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Original Article

The Effect of Kangaroo Mother Care Intervention on the Newborns Health Outcome Delivers at Sulaymaniyah Maternity Teaching Hospital

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ABSTRACT

Background and Objectives: Kangaroo mother care is an intervention for all newborns but especially for premature and low birth weight infants. The method involves babies being carried, usually by the mother, with skin-to-skin contact. It is the most achievable way for decreasing neonatal morbidity and mortality and is practical, inexpensive especially for developing countries. This study intended to assess the effect of kangaroo mother care on the newborns' health outcome at Sulaymaniyah Maternity Teaching Hospital in Sulaymaniyah, Kurdistan Region, Iraq.
Methods: A quasi-experimental, pre-post intervention study was conducted in the Neonatal Intensive Care Unit and Baby Friend Unit of the hospital. One hundred newborn-mother pairs participated in the Kangaroo mother care procedure. The newborns were physiologically monitored before, in the middle and after the procedure.
Result: The highest mean of newborn temperature was 37°C after Kangaroo mother care in the visit three and the lowest mean temperature was 36.1°C before Kangaroo mother care. There were statistically significant differences between the before, middle and after-procedure measurements in temperature, heart rate and respiratory rate (p-value <0.05) on all three visits, while there was no significant difference between the means of the oxygen saturation at all three visits (p-value was more than the standard alpha 0.05 F-test=0.961). There was a highly significant association between oxygen saturation and newborn birth weight and gestational age. Individual vital signs abnormalities were often corrected during the Kangaroo mother care sessions. Newborns involved in the procedure showed steady and statistically significant improvement in vital physiological parameters during three sessions on all three days.
Conclusion: Majority of babies who received Kangaroo mother care showed significant improvement in vital physiological parameters on all three days without using special equipment showing that this strategy can offer improved care to newborn infants. These findings support wider implementation of this strategy.
Keywords: Kangaroo, mother, care, newborn, health, outcome, effects

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INTRODUCTION

Kangaroo mother care (KMC) was first initiated in Colombia in 1978 [1]. The method involves babies being carried on the chest, usually by the mother, with skin-to-skin contact (SSC). SCS is a specially designed form of KMC which influences the physical and psychological development and the health of an infant over the first years of life and provides neurological, autonomic, somatic, behavioural, and motor development benefits. KMC can be applied after birth for maximal effect and can continue to be implemented through the first years of life. Many factors are connected with an infant's growth and development, as well as the initiation and practising of KMC. [2]. The procedure of KMC between the mother and the baby is a secure and economical procedure that has proven advantages for mothers and children in comparison to an incubator caring method. It plays a symbolic role in infant survival, neurodevelopment, and the quality of mother-infant bonding. KMC balances good essence care and helps providers to ration the use of expensive basics such as warmers and incubators for all newborn babies especially pre-term and those with a low-birth-weight (LBW). Skin-to-skin bonding between the mother and her infant reduces maternal postpartum, depressive symptoms and improves autonomy [3].The KMC is done in three stages, the first and second one are performed in the hospital and the third in the family setting. The first stage is practised at the Intensive Care Unit (ICU) facilitating the bonding of the parents with the baby and positioning of the newborn. The second stage occurs in the Kangaroo nursery/unit, where the mother actively co-operates in the care of her child under the supervision of the health team. The third stage occurs after discharge at home where the baby should remain in the kangaroo position most of the day [4].The birth of a premature baby is an extremely stressful situation for parents, producing feelings of fear and insecurity. Therefore, the newborn-mother relationship is essential. KMC for pre-term babies is always related to better cognitive and motor development at six months of age. In addition to neonatal and maternal health outcomes, KMC is an essential tool in reducing the postpartum hospital stay and overall healthcare expense. It provides economic profit to the parents, as pre-term and LBW babies who were given KMC require less time for hospitalization [5]. The World Health Organization (WHO) supported study in Nepal, which showed that hypothermia was common in newborn infants early after birth; increased mortality was noted across all ranges of hypothermia, and the risk was 12 times greater among pre-term babies. [6]. KMC is a practical, inexpensive intervention, for developing countries. It implies putting the newborn baby in intimate skin-to-skin contact with the mother's chest and abdomen with repeated and preferably unique breastfeeding. This is similar to caring for a surrogate, where the premature baby is kept warm in the mother's bag and near to the breasts for unlimited feeding. KMC has emerged as a non-conventional low-cost method that provides warmth, touch, and security to the newborn and is believed to have a significant survival benefit. A recent Cochrane study reported that KMC improves breastfeeding outcomes and cardio -respiratory stability in infants without adverse effects [7]. A quasi-experimental study at Hawler Maternity Teaching Hospital in Erbil, Iraq from February to May 2017 showed that 48% of mothers who received SSC and 46% with routine care had successful breastfeeding. Newborns who received SSC initiated breastfeeding within 2.41 ± 1.38 (M ± SD) minutes after birth, however, newborns who received routine care started breastfeeding in 5.48 ± 5.7 (M ± SD) minutes. [8]Moreover, the prevalence of hypothermia in the newborns who received SSC and routine care was 2 and 42% respectively. This study was conducted to assess the effect of KMC on the newborns' physiological parameters as there has been no research on this subject in the Sulaymaniyah province

