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EFFECTS OF KANGAROO MOTHER CARE ON THE VITAL SIGNS OF LOW-WEIGHT PRETERM NEWBORNS

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ABSTRACT

Objective: The aim of this study was to evaluate the heart and respiration rates, mean arterial pressure, temperature and peripheral oxygen saturation of low-weight preterm newborns, before and after the application of kangaroo mother care. Method: Twenty-two healthy low-weight preterm newborns of both sexes were studied. None of them had neurological, cardiac and/or respiratory deficiencies. Assessments were made after the newborn had been left in an ordinary cot for 30 minutes and after 30 minutes of kangaroo mother care, on three consecutive days. For these evaluations, a heart monitor with a device for non-invasively measuring mean arterial pressure, a sensor for pulse oximetry, a thermometer and a chronometer were utilized. Results: There were no significant changes in mean arterial pressure ($p > 0.05$) or heart rate ($p > 0.05$) after applying kangaroo mother care. However, there were significant increases in axillary temperature ($p < 0.05$) and peripheral oxygen saturation ($p < 0.05$), and a significant decrease in respiration rate ($p < 0.05$). Conclusion: Kangaroo mother care promotes improvement in body temperature, increased peripheral oxygen saturation (thus improving tissue oxygenation), and decreased respiration rate (thus providing greater respiratory comfort for the newborns). This suggests that kangaroo mother care contributes towards beneficial alterations in the low-weight newborns' vital signs.

Key words: Kangaroo mother care, neonatology, preterm, newborns, low weight, physical therapy.

INTRODUCTION

In developing countries, around 21% of infant mortality is caused by perinatal conditions. Most of the causes of neonatal death can be prevented or treated through simple, effective and low-cost intervention, at home or in the community[1].

The kangaroo mother care (KMC) method was devised in 1978, by the neonatologists Edgar Rey Sanabria and Héctor Martinez Gómez, who were doctors at the Child Medical Institute of Bogotá, Colombia. Concerned about the excess numbers of preterm newborns (PTNBs) that needed to be kept together in the same incubator, thereby leading to high percentages of morbidity and neonatal mortality, they observed that the kangaroo is born premature and remains in the mother's pouch until it completes the gestation period. They also observed how the Colombian Indians carried their babies and decided to adapt this for neonatal care[2].

When there was no incubator, they started to put PTNBs in skin-to-skin contact with the mother. In Brazil, KMC began in Santos (SP) and later in Recife (PE). Subsequently, the Ministry of Health decided to issue standard guidelines for this method. Thus, in the Brazilian model, the method is not a substitute for the incubator, but a new way of neonatal care available in nurseries and ICUs[3].

KMC in Brazil has been strongly influenced by Colombia, which served as the basis for the program, and also for other experiences relating to caring for premature infants, such as the Assessment and Individualized Care Program for Neonate Development (AICPND)[4].

According to the Norms for Humanized Care for Low-Weight Newborns, from the Ministry of Health, KMC is a form of neonatal care that consists of early skin-to-skin contact between the mother and her low-weight PTNB, which allows increasingly large participation by the parents in caring for their newborn. This method has the advantages of increasing the mother-child bond; avoiding long periods without sensory stimulation by reducing the mother-child separation time; stimulating breastfeeding by the mother, which favors greater frequency, earlier implementation and longer duration; improving the thermal control, due to greater bed rotation; reducing the number of newborns in intermediate care units; reducing the hospital infection rate; and allowing shorter stays in hospital[5].

In 1996 a workshop on KMC was held, and the ensuing publication served as a guide for the implementation of this intervention in countries with limited resources, thus constituting a consensus about the method. In this, five items needed for its implementation were highlighted: information and support for mothers; health team training; skin-to-skin contact and thermal control; maternal breastfeeding and discontinuation of KMC when the newborn is able to take to the breast with adequate sucking and weight gain; and when there is thermal instability in the kangaroo position and when there is adequate follow-up[6].

Many articles have shown the benefit of KMC, which may contribute towards reducing the mortality rate among low-weight PTNBs[7]; provide calmer and longer sleep[8]; act as an analgesic through the release of endorphins[9]; improve physiological functions in a general manner; and have an effect of sensory stimulation and increased mother-child interaction, including among normal term newborns[10]. The need for adequate training for the professionals involved is emphasized, as is the need for mothers to be well informed regarding the benefits brought through KMC[11].

In this light, the purpose of the present study was to evaluate the possible changes in arterial pressure, peripheral oxygen saturation, temperature, heart rate and breathing rate among low-weight PTNBs following the application of KMC.

