



## A comparative study on the impacts of conventional care versus kangaroo mother care in the intensive care unit of Imam Hussein hospital

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### ABSTRACT

**Introduction:** Annually, approximately 20 million low birth weight infants are born worldwide. Prematurity and low birth weight are significantly linked to infant mortality rates. Neonates in neonatal intensive care units are often separated from their mothers, leading to a lack of parental involvement in care, which poses numerous risks and threats. Preventing these risks typically requires advanced and costly technology as well as highly experienced staff. Kangaroo mother care has been identified as an alternative method that can mitigate these risks. This method fosters better parent-infant bonding, improves weight gain in preterm infants, enables earlier discharge, reduces nosocomial infections, promotes exclusive breastfeeding, lowers hospital costs, increases parental involvement in care, and supports better infant growth and development.

**Methods:** This semi-experimental clinical trial examined the effects of independent variables (kangaroo mother care and incubator care) on dependent variables (body temperature, weight gain, exclusive breastfeeding, and physiological measures) in 130 low birth weight infants admitted to the neonatal intensive care unit at Tehran Imam Hussein Hospital during 2019-2020.

**Results:** This study observed an increase in maternal presence at the hospital. There were no significant differences between the two groups of mothers in terms of quantitative variables such as maternal age, number of pregnancies, and length of maternal hospital stay post-delivery. The average duration of kangaroo mother care was  $12 \pm 8.7$  days, with a mean and standard deviation of  $17.25 \pm 24.81$  hours. No differences were found between the two groups in variables such as gestational age, Apgar score, and weight and height at birth, at stability, and at discharge. However, the duration of antibiotic use, incidence of patent ductus arteriosus, sepsis, apnea, and mortality were significantly higher in the incubator group. Exclusive breastfeeding was more successful and initiated earlier in the kangaroo mother care group. Effectiveness indices, including the time to reach neonatal birth weight, duration of nil per os (NPO), and time to exclusive breastfeeding, showed no significant differences between the groups. The study also revealed that both personnel and parents were satisfied with kangaroo mother care.

**Conclusion:** This study demonstrated that kangaroo mother care reduces mortality, promotes exclusive breastfeeding, enhances emotional bonding between parents and neonates, reduces sepsis and patent ductus arteriosus, and shortens the duration of antibiotic use. Parental and staff satisfaction were higher in the kangaroo mother care group compared to the incubator care group. There were no significant differences in infant growth indices between the two groups, aligning with findings from other studies. Given the importance of doctors' and personnel's knowledge and experience for the successful implementation of kangaroo mother care, the necessity of training courses is evident. This study supports the development of guidelines for educational programs to incorporate this alternative care method in neonatal intensive care units.

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## Introduction

Each year, approximately 20 million low birth weight neonates are born worldwide. Prematurity and low birth weight are significantly associated with increased infant mortality rates [1, 2, 3]. Low birth weight is a major public health issue globally, with the challenges being particularly severe in developing countries [3, 4]. Advanced technologies such as incubators are not universally accessible for all low birth weight infants, often due to a lack of skilled personnel. The incubator method frequently separates neonates from their mothers, depriving them of essential contact. In contrast, kangaroo mother care (KMC) provides an alternative by promoting skin-to-skin contact between the mother and the neonate. KMC is an effective method for warming neonates, encouraging exclusive breastfeeding, protecting against infection, and enhancing parental satisfaction [5, 8].

From 1981 to 2001, the incidence of low birth weight in the United States increased from 6.6% to 7.6%, with rates reported at 20% in Asia and the Pacific, and 10% in Africa [6, 10]. The World Health Organization reports a 10% prevalence of underweight infants in Iran [7]. Low birth weight infants face significant health challenges including respiratory distress syndrome, dyspnea, transient tachypnea of the newborn, congenital pneumonia, pneumothorax, pulmonary hemorrhage, stroke, chronic lung disease, recurrent apnea, hypoglycemia, hypocalcemia, anemia, and hypothermia [9, 11, 12]. Maintaining stable physiological criteria is crucial for premature and low birth weight neonates [15], as changes in these criteria can indicate underlying problems that require prompt diagnosis and stabilization [13, 14]. Less variation in physiological measures suggests better adaptation to the environment and greater neonatal stability.