METHODS

A quasi-experimental, pre-post intervention design was used in this study at Sulaymaniyah Maternity Teaching Hospital in Sulaymaniyah in the Kurdistan Region of Iraq. All mothers of newborn babies in the Neonatal Intensive Care Unit (NICU) and Baby Friend Unit (BFU) were asked to participate in this study. A purposive non-probability sample of one hundred newborn-mother pairs was recruited to participate in the study. The study data were collected from all NICU newborn babies. The mothers were interviewed before KMC and monitored with newborns during KMC procedures in the period between the 8th of January 2019 and the 28th of May 2019. The researchers were trained for a month about KMC as preparation for data collection.The research tool included a field-tested questionnaire about the mother and their newborn demographic information. Direct monitoring and documentation were done in the NICU and BFU. The data collection tool was prepared in English and translated to the Kurdish language to be used for the mothers' interview. The council of the College of Medicine number 4 accepted protocol of the study on the 7th of February 2019, which was also approved by the ethical committee of the College of Nursing at University of Sulaymaniyah. An official letter from the College of Nursing at the University of Sulaymaniyah was sent to the Maternity Teaching Hospitals in Sulaymaniya to obtain facilitation and cooperation during data collection of this study from the 13th of November 2018.Data were collected through direct structured interview of postnatal mothers using a questionnaire. The study questionnaire consisted of three parts, as follows: Part one included four questions about neonatal demography and medical history: gestational age (weeks), birth weight (grams), gender and feeding type. The standard classification of both gestational age and birth weight was used: **Gestational age (9)**

< 28 weeks
Extremely pre-term
28 to less than32 Weeks
Very pre-term
32 to less than 37 Weeks
Moderate to late pre-term
37 to less than 40 Weeks
Full-term
 weeks
Post-term

Newborn Birth weight/gram (10)

<1500
Extremely low birth weight(ELBW)
1500 to less than 2000
Very low birth weight(VLBW)
2000 to less than 2500
Low birth weight(LBW)
2500 to less than 3500
Normal weight (NW)
3500
Overweight(OW)

Regarding age and birth weight as follow re, Heart rate, respiratory rate and Oxygen saturation) **Part two** contained maternal demographic information such as age, education level, occupation, residency, employment and parity.

Part three included the monitoring of physiological parameters, such as body temperature, heart rate, respiratory rate, and oxygen saturation of newborns before and after the demonstration of KMC. The purpose of the study was clearly explained to all the postnatal mothers and relatives, and their verbal consent was obtained before filling the questionnaire. The KMC custom-made was applied on the mother's bare chest, with newborns wearing only a diaper for at least 30 minutes with covering the baby head, back and feet to avoid hypothermia. For implementing KMC, mothers were asked to use any front-opening light dress. Babies were dressed in a cap, socks, and nappy and no other garments. After placing into KMC bag, the baby was placed upright inside mother's clothing against the bare skin of the chest and abdomen. Head was turned to one side and placed in a slightly extended position, and eye-to-eye contact between mother and baby was encouraged. The hips were kept flexed and abducted in a ' frog' position; the arms were also flexed. The baby was allowed to suck on the breast as often as it wanted. The newborns were physiologically monitored before the KMC, in the middle, and after the procedure for consecutive three days in three sessions. Four vital physiological parameters of the newborns, such as axillary temperature, respiration rate (RR/ min), heart rate (HR/ min), and oxygen saturation (SpO2) were assessed, monitored and recorded. An axillary temperature was taken in °C by a digital thermometer. Respiration rate was assessed by observing chest movements for a full one minute. The heart rate and oxygen saturation were monitored by the pulse-oximeter. All mothers of newborns including full-term, pre-term babies, low birth weight babies, and postmature babies were trained about KMC. Newborns on Continuous Positive Airway Pressure (CPAP) and unwilling mothers were excluded from participation in the study. All statistical computation was enhanced using the statistical method software SPSS 21. The data were coded, tabulated, and presented in a descriptive form. The statistical procedures that were applied to determine the results of the present study included:

1. Alpha-Cronbach has been used for testing the reliability of the questionnaire.
2. Descriptive statistical data analysis (newborn demographic characteristics and mother demographic characteristics)
3. Inferential data analysis:
A. One sample t-test
B. Independent samples t-test
C-Parried samples t-test
D-One way ANOVA (F-test)
Reliability of Questionnaire

RESULTS

It can be seen in Table 1 that the Alpha Cronbach measure was used to get the result of the reliability of the questionnaire. As a result, the value of Alpha Cronbach equalled to 0.896, and the validity was 0.803 showing the high reliability of the questionnaire.

