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## Comparison of early umbilical cord clamping v/s delayed cord clamping v/s cord milking on neonatal hemoglobin status: A randomized control study

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### Abstract

**Background & Objectives:** Anemia is common among children in developing countries. In the National Family Health Survey III of India, 70% of children were anemic. In India 81% of infants between 6 and 9 months of age become anemic most due to iron deficiency. In term infants, a brief delay in clamping the umbilical cord after birth results in higher concentrations of hemoglobin (HB) and hematocrit during the neonatal period, increased serum ferritin levels and a lower incidence of iron-deficiency anemia at 4-6 months of age. This study is conducted to compare the effect of delayed cord clamping or umbilical cord milking to early cord clamping on neonatal hematological status at 48 hours of age in term neonates born in GEMS and Hospital, Ragolu, Srikakulam.

**Materials and methods:** The study was conducted in the labor room, obstetrics operation theatre and post natal ward of GEMS and Hospital, Ragolu, Srikakulam during November 2019 to May 2021. The newborn babies were divided into 3 groups of each 55.

**Group 1:** Early cord clamping at 30 sec after birth

**Group 2:** Delayed cord clamping at 60 sec after birth.

**Group 3:** Cord milking in 10-15 sec after birth.

- In our hospital cord clamping is done as early as possible, within 30 sec.
- In this study delayed cord clamping was done at 60 sec after birth because maximum placental transfusion, up to 50-75%, occurs by 1min after birth.
- Cord milking was done by milking of the unclamped cord towards the umbilicus 4 times in 10-15 seconds followed by clamping and cutting of the cord.

All the newborn babies received the same care. At 48hours of age the hemoglobin levels were tested.

**Results:** Total of 165 term babies were included in the study, divided into three groups (early cord clamping, delayed cord clamping and cord milking). There were 55 babies in each group. The mean haemoglobin at 48 hours of life was  $17.192 \pm 1.86$  g/dl in the early cord clamping group,  $19.623 \pm 1.45$  g/dl in the delayed cord clamping group and  $19.635 \pm 1.45$  g/dl in the cord milking group. Milking the umbilical cord four times before clamping and cutting the cord or Delayed clamping of the cord by 60 seconds after delivery showed higher mean haemoglobin levels at 48 hours of life compared to early clamping.

**Conclusions:** We conclude that both delayed cord clamping and cord milking resulted in significantly higher neonatal hemoglobin at 48 hours of life as compared to early clamping with no adverse outcomes.

**Keywords:** Early cord clamping, Delayed cord clamping, Cord Milking, Mean Haemoglobin

### Introduction

Anemia is common among children in developing countries. In the National Family Health Survey III <sup>[1]</sup> of India, 70% of children were anemic. In India 81% of infants between 6 and 9 months of age become anemic most due to iron deficiency <sup>[2]</sup>.

Anemia during infancy and early childhood has been shown to affect cognitive brain function <sup>[3]</sup>.

Maternal iron status, infant birth weight and gestational age, as well as the timing of umbilical cord clamping at birth all contribute to the establishment of adequate total body iron at birth <sup>[4]</sup>.

Placental transfusion occurs most rapidly in the first moments after birth amounting to 80 ml of blood in 1 min and 100 ml at 3 minutes after birth <sup>[5]</sup>. This supplies to 40-50 mg/kg body weight extra iron to body iron at birth which helps to prevent iron deficiency in 1<sup>st</sup> year of life.

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In term infants, delayed umbilical cord clamping between 30 and 180 seconds after birth results in higher concentrations of hemoglobin (HB) and hematocrit during the neonatal period, increased serum ferritin levels and a lower incidence of iron-deficiency anemia at 4-6 months of age [6, 7].

WHO recommends late cord clamping (approximately one to three minutes after birth) for all births for improved haematological status while initiating simultaneous essential new born care [8].

