



The effect of kangaroo mother care in decreasing the duration of hospital admission in preterm and critically ill neonates

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ABSTRACT

Background: Preterm birth is a major healthcare problem affecting 15 million births every year. It is the leading cause of mortality among children aged under 5 years, with a majority of deaths due to preterm birth occurring in the neonatal period. Kangaroo care is an intervention that can influence stress and attachment in mothers of preterm infants and also enhances infant–mother interaction, bonding and attachment, essential for emotional and social development . **Aim of the study** this study aimed to Asses effect of kangaroo care in improving vital signs weight gain of preterm neonates and to asses duration of hospital admission in neonates exposed to kangaroo care. **Patient and 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. 88 patients were split into two groups Group1recieved kangaroo mother care and Group2 didn't receive kangaroo mother care.both groups underwent Complete history taking,general examination,laboratory investigations, vital signs recorded before and after kangaroo care,days of hospitalization and oxygen dependence were recorded in both groups. **Conclusion** Kangaroo mother care is effectively and positively promoted premature and full term infants' physiological stability, improvement of vital signs, laboratory findings ,decreasing length of hospital stay and days of oxygen dependence, fewer complications.

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

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Introduction

In the neonatal intensive care unit (NICU), preterm infants are exposed to stress factors such as invasive hospital procedures, bright light and noise from medical equipment (1,2).

In addition, the separation of babies from their mothers and the neonatal intensive

care unit environment itself limits visual, tactile and acoustic interactions between infants and mothers, affecting maternal bonding (3). Kangaroo care is an intervention that can influence stress and attachment in mothers of preterm infants (3) and also enhances infant–mother interaction,

bonding and attachment, essential for emotional and social development (4).

The expected benefits of kangaroo care include a stable heart rate, improved oxygen saturation and respiratory rate, improved lactation of the infant and increased milk production in the mother (3, 5, 6), and it is also often considered as a stress reducer intervention for infants in the neonatal intensive care unit (7) and positive effects on neurological, cognitive, emotional, behavioural and social development in the short and long term (8). The kangaroo method is also considered an effective strategy to reduce procedural pain in premature infants (9).

The mechanism of KMC through many pathways, mediated through skin to skin, including thermal control, neuroendocrine mechanisms, neuro-endocrine mechanisms involving the release of oxytocin in the mother and neonate, reduced cortisol and stress response, cardio-respiratory stabilization, increased milk production, changes in neonatal microbiome with intermittent KMC has an influence on preventing infection (10)

Patients and 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 neonates 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: Mothers with mental health illnesses. mothers with history 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, minor or major surgery.

Methods:

This study included 88 patients that were split into two groups Group1 received kangaroo mother care and Group2 didn't receive kangaroo mother care. both groups underwent History: All patients will be subjected to: age, sex, residence, cause of admission, prenatal history, mode of delivery, resuscitation, gestational age, apgar and down score were taken in details through predesigned questionnaire. General examination was done on admission including evaluation of moro and suckling reflexes. Systemic examination: cardiac

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Section A -Research paper

,chest, abdomen, musculoskeletal examination Complete neurological examination, Laboratory investigations including CBC, liver and kidney functions, electrolytes, sepsis screen. kangaroo mother care done to group1, On the first day, KMC was provided for 1 hour per day for 5 days per week, the duration was increased to as long as the mother felt comfortable. Counseling and demonstration were repeated for initially hesitant mothers till they were able to offer KMC confidently and correctly. vital signs were recorded before and after kangaroo mother care.serial weight measurement every 3 days from introduction of kangaroo care,days of hospitalization and oxygen dependence were recorded in each group.

Statistical design:

Data analysis was performed using the software SPSS (Statistical Package for the Social Sciences) version 26. Categorical variables were described using their absolute frequencies and were compared using chi square test, Monte Carlo test and Fisher exact test when appropriate. To compare ordinal data between two groups, chi square for trend test was used. Shapiro-Wilk test was used to

verify assumptions for use in parametric tests. Quantitative variables were described using their means and standard deviations or median and interquartile range according to type of data. To compare quantitative data between two groups, independents sample t test (for normally distributed data) and Mann Whitney test (for not normally distributed data) were used. To compare change in one variable over two points of time within same group, paired sample t test (for normally distributed data) and Wilcoxon signed rank test (for not normally distributed data and qualitative data) were used. The level statistical significance was set at $P < 0.05$. Highly significant difference was present if $p \leq 0.001$.