Excellent nursing care can prevent more than five million neonatal deaths in developing countries. Incubators provide a warm and humid environment and facilitate the oxygenation of neonates [16, 20]. However, their primary drawback is the separation of mother and baby, which reduces opportunities for parental communication and disrupts the mother-infant relationship [17, 18, 21]. Skin-to-skin contact stabilizes physiological measures, promotes exclusive breastfeeding, and fosters a healthy emotional relationship between parent and child. Incubator care in low birth weight (LBW) neonates is associated with increased nosocomial infections, delayed weight gain, poor parent-neonate communication, prolonged hospitalization, and high medical costs. Kangaroo mother care (KMC) offers an alternative that

mitigates these risks. In KMC, parent-infant communication and weight gain are improved, early discharge is facilitated, hospital infections are reduced, breastfeeding success is increased, hospital costs are lowered, and parental participation in care and infant development is enhanced [24]. KMC was first proposed by Professor Adgar in 1978 at a neonatal intensive care unit in Colombia. By 1990, this care method was adopted in North America for premature infants and later for term babies [22]. The World Health Organization has endorsed KMC as an alternative method of neonatal care.

Training for neonatal intensive care unit staff and parents is essential for the effective and successful implementation of kangaroo mother care (KMC). With a high incidence of low birth weight pregnancies (7.2% as reported by the Ministry of Health in Iran) and the separation of mothers from their babies during hospitalization, many problems arise for these neonates. We hope this study will be beneficial for promoting KMC in Iran and other countries, as well as in healthcare programs. Managers can use the findings of this research to plan and implement KMC. Educational programs for parents of hospitalized infants are necessary to ensure proper care. We hope this research will help identify an effective method for communities and health organizations, addressing the challenges faced by low birth weight infants in neonatal intensive care units.

## Materials and Method

This study is a cross-sectional (descriptive-analytic) clinical trial. The researcher investigated the effects of independent variables (kangaroo mother care and conventional incubator care) on dependent variables (body temperature, weight gain, exclusive breastfeeding, and physiological measures). The study population comprised low birth weight infants admitted to the intensive care unit at Imam Hossein Hospital in Tehran in 2019. The study sample included 130 low birth weight neonates hospitalized in the neonatal intensive care unit of Imam Hossein Hospital.

Inclusion criteria for neonates were: 1. Absence of congenital anomalies, 2. Birth weight between 1200 and 2499 grams, 3. Fifth-minute Apgar score of six or higher, 4. No respiratory care required in the past 12 hours, 5. No use of umbilical arterial catheter, 6. No phototherapy in the previous 4 hours, 7. Stable body temperature, 8. Extubation at least 8 hours prior, 9. No chest tube, and 10. No symptoms of respiratory distress.

Inclusion criteria for mothers were: 1. Proficiency in Persian, 2. No malignant disease or fever, 3. No addiction or smoking, 4. No AIDS or acute

respiratory and heart disease, 5. Biological mothers, 6. No convulsions or seizure disorders, and 7. Ability for self-care.

In this study, sampling was initially non-random, with members of each group then selected randomly through lottery. The sample size was determined using a 95% confidence interval ( $\alpha = 0.05$ ,  $\beta = 0.2$ ), estimating a total of 130 low birth weight neonates. Data collection consisted of two sections: the first gathered demographic information such as age, mother's occupation, type of delivery, gestational age, neonatal hospital stay, and feeding methods, while the second focused on neonatal physiological measures recorded before, during, and after care, hospitalization, weight gain, and exclusive breastfeeding.

To ensure the validity of the collected data and the content validity of the method, information was gathered from scientific resources, articles, and studies of other researchers. This was then adjusted based on the input from 10 faculty members, two doctors, and three specialist neonatal nurses from the neonatal intensive care unit. Once confirmed, the questionnaire was used for investigation. For validated pulse oximetry devices and axillary electronic thermometers, standard and reliable brands were utilized.

Prior to commencing care for the mother and infant, demographic information was completed in the first part of a questionnaire. Additionally, detailed explanations about kangaroo mother care were provided to the mothers involved. Sampling was conducted between 11-12 in the morning on all days to account for variable physiological symptoms observed at different times of the day.