An alternative method to delayed cord clamping that takes 10-15 seconds and therefore does not interfere with neonatal resuscitation is active placental transfusion (milking the umbilical cord toward the baby before clamping).

**Objectives:** To compare the effect of delayed cord clamping or umbilical cord milking to early cord clamping

on neonatal hematological status at 48 hours of age in term neonates.

**Methodology**

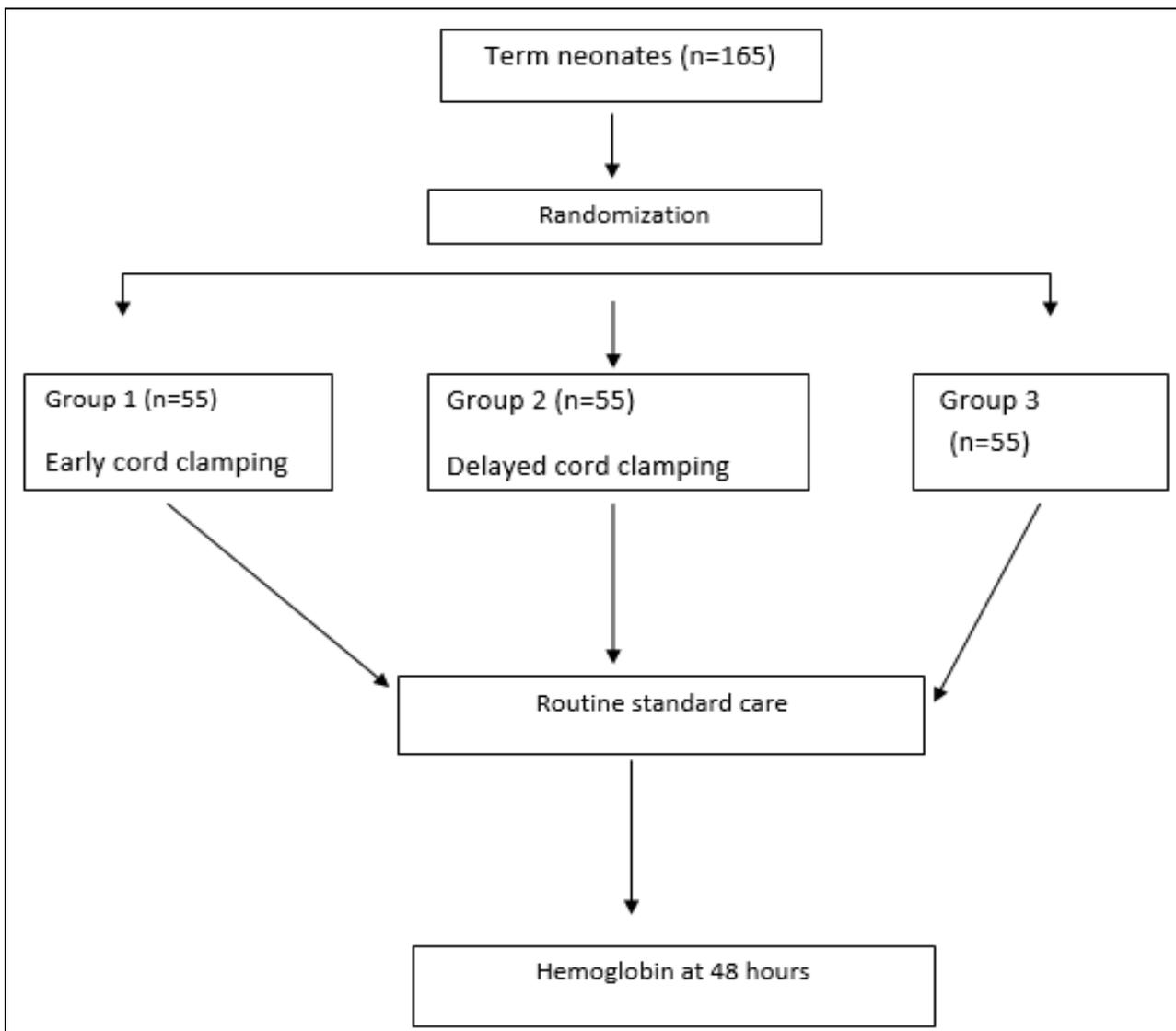
**Study area and population:** The study was conducted on 165 Term newborns delivered by Normal vaginal delivery or lower segment caesarian section in the labor room, obstetrics operation theatre and post natal ward of Gems and Hospital, Ragolu, Srikakulam.

