



## **Effect of Kangaroo Mother Care Educational Program on Nurses' Performance and Physiological Parameters of Preterm Neonates**

**Gawhara Gad Soliman Ebrahim<sup>1</sup>, Eman Abd Elsamea Elguoshy Hassanen<sup>2</sup>,  
Aml Reda Mohamed Ebrahim Mansy<sup>3</sup>**

<sup>1</sup>Assistant Professor of Pediatric Nursing, Faculty of Nursing, Mansoura University

<sup>2,3</sup>Lecturer of Pediatric Nursing, Faculty of Nursing, Mansoura University

### **ABSTRACT**

**Background:** Kangaroo Mother Care (KMC) is a comprehensive, humanized, cost effective, developmentally supportive therapy for hospitalized preterm infants and proven method of care for low-birth-weight infants. It is a useful method for addressing a baby's demands for warmth, nursing, stimulation, safety, and affection as well as for preventing infections and shortening hospital stays. **The study aimed to** evaluate the effect of kangaroo care educational program on nurses' performance and physiological parameters of preterm neonates. **Study design:** A quasi-experimental (pre/post-test) research design was utilized. **Setting:** This study was carried out at Neonatal Intensive Care Unit at Mansoura University Children Hospital, Mansoura City. **Subjects:** A convenient sample of 50 nurses working at NICU and a purposive sample of 50 preterm neonates and their mothers in NICU. **Results:** The study revealed that there was a significant improvement in nurses' knowledge and practices about KMC and also a significant improvement in the physiological parameters of preterm neonates immediately after and three months later than pre implementation of educational program. **Conclusion:** Implementing an educational program about KMC effectively improved nurses' knowledge and practices and physiological parameters of preterm neonates. **Recommendation:** Periodic KMC training for nurses is needed and should aim to build nurses' competence in providing KMC in different health care settings.

**Key words:** Educational program, KMC, Nurses performance, Preterm neonates, Physiological parameters.

### **Introduction**

Preterm neonates in the neonatal intensive care unit (NICU) are subjected to various stressors, including bright light, noise from medical equipment, and invasive hospital procedures. Preterm neonate may respond physiologically and behaviorally to valuable and essential NICU

therapies. Maternal bonding is further impacted by the setting of the neonatal critical care unit and the separation of newborns from their mothers, which restricts the visual, tactile, and auditory attachment between infant and mother (Medina et al., 2018; Ljungblad et al, 2022; Cho et al, 2016).

Though they make up 15% of all newborns globally, low birth weight babies who are born prematurely, small for their gestational age, or both account for 70% of all neonatal deaths. One of the most successful interventions for enhancing the attachment, physiological parameter and lower the incidence of many neonatal problems is kangaroo mother care (KMC), which is defined as a method of care of preterm neonates. The method involves preterm being carried usually by the mother with constant skin-to-skin contact between the preterm and the mother (or another caregiver if skin-to-skin contact with the mother is not possible). According to World Health Organization (WHO) standards, when an infant's condition starts to stabilize, short, intermittent sessions of kangaroo mother care should be started. Once the infant's condition has stabilized, kangaroo mother care should be continued (**Linner et al., 2020**).

Kangaroo position (skin-to-skin contact between mother and newborn), nursing, and prompt discharge with close follow-up are the three components of KMC. This process, which can be carried out day or night, provides the best conditions for a newborn's transition to life outside the womb. Better cognitive and motor development by the time the baby is six months old is another benefit of kangaroo mother care for preterm babies. Kangaroo mother care is a valuable tool in lowering postpartum hospital stays, which lowers overall healthcare costs and helps the parents economically in addition to the benefits to newborn and maternal health (**Rahman, et al., 2017; Septiana et al., 2021**).

Compared to the incubator care approach, skin-to-skin contact between a mother and her infant is a proven advantage for both parties and is a safe and affordable treatment. It has a big impact on mother-baby bonding quality, neurodevelopment, and newborn survival. In addition to enhancing high-quality care, kangaroo mother care enables caregivers to limit the usage of costly equipment like incubators and heaters. Through early skin-to-skin contact, kangaroo care gives babies tactile stimulation, kinesthetic visual stimuli from direct skin contact and olfactory stimuli from suckling (**Akbari et al., 2018**).

Skin-to-skin contact between the mother and child reduces postpartum depression symptoms in the mother and enhances mother-child bonding in preterm and low birth weight (LBW) preterm neonates who are undergoing KMC who are preterm or low birth weight acquire more weight daily, have better respiratory and heart rate control, and have adequate oxygenation. Additionally, it helps the baby start breastfeeding at an early age and do so successfully. This lowers the risk of necrotizing enterocolitis, which is the primary cause of death for preterm neonates. It also helps babies in the neonatal intensive care unit feel less stressed and has long- and short-term benefits for their neurological, cognitive, emotional, behavioral, and social development (**Mekonnen et al., 2019**).

