



The Effect of kangaroo Mother Care in Improvement of Weight Gain and Vital Signs Stability in Preterm and Critically Ill Neonates

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ABSTRACT

Background: Preterm births affect 15 million births annually. The effects of preterm births have been extensively studied and have been linked to intrauterine inflammation and the premature development of developing organ systems. Kangaroo care is an intervention that can alter stress and attachment in mothers of preterm infants and also promotes infant-mother connection, bonding and attachment, crucial for emotional and social development. The study aimed to evaluate how kangaroo care can improve the vital signs and weight gain of critically ill and premature newborns.

Methods: The neonatal intensive care unit of the pediatric intensive care unit of the Children Hospital, Faculty of Medicine, Zagazig University, was the site of this case-control research on newborns getting kangaroo mother care. Two groups of eighty-eight patients were formed; Group 1 received kangaroo mother care, while Group 2 did not. Complete history taking, a general examination, laboratory testing, and recording of vital signs prior to and following kangaroo care were performed on both groups.

Results: There was a significant increase in temperature, decrease in respiratory rate to normal, decrease in heart rate to normal after one hour of kangaroo care in both terms and preterms and a significant increase in weight gain among kangaroo care group compared with group who didn't receive kangaroo mother care.

Conclusions: The physiological stability, improvement of vital signs, and test results of premature and full-term children are all favorably and efficiently encouraged by kangaroo mother care.

Keywords: Preterm; kangaroo mother care; neonatal mortality; prematurity; low birth weight

INTRODUCTION

Preterm infants are subjected to stressors in the neonatal intensive care unit (NICU), including intense light, invasive hospital procedures, and noise from medical equipment [1,2]. Furthermore, the setting of the neonatal intensive care unit and the newborns' separation from their moms restrict the visual, tactile, and auditory interactions that occur between mothers and their babies, which has an impact on maternal bonding [3].

The foundation of kangaroo mother care is the idea that premature babies should be viewed as extero-gestational fetuses in need of their own mother's protection and stimulation. This approach has been shown to be useful and successful for temperature regulation, nursing, the mother-infant bond, and the health of both preterm, low birth weight, and full-term newborns since it was first introduced about 35 years ago [4].

In addition to being thought of as a stress-reduction intervention for infants in the neonatal intensive

care unit [5], kangaroo care is expected to provide a stable heart rate, improved oxygen saturation and respiratory rate, improved lactation of the infant, and increased milk production in the mother [3, 6, 7]. It is also thought to have positive effects on neurological, cognitive, emotional, behavioral, and social development in the short and long term [8]. For premature infants, the kangaroo approach is also thought to be a successful way to lessen procedural pain [9].

Intermittent KMC can prevent infection through a variety of mechanisms that are mediated through the skin, such as temperature control, neuroendocrine mechanisms, neuro-endocrine mechanisms involving the release of oxytocin in both the mother and the neonate, decreased cortisol and stress response, cardio-respiratory stabilization, increased milk production, and changes in the neonatal microbiome [10].

METHODS

This case-control study on neonates receiving kangaroo mother care was conducted in the neonatal intensive care unit, Pediatric Intensive Care Unit of Children Hospital, Faculty of Medicine, Zagazig University, from July 2023 to December 2023. This study was approved by the ethical committee of the Faculty of Medicine, Zagazig University. Informed written consents were taken from parents of the included patients.

Inclusion criteria included neonates who were less than 37 weeks gestational age (GA), neonates were 37 weeks or more gestational age who were critically ill. Mothers in KC had to remain on the Kangaroo Care Unit (KCU) for at least seven consecutive days.

Exclusion criteria included mothers with mental health illnesses, mothers with histories of illicit drug use, mothers who had endocrine and/or neurological disorders, nail diseases, a habit of biting their nails, or who were unable to be with their infant in the first week of life, neonates with malformations or who were transferred to another institution, neonates who had severe or critical illness, including congenital anomalies, severe periventricular/intraventricular hemorrhage, respiratory difficulties, and minor or major surgery.

This study included 88 patients that were divided into two groups: group1 received kangaroo mother care and group 2 didn't receive kangaroo mother care.

Choice of neonates undergoing the study: To choose patients randomly, we decided that neonates admitted to our NICU on days of Saturday, Sunday and Monday from July 2023 to December 2023 will undergo kangaroo mother care. Their total number was 100, only 44 of them agreed to undergo the study. Neonates admitted on Tuesday, Wednesday and Thursday didn't receive kangaroo other care. Their number was 120, only 44 of them agreed to undergo the study.