Table 1: Reliability and Validity

Methods	Result
Alpha Cronbach	0.896
Validity	0.803

Table 2 demonstrates that 36% of the newborns were full-term and post-term in gestation age (the highest rate among all levels of gestational age) followed by 19% of moderate and late pre-term (9%). Regarding the birth weight, more than half of newborns (51%) had normal weight (2500 - 3500gms) followed by 18% of low birth weight infants (2000 - 2500gms). The majority of the newborns were male reaching 60% of the total. Regarding the feeding type, 46% of newborns were bottle-fed, which was the highest percentage among all the feeding types, 24% were breastfed, and only 3% were on the nasogastric tube (NGT) feeding. Table 3 indicates that out of 100 mothers, 51% were between 20 – 30 years of age. The second-largest group of mothers were 30 to 40 years old (40%). Most of the participants (63%) lived in urban areas. Regarding educational level, the data showed that 26% of mothers had a secondary level of education and 24% were educated at higher education institutions. The most frequent occupation was being a housewife (83%). Among the study participants, 57% of the mothers' parity was low multipara , which represented the highest frequency among all levels of

Table 2: Distribution of the newborns' demographic characteristics

Characteristics		Frequency	Percent
Gestational age/week			
< 28 weeks	Extremely pre-term	0	(0)
28 to less than32 W	Very pre-term	9	(9)
32 to less than 37 W	Moderate to late pre-term	19	(19)
37 to less than 40 W	Full-term	36	(36)
> 40 weeks	Post-term	36	(36)
Total		100	(100)
Birth weight (grams)			
< 1500	Extremely low birth weight (ELBW)	7	(7)
1500 to less than 2000	Very low birth weight (VLBW)	8	(8)
2000 to less than 2500	Low birth weight(LBW)	18	(18)
2500 to less than 3500	Normal weight (NW)	51	(51)
≥ 3500	Overweight (OW)	16	(16)
Total		100	(100)
Gender			
Male		60	(60)
Female		40	(40)
Total		100	(100)
Feeding type			
Breastfeeding		24	(24)
Bottle feeding		46	(46)
Mixed feeding		9	(9)
NGT (nasogastric tube)		3	(3)
NPO (nothing per oral)		18	(18)
	Total	100	(100)

Table 3: Distribution of the mothers' demographic characteristics

Characteristic	Frequency	Percent
Mother age/ years		
Less than 20	6	(6)
20 – 30	51	(51)
30 – 40	40	(40)
More than 40	3	(3)
Total	100	(100)
Residency		
Rural	11	(11)
Urban	63	(63)
Suburban	26	(26)
Total	100	(100)
Level of education		
Illiterate	17	(17)
Read & write	16	(16)
Secondary educated	26	(26)
Preparatory educated	17	(17)
Higher education	24	(24)
Total	100	(100)
Employment		
Employed	17	(17)
Housewife	83	(83)
Total	100	(100)
Parity		
Primipara	29	(29)
Low multipara (1-3)	57	(57)
Grand multipara (4-8)	14	(14)
Total	100	(100)