Results

This study included 44 patients underwent kangaroo care 25 of which were preterm ,their mean age was (32.48 ± 2.22) and 19 were full term their mean age was (38.11 ± 0.81) and 44 patients as 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) .

Table (1) Comparison between the studied groups regarding gestational age:

	Kangaroo care		χ^2	p
	Done N=44 (%)	Not done N=44 (%)		
Gestational age				
Preterm	25 (56.8%)	24 (54.5%)	0.046	0.83
Term	19 (43.2%)	20 (45.5%)		

χ^2 Chi square test

There is statistically non-significant difference between the studied groups regarding gestational age. About 57% and 55% within group underwent Kangaroo care versus control group were preterm.

Table (2) Demographic data in the studied groups among preterms

	Kangaro 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:				
Negative	21 (84%)	20 (80%)	Fisher	>0.999
Positive	4 (16%)	4 (20%)		
Consanguinity:				
Negative	19 (76%)	22 (91.7%)	Fisher	0.138
Positive	6 (24%)	2 (8.3%)		
	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

There is statistically non-significant difference between the studied groups regarding age at admission, gender, family history or consanguinity among preterm neonates.

Table (3) prenatal, natal ,postnatal history, mode of delivery, resuscitation, apgar and down score among preterm neonates in the studied groups:

	Kangaro 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		
Tactile stimulation	1 (4%)	0 (0%)	MC	<0.001**
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

There is decrease in the need of resuscitation in kangaroo care group among preterm neonates. There is statistically **significant** increase in apgar score 1, 5, 10, 15 and 20 minutes in kangaroo care group among preterms. There is statistically non-significant difference between the studied groups regarding prenatal history, mode of delivery, gestational age or Down score.

Table (4) clinical and radiological data in the studied groups among preterm neonates on admission:

	Kangaroo care		χ^2	P
	Done N=25 (%)	Not done N=24 (%)		
General examination:				
Poor moro and suckling	19 (76%)	11 (45.8%)	4.694	0.03*
Good moro and suckling	6 (24%)	12 (54.2%)		
Cardiac examination:				

No murmur	19 (46.3%)	22 (53.7%)	Fisher	0.247
Murmur	0 (0%)	3 (100%)		
Chest examination:				
Diminished bilaterally	18 (72%)	8 (33.3%) ^b	MC	<0.001**
Diminished unilaterally	0 (0%)	6 (25%) ^b		
Wheezes	0 (0%)	5 (20.8%) ^b		
Bilateral equally	7 (28%)	5 (20.8%)		
Chest X ray:				
Aerated	12 (48%)	4 (16.7%) ^b	MC	<0.001**
Bilateral haziness	6 (24%)	3 (12.5%)		
Unilateral haziness	0 (100%)	6 (25%) ^b		
Hyperinflation	0 (0%)	6 (25%) ^b		
GGA	7 (28%)	5 (20.8%)		

χ^2 Chi square test MC Monte Carlo test * $p < 0.05$ is statistically significant ** $p \leq 0.001$ is statistically highly significant

There is statistically significant deterioration in Moro, suckling reflexes, radiological signs in kangaroo care group among preterm neonates. There is statistically non-significant difference between the studied groups regarding cardiac examination.

Table (5) Weight gain in the studied groups among preterm neonates:

	Kangaroo care		Z	P
	Done (n=25) Median (IQR)	Not done (n=24) Median (IQR)		
Weight				
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

There is statistically significant increase in rate of weight gain in kangaroo care group among preterm neonates.