METHOD

Participants

During the study period, 30 PTNBs were hospitalized in the maternity ward of Hospital dos Fornecedores de Cana de Piracicaba. Of these, five were excluded from the study because they were discharged from hospital before the third evaluation, and three because their mothers did not accept participating in the study. Thus, 22 PTNBs of both sexes were assessed, with gestational age of 28 to 33 weeks (M= 30.6; SD= 1.8) and weighing between 1050 and 1500 grams (M= 1330; SD= 0.182) (Table 1). They were healthy, clinically stable and did not have any respiratory, cardiac and/ or neurological dysfunctions. This selection was done after obtaining approval from the Research Ethics Committee (Approval No. 80/04) and authorization from the person responsible for the children by means of their signing a formal free and informed consent statement.

Materials

To evaluate the peripheral oxygen saturation ($SapO_2$) and mean arterial pressure, the EMAI RX-300A non-invasive configurable monitor was used, connected to the Moriya M1000 wrist oximeter sensor and to the Moriya M1000a cuff for arterial pressure evaluation. Body temperature was measured using the Gold Flash clinical thermometer, graduated every 0.1°C. A chronometer was used to check the breathing rate and the time of KMC application.

Procedure

The evaluations were done once a day, for three consecutive days, one hour after the PTNBs had been fed in the afternoon, because of the calmer hospital routine at this period.

The PTNBs were put in a normal cradle, lying down on their backs, wearing only a diaper, for a period of 30 minutes. The data were collected when the newborn reached behavioral state 3 on the Prechtl scale[12], which corresponds to open eyes and no movements, thus indicating a calm state. The room was climate controlled with a temperature of 26°C and relative air humidity of 40%.

The first assessment was the body temperature, for three minutes, with the thermometer located in the PTNB's axillary folds.

A sensor was placed on the sole of the PTNB's right foot and a cuff was placed around the lower part of its right leg (always on the right leg for standardization). Three minutes after putting the wrist oximeter and arterial pressure monitor on the infant, the oxygen saturation, heart rate and arterial pressure were checked.

The assessment was completed with measurement of the breathing rate for one minute on the chronometer.

The PTNB was placed vertically in front of the mother, with its head turned sideways. Its arms were flexed and adducted, with the elbows close to the trunk, and its legs were also flexed and adducted. The infant was then wrapped in a moldable fabric for greater safety, and the mother was wearing a hospital gown, allowing contact between her skin and the skin of the PTNB. She remained lying down on the hospital bed with the headrest raised to 45º. The PTNB stayed in the kangaroo position for thirty minutes, and then the vital signals and oximeter data were again collected.

The results obtained for the quantitative variables (heart rate, breathing rate, arterial pressure, temperature and oxygen saturation) were discussed based on the exploratory analysis (tables, graphs and descriptive measurements), and the variation between the conditions before and after applying KMC was analyzed using the paired data analysis methodology: Wilcoxon's nonparametric test, with a significance level of 5%. This test was applied with the aim of only having one analysis method. The analyses were processed using the *STATGRAPHICS PLUS 5.0* computing system.

RESULTS

Twenty-two low-weight PTNBs were analyzed: 10 females and 12 males (Table 1).

Table 1. Birth weight, gestational age and sex of the premature infants evaluated.

		Weight				Gestational Age			
Sex	*N*	*Minimum*	*Maximum*	*Mean*	*Deviation*	*Minimum*	*Maximum*	*Mean*	*Deviation*
F	10	1.05	1.55	1.3	0.2	28	33	30.8	1.99
M	12	1.05	1.55	1.36	0.17	28	33	30.5	1.73

The results revealed a significant increase in temperature and peripheral oxygen saturation, and significant decrease in breathing rate.

The median temperature before applying the method was approximately 36.4°C, and 30 minutes after applying the method, it went up to 36.65°C (Table 2).

The median peripheral oxygen saturation value was 93.8% before the application, and 30 minutes after applying KMC, it became approximately 97.3% (Table 2).

The median breathing rate before applying the method was 41.35 breaths per minute (bpm), and thirty minutes after applying the method, it became 36.8 bpm (Table 2).

The results revealed that the mean arterial pressure and heart rate did not show any significant statistical differences 30 minutes after applying KMC (Table 2), with p-values of 0.625 and 0.538 respectively.

Table 2. Vital Signals and $SapO_2$ before and after KMC.

Vital signals and $SapO_2$		Minimum	Median	Maximum	P Value
HR	BEFORE	121.70	136.50	166.00	p = 0.538
	AFTER	118	139.3	176	p = 0.538
AP	BEFORE	42.6	51.4	62.7	p = 0.625
	AFTER	26	36.8	44.3	p = 0.625
BR	BEFORE	29	41.35	46.6	p = 0.000
	AFTER	26	36.8	44.3	p = 0.000
$SapO_2$	BEFORE	80	93.8	98	p = 0.000
	AFTER	89	97.3	100	p = 0.000
Temp.	BEFORE	35.4	36.4	36.8	p = 0.000
	AFTER	35.8	36.65	37.7	p = 0.000

HR= heart rate; AP= arterial blood pressure; BR= breathing rate; $SapO_2$= Peripheral oxygen saturation; Temp= Temperature.