Initially, the mother and baby were slowly eased out of the incubator, with the neonate placed on a mat. The mother sat on a chair, and a private environment was created for her. Physiological measures were recorded five minutes before and after the baby was placed on the mother's chest, including heart rate and arterial oxygen saturation using a pulse oximeter device. The axillary temperature was recorded in the back sleeping position with an electronic thermometer for 30 seconds. Respiratory movements of the chest and abdomen were counted while the newborn peacefully slept for a full minute.

Next, the mother opened her gown, sat on a chair, and placed the naked baby on her chest. Her partner assisted in putting on hats and socks and positioning the neonate between the mother's chest for breastfeeding. Physiological criteria were monitored and recorded at 30 and 50 minutes during the care. After completing the registration form, the baby was returned to the mat for kangaroo mother care (maximum: 1 hour per day). Physiological status was again recorded

five minutes later. Similar physiological criteria were recorded during conventional care as well.

It's important to note that no painful procedures were performed before or during either method of care, and the room temperature was maintained between 26-29 degrees Celsius. If any of the following symptoms occurred - temperature below 35.5 degrees Celsius, heart rate below 100 or above 180 beats per minute, apnea lasting more than 20 seconds, or arterial blood oxygen dropping below 87 percent - infants were excluded from kangaroo mother care. Additionally, mothers' questions were addressed during the care.

Limitations of this research include maternal anxiety, which could impact neonatal physiological criteria, uncontrollable environmental conditions (such as sounds from monitoring tools and the care room) that could affect physiological criteria, and laboratory errors that could impact culture results.

In the incubator care group, the incidence of sepsis was 72.6%, compared to 38.2% in the kangaroo mother care group, with a statistically significant difference determined by the Chi-square test ( $p$  value = 0.002). The occurrence of patent ductus arteriosus was 19.3% in the incubator group and 5.9% in the kangaroo mother care group, which was also deemed statistically significant ( $p$  value = 0.04). Apnea was observed in 27.4% of infants in the incubator group, whereas it was 17.6% in the kangaroo mother care group, with a significant difference noted ( $p$  value = 0.04).

A higher proportion of infants in this study were discharged with complete recovery, with no neonatal mortality reported in the kangaroo mother care group compared to a mortality rate of 11.3% in the incubator care group. A significant difference in discharge status between the two groups was observed ( $p$  = 0.02). Exclusive breastfeeding rates were 30.6% in the incubator group and 61.8% in the kangaroo mother care group, with a significant difference determined using the chi-square method ( $p$  = 0.02).

Furthermore, the duration of antibiotic consumption was longer in the incubator care group compared to the kangaroo mother care group, with a significant difference noted ( $P$  value = 0.03). The incidence of exclusive breastfeeding was significantly lower in conventional care compared to kangaroo mother care.

## Results

In this study, it was observed a higher proportion of the mothers who were younger (aged 27-28 years), had an educational level below high school, and had experienced a twin delivery [Table 1].

**Table 1:** mean and sd for quantitative variables of parents

variables	P value	Kangaroo mother care care		Conventional care	
		Range	Mean and sd	Range	Mean and sd
Mother age	NS	17-42	28.01( ± 5.56)	18-46	27.27( ± 6.77)
Number of pregnancy	NS	1-6	1.52 (± 1.07)	1	1.48(±0.8)
Mother admit duration after pregnancy at hospital(days)	NS	1-24	۷.۸۶(±3.03)	1-4	2.94(±0.5)
Duration of mother staying at hospital after neonate admission in NICU(days)	NS	0-24	8.73 ( ±8.27)	1-28	6.08(±9.52)
Father's age	NS	22-49	32(± 5.45)	20-55	31.33(±7.07)
Duration of father staying at hospital after hospitalization of neonate(days)	NS	0-10	2.7 ( ±2.03)	1-12	4.63(±2.87)

The presence of mothers in the hospital following kangaroo mother care increased from an average of 6 days to 8 days. Most mothers received good pregnancy care, and there was no significant difference between the two groups regarding maternal diseases during pregnancy. Additionally, more fathers participating in the study had at least a diploma-level education, and the average monthly income for most families

ranged from 200 to 400 dollars.