Table (6) outcome of the studied groups among preterm neonates:

	Kangaroo care		χ^2	p
	Done N=25 (%)	Not done N=24 (%)		
Outcome:				
Died	4 (16%)	10 (41.7%)	3.953	0.047*
Improved	21 (64%)	14 (58.3%)		

Complications:				
None	18 (72%)	13 (54.2%)	MC	0.34
BPD	3 (12%)	1 (4.2%)		
NEC	0 (0%)	2 (8.3%)		
Sepsis	4 (16%)	8 (33.3%)		
	Median (IQR)	Median (IQR)	Z	p
LOS (days)	8(5 – 15)	15(10 – 20)	-3.008	0.003*
Days of O2 dependence	6(4 – 11)	12.5(10 – 18.75)	-2.959	0.003*

χ^2 Chi square test MC Monte Carlo test Z Mann Whitney test

There is statistically **significant** difference between the studied groups regarding outcome (mortality is increased in non kangaroo care group). There is statistically non-significant difference between the studied groups regarding complications. There is statistically **significant** decrease in length of hospital stay and days of oxygen dependence in kangaroo care group among preterm neonates.

Table (7) of term: Demographic data in the studied groups among term patients:

	Kangaroo 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

χ^2 Chi square test t independent sample t test Z Mann Whitney test

There is statistically non-significant difference between the studied groups regarding age at admission, gender, family history or consanguinity among term patients.

Table (8) prenatal, natal ,postnatal history, mode of delivery, resuscitation, apgar and down score in the studied groups among term neonates:

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

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

There is statistically **significant** difference between the studied groups regarding mode of delivery and gestational age. There is decrease in the need of resuscitation in kangaroo care group among term patient. There is statistically significant increase in apgar score 1, 5, 10, 15 and 20 minutes in kangaroo care group in term patients. There is statistically non-significant difference between the studied groups regarding prenatal history, resuscitation, Down score, or APGAR at 15 and 20 minutes.

Table (9) clinical and radiological data in the studied groups on admission among term neonates:

	Kangaroo care		χ^2	p
	Done N=19 (%)	Not done N=20 (%)		
General examination:				
Poor moro and suckling	1 (5.3%)	13 (65%)	15.11	<0.001**
Good moro and suckling	18 (94.7%)	7 (35%)		
Cardiac examination:				
No murmur	19 (46.3%)	22 (53.7%)	Fisher	0.247
Murmur	0 (0%)	3 (100%)		
Chest examination:				
Diminished bilaterally	4 (21.1%)	3 (15%)	MC	0.4
Diminished unilaterally	6 (31.6%)	4 (20%)		
Bilateral creps	2 (10.5%)	0 (0%)		
Bilateral equally	7 (36.8%)	13 (65%)		
Chest X ray:				
Aerated	3 (15.8%)	8 (40%)	MC	0.82
Bilateral haziness	4 (21.1%)	3 (15%)		
Unilateral haziness	1 (5.3%)	1 (5%)		
Ground glass appearance	1 (5.3%)	1 (5%)		
Hyperinflation	4 (21.1%)	4 (20%)		
Pneumonia	4 (21.1%)	3 (15%)		
White lung	1 (5.3%)	0 (0%)		

χ^2 Chi square test MC Monte Carlo test *p<0.05 is statistically significant

There is statistically **significant** deterioration in general examination in non kangaroo care group.

Table (10) 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

There is significant increase in rate of weight gain in kangaroo care group among term patients.

Table (11) Outcome of the studied groups among term patients:

	Kangaroo care		χ^2	p
	Done N=19 (%)	Not done N=20 (%)		
Outcome:				
Died	1 (5.3%)	7 (35%)	Fisher	0.044*
Improved	18 (94.7%)	13 (65%)		
Complications:			MC	0.023*
None	17 (89.5%)	13 (65%)		
BPD	1 (5.3%)	0 (0%)		
Sepsis	1 (5.3%)	7 (35%)		
	Median (IQR)	Median (IQR)	Z	p
LOS (days)	8(5 – 12)	14.5(10 – 22)	-2.61	0.009*
Days of O2 dependence	6(4 – 10)	11(7.25 – 18)	-2.733	0.006*

χ^2 Chi square test, MC Monte Carlo test, *p<0.05 is statistically significant Z Mann Whitney test

There is statistically **significant** increase in mortality among non kangaroo care group. There is statistically **significant** difference between the studied groups regarding complications(89.5% versus 65% of those who did and did not receive Kangaroo care developed no complications).There is statistically significant decrease in length of hospital stay and days of oxygen dependence in kangaroo care group.