Table 4 shows the means of the physiological parameters of the whole sample. There were highly statistically significant differences in means between the before, middle and after KMC measurements in temperature, heart rate and respiratory rate at all three visits (P< 0.05). The highest mean of temperature (37˚C after KMC) was at Visit 3 and the lowest mean (36.1˚ C before KMC) was recorded at Visit 1. There were no statistically significant differences between the means of the oxygen saturation at Visit 1 (p=0.088), Visit 2 (p=0.721) and Visit 3 (p=0.384) because the result of the p-value was more than the standard alpha 0.05.Table 5 shows the association between gestational age and temperature at all three visits(before KMC, in the middle of KMC, after KMC). There were statistically significant differences between gestational age and temperature because the p-values were less than the standard alpha 0.05 by using ANOVA table (F-test). The Mean ± SD of temperature (Visit 3 after KMC) in full-term and post-term newborns was 36.9 ± 0.18, which was the highest value of the mean. Furthermore, the mean ± S.D in at Visit 1 in very pre-term infants was 35.6 °C ± 0.72, which was the lowest value of the mean.Table 6 shows the association between gestational age and heart rate. Data show that there was a statistically significant difference between gestational age and heart rate (during and after KMC (p=0.01). In contrast, the data from Visit 1 (p= 0.22), Visit 2 (p=0.165), and Visit 3 (p=0.645),(all visits, p=0.18) before KMC (p=0.222), in the middle of KMC (p=0.43) show that there was no statistically significant difference between gestational age and heart rate because the p-value was greater than the common alpha 0.05. The mean ± SD of heart rate before KMC in moderate to late pre-term was 144 ± 14.99, which was the highest value of the mean. Furthermore, the mean and standard deviation of heart rate after KMC in post-term newborns was 116 ± 7.37, which was the lowest value of the mean. Table 7 demonstrates the association between gestational age and respiratory rate during all three visits, before KMC, in the middle of KMC and after KMC). There was a statistically significant difference between gestational age and respiratory rate at Visit 3 (p-value = 0.001) and after KMC (p-value = .048) because the p-value was less than the standard alpha 0.05. The means ± SDs of the respiratory rate before KMC in very pre-term and moderate to late pre-term infants were 43 ± 6.5 and 43 ± 6.16 respectively, which were the highest values of the mean. Otherwise, the mean ± SD of respiratory rate after KMC in post-term newborns was 35 ± 3.42, which was the lowest value of the mean. Table 8 indicates the association between gestational age and oxygen saturation., There was statistically significant difference between gestational age and oxygen saturation at Visit 1 (p=0.046), Visit 2 (p=0.005), Visit 3 (p=0.047), (all visits, p=0.003), before KMC (p=0.008), in the middle of KMC (p=0.045), and after KMC (p=< 0.001) because the p-values were less than the common alpha 0.05. Table 9 shows the association between birth weight and temperature. There was a statistically significant difference between birth weight and temperature at Visit1 (p=0.028), Visit 2 (p=0.001), Visit 3 (p=< 0.001), (al visits, p=0.001), before KMC (p=0.007), in the middle of KMC (p=0.001) and after KMC (p=< 0.001) because of the p-value < 0.05 . The mean ± S.D of the temperature after KMC in babies weighing less than1500 grams was 36 ± 0.69 which was the lowest value of the mean.

Table 4: The mean values of physiological parameters of newborns at three visits

	Physiological Parameter	Visits 1 Before	Visits 1 Middle	Visits 1 After	Visits 2 Before	Visits 2 Middle	Visits 2 After	Visits 3 Before	Visits 3 Middle	Visits 3 After
Temperature °C	Mean	36.1	36.4	36.6	36.5	36.6	36.8	36.6	36.8	37
	S.D	0.73	0.54	0.49	0.5	0.41	0.35	0.42	0.33	0.27
	Minimum	33.8	34.6	34.6	34.6	35.2	35	38.1	37.9	37.8
	Maximum	38.3	38.1	38.1	35.1	35.6	35.9	37.8	37.9	37.8
	F- test		17.23			15.808			23.458	
	Sig.		< 0.001			< 0.001			< 0.001	
Heart Rare Beats/ minute	Mean	145	130	123	138	130	119	132	123	115
	S.D	19.39	14.69	12.2	17.04	14.86	12.86	12.89	13.7	10.92
	Minimum	79	91	96	99	100	93	100	98	95
	Maximum	184	178	158	190	168	154	160	168	152
	F- test		52.745			40.142			44.141	
	Sig.		< 0.001			< 0.001			< 0.001	
Respiratory Rate Breath/ minute	Mean	43	40	37	42	39	37	41	39	36
	SD.	6.73	4.93	5.3	6.19	5.65	5.55	7.08	7.1	6.96
	Minimum	20	22	24	28	26	24	28	24	24
	Maximum	72	58	58	56	54	52	62	60	60
	F- test		27.984			23.640			10.775	
	Sig.		< 0.001			< 0.001			< 0.001	
Oxygen Saturation%	Mean	98	98	99	98	98	98	98	99	99
	SD.	2.33	2.1	1.77	1.79	1.97	1.67	1.55	1.57	1.41
	Minimum	88	91	92	92	92	91	94	94	95
	Maximum	100	100	100	100	100	100	100	100	100
	F- test		2.452			0.24			0.961	
	Sig.		0.088			0.787			0.384	