**Study design:** Randomized controlled trial

**Time frame:** November 2019 to May 2021

**Inclusion criteria:** Term newborns delivered in Gems and Hospital, Ragolu, Srikakulam.

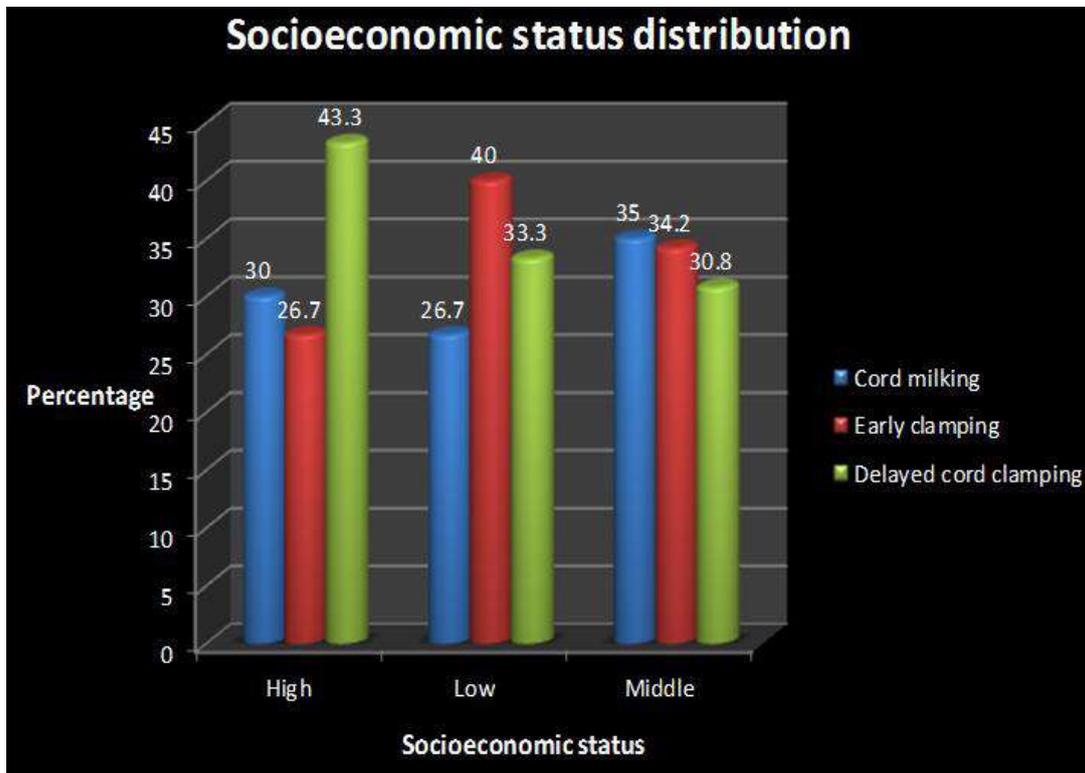
**Flow chart of study procedure**



**Observations**

**Table 1:** Distribution of socioeconomic status

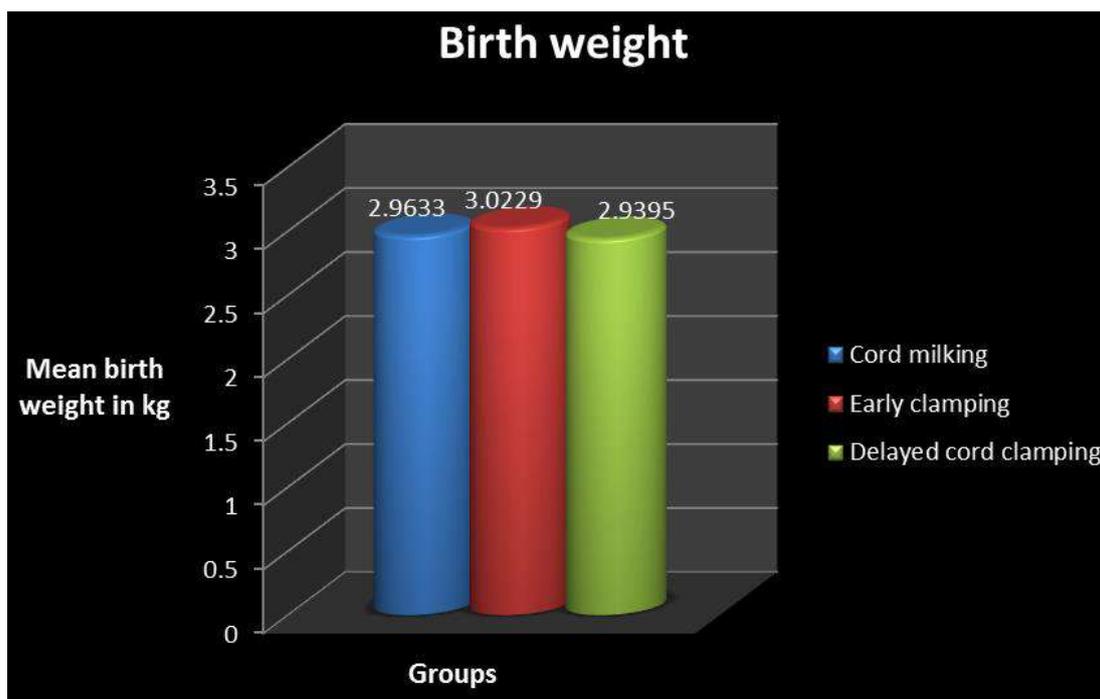
Socio economic status	Cord milking group	Early clamping group	Delayed cord clamping Group	Chi-square	P-Value
High (n=30)	9 (30.0%)	8 (26.7%)	13 (43.3%)	2.150	.708
Low (n=15)	4 (26.7%)	6 (40.0%)	5 (33.3%)		
Middle(n=120)	42 (35.0%)	41 (34.2%)	37(30.8%)		



**Fig 1:** The socioeconomic status of mothers among three study groups was similar with p value of 0.708

**Table 2:** Birth Weight

Variable	Group	Mean	SD	F-value	P-value
Birth weight in Kg	Cord milking	2.9633	0.37951	0.768	0.465
	Early clamping	3.0229	0.34684		
	Delayed cord clamping	2.9395	0.36403		



**Fig 2:** The mean birth weight of babies in all three groups was comparable with p value of 0.465

**Table 3:** Maternal Hemoglobin

Variable	Group	Mean	SD	F-value	p-value
Maternal Hemoglobin in g/dl	Cord milking	11.587	1.2123	1.160	0.316
	Early clamping	11.240	1.2675		
	Delayed cord clamping	11.484	1.2026		