Table (12) Vital data on admission and discharge in preterms and full terms in kangaroo care group:

	Mean \pm SD	p
Temperature:		
On admission	36.81 \pm 0.28	<0.001**
On discharge	37.11 \pm 0.18	
Systolic blood pressure:		
On admission	66.95 \pm 9.24	0.004*
On discharge	70.23 \pm 5.94	
Diastolic blood pressure		
On admission	30.43 \pm 6.05	0.044*
On discharge	32.02 \pm 3.4	
Heart rate		
On admission	148.7 \pm 11.06	<0.001**
On discharge	144.52 \pm 10.93	
Respiratory rate		
On admission	55.45 \pm 8.29	<0.001**
On discharge	51.66 \pm 7.94	

P for paired sample t test * $p < 0.05$ is statistically significant ** $p \leq 0.001$ is statistically highly significant

There is 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.

Discussion:

Preterm birth is a major healthcare problem affecting 15 million births every year. It is the leading cause of mortality among children aged under 5 years, with a majority of deaths due to preterm birth occurring in the neonatal period.(11). kangaroo mother care method is effective and beneficial for thermal control, breastfeeding, maternal–infant relationship, and health of both preterm, low birth weight and full-term infants. enhanced KMC practice has been strongly recommended also in high-tech neonatal intensive care units (NICUs).(12)

In this study we found that among preterm babies, kangaroo care group had worse apgar score at 1,5 ,10 ,15 min than none kangaroo care group,while among full term babies, kangaroo care group had worse apgar score at 1,5,10 minutes.

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

The study result showed significant increase in temperature after one hour of kangaroo care in both terms and preterms ,the findings is consistent with many studies in this regard (13-18). Only a study, before and after, showed that the newborns temperature reduced during KMC compared to the

incubator care, although the temperature rates were in the normal range.(19) showed that even in newborns transferring with KMC compared to incubator care, the HR, respiratory rate, arterial oxygen saturation rate, and the temperature remain constant. Hence, we can say that the KMC leads to the temperature stability or its increase in the normal range. Indeed, putting the newborn in skin contact with the mother will prevent the heat loss (20). Increasing temperatures, particularly for low-weight and premature newborns with tendency to hypothermia is very useful and improves the treatment outcomes, while the metabolic rate and oxygen consumption increase with the heat loss and lead to physiological and metabolic instability, homeostatic problems, apnea intensifying, and impaired weight gain (18, 21).

The reasons for the beneficial effects of KMC are yet to be fully explored. Heat transfer from mother to baby is obvious. The intimate and early skin-to-skin contact between mother and baby, with repeated nutritive and non-nutritive suckling, possibly also evokes neuropsychological responses that program physiology and behavior. Further, during KMC, the infant experiences maternal heart sounds, rhythmic maternal breathing, warmth and prone positioning, all

of which offer gentle stimulation across auditory, tactile, vestibular, and thermal sensory systems, which may in sum total have a tranquilizing effect on the baby, allowing physiological parameters to stabilize (22).

Study also showed significant decrease in respiratory rate to normal level after one hour of kangaroo care which is consistent with results of these studies (6), in which there was significant decrease in respiratory rate but participants of this study were physiologically stable after extubation or oxygen therapy was completed. Also (23) in which there was decrease in respiratory rate but no baby had respiratory distress at baseline.

There is also significant decrease in heart rate after kangaroo care to normal level Which is consistent with 26 in which there was decrease in the heart rate of the group who received kangaroo care greater than that of control group but the difference was not significant. . The heart rate was probably affected by holding the infants upright and positioning them directly on the chest, which is considered to induce deep sleep in preterm infants because of the stable embracing position on the mother's chest. Other research studies showed different findings (6).