The mean duration of kangaroo mother care was  $12 \pm 8.7$  days and  $17.25 \pm 24.81$  hours, with no significant difference in quantitative variables of infants between the two groups, including gestational age, Apgar scores, birth weight, length, head circumference, stability time, and discharge [Table 2].

**Table 2:** mean and sd in quantitative variables of neonates (Emam Hossein hospital, 2019)

Variable	P value	Kangaroo mother care care (۶۸)		Conventional care (۶۲)	
		range	Mean and sd	Range	Mean and sd
Gestational age(wk)	NS	27-39	۳۱.۹۱(± ۲.۴)	۴۰-۴۷	۳۲.۸۱(± ۲.۸)
Apgar score (1th minute)	NS	2-9	۷.۵(± ۱.۳۴)	4-9	7.62(±1.43)
Apgar score(5 <sup>th</sup> minutes)	NS	5-10	۹.00(± ۰.۷۷)	6-10	9(±1.06)
Birth weight(gr.)	NS	1060-2300	۱۶۰۵.۸۸ (۳۴۹.۲۲±)	1020-2450	1668.25(±428)
Length(cm)	NS	31-49	41.97(±3.94)	27-50	42.51(±4.29)
Head circumference(cm)	NS	21-35	29.62(±2.34)	26-34	30.16(±2.28)
Weight at stability time	NS	910-2250	1530.45(±349)	890-2470	1612.92(±426.64)
Length at stability time	NS	28-49	42.22(±4.7)	27-50	42.58(±4.30)
Head circumferences at stability time	NS	21-35	29.58(±2.21)	24-34	30.22(±2.37)
Weight at discharge	NS	1550-2530	1755.88(±199.09)	1310-2500	1792.37(±254.25)
Length at discharge	NS	31-49	42.73(±3.68)	28-59	43.14(±4.41)
Head circumferences at discharge	NS	26-35	31.17(±1.60)	28-34	31.41(±1.48)
Antibiotic prescription(days)	.03	3-44	9.40(±8.7)	5-40	14.35(±8.71)
Kangaroo care(days)	-	۴۶-۱	۸.۷۱2(±	-	-
Kangaroo care (hours)	-	۱۰۰-۱	۲۴.۸۱( ۱۷.۲۵±	-	-

However, a significant difference was observed between the two groups in terms of antibiotic consumption (P value = 0.03, chi-square test).

There were no significant differences in the occurrence of surfactant administration,

hypothermia, necrotizing enterocolitis, ventricular hemorrhage, and gastroesophageal reflux between the two care methods. However, neonatal sepsis increased in the incubator care group, with a relative frequency difference that was statistically significant [Table 3].

**Table 3:** frequency of complication in two groups of study

variant	P value	Kangaroo mother care care (r <sup>^</sup> )	Incubator care(r <sup>^</sup> )		
		percentile	absolute	percentile	absolute
	NV	0	0	0	0
hypothermia	0.0002	38/42	26	22/26	45
sepsis	0.0002	17/26	12	27/26	17
Apnea	NS	30/9	21	37	23
IVH	NS	1/5	1	1.6	1
NEC	0.04	5/9	4	19/23	12

NS=No Significant    NV= No Valid

## Discussion

Previous studies have highlighted indicators such as the effectiveness of care, mortality rate, infection rate, exclusive breastfeeding, and growth rate, along with metabolism and thermal protection, which were found to be superior in kangaroo mother care [1-6]. The findings of this study indicated that the average maternal hospital stay was 2.94 days for incubator care and 3.03 days for kangaroo mother care. Similar results have been reported in studies conducted in Colombia and North America [10, 14, 20]. Additionally, the presence of mothers in the hospital was observed to increase in the kangaroo mother care group.

There were no significant differences between the two groups regarding maternal diseases during pregnancy. A larger proportion of fathers participating in the study had obtained a diploma or higher education. The average monthly income for most families fell within the range of 200 to 400 dollars. Additionally, there were no significant differences observed between the two groups in various indices, including gestational age (in weeks), first-minute Apgar score, fifth-minute Apgar score, birth weight (in grams), birth length (in centimeters), head circumference at birth, weight-length ratio, head circumference at stability time, weight at discharge, discharge height, and head circumference at discharge.