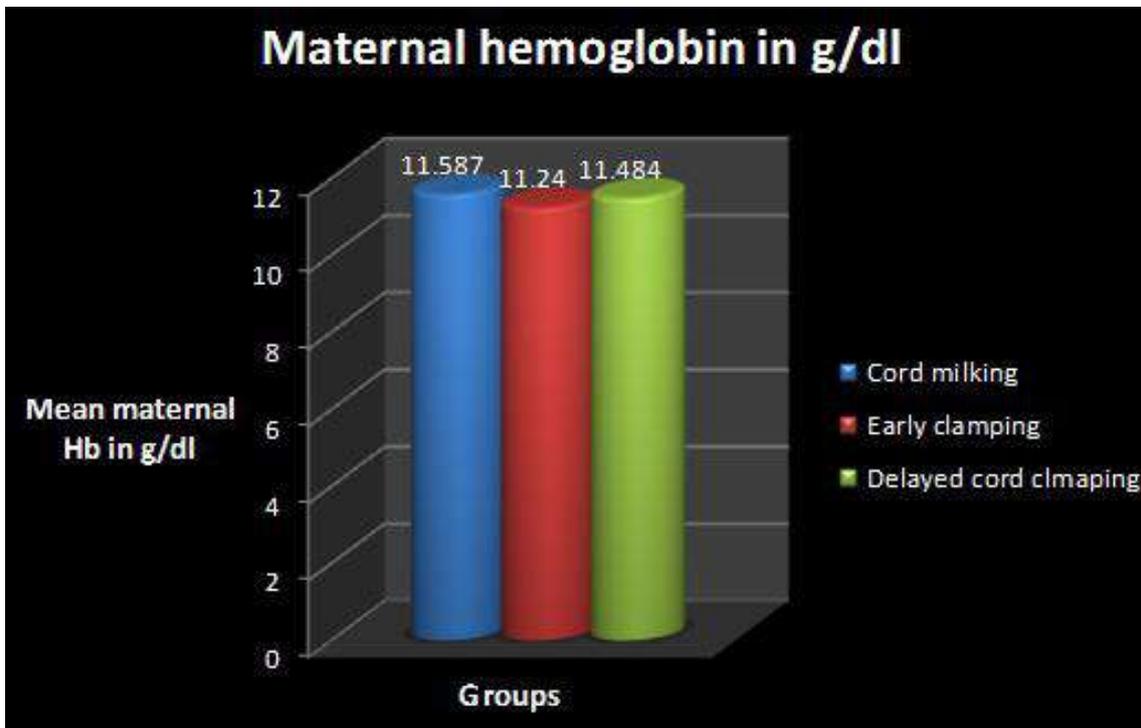


Fig 3: Means of maternal hemoglobin (g/dl) of babies in all three groups were comparable with p value of 0.627

Table 4A: Hemoglobin at 48hrs of life

Variable	Group	Mean	SD	F-value	p-value
Hemoglobin at 48hrs g/dl	Cord milking (n=55)	19.635	1.4572	42.439	.000
	Early clamping (n=55)	17.192	1.8630		
	Delayed cord clamping (n=55)	19.623	1.4507		