### **Significance of the study**

In Egypt, there are still a lot of premature babies even with greater efforts to prevent prematurity. It might reach around 41,728 babies annually. These numbers may indicate that there is

a high incidence of newborn critical care as well as short- and long-term social development (**Deng et al., 2018**). Preterm delivery's detrimental effects claim the lives of one million newborns every year. Low-birth-weight babies who survive the early neonatal period are more likely to experience developmental problems, early growth retardation, infections, and early mortality in neonates (**Gomaa et al., 2022**). Research from both developed and developing nations has shown that KMC has a number of beneficial effects on newborns, such as a decreased mortality rate, enhanced feeding support for weight gain, and the maintenance of physiological parameters like respiration, heart rate, oxygen saturation, and proper thermoregulation. Being the moms' first point of contact and the source of information about the KMC Method, the kangaroo care education nurse's job is vital. By exchanging information, abilities, and responsibilities pertaining to acting as the child's primary caregiver and meeting all of their physical and emotional requirements, the goal is to continuously involve the mother. In order to raise mothers' awareness of preventing infant problems, nursing staff must educate them on essential KMC methods. Additionally, nurses must supervise the implementation process to guarantee its effectiveness (**Erduran & Yaman Sözbir, 2022; El-Sayed et al., 2018**).

### **Aim of the study**

#### **The aim of this study is to:**

Evaluate the effect of kangaroo mother care educational program on nurses' performance and physiological parameters of preterm neonates through:

- 1- Assess nurses' knowledge about kangaroo mother care pre- implementation of the educational program.
- 2- Assess nurses' practices about kangaroo mother care, pre-implementation of the educational program.
- 3- Assess physiological parameters of preterm neonates' pre-implementation of the educational program
- 4- Design educational program based on initial assessment of nurses' knowledge and practices about kangaroo mother care in NICU
- 5- Implement educational program for nurses about kangaroo mother care.
- 6- Evaluate the effect of educational program about kangaroo mother care on knowledge and practices of nurses immediately post and follow up 3 months later.
- 7- Evaluate the effect of educational program about kangaroo mother care on physiological parameters of preterm neonates 30 minutes prior and 30 minutes every day for 6 days after implementation of KC.

### **Research Hypothesis:**

**H1:** Implementing an educational program for nurses are expected to improve nurses' knowledge about kangaroo mother care

**H2:** Implementing an educational program for nurses are expected to improve nurses' practice regarding kangaroo mother care

**H3:** Implementing an educational program for nurses are expected to improve physiological parameters of the premature neonates

## Operational definition

**Nurses' Performance:** it means knowledge and practice of nurses regarding caring of preterm infants in NICU

**Physiological parameters:** is a physiological phenomenon that occurs in response to stimulation from the interaction between humans and their environment. Measurements of physiological parameters include body weight, temperature, heart and respiratory rates, and oxygen saturation. (Bera et al., 2014).

**Preterm infants:** is defined as birth occurring prior to the 37th week of pregnancy (Schroeder, 2016).

### Research design:

A quasi-experimental (pre/post-test) research design using one group (before, immediately after, and three-month follow-up) was used.

### Setting:

The Neonatal Intensive Care Unit at Mansoura University Children Hospital (MUCH), in Mansoura City, was the site of this study.

### Subjects:

Based on data from literature (El Tatawy et al., 2022), considering level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula:

$$n = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 \times p(1-p)}{(d)^2} \text{ where, } p = \text{pooled}$$

proportion obtained from previous study;  $d$  = expected difference in proportion of events;  $Z_{\alpha/2} = 1.96$  (for 5% level of significance) and  $Z_{\beta} = 0.84$  (for 80% power of study). Therefore,

$$n = \frac{2(1.96 + 0.27)^2 \times 0.1(1-0.27)}{(0.24)^2} = 50.$$

The sample size is a convenient sample of neonatal nurses working at NICU, totaling 50 participants. The nurses were selected based on their availability, affiliation with the mentioned settings, and their role in caring for preterm neonates. A purposive sample of 50 preterm neonates and their mothers at NICU was intentionally chosen based on predetermined inclusion criteria. The selection criteria for preterm neonates **included in the study were as follows:** admitted to NICU less than 1 month to more than 2 moths, Gestational age 34 to more than 37 weeks, Weight from 1500 to more than 2000 grams, both genders and mothers of preterm neonates are available in the hospital, healthy, and willing to be involved in the research study.