Study also showed significant decrease in length of hospital stay and days of oxygen dependance in kangaroo care group which is consistent with results of 50 (24) which compared massage therapy and KMC effect

on length of hospital stay of preterm babies also consistent with (25).

Lamy Filho et al., (26) demonstrated that the newborn infants in the kangaroo units had shorter length of hospital stay (18.9 vs. 24.1 days) than those admitted to the conventional units. The difference was 5.2 days less for the kangaroo group, with borderline significance ($p = 0.067$). After adjustment, this difference reduced to -4.3 days and was no longer significant ($p = 0.140$).

These results are in contrary to results of 35 in which there was no difference in both groups as they didn't use a fixed target weight criteria for discharge .

We noticed that in kangaroo care group there is more rapid recovery and more rapid weight gain that lead to shorter hospital stay and shorter days of oxygen dependance and fewer complications particularly BPD. These results were observed in both preterm and fullterm babies.

Our study showed significant increase in weight gain among kangaroo care group than non kangaroo care group which is similar to results of 35 who We demonstrated an average weight-gain per day in the KMC babies of 23.99g versus 15.58g in the conventional method of care. However, the weight of preterm babies at 40 weeks postmenstrual age was lower than the average birth weight of normal full term Indian babies even in the KMC group. The lack of use of formula feeds, fortifiers and

shorter duration of Kangaroo care could have resulted in poorer weight gain.

Results are also similar to which showed that the average weight-gain was more and statistically significant in the KMC group compared to the conventional group. In another study (27), average weight-gain in KMC babies was more than double the average weight-gain per day of the babies in the control group.

Among preterm neonates ,There is a ratio of 84% improvement and discharge and 16 % death in kangaroo care group among preterm neonates, while in non kangaroo care group 58% improved and 41% died.72% of kangaroo care group didn't have any complications at discharge while 54% didn't have complications in non kangaroo care group and 46% had complications .the commonest complication was sepsis.

Among full term neonates, There is a ratio of 94% improvement and discharge and 5% death in kangaroo care group while in non kangaroo care group 65% improved and 35% died.89% of kangaroo care group didn't have any complications at discharge while 65% didn't have complications in non kangaroo care group and 35% had complications .the commonest complication was sepsis.

Thus we can say that intermittent kangaroo mother care in NICU have a great rule in reducing neonatal morbidity and mortality which is consistent with study of (28) that showed no neonatal death in KMC babies in six months data .In 3 babies infection was recorded during stay in hospital

but they recovered and were discharged back to KMC room. Also consistent with (29)

Conclusion:

The current study concluded that Kangaroo Mother Care (KMC) was effectively and positively promoted premature and full term infants' physiological stability, improvement of vital signs, laboratory findings ,decreasing length of hospital stay and days of oxygen dependence, fewer complications.

In this study:

- Our study included 44 patients underwent kangaroo care 25 of which were preterm ,their mean age was (32.48 ± 2.22) and 19 were full term their mean age was (38.11 ± 0.81) and 44 patients as 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)
- The most common risk factor in prenatal history among preterm babies was antepartum hemorrhage in kangaroo care group while no maternal risk factors in most neonates in control group,while In full terms most neonates didn't have maternal risk factors in both studied groups. Among preterm babies, kangaroo care group had worse apgar score at 1,5 ,10 ,15 min than none kangaroo care group,while among full term babies, kangaroo care group had worse apgar score at 1,5,10 minutes.The most common provisional diagnosis in preterm neonates in kangaroo care group

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was uncertain and in 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 worse initial examination than non kangaroo care group.

- The study result showed 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.
- Our study showed significant increase in weight gain among kangaroo care group compared with group who didn't receive kangaroo mother care.
- There was statistically significant decrease in hemoglobin and hematocrit level on discharge among preterm and full term babies this may be attributed to physiologic anemia of the newborn. There is also 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 significant decrease in crp on discharge in non kangaroo care group among preterm and fullterm patients.
- Among preterm neonates ,There is a ratio of 84% improvement and discharge and 16 % death in kangaroo care group among preterm neonates, while in non kangaroo care group 58% improved and 41% died.72% of kangaroo care group

didn't have any complications at discharge while 54% didn't have complications in non kangaroo care group and 46% had complications .the commonest complication was sepsis.