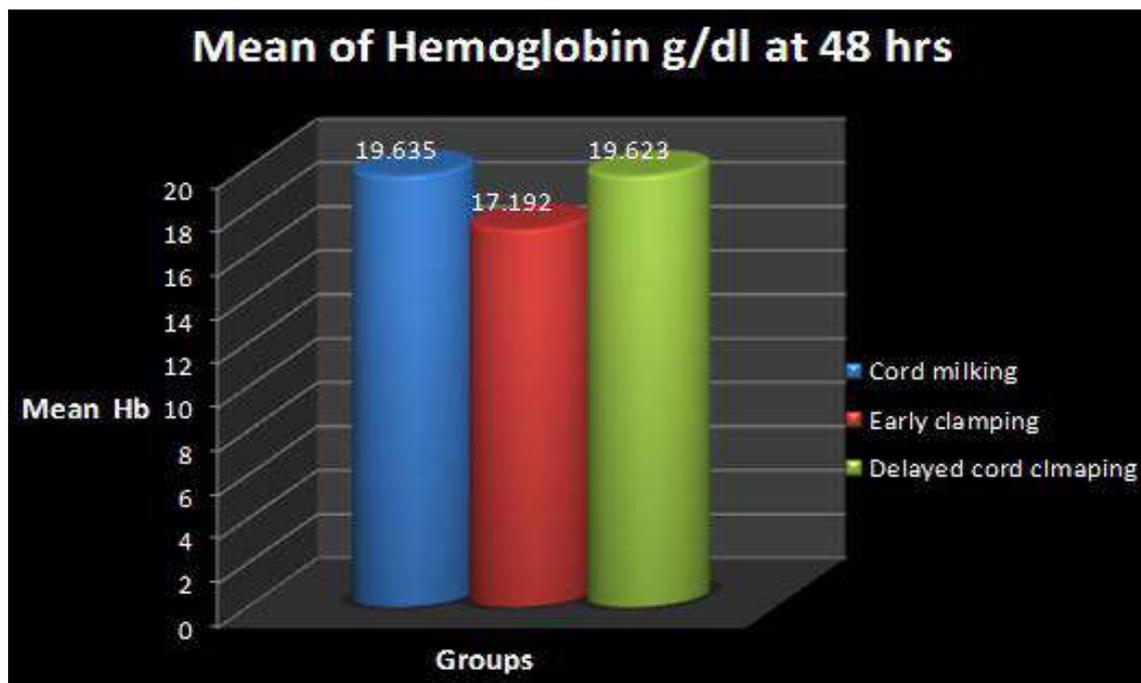
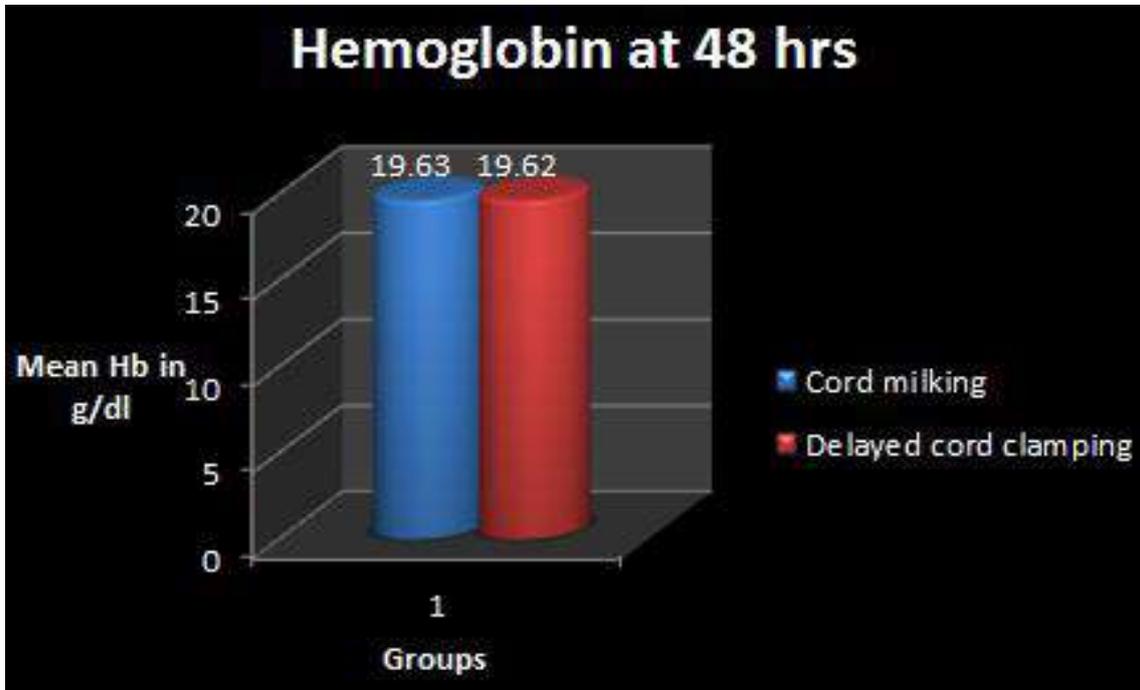