**Exclusion criteria** encompass preterm neonates admitted with hemodynamically unstable, preterm with intraventricular hemorrhage, post-surgery or open wound, chest drains, ECMO, gastroschisis and meningomyelocele and receiving respiratory therapy with a ventilator

**Tools: Three tools were used in the current study:**

**Tool I: A structured Questionnaire Sheet of the studied subjects** (pre/post & follow up -test): the researcher designed it to assess socio-demographic characteristics of the studied subjects, it contained the following:

**Part I: -socio-demographic data of studied nurses:** It was focused on the socio-demographic characteristics of the nurses including their age, education, years of experience and previous participation of training courses related to KMC

**Part II: - Preterm neonates and their mothers' socio-demographic data:** It was

focused on the socio-demographic characteristics of premature infants and their mothers. For preterm neonates; age, gender, residence, birth order, length of stay in NICU, feeding, gestational age, time to initiation of skin-to-skin contact by mother after admission of preterm to NICU and duration of skin-to-skin contact in kangaroo mother care per day. For mothers; age, education and occupation.

### **Part III: Neonatal nurses' knowledge regarding kangaroo care**

It was adapted from **Adisasmita et al, (2021); Al-Shehri, & Binmanee, (2021)**. It was used to investigate the effect of kangaroo care educational program on nurses' knowledge. Knowledge of kangaroo care including; definition, position, best time to place each preterm in skin-to-skin contact with his/her mother, type and duration of position, indication, benefits and contraindications was the focus of the study.

**Scoring system of nurses' knowledge:** Scores were estimated to examine the effect of kangaroo care educational program on nurses' knowledge about KMC; in which each correct answer will be given a score one, while a score zero will be given for incorrect, missed or unknown answers. The overall scores of knowledge were divided into three categories; poor if score < 50, good if score 50- <75% and fair if score  $\geq$  75.

**Tool II: Observational checklists**, which the researcher created after reviewing current literature (**Tadele et al., 2023**). The nurse's practices in areas related to KMC steps.

**Scoring system of nurses' practices:** Scores were estimated to examine the effect of kangaroo care educational program on nurses' practices about KMC; in which each correctly completed step was given a score of one, while incorrectly completed and uncompleted steps was given a score of zero through direct observation (concurrent assessment). The overall scores of studied nurses' practices were divided into two categories; competent if score 85% and incompetent if score less than 85%.

**Tool III: Preterm neonates' physiological parameters sheet;** these included measuring basic physiological measurements before and after KMC in the hospital per day for 6 days. These measurements included temperature, oxygen saturation, heart rate, and respiratory rate. Preterm neonates' physiological parameters were assessed 30 minutes prior and 30 minutes following KC.

### **Method**

**Ethical considerations followed through;** the Mansoura Faculty of Nursing's Research Ethics Committee officially approved the study (P 0499), participants were informed that participation in the study is voluntary; each participants nurses & mothers were provided oral informed consent prior to the study's start and after it was explained to them; and throughout the study, assurances were made regarding the anonymity and confidentiality of the data collected. Participants in the study did not experience any physical or psychological harm and maintain their privacy in the study setting and any participant has the right to withdraw at any stage freely without any responsibilities.

## **Tool validity and reliability**

A panel of five experts in the field of nursing care evaluated and revised the study tools' content validity for its clarity, content, a sequence of items, and relevance or irrelevance of its content. Their recommendations were followed, and the necessary changes were made. For tools I and II, the dependability of internal consistency as measured by the Cronbach's alpha coefficient was 0.96 and 0.752, respectively. Coefficient alpha used to measure overall reliability for two tools was 0.946. For tools III, the Cronbach's alpha coefficient was 0.854 (El Tatawy et al., 2022).

## **Pilot study**

A pilot study was carried out with 10% of the total subjects' size (5 nurses & 5 preterm neonates and their mothers) to confirm the feasibility and applicability of the tools. The subjects of the pilot study were included in the study total sample because there were no significant changes required in the study tool.

## **Fieldwork**

### **Process of data collection**

The data collection was extended over a period of four months, this period was begun from the end of July 2023 until the end of November 2023. The researcher begins by introducing herself to the nurses and mothers and giving them a brief overview of the purpose and nature of the study. The study's framework was implemented in the following four phases. The researcher attended six days per week and on three shifts in the study setting from 9.00 am, 2.00 pm and 7.00 pm.

**Assessment phase;** each nurse interviewed individually by the researcher to assess knowledge and practices about kangaroo mother care, each mother interviewed individually by the researcher to collect their sociodemographic characteristics and preterm neonates' outcome were assessed prior implementation of the educational program, using tool I (part I, II & III) and tool II. Each preterm was assessed pre implementation of the educational program, using tool III

**Planning phase;** goals, priorities, and expected outcomes were developed in response to the assessment phase's findings regarding the nurses' knowledge gaps and their practical needs regarding KMC intervention. During this phase, three sessions were planned by the researcher for the nurses to provide them with knowledge and practices about KMC intervention (two sessions focused on KMC knowledge and one session on KMC practices). **Theoretical part:** Contains information about the definition of kangaroo mother care, how to prepare a baby and parents for it, the position (technique), advantages, and indications and contraindications of kangaroo mother care were all covered in the first two didactic sessions.

**Practical part:** The steps of kangaroo mother care were covered in the second practical chapter, (the third session). A variety of instructional techniques, including lectures, group discussions, demonstrations, and re-demonstrations, were employed. The researcher completed both didactic (theoretical) and practical sessions in the NICU.

