

## Impact of Kangaroo Position on Serum Nitric Oxide in Preterm Infants

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### ABSTRACT

**Background:** Kangaroo mother care is a standardized protocol-based care for preterm and low birth weight infants. The core feature is early positioning of the infant, prone and upright on the mother or father's chest to maximize skin to skin proximity. Kangaroo mother care (KMC) is a safe and effective method of caring for low birth weight infants and is promoted for its potential to improve newborn survival.

The aim of this study was to investigate serum nitric oxide (NO) in stable preterm infants before and after 60 min kangaroo position & to find out a relation between serum NO and neonatal temperature during that position. **Results:** showed a statistically significant increase in body temperature, peripheral oxygen saturation and mean arterial blood pressure immediately after 60 min of KMC compared to the results before this maneuver. There was significant increase in NO immediately after 60 minutes KMC. **Conclusion:** Kangaroo position could increase body temperature through NO dependent mechanisms. KMC is effective in improving all vital signs especially Temperature in preterm infants avoiding the harmful consequences of hypothermia in those infants.

**Key words:** nitric oxide, Kangaroo mother care , preterm.

### INTRODUCTION

Premature infants are highly vulnerable group of the population<sup>1</sup>.

Kangaroo mother care (KMC) implies placing the newborn pre-term baby in intimate skin to skin contact with the mother's chest and abdomen where the premature baby is kept warm and close to the breast for unlimited feeding. KMC has emerged as a non-conventional low cost method for new born care that provides warmth, touch, and security to the newborn and is believed to confirm significant survival benefit<sup>2</sup>.

Nitric oxide (NO) is an important cellular signaling molecule, having a vital role in many biological processes. It plays a key role in signaling the smooth muscles surrounding blood vessels to relax thus leading to increased blood flow and vasodilatation through contribution to endothelial nitric oxide synthase (eNOS) that found primarily in endothelial cells<sup>3</sup>.

Heat is a stimulus for the NO pathway which exerts a significant vasodilatory effect<sup>4</sup>.

And this action resembles skin to skin contact during KMC which enables mother's breasts to generate heat in response to the thermal needs of the baby<sup>5</sup>.

### SUBJECTS AND METHODS

A prospective study was carried out on forty-five healthy clinical stable preterm neonates, with gestational age between 34 to 36 weeks

from Neonatal Intensive Care Units of Al-Zhara and Ain Shams University Hospitals.

#### Inclusion criteria:

-Late preterm neonates of gestational age between 34-36weeks  
-All infants are clinically stable preterms.

#### Exclusion criteria:

-full term infants  
-preterm on mechanical ventilators  
-infants of pre-eclamptic mother  
-sepsis ,hypoxia  
-hypoxic – ischemic encephalopathy  
-neonatal convulsions  
-infants on medication  
-congenital heart disease  
-jaundice

All studied cases were subjected to full history taking, complete clinical examination and anthropometric measurements, their vital signs (temperature, heart rate, respiratory rate ,blood pressure ,oxygen saturation (SpO<sub>2</sub>) ) were assessed by monitor apparatus Angelus NoA1010676 and pulse oximeter. Venous blood samples (about 2 ml) were withdrawn before and after Kangaroo position and were centrifuged for 15 min at 1000xg.Serum samples were stored at -20 C° for assay of serum level of NO by ELISA technique (using ELISA Plate Reader Das and kit catalog number kGE001).

This study determines nitric oxide concentrations based on the enzymatic conversion of nitrate to nitrite by nitrate reductase. The reaction was followed by

colorimetric detection of nitrite as an azo dye product of the Griess Reaction which based on the two step diazotization reaction in which acidified NO<sub>2</sub><sup>-</sup> produces a nitrosating agent, which reacts with sulfanilic acid to produce the diazonium ion. The end result chromophoric azo-derivative that absorbs light at 540-570 nm.

The study was approved by the Ethics Board of Al-Azhar University.

### Statistical analysis

After data collection, statistical analysis was done using (SPSS program version 20). Quantitative data were presented as a number and percentages while quantitative data were presented as mean ,standard deviations and ranges.The comparison between two groups was done using paired t-test.The results considered significant when P value was <0.05

## RESULTS

**Table (1): Nitric oxide and Temperature of the studied group before KMC**

	Mean	SD	p-value
Temp(C°)	36.30	0.21	0.001
Nitric oxide (u mol/L)	43.23	10.2	0.001