Both groups underwent full history taking. All patients were subjected to: age, sex, residence, cause of admission, prenatal history, mode of delivery, resuscitation, gestational age, Apgar, and down score, which were taken in detail through a predesigned questionnaire. General examination was done on admission including evaluation of moro and suckling reflexes. Systemic examination was done including cardiac, chest, abdomen, and musculoskeletal examination. Complete neurological examination, chest x-ray and laboratory investigations including CBC, liver and kidney functions, electrolytes, and sepsis screening were done. Kangaroo mother care was done to group1, and vital signs were recorded before and after kangaroo mother care. Serial weight measurements every 3 days from introduction of kangaroo care were done.

STATISTICAL ANALYSIS

The statistical package for the social sciences, or SPSS, version 26 was used to analyze the data. Categorical variables were described using their absolute frequencies, and when comparing them between two groups, they were compared using chi square for trend test, Monte Carlo test, and Fisher exact test, as appropriate. The Shapiro-Wilk test was used to confirm assumptions used in parametric tests, and quantitative variables were described using their means and standard deviations, or, depending on the type of data, their median and interquartile range. For comparing quantitative data between two groups, the independent sample t-test (for normally distributed data) and Mann-Whitney test (for not normally distributed data) were employed. The paired sample t-test (for normally distributed data) and the Wilcoxon signed rank test (for not normally distributed data and qualitative data) were used to compare changes in a single variable over two time points within the same group. $P < 0.05$ was chosen as the level of statistical

significance. P values ≤ 0.001 were considered statistically significant.

RESULTS

This study included 44 patients who underwent kangaroo care, 25 of whom were preterm; their mean age was (32.48 ± 2.22) ; 19 were full term; their mean age was (38.11 ± 0.81) ; and 44 patients as a control group who didn't undergo kangaroo care 24 of them were preterm; their mean age was (33.25 ± 3.23) and 20 were full term their mean age was (37.3 ± 0.57) .

When it comes to preterm neonates, there are statistically non-significant differences between the groups under study in terms of gestational age, gender, family history, age of admission, and consanguinity (Table 1).

There is a decrease in the need for resuscitation in kangaroo care group among preterm neonates. There is a statistically significant increase in Apgar score 1, 5, 10, 15, and 20 minutes in kangaroo care group among preterms. When it comes to prenatal history, birth style, gestational age, or Down score, there is a statistically non-significant difference between the groups under study (Table 2).

Table 3 shows that among preterm newborns, there is a statistically significant increase in the rate of

weight growth in the kangaroo care group. When it comes to term patients' age at admission, gender, family history, or consanguinity, there is a statistically non-significant difference between the groups under study (Table 4).

Regarding gestational age and delivery mode, there is a statistically significant difference between the groups under investigation. There is a decrease in the need for resuscitation in kangaroo care group among term patients. There is a statistically significant increase in Apgar score 1, 5, 10, 15, and 20 minutes in kangaroo care group in term patients. The variations between the analyzed groups' babies's APGAR at 15 and 20 minutes, resuscitation, Down score, and prenatal history are statistically not significant (Table 5).

There is a significant increase in the rate of weight gain in kangaroo care group among term patients (Table 6). There is a significant increase in temperature, decrease in heart rate to normal, increase in blood pressure after kangaroo care. Overall, we can say kangaroo mother care leads to normalization of vital signs in both preterm and term neonates (Table 7).

Table 1: Demographic data in the studied groups among preterms

	Kangaroo care		χ^2	p
	Done N=25 (%)	Not done N=24 (%)		
Gender:				
Male	15 (60%)	12 (50%)	0.495	0.482
Female	10 (40%)	12 (50%)		
Family history of similar conditions :			Fisher	>0.999
Negative	21 (84%)	20 (80%)		
Positive	4 (16%)	4 (20%)		
Consanguinity:			Fisher	0.138
Negative	19 (76%)	22 (91.7%)		
Positive	6 (24%)	2 (8.3%)		
Gestational age:			0.046	0.83
Preterm	25 (56.8%)	24 (54.5%)		
Term	19 (43.2%)	20 (45.5%)		
	Median (IQR)	Median (IQR)	Z	p
Age at admission (hour)	4 (2 – 4.5)	1.07 (0.54 – 13)	-0.533	0.594

χ^2 Chi square test t independent sample t test Z Mann Whitney test *p<0.05 is statistically significant
**p<0.001 is statistically highly significant

Table 2: Prenatal, natal, postnatal history, mode of delivery, resuscitation, Apgar and Down score among preterm neonates in the studied groups