## Implementation phase

Goals, priorities, and expected outcomes were developed after the assessment phase in order to address the practical needs and knowledge gaps that nurses had with regard to KMC. Through the use of a booklet with three main chapters based on an assessment of the nurses' actual educational needs, the program's objectives and contents were determined after a thorough review of the relevant literatures and translated into Arabic. Each chapter's explanation took up two didactic sessions and one practical session with nurses, who were divided into small groups of eight to ten for each; each session lasted 30 to 45 minutes during the morning and afternoon shifts, with 4-5 nurses participating. A variety of educational methods and media were used to implement KMC, including group discussion, brainstorming, demonstration and repetition, video films, posters, and booklets. Physiological parameters of preterm infants as; temperature, oxygen saturation, heart rate, and respiratory rate were measured 30 minutes before and 30 minutes after KMC in the hospital per day for 6 days. The researcher observes nurses' practices pre and post implementation of the KMC sessions on the mothers and their neonates after maintaining mothers' privacy by using of braves at NICU, and after assessment of neonates' conditions and their physiological parameters before implementing the KMC on them. Using a tool (II& III).

## 4) Evaluation phase

After the implementation of the KMC educational intervention, nurses' knowledge and

practices and physiological parameters of preterm were evaluated immediately and after three months follow-up using the previously mentioned study tools.

## Study outcome

- Enhancement of nurses' knowledge about kangaroo mother care
- Enhancement of nurses' practices about kangaroo mother care
- Enhancement of preterm neonates' physiological parameters

## Statistical analysis

The data collected was processed, organized, and analyzed using statistical Package of social sciences (SPSS) version 26. Descriptive statistics such as frequencies and percentage were used to present the data for qualitative variables, while means and standard deviations were used for quantitative variables. For comparing quantitative continuous data before and after implementing the educational intervention, the t-test was employed. As For comparing qualitative variable, the Chi square test and fisher's exact test were used. The significance level (P-value) was set as 0.05 and the P-value less than or equal 0.001 was considered exceptionally significant.

## Results:

**Table (1)** illustrates that more than half of the studied nurses (58%) aged from 30 - < 40 years old with the mean age of  $31.4 \pm 5.2$  years. As regards nurses' educational level, it was noticed that half of them (50%) had a nursing diploma and (46%) of them had from five years of experience to less than 10 years. The same table also, revealed

that the majority of the studied nurses (82%) did not attend previous training about the effect of kangaroo mother care.

**Table (2)** revealed that slightly more than two thirds of the studied premature infants (68%) had from 34 - < 37 weeks of Gestational age and more than half of them were boys (58%). Regarding Time to initiation of skin-to-skin contact by mother it was found that (30%) of mothers begins initiation of skin-to-skin contact to the studied premature infants from 12 to less than 24 hours after admission of preterm to NICU.

**Table (3)** showed that two thirds of mothers (62%) aged 21 to 30 years; while the majority of mothers who have university degree and unemployed were respectively (64% &80%).

**Table (4)** illustrated that there were statistically significant differences in the nurse's knowledge between pre implementation and immediately after as well as between pre and after 3 months of the kangaroo care educational program implementation

**Table (5)** clarified that nurses' practices about kangaroo care pre, immediate post, and follow-up after implementation of the educational program were highly statistically significant.

**Table (6)** revealed nurse's distribution according to their total knowledge score, it was noticed that among all participants, 6% of the nurses in the study had good knowledge before the educational program implementation. This percentage improved to 80% and 68% Immediately after and after 3 months respectively

with highly statistically significant differences between before and immediately after the program and between before and after 3 months ( $P = <0.001^{**}$  for each of them). In relation to total nurses' practices, this table illustrated that 20% of the studied nurses had competent practices before the educational program implementation compared with 86% and 74% in the immediate post and at follow-up, respectively, with highly statistically significant differences between before and immediately after the program and between before and after 3 months ( $P = <0.001^{**}$  for each of them).

Table (7) represented that there were a highly statistically significant differences between mean scores of vital signs among studied preterm neonates pre and after implementation of kangaroo care educational program along fourth, fifth, and six days of kangaroo mother ( $p = <0.001^{**}$  for all of them Association between Nurses' Knowledge Scores and Practice Scores is presented in Table (8). It is revealed from the table that 10% of nurses had "Good" Knowledge score and "Competent" practices score pre implementation of the educational program with no statistically significant difference ( $P=0.228$ ). Immediately after the program the majority (90.7%) of nurses who had "Good" Knowledge score had a "Competent" practice score with statistically significant difference. After 3 months later 86.1% of nurses who had "Good" knowledge score had "Competent" practice score and statistically significant difference was found.