Table 5: The association between gestational age and temperature

Temperature		28 to < 32 W Very Pre-term	32 to < 37 W Moderate to late Pre-term	37 to < 40 W Full-term	≥ 40 W Post-term
Visit 1	Mean± S.D	35.6 ± 0.72	36.5 ± 0.72	36.4 ± 0.41	36.5 ± 0.57
	F-Test		8.039		
	Sig.		< 0.001		
Visit 2	Mean± S.D	36.1 ± 0.55	36.6 ± 0.57	36.7 ± 0.24	36.7 ± 0.27
	F-Test		7.307		
	Sig.		< 0.001		
Visit 3	Mean± S.D	36.3 ± 0.44	36.8 ± 0.37	36.9 ± 0.18	36.9 ± 0.23
	F-Test		13.813		
	Sig.		< 0.001		
General	Mean± S.D	36 ± 0.53	36.6 ± 0.52	36.7 ± 0.24	36.7 ± 0.27
	F-Test		10.687		
	Sig.		< 0.001		
Before	Mean± S.D	35.7 ± 0.63	36.5 ± 0.68	36.5 ± 0.34	36.5 ± 0.37
	F-Test		+68.159		
	Sig.		< 0.001		
Middle	Mean± S.D	36 ± 0.49	36.6 ± 0.51	36.7 ± 0.24	36.7 ± 0.27
	F-Test		10.251		
	Sig.		< 0.001		
After	Mean± S.D	36.3 ± 0.52	36.8 ± 0.4	36.9 ± 0.17	36.9 ± 0.18
	F-Test		13.595		
	Sig.		< 0.001		

Table 6: The association between gestational age and heart rate

Heart Rate		28 to < 32 W Very Pre-term	32 to < 37 W Moderate to late Pre-term	37 to < 40 W Full-term	≥ 40 W Post-term
		Gestational Age / Weeks			
Visit 1	Mean± S.D	130 ± 10.64	138 ± 14.17	133 ± 12.74	131 ± 13.43
	F-Test		1.497		
	Sig.		0.22		
Visit 2	Mean± S.D	131 ± 15.17	134 ± 15.64	128 ± 10.29	127 ± 13.11
	F-Test		1.737		
	Sig.		0.165		
Visit 3	Mean± S.D	125 ± 8.61	125 ± 10.19	123 ± 11.42	122 ± 11.02
	F-Test		0.557		
	Sig.		0.645		
General	Mean± SD.	129 ± 9.04	133 ± 11.09	128 ± 9.41	126 ± 10.15
	F-Test		1.662		
	Sig.		0.18		
Before	Mean± SD.	134 ± 11.22	144 ± 14.99	137 ± 12.16	137 ± 14.29
	F-Test		1.492		
	Sig.		0.222		
Middle	Mean± SD.	127 ± 8.49	131 ± 11.73	127 ± 10.49	126 ± 11.86
	F-Test		0.929		
	Sig.		0.43		
After	Mean± SD.	125 ± 9.00	123 ± 10.09	118 ± 9.63	116 ± 7.37
	F-Test		3.57		
	Sig.		0.017		

Table 7: The association between gestational age and respiratory rate

Respiratory Rate		28 to < 32 W Very Pre-term	32 to < 37 W Moderate to late Pre-term	37 to < 40 W Full-term	≥ 40 W Post-term
		Gestational Age / Weeks			
Visit 1	Mean± S.D	37 ± 5.1	39 ± 4.59	41 ± 5.25	41 ± 3.83
	F-Test		1.842		
	Sig.		0.145		
Visit 2	Mean± S.D	41 ± 6.67	41 ± 6.54	39 ± 4.87	38 ± 4.39
	F-Test		1.581		
	Sig.		0.199		
Visit 3	Mean± S.D	45 ± 9.23	40 ± 6.12	38 ± 5.98	36 ± 5.49
	F-Test		5.732		
	Sig.		0.001		
General	Mean± SD.	41 ± 5.2	40 ± 4.89	39 ± 3.93	38 ± 3.66
	F-Test		1.534		
	Sig.		0.211		
Before	Mean± SD.	43 ± 6.5	43 ± 6.16	42 ± 4.72	41 ± 4.57
	F-Test		0.658		
	Sig.		0.58		
Middle	Mean± SD.	42 ± 5.22	40 ± 5.12	39 ± 3.81	38 ± 3.81
	F-Test		1.528		
	Sig.		0.212		
After	Mean± SD.	39 ± 5.18	38 ± 4.65	36.7 ± 4.18	35 ± 3.42
	F-Test		2.586		
	Sig.		0.048		

Table 8: The association between gestational age and oxygen saturation

Oxygen Saturation		Gestational Age / Weeks 28 to < 32 W Very Pre-term	32 to < 37 W Moderate to late Pre-term	37 to < 40 W Full-term	≥ 40 W Post-term
Visit 1	Mean± S.D	97 ± 2.39	98 ± 1.85	98 ± 1.84	99 ± 1.37
	F-Test		2.769		
	Sig.		0.046		
Visit 2	Mean± S.D	97 ± 2.25	98 ± 1.79	98 ± 1.3	99 ± 1.12
	F-Test		4.482		
	Sig.		0.005		
Visit 3	Mean± S.D	98 ± 1.57	98 ± 1.27	99 ± 0.95	99 ± 1.32
	F-Test		2.752		
	Sig.		0.047		
General	Mean± SD.	97 ± 1.88	98 ± 1.48	99 ± 0.94	99 ± 0.91
	F-Test		5.012		
	Sig.		0.003		
Before	Mean± SD.	97 ± 2.24	98 ± 1.6	98 ± 1.25	99 ± 1.02
	F-Test		4.199		
	Sig.		0.008		
Middle	Mean± SD.	97 ± 1.89	98 ± 1.69	98 ± 1.05	99 ± 1.08
	F-Test		2.77		
	Sig.		0.045		
After	Mean± SD.	97 ± 2.05	98 ± 1.4	99 ± 0.83	99 ± 0.89
	F-Test		6.931		
	Sig.		< 0.001		