DISCUSSION

It is known to be very difficult to maintain body temperature in low-weight PTNBs, and this is mainly die to their lack of sweating, their defective heat production caused by less movement, the immaturity of their nerve centers, the scarcity of subcutaneous cellular tissue and the oxygen offer, which is limited by respiratory disorders. Prolonged hypothermia demands greater energy and oxygen consumption for heat production, which impairs weight gains[13].

Thus, PTNBs are removed from the incubator occurs when they show maturity in relation to thermal control, independent of their weight. Hence, they are kept at a normal temperature, i.e. with their axillary temperature varying between 36 and 36.5°C[13].

The results relating to body temperature from the present study showed that there was a significant increase in the PTNBs' body temperature after applying KMC for 30 minutes. These results are in agreement with Basseto[14] and Miltersteiner et al.,[15] who, when also studying body temperature during the application of KMC, found a significantly higher temperature and attributed the better thermal control to the application of this method. Thermal control is very important for PTNBs because of their great tendency towards hypothermia, and it thus contributes towards homeostasis. The improvement in thermal control that was attributed to KMC by Miltersteiner et al.[15] is important in physical therapy, since it is important to have an adequate thermal control to be able to continue with the physical therapeutic treatment.

The Kangaroo position avoids body heat loss and is associated with heat maintenance or increase while the infant is in this position[14]. Thus, KMC is extremely positive because it contributes towards weight gains for newborns and avoids the harmful consequences of heat loss.

According to Dood[16] and Bohnhorst[17], when newborns lose a lot of heat, their metabolism and oxygen consumption increases, thereby reducing their metabolic efficiency and impairing their physiological stability. This may result in increased apnea and impaired weight gain. Thus, it is suggested that, during KMC, the body temperature must always be monitored.

This study also showed an improvement in tissue oxygenation, as shown by the increased $SapO_2$ after performing KMC. This may have occurred because the newborn was calm and comfortable in contact with its mother, which probably decreased the consumption of oxygen. These results were in agreement with the findings of Miltersteiner et al.[15], Tornhage et al.[18] and Gazollo et al.[19], who also obtained increased $SapO_2$ and, through this, promotion of improved tissue oxygenation.

This can also be explained by the fact that the heart rate remained unchanged, even when there was a significant increase in temperature, since this increase in temperature would normally lead to increased breathing rate and heart rate.

In this study there was no statistically significant difference in relation to the heart rate assessment after applying KMC. On the other hand, studies by Gazollo et al.[19] and Miltersteiner et al.[15] showed increased heart rate in the PTNBs. However, the results from the present study are in accordance with Törnhage et al.[18], who did not find a significantly increased heart rate.

Although the Dood[16] study revealed an increased heart rate, even with non-significant values, it suggests that the increase in the heart rate may occur because of the change in the newborn's body position from supine to vertical and the handling, which leads to increased stress for the newborn. On the other hand, decreases in heart rate may be associated with lower stress, calmer experiences in relation to the hospital routine, calm sleep, or even bradycardia.

However, according to Sontheimer et al.[20], the heart and breathing rates are uncertain data, because the mother's respiratory and cardiac patterns may be superimposed on the newborn's.

With regard to the measurements of mean arterial pressure, this study did not show any significant difference, but there was a decrease in the breathing rate. These results are in agreement with what was obtained by Gazollo et al.,[19] who, assessing the effectiveness of KMC among babies that underwent intensive postoperative cardiac care during the first hours following intubation, did not find any significant difference in the arterial blood pressure.

CONCLUSIONS

In the light of the results obtained under the experimental conditions utilized, it can be suggested that KMC promoted an improvement in body temperature, thereby contributing towards improvement of thermal control, increased peripheral oxygen saturation, improvement of tissue oxygenation and reduced breathing rate, which brought greater respiratory comfort to the newborns. Thus, KMC promoted beneficial physiological changes for low-weight PTNBs and contributed significantly to their physiological control.

It cannot be disregarded in these results that the physiological improvement might also have been influenced by the PTNB's maturation. However, it must be taken into consideration that this study was conducted over a period of three consecutive days.

Therefore, this method deserves to be greatly encouraged, because as it is a simple, effective and low-cost method, it can be applied in any hospital. It thus brings in an important contribution towards physical therapy, as an additional resource for treating low-weight PTNBs that is effective in maintaining and improving vital signs.

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