	N	%
<b>Age (Years)</b>		
20 – < 30	18	36.0
30 – < 40	29	58.0
40 – < 50	3	6.0
<b>Mean ±SD</b>	31.4 ±5.2	
<b>Educational level</b>		
Nursing Diploma	25	50.0
Technical Institute	9	18.0
Bachelor's Degree	16	32.0
<b>Years of experience in NICU</b>		
1 – < 5	14	28.0
5 – <10	23	46.0
10 or More	13	26.0
<b>Previous attending training about the effect of kangaroo mother care</b>		
Yes	9	18.0
No	41	82.0

	N	%
<b>Gestational age (Weeks)</b>		
34 – <37	34	68.0
37 or More	16	32.0
<b>Neonates Gender</b>		
Male	29	58.0
Female	21	42.0
<b>Residence</b>		
Rural	16	32.0
Urban	34	68.0
<b>Birth Order</b>		
First	19	38.0
Second	28	56.0
Third	3	6.0
<b>Length of stay in NICU</b>		
Less than 1 month	20	40.0
1 month – less than 2 months	14	28.0
2 months or more	16	32.0
<b>Feeding Method</b>		
Breast	10	20.0
Bottle	17	34.0
Gavage	17	34.0
Total parenteral nutrition	6	12.0

<b>Duration of breast-feeding/ day</b>		
Less than half an hour	10	20.0
More than half an hour	40	80.0
<b>Time to initiation of skin-to-skin contact by mother after admission of preterm to NICU</b>		
Less than 2 hours	9	18.0
2 to less than 6 hours	11	22.0
6 to less than 12 hours	6	12.0
12 to less than 24 hours	15	30.0
24 hours	9	18.0
<b>Duration of skin-to-skin contact in kangaroo care/ day</b>		
Less than half an hour	24	48.0
More than half an hour	26	52.0

**Table (3). Characteristics of the preterm neonates' mothers (n=50)**

	N	%
<b>Age</b>		
Less than 20	4	8
21-30	31	62
More than 30	15	30
<b>Education</b>		
Illiterate	1	2
Non-university degree	17	34
University degree	32	64
<b>Occupation</b>		
Employed	10	20
Un employed	40	80

<b>Table (4). Nurses' knowledge about kangaroo mother care at pre-educational program, immediate post and follow-up (n= 50)</b>																
	Pre – Educational program				Immediate Post				Follow – Up				Pre – Educational program / Immediate Post		Pre – Educational program / Follow – Up	
	Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		X <sup>2</sup>	P	X <sup>2</sup>	P
	N	%	n	%	N	%	N	%	N	%	N	%				
Kangaroo mother care (KMC) awareness	40	80.0	10	20.0	13	26.0	37	74.0	14	28.0	36	72.0	29.265	<0.001**	27.214	<0.001**
Definition of kangaroo mother care	7	70.0	3	30.0	5	13.5	32	86.5	10	27.8	26	72.2	13.211	<0.001**	5.988	0.014*
Technique (position) of kangaroo mother care	37	74.0	13	26.0	11	22.0	39	78.0	15	30.0	35	70.0	27.083	<0.001**	19.391	<0.001**
Ideal time to place every healthy newborn in skin to skin contact according to world health organization	37	74.0	13	26.0	10	20.0	40	80.0	16	32.0	34	68.0	29.265	<0.001**	17.703	<0.001**
Type of position during kangaroo mother care	40	80.0	10	20.0	7	14.0	43	86.0	16	32.0	34	68.0	43.717	<0.001**	23.376	<0.001**
Duration of baby position in continuous kangaroo position	35	70.0	15	30.0	10	20.0	40	80.0	18	36.0	32	64.0	25.252	<0.001**	11.601	<0.001**
Duration of baby position in intermittent kangaroo position	35	70.0	15	30.0	11	22.0	39	78.0	13	26.0	37	74.0	23.188	<0.001**	19.391	<0.001**
Eligibility criterion for kangaroo position in NICU	38	76.0	12	24.0	9	18.0	41	82.0	19	38.0	31	62.0	33.761	<0.001**	14.728	<0.001**
Advantage of kangaroo position	39	78.0	11	22.0	13	26.0	37	74.0	17	34.0	33	66.0	27.083	<0.001**	19.642	<0.001**
Contraindication for kangaroo position in NICU	34	68.0	16	32.0	12	24.0	38	76.0	19	38.0	31	62.0	19.484	<0.001**	9.032	0.002*