	Kangaroo care		χ^2	p
	Done N=25 (%)	Not done N=24 (%)		
Prenatal history:				
Anemia	1 (4%)	0 (0%)	Fisher	>0.999
PROM	3 (6.8%)	9 (37.5%)	Fisher	0.241
UTI	1 (4%)	0 (0%)	Fisher	>0.999
Antepartum hemorrhage	5 (20%)	0 (0%)	Fisher	0.05
Asthma	1 (4%)	0 (0%)	Fisher	>0.999
Cardiac	2 (8%)	0 (0%)	Fisher	0.49
Diabetic	1 (4%)	0 (0%)	Fisher	>0.999
Hypertensive	1 (4%)	0 (0%)	Fisher	>0.999
Preeclampsia	4 (16%)	2 (8.3%)	Fisher	0.667
NMRF	6 (24%)	10 (41.7%)	1.738	0.187
Oligohydramnios	1 (4%)	0 (0%)	Fisher	>0.999
Placenta accreta	1 (4%)	0 (0%)	Fisher	>0.999
Placenta previa	1 (4%)	1 (4.2%)	Fisher	>0.999
Hypothyroidism	0 (0%)	1 (4.2%)	Fisher	>0.999
Premature contractions	0 (0%)	1 (4.2%)	Fisher	0.116
NAD	1 (4%)	0 (0%)	Fisher	>0.999
Mode of delivery:				
CS	19 (76%)	20 (83.3%)	3.065	0.725
NVD	6 (24%)	4 (16.7%)		
Resuscitation:				
No need	12 (48%)	20 (83.3%) ^b	MC	<0.001**
Tactile stimulation	1 (4%)	0 (0%)		
Ambu bag	12 (48%)	4 (16.7%) ^b		
	Mean ± SD	Mean ± SD	T	p
Gestational age (week)	32.48 ± 2.22	33.25 ± 3.23	-0.968	0.339
APGAR 1 minutes	5.52 ± 1.39	8.38 ± 1.1	-7.969	<0.001**
APGAR 5 minutes	7.2 ± 1.26	9.13 ± 1.12	-5.658	<0.001**
APGAR 10 minutes	7.88 ± 1.13	9.33 ± 0.87	-5.034	<0.001**
APGAR 15 minutes	8.96 ± 0.94	8.89 ± 0.51	-3.889	<0.001**
APGAR 20 minutes	9.36 ± 0.51	9.83 ± 0.48	-2.389	0.022*
	Median (IQR)	Median (IQR)	Z	p
Down score	5(4 – 7)	5(5 – 7)	-0.655	0.512

χ^2 Chi square test t independent sample t test Z Mann Whitney test *p<0.05 is statistically significant
 **p<0.001 is statistically highly significant

Table 3: Weight gain in the studied groups among preterm neonates

	Kangaro care		Z	P
	Done (n=25) Median (IQR)	Not done(n=24) Median (IQR)		
Weight in kgs:				
On admission	1.7 (1.5 –1.89)	1.85 (1.33 –2)	-1.206	0.228
Day 3	1.61 (1.45 –1.78)	1.79 (1.29 –1.98)	-1.503	0.133
Day 6	1.67 (1.55 –1.8)	1.75 (1.27 –1.94)	-0.911	0.362
Day 9	1.72 (1.6 –1.84)	1.71 (1.33 –2)	-0.281	0.779
On discharge	1.9 (1.41 –2)	1.94 (1.65 –2.1)	-0.411	0.681
p	<0.001**	0.001**		
% change in weight	12.5 (2.57, 12.5%)	4.74 (0, 7.64%)	-2.552	0.011*

Z Mann Whitney test *p<0.05 is statistically significant p for Wilcoxon signed rank test

Table 4: Demographic data in the studied groups among full term neonates

	Kangaro care		χ ²	p
	Done N=19 (%)	Not done N=20 (%)		
Gender:				
Male	10 (52.6%)	15 (75%)	2.119	0.146
Female	9 (47.4%)	5 (25%)		
Family history:				
Negative	18 (94.7%)	16 (80%)	Fisher	0.342
Positive	1 (5.3%)	4 (20%)		
Consanguinity:				
Negative	14 (73.7%)	13 (65%)	0.345	0.557
Positive	5 (26.3%)	7 (35%)		
	Median (IQR)	Median (IQR)	Z	p
Age at admission (hour)	18 (5 –168)	10 (0.25 –20)	-1.548	0.122

χ² Chi square test t independent sample t test Z Mann Whitney test

Table 5: Prenatal, natal, postnatal history, mode of delivery, resuscitation, Apgar and Down score in the studied groups among term neonates