Table 9: The association between birth weight and temperature

Temperature		Birth weight (grams) <1500 ELBW	1500 – 2000 VLBW	2000 – 2500 LBW	2500 – 3500 NW	> 3500 OW
Visit 1	Mean± S.D	36 ± 1.1	36 ± 0.99	37 ± 0.5	36 ± 0.4	37 ± 0.34
	F-Test			2.85		
	Sig.			0.028		
Visit 2	Mean± S.D	36 ± 0.76	36 ± 0.79	37 ± 0.29	37 ± 0.24	37 ± 0.19
	F-Test			5.411		
	Sig.			0.001		
Visit 3	Mean± S.D	36 ± 0.6	37 ± 0.51	37 ± 0.2	37 ± 0.2	37 ± 0.22
	F-Test			8.186		
	Sig.			< 0.001		
General	Mean± S.D	36 ± 0.79	36 ± 0.71	37 ± 0.32	37 ± 0.25	37 ± 0.19
	F-Test			5.434		
	Sig.			0.001		
Before	Mean± S.D	36 ± 0.99	36 ± 0.91	37 ± 0.45	36 ± 0.33	37 ± 0.3
	F-Test			3.756		
	Sig.			0.007		
Middle	Mean± S.D	36 ± 0.73	36 ± 0.71	37 ± 0.31	37 ± 0.26	37 ± 0.18
	F-Test			5.473		
	Sig.			0.001		
After	Mean± S.D	36 ± 0.69	37 ± 0.58	37 ± 0.2	37 ± 0.18	37 ± 0.13
	F-Test			8.12		
	Sig.			< 0.001		

Table 10 demonstrates the association between birth weight and heart rate. There was a statistically significant difference between birth weight and heart rate after KMC (p=0.042) because the result of the p -value was less than the standard alpha 0.05 using ANOVA table (F-test). The temperature at all visits before KMC and in the middle KMC showed no statistically significant differences between the birth weight and heart rate because of the p-value >0.05. The mean ± SD of the heart rate in the middle of KMC in newborns with a weight of 2000 – 2500 grams was 125 ± 6.45, which was the lowest value of the mean, and the majority of the means of the heart rate in the middle of KMC in infants weighing less than 1500 grams were 133.Table 11 shows the association between birth weight and respiratory rate. There was a statistically significant difference between birth weight and respiratory rate at Visit 3 (p=< 0.001), (all visits, p=0.049) in the middle of KMC, (p=0.015) and after KMC (p=0.024) as indicated by the p-value < 0.05. In contrast, at Visit 1 (p=0.438) , Visit 2 (p=0.093) and before significant difference between birth weight and respiratory rate as the p-value was more than the common alpha 0.05 by using ANOVA table (F-test). The mean± SD of the respiratory rate before KMC in newborns with a weight of less than 1500grams was 41 ± 4.18), which was the highest value of the mean. Table 12 shows the association between birth weight and oxygen saturation. There was a statistically significant difference between birth weight and oxygen saturation at Visit 1 (p=0.007) ,Visit 2 (p=< 0.001), Visit 3 (p=0.048), (all visits ,p=0.001), before KMC (p=< 0.001), in the middle of KMC (p=0.018) and after KMC (p=0.001) because of the p-value < 0.05 by using ANOVA table (F-test). The mean ± SD of oxygen saturation in the middle of KMC in newborns weighing 2500 – 3500 grams was 99 ± 1.07 had the highest value of the mean. At the same time, the mean ± SD of oxygen saturation in the middle of KMC in infants with weight less than 1500 grams was 97 ± 1.66, which was the lowest value of the mean.