\* Statistical significance at 0.05 levels

\*\* Highly statistical significance at 0.001 level

**Table (5). Nurses' practices of kangaroo mother care at pre-educational program, immediate post and follow-up (n=50)**

	Pre – Educational program						Immediate Post						Follow – Up						Pre – Educational program / Immediate Post		Pre – Educational program / Follow – Up	
	Not Done		Done Incorrectly		Done Correctly		Not Done		Done Incorrectly		Done Correctly		Not Done		Done Incorrectly		Done Correctly		X <sup>2</sup>	P	X <sup>2</sup>	P
	N	%	N	%	n	%	n	%	n	%	n	%	n	%	N	%	X <sup>2</sup>	P	X <sup>2</sup>	P		
Undresses the baby gently, except for cap, nappy and socks.	34	68.0	10	20.0	6	12.0	5	10.0	8	16.0	37	74.0	7	14.0	12	24.0	31	62.0	44.135	<0.001**	34.854	<0.001**
Places the baby prone on mother's chest in an upright position with the head slightly extended	35	70.0	10	20.0	5	10.0	6	12.0	6	12.0	38	76.0	7	14.0	11	22.0	32	64.0	46.837	<0.001**	38.416	<0.001**
Covers the baby with mother's 'pallu' or gown; wraps the baby-mother duo with an added blanket or shawl depending upon the room temperature	33	66.0	9	18.0	8	16.0	3	6.0	9	18.0	38	76.0	6	12.0	13	26.0	31	62.0	44.565	<0.001**	32.983	<0.001**
Advises mother to breastfeed the baby frequently	32	64.0	9	18.0	9	18.0	3	6.0	6	12.0	41	82.0	6	12.0	14	28.0	30	60.0	45.108	<0.001**	30.184	<0.001**
Ensures warm room with room temperature maintained between 26 – 280 C.	35	70.0	9	18.0	6	12.0	4	8.0	6	12.0	40	80.0	9	18.0	12	24.0	29	58.0	50.371	<0.001**	30.906	<0.001**
Advises the mother to provide KMC for 1 hour per session if applicable. The length of skin-to-skin contact should be for as long as possible	32	64.0	10	20.0	8	16.0	3	6.0	8	16.0	39	78.0	6	12.0	11	22.0	33	66.0	44.697	<0.001**	33.080	<0.001**

\* Statistical significance at 0.05 level

\*\* Highly statistical significance at 0.001 level

**Table (6). Total percent of nurses' knowledge and practices of kangaroo care pre-educational program, immediate post and follow-up (n= 50)**

Items	Pre – Educational program		Immediate Post		Follow – Up		Pre – Educational program / Immediate Post		Pre – Educational program / Follow – Up	
	N	%	N	%	N	%	X <sup>2</sup>	P	X <sup>2</sup>	P
<b>Total Percent Scores of Nurses' Knowledge</b>										
Poor Knowledge	43	86.0	4	8.0	7	14.0				
Fair Knowledge	4	8.0	6	12.0	9	18.0				
Good Knowledge	3	6.0	40	80.0	34	68.0	64.598	<0.001**	53.816	<0.001**
<b>Total Percent Scores of Nurses' Practices Level</b>										
Incompetent Practice	40	80.0	7	14.0	13	26.0				
Competent Practice	10	20.0	43	86.0	37	74.0	43.717	<0.001**	29.265	<0.001**

\* Statistical significance at 0.05 level

\*\* Highly statistical significance at 0.001 level

**Table (7). Physiological parameters of the studied preterm neonates before 30 minutes and after 30 minutes of implementation of kangaroo mother care along six days.**

Physiological parameters	Days of applying kangaroo care	Pre – Educational program	Post – Educational program	Student’s T – Test	
		Mean ±SD	Mean ±SD	T	P
<b>Temperature</b>	<b>1st day</b>	37.9 ±0.2	37.8 ±0.4	1.581	0.117
	<b>2nd day</b>	38.2 ±0.6	37.9 ±0.8	2.121	0.036*
	<b>3rd day</b>	38.1 ±0.6	37.8 ±0.5	2.716	0.008*
	<b>4th day</b>	38.3 ±0.5	36.9 ±0.5	14.000	<0.001**
	<b>5th day</b>	38.0 ±0.4	37.1 ±0.3	12.727	<0.001**
	<b>6th day</b>	38.5 ±0.5	37.2 ±0.3	15.764	<0.001**
<b>Heart rate b/m</b>	<b>1st day</b>	89.5 ±11.8	92.7 ±15.4	1.166	0.246
	<b>2nd day</b>	92.1 ±10.8	89.9 ±7.0	1.208	0.229
	<b>3rd day</b>	93.7 ±14.7	89.4 ±8.0	1.816	0.072
	<b>4th day</b>	91.6 ±14.4	83.5 ±7.4	3.537	<0.001**
	<b>5th day</b>	92.0 ±13.1	82.1 ±7.3	4.667	<0.001**
	<b>6th day</b>	93.9 ±10.9	82.4 ±8.0	6.014	<0.001**
<b>Respiration c/m</b>	<b>1st day</b>	23.9 ±7.0	25.6 ±7.6	1.163	0.247
	<b>2nd day</b>	23.2 ±6.7	23.9 ±3.5	0.654	0.514
	<b>3rd day</b>	23.6 ±6.1	22.4 ±2.0	1.321	0.189
	<b>4th day</b>	24.0 ±5.9	19.7 ±2.7	4.686	<0.001**
	<b>5th day</b>	24.8 ±5.4	18.6 ±1.7	7.744	<0.001**
	<b>6th day</b>	23.7 ±4.5	17.6 ±1.3	9.208	<0.001**
<b>O2 saturation</b>	<b>1st day</b>	95.4 ±1.6	95.1 ±2.2	0.779	0.437
	<b>2nd day</b>	94.9 ±1.1	95.2 ±1.0	1.427	0.156
	<b>3rd day</b>	94.7 ±1.4	95.4 ±1.3	2.590	0.011*
	<b>4th day</b>	93.3 ±1.3	96.1 ±1.2	11.191	<0.001**
	<b>5th day</b>	93.4 ±1.5	96.9 ±1.0	13.728	<0.001**
	<b>6th day</b>	93.4 ±1.2	97.2 ±1.4	14.572	<0.001**