	Kangaro care		χ ²	p
	Done N=19 (%)	Not done N=20 (%)		
Prenatal history:				
Suspected pneumonia by 4D	1 (5.3%)	0 (0%)	Fisher	>0.999
	3 (15.9%)	0 (0%)	Fisher	0.106
Anemia	1 (5.3%)	1 (5%)	Fisher	>0.999
PROM	1 (5.3%)	0 (0%)	Fisher	>0.999
UTI	1 (5.3%)	0 (0%)	Fisher	>0.999
Gestational hypertension	1 (2.3%)	0 (0%)	Fisher	>0.999
Preeclampsia	12 (63.2%)	11 (55%)	0.268	0.604
NMRF	0 (0%)	4 (20%)	Fisher	0.106
Hypertension	0 (0%)	4 (20%)	Fisher	0.106
Hypothyroidism				
Mode of delivery				

CS NVD	18 (94.7%) 1 (5.3%)	11 (55%) 9 (45%)	Fisher	0.008*
Postnatal resuscitation No need Suction Intubation	17 (89.5%) 1 (5.3%) 1 (5.3%)	20 (100%) 0 (0%) 0 (0%)	MC	0.22
	Mean ± SD	Mean ± SD	T	p
Gestational age (week)	38.11 ± 0.81	37.3 ± 0.57	3.605	<0.001**
APGAR 1 minutes	7.37 ± 1.42	8.9 ± 0.64	-4.297	<0.001**
APGAR 5 minutes	8.53 ± 0.96	9.55 ± 0.69	-3.835	<0.001**
APGAR 10 minutes	9.21 ± 0.89	9.8 ± 0.41	-2.722	0.012*
APGAR 15 minutes	9.84 ± 0.5	10.0 ± 0	-1.372	0.187
APGAR 20 minutes	9.89 ± 0.46	10.0 ± 0	-1	0.311
	Median (IQR)	Median (IQR)	Z	p
Down score	4(1 – 5)	4(4 – 5)	-1.372	0.17

χ² Chi square test t independent sample t test Z Mann Whitney test *p<0.05 is statistically significant
**p<0.001 is statistically highly significant *p<0.05 is statistically significant

Table 6: Weight gain in the studied groups among term neonates

	Kangaroo care		Z	p
	Done (n=19) Median (IQR)	Not done(n=20) Median (IQR)		
Weight: On admission	3 (2.6 –3.1)	3 (2.33 –3.1)	-0.986	0.324
Day 3	3 (2.66 –3.2)	2.9 (2.26 –3)	-1.712	0.087
Day 6	3.1 (2.7 –3.4)	2.9 (2.25 –2.92)	-2.439	0.015*
Day 9	3.18 (2.8 –3.5)	2.95 (2.35 3)	-2.397	0.017*
On discharge	3.45 (2.92 –3.5)	3.1 (2.43 –3.2)	-2.656	0.008*
p	<0.001**	0.001**		
% change	12.31(3.45 – 22.58%)	3.89 (1.12, 6.67%)	-2.519	0.012*

Z Mann Whitney test *p<0.05 is statistically significant p for Wilcoxon signed rank test

Table 7: Vital data before and after kangaroo mother care among preterm and full term patients

	Mean ± SD	t	p
Temperature: Before KMC After KMC	36.81 ± 0.28 37.11 ± 0.18	-8.47	<0.001**
Systolic blood pressure: Before KMC After KMC	66.95 ± 9.24 70.23 ± 5.94	-3.088	0.004*
Diastolic blood pressure: Before KMC After KMC	30.43 ± 6.05 32.02 ± 3.4	-2.076	0.044*
Heart rate: Before KMC After KMC	148.7 ± 11.06 144.52 ± 10.93	8.332	<0.001**
Respiratory rate: Before KMC After KMC	55.45 ± 8.29 51.66 ± 7.94	14.998	<0.001**

t paired sample t test * p<0.05 is statistically significant **p<0.001 is statistically highly significant

DISCUSSION

A significant healthcare issue, preterm birth affects 15 million newborns annually. Preterm birth is the primary cause of death for children under the age of five, with the bulk of these deaths happening during the neonatal stage. This is most likely the cause of the rise in studies on preterm conducted over the past 25 years [11].

The kangaroo mother care method is good for the health of full-term and preterm newborns, as well as for controlling body temperature, breastfeeding, and the mother-infant bond [4].

This study included 44 patients who underwent kangaroo care, 25 of whom were preterm; their mean age was (32.48 ± 2.22) ; 19 were full term; their mean age was (38.11 ± 0.81) ; and 44 patients as a control group who didn't undergo kangaroo care 24 of them were preterm; their mean age was (33.25 ± 3.23) and 20 were full term; their mean age was (37.3 ± 0.57) .