Fig 4A: The mean hemoglobin levels of babies subject to cord milking (19.63±1.42) and those subject to delayed cord clamping (19.62±1.45) were significantly higher than the mean hemoglobin levels of babies in the early clamping group (17.19±1.86) with p value of 0.000

Table 4B: Comparison of mean haemoglobin at 48hrs among the cord milking and delayed cord clamping

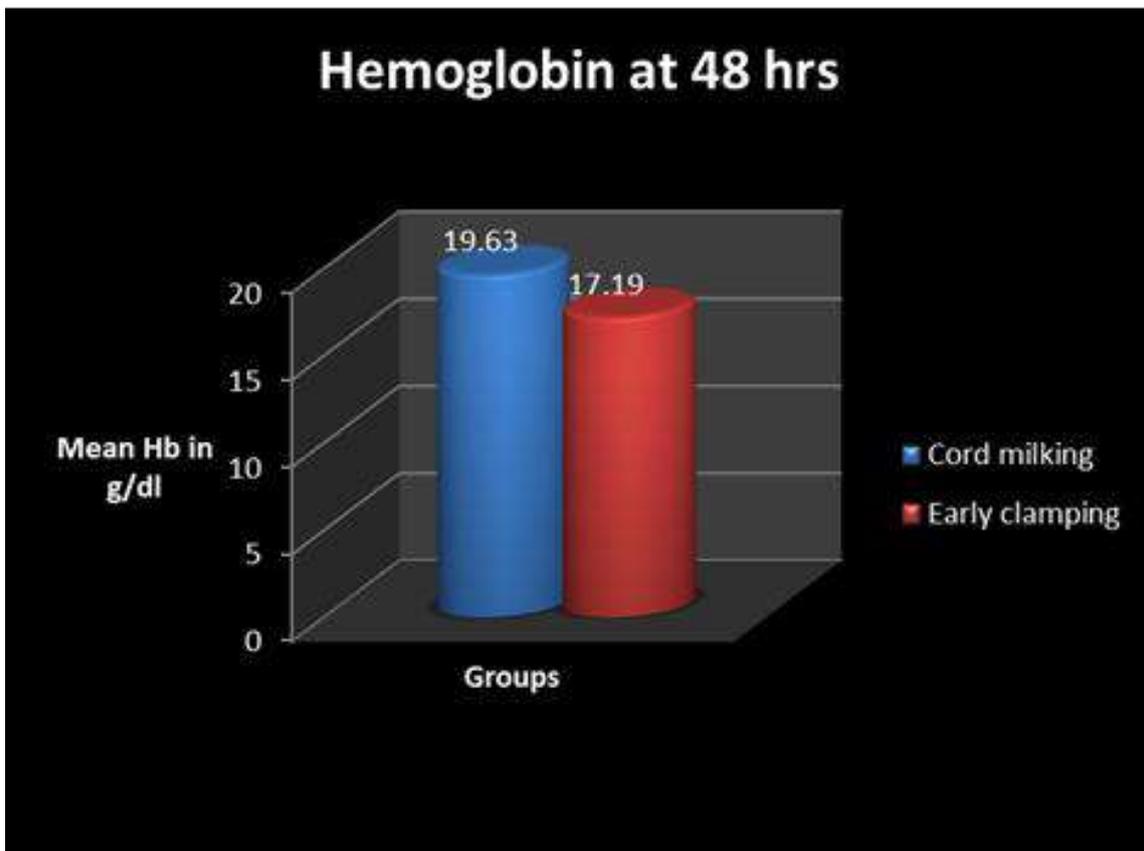
Variable	Group	Mean	SD	t-value	p-value
Hemoglobin at 48hrs g/dl	Cord milking (n=55)	19.635	1.4572	42.439	.968
	Delayed cord clamping (n=55)	19.623	1.4507		