**Table (2): Nitric oxide and Temperature of the studied group after 60 min KMC**

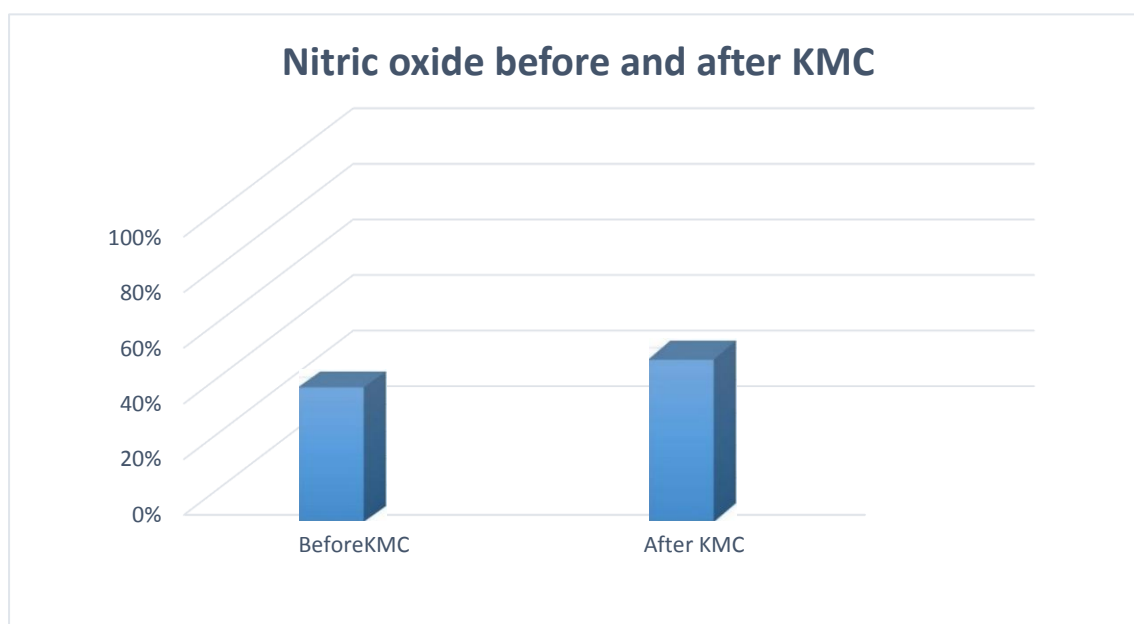
	Mean	SD	P-value
Temp(C°)	36.58	0.18	0.001
Nitric oxide (u mol/L)	53.28	12.5	0.001

**Table (3): Comparison between nitric oxide before and after 60 min KMC**

	Before KMC		After (60 min) KMC		Mean difference	Paired t-test	
	Mean	SD	Mean	SD		t	p-value
Nitric oxide (u mol/L)	43.23	10.2	53.28	12.5	0.54	-8.841	0.001

**Table (4): Comparison between temperature before and after 60 min KMC**

	Before KMC		After (60 min) KMC		Mean difference	Paired t-test	
	Mean	SD	Mean	SD		t	p-value
Temperature (C°)	36.3	0.21	36.58	0.18	-0.28	-23.491	0.001



**Comparison between nitric oxide before and after 60 min KMC**

## DISCUSSION

NO is an important cellular signaling molecule, having a vital role in many biological processes. It is the intercellular signal that controls vascular tone, insulin secretion, airway tone, peristalsis, cardiac function, angiogenesis and is involved in the development of nervous system <sup>6</sup>.

Nitric oxide is produced by endothelial cells and is being considered as a potent vasodilator due to the effects in the vascular smooth muscle relaxation<sup>7</sup>.

Regulation of temperature is a significant benefit of KMC, as many studies showed during KMC, an infant's temperature increased by 0.22°C, and studies showed the temperature after KMC increased by 0.14°C <sup>8</sup>.

In current study as regard body temperature, there was a significant increase in the preterm body temperature after KMC, which is in agreement with the results of **Dehghani et al.**<sup>9</sup> While **Crandall & Maclean**<sup>10</sup> concluded that whole body heating does not increase cutaneous interstitial NO concentration in humans.

In our study, there was a statistically significant increase in serum nitric oxide level of the studied infants before and after 60 min. KMC  $p < (table\ 3)$ .

Our results were supported by **Ives et al**<sup>11</sup> who observed a significant increase in NO level after direct heat and found that heating the endothelial cells resulted in shear stress- induced eNOS phosphorylation which exerts a significant vasodilatory effect through either: directly by reducing the impact of sympathetic nerves innervating smooth muscle or by relaxing the smooth muscle providing vasodilatation<sup>11</sup>.

On the other hand due to different method, our results revealed disagreement with **Zhao et al**<sup>12</sup> who showed that bioactive nitric oxide concentration does not significantly increase during reactive hyperemia in human skin using amperometric electrode technique which is sensitive enough to detect small changes in NO level<sup>12</sup>.

## CONCLUSION

We concluded that:

- Kangaroo mother care is effective in improving all vital signs especially Temperature in preterm infants avoiding the harmful consequences of hypothermia in those infants.
- Kangaroo position could increase body temperature through NO dependent mechanisms.

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