Revealed that there was a statistically significant difference pre- and post-educational program concerning temperature, heart rate, respiration, and O2 saturation at p-value <0.05.

**Table (8). Association between nurses' knowledge and practice about KC pre implementation, immediately post and at follow up**

	Pre – Educational program				Immediate Post				Follow – Up			
	Incompetent Practice (n=40)		Competent Practice (n=10)		Incompetent Practice (n=7)		Competent Practice (n=43)		Incompetent Practice (n=13)		Competent Practice (n=37)	
	N	%	N	%	N	%	N	%	n	%	n	%
<b>Knowledge Level</b>												
Poor Knowledge	36	90.0	7	70.0	4	57.1	0	0.0	7	53.8	0	0.0
Fair Knowledge	2	5.0	2	20.0	2	28.6	4	9.3	3	23.1	6	16.7
Good Knowledge	2	5.0	1	10.0	1	14.3	39	90.7	3	23.1	31	86.1
<b>Fisher's exact test</b>	X <sup>2</sup> =2.955, P=0.228				X <sup>2</sup> =30.828, P<0.001**				X <sup>2</sup> =25.388, P<0.001**			

\* Statistical significance at 0.05 level

\*\* Highly statistical significance at 0.001 level

### Discussion:

In the neonatal intensive care unit (NICU), preterm neonates are exposed to stress factors such as invasive hospital procedures, bright light and noise from medical equipment (Gao et al, 2015, Cong et al, 2017; Blume-Peytavi et al, 2016; Medina et al, 2018; Chan, et al., 2016; Campbell-Yeo et al., 2019). Through early skin-to-skin contact, kinesthetic visual stimuli from direct skin contact and olfactory stimuli from suckling, kangaroo care gives babies tactile stimulation. Additionally, it fosters the contact, attachment, and bonding that are necessary for the emotional and social development of the child and mother (Moore et al., 2016; Chi Luong et al., 2016). This study set out to assess how the kangaroo mother care educational program affected the physiological parameters of preterm neonates and the performance of nurses. The study's findings confirmed the theories that

following the intervention, participants' knowledge, practice, and attitude ratings were higher than they had been previously. Furthermore, after intervention, it enhanced the physiological stress indicators in preterm neonates.

This study found that more than half of the studied nurses aged from 30 - < 40 years old with the mean age of 31.4±5.2 years. As regards nurses' educational level, it was noticed that half of them had a nursing diploma degree and more than two fifth of them had from five years of experience to less than 10 years. Furthermore, the vast majority of the nurses under study had not previously received instruction regarding the impact of kangaroo mother care. This result is consistent with (Al-Shehri & Binmanee, 2021) in their study about Kangaroo mother care practice, knowledge, and perception among NICU nurses in Riyadh, Saudi Arabia, revealed that over two thirds of the participants were middle-aged, falling

between the ages of 31 and 40. In relation to educational background, the majority of the nurses investigated held a diploma. The majority of respondents did not participate in the KMC training program, and the fair duration of their work experience at NICUs (5–10 years) may have contributed to their lack of concern for such training given their focus on job-related stress. According to the researcher's point of view, participation in this kind of training is required, and their attendance should be adjusted to fit their job schedules. Almost two thirds of the studied preterm infants were between 34 and < 37 weeks gestational age, with more than half being boys (58%).

This study presented two thirds of mothers aged 21 to 30 years; while the majority of mothers who have university degree and unemployed were respectively. This result contradicts with (**Parsa et al, 2023**) in their study about the effect of kangaroo mother care on physiological parameters of premature infants in Hamadan City, illustrated that more than half of the mothers aged 21 to 30 years, more than one third of them have a secondary education and less than half of them is unemployed

Regarding the amount of time it takes for mothers to initiate skin-to-skin contact with their newborn, it was shown that less than one third of mothers start doing so between 12 to less than 24 hours after the preterm is admitted to NICU. This was supported by (**Ahmed et al, 2023**). Who stated the same result in his study Effect of Kangaroo Mother Care Discharge Guide Program on

Mothers and Preterm Neonates Outcomes? The mother's illiteracy, poor knowledge, practice, and limited attendance at workshops or training modules for nurses working at NICUs may all contribute to the delayed initiation of skin-to-skin contact immediately after delivery. Additionally, nurses may face multiple practice barriers related to their working conditions and a shortage of locations for conducting KMC application to maintain the mother's privacy and dignity.