Among preterm babies, kangaroo care group had worse Apgar scores at 1, 5, 10, and 15 minutes than non kangaroo care group, while among full-term babies, kangaroo care group had worse Apgar scores at 1, 5, and 10 minutes.

The most common provisional diagnosis in preterm neonates in kangaroo care group was uncertain and in the control group was RDS, while in full-term babies, the most common provisional diagnosis was TTN.

Among preterm and full-term babies, kangaroo care group had a worse initial examination than non kangaroo care group.

The study's findings, which are in line with numerous other researches in this area, revealed a substantial rise in temperature in both terms and preterms after one hour of kangaroo care [12–17]. While the temperature rates were within the normal range, only one study [18] demonstrated that the babies' temperature dropped with KMC as opposed to incubator care. As it demonstrated that the temperature, arterial oxygen saturation rate, respiration rate, and heart rate do not change in neonates transferred with KMC as opposed to those receiving incubator care. Therefore, we may conclude that the KMC causes the temperature to stabilize or rise within the normal range. In fact, the baby won't lose heat if they are in close skin-to-skin contact with their mother [19]. Raising the temperature is beneficial for improving treatment outcomes, especially for low-weight and premature

newborns, who are more susceptible to hypothermia. However, this also increases oxygen consumption and metabolic rate due to heat loss, which can cause homeostatic issues, apnea that worsens, physiological and metabolic instability, and impaired weight gain [20]. The results of these studies [3], in which there was a significant decrease in respiratory rate but participants were physiologically stable after extubation or oxygen therapy was completed, are consistent with the study's findings that there was a significant decrease in respiratory rate to a normal level after one hour of kangaroo care. Additionally, [6] showed a drop in respiratory rate but no infant at baseline experienced respiratory distress.

The heart rate also significantly drops to normal after receiving kangaroo care, which is in line with [3], which found that while the heart rate of the group receiving kangaroo care decreased more than that of the control group, the difference was not statistically significant. The babies' heart rate was most likely impacted by being held upright and placed squarely on the mother's chest, which is thought to put premature babies to sleep because of the secure, embracing position. Different results were found in other research investigations [21]. The change in position and bed after receiving kangaroo care resulted in an improved heart rate, which was brought about by the infants' elevated body warmth from skin-to-skin contact with their mothers. Moreover, [6] demonstrated a rise in heart rate during kangaroo mother care; nonetheless, the heart rates of all patients were normal and stable.

Similar to the findings of [22], our study revealed a significant increase in weight gain within the kangaroo care group compared to the non-kangaroo care group. We showed that the KMC newborns gained an average of 23.99 g of weight each day, compared to 15.58 g in the babies receiving conventional care. Even in the KMC group, preterm kids' weight at 40 weeks postmenstrual age was less than that of typical full-term Indian newborns at birth. Less weight gain might have been the outcome of using fortifiers, formula feeding, and kangaroo care for a shorter period of time.

Similar results were obtained, indicating that there was a statistically significant increase in average weight gain in the KMC group as compared to the traditional group. In a different study [23], the average daily weight increase of the KMC babies

was more than double that of the control group babies.

In our study, we compared laboratory data in both groups, there was a statistically significant decrease in hemoglobin and hematocrit levels on discharge among preterm and full-term babies this may be attributed to physiologic anemia of the newborn. There is also a significant decrease in TLC on discharge in kangaroo care group among term babies; this may be attributed to strict hygienic measures, emphasis on hand washing and other measures to reduce sepsis.

There is a significant decrease in albumin and total protein levels in non kangaroo care group among preterm and full-term babies. There is a significant increase in calcium and decrease in potassium in kangaroo care group among preterm babies.

There is a significant decrease in crp on discharge in non kangaroo care group among preterm and full-term patients.

CONCLUSIONS

The current study found that Kangaroo Mother Care (KMC) successfully and favorably enhanced the physiological stability, improvement of vital signs, and laboratory results of both premature and full-term infants.

Recommendations:

The present study's conclusions lead to the following recommendations being put forth:

1. A comprehensive educational program designed to equip all neonatal nurses with the skills is required to execute the KMC.
2. Use pamphlets, posters, kangaroo care practical guides, and support groups to educate all expectant mothers on the advantages and management of KMC. These resources may also help the women even after the baby is delivered.
3. Hospital assistance for the moms is necessary to enable and sustain early KMC beginning by granting the mother unrestricted access to see her premature infants at all times.
4. Assist the mothers of newborns delivered by cesarean section to start KMC as soon as feasible for premature or ill infants (able to tolerate transfer and skin contact without physiologic or behavioral compromise).

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