. These findings agreed with Austin & Sullivan in a study about "A Comparison of Kangaroo Mother Care and Conventional Incubator Care for Thermal Regulation of Infants≤ 2000 g in Nigeria Using Continuous Ambulatory Temperature Monitoring" [23]. The study revealed that kangaroo care group developed more prolonged duration of sleeping and fewer crying episodes.

Besides, Heyns & Warren added in their study "Nosocomial Transmission of Mycobacterium tuberculosis in Kangaroo Mother Care Units"that the risk of apnea in a kangaroo care group was reduced [24]. Sloan et al., Also in their study which was entitled '' Kangaroo Mother Method: Randomized Controlled Trial of an Alternative Method of Care for Stabilized Low-Birth Weight Infants'' illustrated that neonates in kangaroo care group experienced lower episodes of Lower- respiratory-tract disorders, apnea and aspiration than neonates in the control group [25]. Besides, they had more prolonged periods of deep sleeping and fewer crying attacks.

Moreover, the present study revealed that the neonates in the study group had better suckling and were more active (active movements) than neonates in the control group. This finding was supported by Ahmed et al., who concluded that neonates who received kangaroo care (KMC) intervention had more active movement, improved suckling reflex and earlier discharge'' than neonates who did not [26]. On the other hand, this finding did not agree with Johnston & Filion who mentioned that there was no difference between levels of activity of children who were exposed to kangaroo care and control group (P=0.2) [27].

Regarding maternal satisfaction of Kangaroo care sessions, the present study showed that the majority of mothers were satisfied from the experience of kangaroo care sessions. This finding was consistent with Dilen & Elservier Who also concluded that mothers had positive experience with Kangaroo care method [28]. According to Arzani et al., This could be attributed to their high levels of self-esteem, feelings of peace, merit and ability in motherhood that were associated with this experience [17].

Conclusion

Based on the findings of the present study the following is concluded: Low birth weight infants who attended Kangaroo care sessions had better physiological measurements, more weight gain and shorter duration of hospitalization than neonates who did not attend kangaroo care sessions

Recommendations

1. Kangaroo care should be integrated as a part of routine daily care for low birth weight infants at NICUs.
2. In each neonatal intensive care unit, there should be a specially prepared private part for conducting kangaroo care sessions.
3. Nurses should provide mothers with necessary aprons ensure a relaxing and comforting atmosphere before conducting kangaroo care sessions as well as provide mothers with all needed care.
4. This current study needs to be applied on a larger sample to ensure the generalization of the results.

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