It is worth noting that in Edgar's research, these indices showed improvement in the kangaroo mother care group, which contrasts with our findings [24, 18].

In this study, the use of antibiotics decreased significantly in the kangaroo mother care group (P value = 0.03). No significant differences were observed between the two groups in surfactant administration, hypothermia, necrotizing enterocolitis, intraventricular hemorrhage, and gastroesophageal reflux. These specific items were not investigated in other studies, thus making comparisons difficult. However, neonatal sepsis increased after incubator care in our study. There was a significant relative frequency difference between patent ductus arteriosus and sepsis in the two groups.

A higher proportion of infants in both groups were

discharged with complete recovery. World Health Organization research has shown that neonates in kangaroo mother care exhibit decreased rates of sepsis and mortality, a finding also reported on the organization's website. Exclusive breastfeeding rates were higher in the kangaroo mother care group, and neonatal ability for breastfeeding at discharge was superior in this group. These findings are consistent with the results of investigations conducted by Anderson and Champak [8, 13].

The mean weight gain, increase in mean height, and head circumference did not show significant differences between the two groups. Various effectiveness indices, such as the time taken to reach the baby's birth weight (in days), duration of non-per oral feeding (in days), time required to start feeding through the mouth (in days), time spent exclusively breastfeeding (in days), and initiation of full feeding (in days), did not exhibit significant variations between the two groups in this study.

While evidence suggests that kangaroo mother care may not necessarily increase survival rates, there have been no investigations confirming an increase in mortality rates associated with this care method [11, 12]. Our findings align with those of other published papers in this regard. Temperature control was reported to be more effective in kangaroo mother care in other studies, with a reduced risk of hypothermia documented [14, 22]. However, neither of our study groups experienced hypothermia, making it impossible to investigate differences in this aspect.

It's noteworthy that reports indicate higher maternal stress levels with conventional methods, while skin-to-skin maternal contact enhances satisfaction for both mothers and neonates. In kangaroo mother care, mothers tend to experience increased confidence, higher self-esteem, and a sense of satisfaction with their role, which can have positive effects on their premature infants [14, 22]. The findings of our study similarly revealed that mothers' satisfaction with kangaroo mother care surpassed that with incubator care.

Therefore, to enhance neonatal care, it is imperative to integrate the kangaroo mother care

method into Neonatal Intensive Care Units. This approach fosters stronger emotional bonds between mothers and babies, maintains stability in neonatal physiological indicators, increases rates of exclusive breastfeeding, reduces the incidence of infectious diseases, and lowers mortality rates in low birth weight neonates. However, further evidence regarding the superiority of maternal care is warranted, and national and local facilities must adapt guidelines to their specific contexts to ensure successful implementation and follow-up care of low birth weight neonates in neonatal intensive care units. Additionally, training programs for kangaroo mother care teams and parents are essential for the advancement of this caregiving approach, both in our country and globally.

## Conclusion

This study demonstrated that kangaroo mother care significantly reduces mortality rates, promotes exclusive breastfeeding, fosters stronger emotional bonds between parents and neonates, decreases the incidence of sepsis, lowers the occurrence of patent ductus arteriosus, and reduces the duration of antibiotic usage. Furthermore, both parents and personnel express higher levels of satisfaction with kangaroo mother care compared to incubator care. There were no significant differences observed in infant growth indices between the two groups, aligning with findings from previous investigations. Given the importance of proper implementation and follow-up of kangaroo mother care for the well-being of both mothers and neonates, it is evident that training courses are essential to enhance the knowledge and experience of healthcare professionals in this area.

This study contributes to the development of guidelines for educational programs aimed at implementing alternative care methods in neonatal intensive care units. It supports the conclusion that Kangaroo Mother Care (KMC) facilitates early breastfeeding initiation compared to conventional care methods. Additionally, KMC enhances growth and reduces morbidities in low birth weight infants. It is a simple and well-received approach by mothers, which can also be continued at home. KMC proves to be a safe and cost-effective intervention, effectively reducing the length of hospital stays for preterm and/or low birth weight infants. Managed infants exhibit improved weight gain, earlier hospital discharge, and notably higher rates of exclusive breastfeeding. Consequently, KMC serves as an excellent complement to routine preterm care in a nursery.

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Not applicable

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