- Among full term neonates, There is a ratio of 94% improvement and discharge and 5% death in kangaroo care group while in non kangaroo care group 65% improved and 35% died.89% of kangaroo care group didn't have any complications at discharge while 65% didn't have complications in non kangaroo care group and 35% had complications .the commonest complication was sepsis.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:

1. Educational training program for all neonatal nurses in skills necessary to implement the KMC.
2. Inform all pregnant women about the benefits and management of KMC through booklets, posters, kangaroo care practical guide and support groups that may assist them even after delivery.
3. Hospital support for the mothers is needed to facilitate and continues early initiation of KMC through allowing the mother to visit her premature infants' all of the time without restrictions.
4. Help the mothers who are delivered through cesarean section neonates and premature or sick neonates initiate KMC

as soon as possible (able to tolerate transfer and skin contact without physiologic or behavioral compromise).

Reference:

1. Cong X, Wu J, Vittner D, Xu W, Hussain N, Galvin S, Fitzsimons M, McGrath JM, Henderson WA. The impact of cumulative pain/stress on neurobehavioral development of preterm infants in the NICU. *Early human development*. 2017 May 1;108:9-16.
2. Gao H, Xu G, Gao H, Dong R, Fu H, Wang D, Zhang H, Zhang H. Effect of repeated Kangaroo Mother Care on repeated procedural pain in preterm infants: A randomized controlled trial. *International journal of nursing studies*. 2015 Jul 1;52(7):1157-65.
3. Cho ES, Kim SJ, Kwon MS, Cho H, Kim EH, Jun EM, Lee S. The effects of kangaroo care in the neonatal intensive care unit on the physiological functions of preterm infants, maternal–infant attachment, and maternal stress. *Journal of pediatric nursing*. 2016 Jul 1;31(4):430-8.
4. Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane database of systematic Reviews*. 2016(11).
5. Ionio C, Ciuffo G, Landoni M. Parent–infant skin-to-skin contact and stress regulation: A systematic review of the literature. *International journal of environmental research and public health*. 2021 Apr 28;18(9):4695.
6. Bera A, Ghosh J, Singh AK, Hazra A, Som T, Munian D. Effect of kangaroo mother care on vital physiological parameters of the low birth weight newborn. *Indian Journal of Community Medicine*. 2014 Oct 1;39(4):245-9.
7. Pados BF. Physiology of stress and use of skin-to-skin care as a stress-reducing intervention in the NICU. *Nursing for Women's Health*. 2019 Feb 1;23(1):59-70.
8. Charpak N, Tessier R, Ruiz JG, Hernandez JT, Uriza F, Villegas J, Nadeau L, Mercier C, Maheu F, Marin J, Cortes D. Twenty-year follow-up of kangaroo mother care versus traditional care. *Pediatrics*. 2017 Jan 1;139(1).
9. Campbell-Yeo M, Johnston CC, Benoit B, Disher T, Caddell K, Vincer M, Walker CD, Latimer M, Streiner DL, Inglis D. Sustained efficacy of kangaroo care for repeated painful procedures over neonatal intensive care unit hospitalization: a single-blind randomized controlled trial. *Pain*. 2019 Nov 1;160(11):2580-8.
10. Brotherton H, Gai A, Tann CJ, Samateh AL, Seale AC, Zaman SM, Cousens S, Roca A, Lawn JE. Protocol for a randomised trial of early kangaroo mother care compared to standard care on survival of pre-stabilised preterm neonates in The Gambia (eKMC). *Trials*. 2020 Dec;21:1-4.