Table 10: The association between birth weight and heart rate

Heart Rate		Birth weight (grams) <1500 ELBW	1500 – 2000 VLBW	2000 – 2500 LBW	2500 – 3500 NW	> 3500 OW
Visit 1	Mean± S.D	133 ± 11.75	135 ± 15.98	132 ± 11.0	132 ± 13.58	134 ± 12.42
	F-Test			0.212		
	Sig.			0.931		
Visit 2	Mean± S.D	140 ± 12.05	123 ± 12.35	130 ± 12.61	127 ± 12.61	132 ± 13.76
	F-Test			2.153		
	Sig.			0.08		
Visit 3	Mean± S.D	129 ± 10.94	125 ± 8.31	119 ± 5.62	123 ± 11.81	125 ± 11.99
	F-Test			1.329		
	Sig.			0.265		
General	Mean± SD.	134 ± 8.94	128 ± 11.29	127 ± 7.68	127 ± 10.42	130 ± 11.16
	F-Test			0.972		
	Sig.			0.427		
Before	Mean± SD.	141 ± 9.08	137 ± 15.37	138 ± 14.11	138 ± 13.0	140 ± 16.49
	F-Test			0.158		
	Sig.			0.959		
Middle	Mean± SD.	133 ± 10.36	127 ± 9.61	125 ± 6.45	126 ± 11.84	132 ± 12.55
	F-Test			1.674		
	Sig.			0.162		
After	Mean± SD.	129 ± 9.57	121 ± 11.05	119 ± 7.12	117 ± 9.35	119 ± 8.35
	F-Test			2.582		
	Sig.			0.042		

Table 11: The association between birth weight and respiratory rate

Respiratory Rate		Birth weight (grams) <1500 ELBW	1500 – 2000 VLBW	2000 – 2500 LBW	2500 – 3500 NW	> 3500 OW
Visit 1	Mean± S.D	37 ± 5.97	39 ± 3.05	40 ± 4.83	40 ± 4.78	41 ± 4.32
	F-Test			0.952		
	Sig.			0.438		
Visit 2	Mean± S.D	44 ± 5.19	41 ± 7.55	39 ± 5.73	38 ± 4.88	39 ± 3.93
	F-Test			2.055		
	Sig.			0.093		
Visit 3	Mean± S.D	48 ± 7.91	43 ± 7.39	39 ± 5.43	37 ± 5.94	37 ± 5.27
	F-Test			6.015		
	Sig.			< 0.001		
General	Mean± SD.	43 ± 4.31	41 ± 5.04	39 ± 4.21	38 ± 3.97	39 ± 3.54
	F-Test			2.476		
	Sig.			0.049		
Before	Mean± SD.	44 ± 5.47	44 ± 7.23	42 ± 5.88	41 ± 4.63	43 ± 4.29
	F-Test			1.025		
	Sig.			0.398		
Middle	Mean± SD.	44 ± 4.29	41 ± 4.88	39 ± 3.87	38 ± 4.15	39 ± 3.48
	F-Test			3.25		
	Sig.			0.015		
After	Mean± SD.	41 ± 4.18	38 ± 4.09	37 ± 4.14	36 ± 4.03	36 ± 3.66
	F-Test			2.958		
	Sig.			0.024		

Table 12: The association between birth weight and oxygen saturation

Oxygen Saturation		Birth weight (grams) > 1500 ELBW	2000 – 1500 VLBW	2500 – 2000 LBW	3500 – 2500 NW	< 3500 OW
Visit 1	Mean± S.D	1.95 ± 96	1.34 ± 98	1.6 ± 98	1.54 ± 98	2.26 ± 98
	F-Test			3.775		
	Sig.			0.007		
Visit 2	Mean± S.D	2.08 ± 96	1.59 ± 98	1.57 ± 98	1.33 ± 99	0.87 ± 99
	F-Test			5.573		
	Sig.			0.001 >		
Visit 3	Mean± S.D	1.58 ± 97	1.19 ± 98	1.32 ± 99	1.17 ± 99	1.13 ± 99
	F-Test			2.497		
	Sig.			0.048		
General	Mean± SD.	1.61 ± 97	1.17 ± 98	1.4 ± 98	0.92 ± 99	1.13 ± 98
	F-Test			5.433		
	Sig.			0.001		
Before	Mean± SD.	1.8 ± 96	0.79 ± 99	1.61 ± 98	1.11 ± 98	1.39 ± 98
	F-Test			6.394		
	Sig.			0.001 >		
Middle	Mean± SD.	1.66 ± 97	1.56 ± 98	1.5 ± 98	1.07 ± 99	1.26 ± 98
	F-Test			3.128		
	Sig.			0.018		
After	Mean± SD.	1.86 ± 97	1.54 ± 98	1.32 ± 99	0.87 ± 99	1.06 ± 99
	F-Test			4.842		
	Sig.			0.001		

DISCUSSION

A study was performed at NICU/BFU at the maternity teaching hospital in Sulaimaniyah over six months between the 8th of January 2019 and the 28th of May 2019. The period of one month before the study was used for training about KMC.