Regarding the nurse's knowledge pre implementation and immediately after as well as between before and after 3 months of the kangaroo mother care educational program application there were statistically significant differences was found in this study. This finding supported by (**Rocha et al, 2018**) in their study on respiratory care for neonates on ventilator, they demonstrated a significant correlation between nurses' training status and KC knowledge scores. The current study's findings may be the result of nurses' individual opinions about KMC, which should be taken into account when offering these educational programs to guarantee the efficacy of instruction. After completing extensive simulation-based training programs in KMC skills, nurses' competency, views of KC, and willingness to facilitate parental interactions with mothers all saw significant improvements.

Regarding Nurses Practices, it has been found highly statistically significant differences regarding kangaroo mother care pre, immediate post, and follow-up after application of the educational program. These findings are supported

by (Noren et al., 2018). Becoming a mother – mother's experience of kangaroo mother care, who found that mothers' practices improved after teaching programs. Hence, other researchers recommended that preterm neonates require special attention in relation to care to reduce mortality and morbidity rate by using KMC technique (Cristóbal Cañadas et al., 2022). KMC training is required for better practices and understanding of all the KC components. Despite the existing evidence of the effectiveness of the KC approach, it is not a routine practice in NICU. It was reported that nurses were task oriented and tended to focus more on the technical details of infant care, such as medical procedures and ventilator readings, rather than other aspects of nursing care, such as involving mothers in infant care (Shattnawi et al., 2019). The enhancement of nurses' knowledge & practice post KC program suggests that the training program effectively enhanced their abilities and competence in this area.

Preterm neonates typically exhibit cardiopulmonary instability as a result of their delayed development. Accordingly, the results of the present investigation demonstrated that KMC was effective in stabilizing the preterm neonates' physiological stress measures. Preterm neonates treated with KMC had more consistent body temperature, oxygen saturation, heart rate, and respiration rate. This finding supports the study hypothesis, which stated that newborns that underwent KMC techniques had much better physiological stress measures following intervention than before program implementation.

The current study's findings are in line with those of (Bergh et al., 2016) who came to the conclusion that KMC may more effectively and positively enhance biological stability in preterm neonates than did conventional care. Moreover, Boundy et al. (2016) stated that the application of KMC had positive effects on physiological stress parameters among neonates. In contrast, Cho et al. (2016) found that while there was a significant difference in the respiratory rates in the group receiving KC, there was no significant difference in SpO<sub>2</sub> levels.

It is true that the neonates won't lose heat if they remain in skin-to-skin contact with their mother. Raising the temperature, especially for LBW and preterm neonates with a tendency to hypothermia, is beneficial and improves the treatment outcomes. Heat loss increases the metabolic rate and oxygen demand, which leads to homeostatic problems, a worsening of apnea, physiological and metabolic instability, and impaired weight gain (Badr et al., 2022). This indicates that KMC is a simple yet effective treatment that can prevent a number of problems, particularly in neonates with LBW. It is also one of the more affordable options. The study also revealed a significant relationship between practice and knowledge. The present study's results validated the postulated hypotheses, which suggested that mothers' knowledge and practice of KMC differed significantly, and that the discharge guideline program improved the physiological stress parameters of preterm neonates compared to pre intervention. Therefore, the cornerstone of the health care team's educational efforts is raising

awareness about KMC (Ahmed et al., 2023). From the point of view of the researcher, it is important to apply KC as an integral part of basics intervention in NICU due to its importance for improving preterm physiological parameters and improving their health status.

### Conclusion

Based on the study findings and research hypothesis of the current study, it is concluded that there was an improvement in pediatric nurses' knowledge and practices about kangaroo mother care immediately after and three months later implementation of educational program than pre implementation of educational program. Additionally, KMC improves the physiological characteristics of premature babies.

### Recommendations

**Based to the Based on the current study findings, the following recommendations were proposed:**

- Nurses should implement KMC guidance program for mothers' pre-neonatal discharge to promote mothers' infant bonding.
- There should be more nurse training programs at KC. Further research is required to determine the impact of KMC on mothers' psychological well-being and the long-term effect of KMC in low birth weight and preterm infants.
- Policymakers and healthcare providers should provide facilities that facilitate KMC in addition to on-site training and explicit guidelines or standard operating procedures for each relevant ward.

- Ongoing training program must be conducted periodically for NIC nurses to update their knowledge and practice regarding neonatal care
- Developing of KMC guidelines and protocols is recommended at the NICU.
- Policymakers and healthcare providers should take into consideration increasing the duration of KMC to improve the health status of premature neonates

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