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11. Walani SR. Global burden of preterm birth. *International Journal of Gynecology & Obstetrics*. 2020 Jul;150(1):31-3.
12. Davanzo R, Brovedani P, Travan L, Kennedy J, Crocetta A, Sanesi C, Strajn T, De Cunto A. Intermittent kangaroo mother care: a NICU protocol. *Journal of Human Lactation*. 2013 Aug;29(3):332-8
13. Ramani M, Choe EA, Major M, Newton R, Mwenechanya M, Travers CP, Chomba E, Ambalavanan N, Carlo WA. Kangaroo mother care for the prevention of neonatal hypothermia: a randomised controlled trial in term neonates. *Archives of disease in childhood*. 2018 May 1;103(5):492-7.
14. Gazzolo D, Masetti P, Meli M. Kangaroo care improves post-extubation cardiorespiratory parameters in infants after open heart surgery. *Acta Paediatr* 2000;89:728-9.
15. Bauer K, Pyper A, Sperling P, Uhrig C, Versmold H. Effects of gestational and postnatal age on body temperature, oxygen consumption, and activity during early skin-to-skin contact between preterm infants of 25-30-week gestation and their mothers. *Pediatr Res* 1998;44:247-51.
16. Miltersteiner AR, Miltersteiner DR, Rech VV. Respostas fisiologicas da posicao Mae. Canguru em bebes pre-terminos. *Rev Bras Saude Matern Infant* 2003;3:447-55.
17. Chwo MJ, Anderson GC, Good M, Dowling DA, Shiao SH, Chu DM. A randomized controlled trial of early Kangaroo care for preterm infants: Effects on temperature, weight, behavior, and acuity. *J Nurs Res* 2002;10:129-42.
18. Bohnhorst B, Gill D, Dördelmann M, Peter CS, Poets CF. Bradycardia and desaturation during skin-to-skin care: No relationship to hyperthermia. *J Pediatr* 2004;145:499-502.
19. El-Nagger NM, El-Azim HA, Hassan SM. Effect of kangaroo mother care on premature infants' physiological, behavioral and psychosocial outcomes in Ain Shams Maternity and Gynecological Hospital, Cairo, Egypt. *Life Sci J*. 2013;10(1):703-16.
20. Sontheimer D, Fischer CB, Buch KE. Kangaroo transport instead of incubator transport. *Pediatrics* 2004;113:920-3
21. Almeida CM, Almeida AF, Forti EM. Effects of Kangaroo mother care on the vital signs of low-weight newborns. *Rev Bras Fisioter* 2007;11:756-60.
22. Jefferies AL, Canadian Paediatric Society, Fetus and Newborn Committee. Kangaroo care for the preterm infant and family. *Paediatrics & child health*. 2012 Mar 1;17(3):141-3.
23. Begum EA, Bonno M, Ohtani N, Yamashita S, Tanaka S, Yamamoto H, Kawai M, Komada Y. Cerebral oxygenation responses during kangaroo care in low birth

The effect of kangaroo mother care in decreasing the duration of hospital admission in preterm and critically ill neonates

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weight infants. BMC pediatrics. 2008 Dec;8:1-9.

24. Rangey PS, Sheth M. Comparative effect of massage therapy versus kangaroo mother care on body weight and length of hospital stay in low birth weight preterm infants. International journal of pediatrics. 2014 May 25;2014.

25. Ramanathan K, Paul VK, Deorari AK, Taneja U, George G. Kangaroo Mother Care in very low birth weight infants. Indian J Pediatr 2001;68:1019-23

26. Lamy Filho F, Silva AA, Lamy ZC, Gomes MA, Moreira ME. Evaluation of the neonatal outcomes of the kangaroo mother method in Brazil. Jornal de Pediatria.

27. Samra NM, El Taweel A, Cadwell K. Effect of intermittent kangaroo mother care on weight gain of low birth weight neonates with delayed weight gain. The Journal of perinatal education. 2013 Jan 1;22(4):194-200

28. Rasul N, Rashid M, Abbas A, Sohail R. First experience of implementation of kangaroo mother care in Punjab-Pakistan to reduce morbidity and mortality in preterm infants. Ann King Edw Med Univ. 2017 Oct 1;23:496-502.

29. Shrivastava SR, Shrivastava PS, Ramasamy J. Utility of kangaroo mother care in preterm and low birthweight infants. South African Family Practice. 2013 Sep 10;55(4):340-4.