The procedure of KMC is an easy and inexpensive procedure for the care of newborns. KMC enhances both newborn and maternal well-being and can be practised in any situation without the requirement of special equipment such as special cots, heaters and incubators. Even though initially perceived for use only in developing countries with limited resources, its use has gradually expanded globally as medical caregivers, parents, and administrators have become highly familiar with its physiological, psychological, and cost benefits. (11,12,13) This study is generally in agreement with earlier studies, as the regular upward trend in temperature during KMC sessions and throughout our study had a p -value of 0 (p=< 0.001), which was a very highly significant finding. Another study about the KMC on pre-term babies found that the mean axillary temperature and the mean heart rate was higher during KMC than during routine care. (14) KMC raises the newborn's temperature, and as the goal is to 'retain the warm of the newborn', the intervention is one of the most inexpensive ways to protect babies during the critical neonatal period (15). Similarly, in this study, very highly significant differences were found in heart rate and respiratory rate before and after KMC at p=< 0.001. Similarly, Hoe et al. who studied the KMC effect on the mother and newborn physiology, stated that kangaroo care promotes stability of physiological function. (16) In his study, the heart rate remained stable, but the respiratory rate ranged between 20 to 72 (mean 41.2), and breathing difficulties did not x occur during KMC (17). In agreement to the finding of this study, studies about the effects of KMC on the vital signs of low-birth-weight and pre-term newborn found no significant changes in the physiological parameter of oxygen saturation among newborns (18,19). In contrast to that, another study showed increased SpO2 (93.8% vs 97.3%) after performing KMC (20). Earlier studies about KMC and oxygen saturation and paternal bonding found a decrease in apnea and improvement in oxygen saturation in mechanically ventilated newborns who were able to tolerate KMC transfer and position changes. (21) In the cohort study by Nurian et al. who compared the effect of KMC and conventional care methods on physiological criteria in low birth weight infants in Shahid Beheshti University of Medical Sciences at Tehran in 2009, significant changes were seen between two groups in terms of heart rate, oxygen saturation and respiratory rate 5 minutes after the intervention (p < 0.05). The result shows that KMC affects the sustainability of physiological parameters during care. Thus, caregivers should use KMC for mothers and infants [22].In this study, the infants born before 32-week gestation gained more benefits from KMC application than moderate to late pre-term. In these babies the temperature and gestational age had the p-value = < 0.001 at all three visits and (before, middle, after KMC). Heart rates difference between the general means of three visits and the three checking periods had p-value between 0.18 and 0.017 that indicates there was a significant difference in the mean and standard deviation of heart rate before KMC in moderate to late pre-term (144 ±14.99). Otherwise, the mean and SD of heart rate after KMC in post-term newborns was 116± 7.37, which was the lowest value of the mean, Respiration rate had minimal changes, and oxygen saturation had the p-value = < 0.001 at three visits. Contrary to this study findings, a meta-analysis study to determine the physiological effects of skin-to-skin contact on newborns and mothers concluded that, although there was an increase in body temperature of 0.22°C, there was no change in heart rate. Likewise, change in oxygen saturation in another study was statistically not clinically significant; showing the decline in oxygen saturation of 0.60% during periods of KMC. Prematurity did not affect the regularity of these parameters. [23]Regarding the association between KMC and birth weight, it can be stated that all newborns especially low birth weight newborns receiving KMC showed a modest but statistically significant rise in temperature, respiration rate, heart rate, and oxygen saturation without the requirement for any special equipment. This can aid to avoid complications and the need for more detailed measurements. There is a room for making KMC the standard of care for the LBW newborns in most settings. Nonetheless, adequate planning and labour would be required to motivate and train mothers to carried out KMC and to monitor that they do so satisfactorily [24].Furthermore, KMC does have comparative benefits over conventional care, especially with aspects of improving neonatal survival, supporting exclusive breastfeeding, and promoting early discharge from the hospital. Even though it was initially proposed for resource-constrained settings to decrease the high neonatal mortality rates related with pre-term and LBW infants, KMC is now been recommended by the WHO for neonatal care in both developed (highin come) and developing (low-income) countries. In developed countries, there appears to be a huge gap in its implementation due to the high accessibility of incubators and other technology components of conventional care. Inputs have been made regarding KMC implementation in many developing countries where facility-based KMC has been individualized. Continuous training for health professionals and provision of facilities is needed, which could be financed by international aid organizations to scale up the program in these settings (25,26).

CONCLUSION

Kangaroo Mother Care is protective against a variety of adverse effects on newborn outcomes and has not shown evidence of harm. From the available evidence, KMC significantly improves physiological variables and thus it may positively influence the newborns' physical health. The KMC is one of the essential, inexpensive methods that significantly improves the newborns' physiological outcomes. In Sulaymaniyah, it has the potential to improve neonatal survival, support exclusive breastfeeding, and promote early discharge from the hospital.

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CONFLICT OF INTEREST

The authors report no conflict of interests.

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