**Fig 4B:** The mean hemoglobin levels of babies subject to cord milking were  $19.63 \pm 1.42$  and mean HB in the delayed cord clamping was  $19.62 \pm 1.45$ . There was no statistically significantly difference in the mean Hemoglobin in the two groups (p value of 968)

**Table 4C:** Comparison of mean haemoglobin at 48hrs among the cord milking and early clamping groups

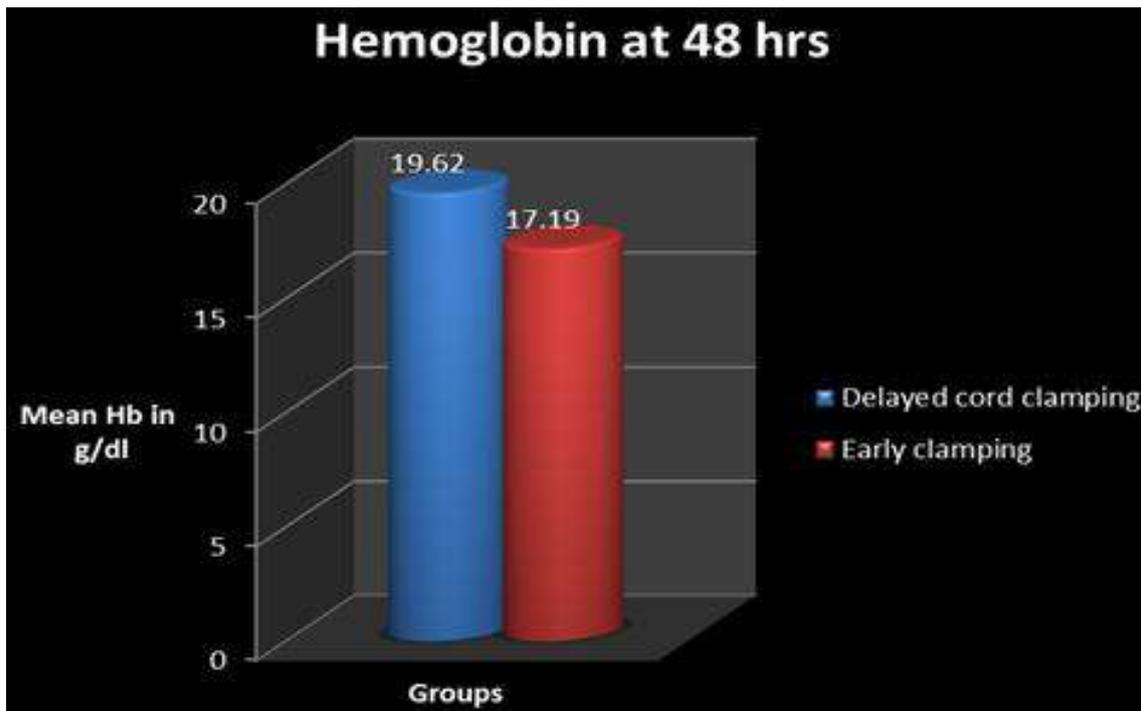
Variable	Group	Mean	SD	t-value	p-value
Hemoglobin at 48hrs g/dl	Cord milking (n=55)	19.635	1.4572	7.68	0.0001
	Early clamping (n=55)	17.192	1.8630		



**Fig 4C:** The mean hemoglobin levels of babies subject to cord milking ( $19.63 \pm 1.45$ ) was significantly higher than the mean hemoglobin levels of babies in the early clamping group ( $17.19 \pm 1.86$ ) with p value of 0.0001

**Table 4D:** Comparison of mean haemoglobin at 48hrs among the delayed cord clamping and early clamping

Variable	Group	Mean	SD	t-value	p-value
Hemoglobin at 48hrs g/dl	Delayed cord clamping (n=55)	19.625	1.4507	7.64	0.0001
	Early clamping (n=55)	17.192	1.8630		



**Fig 4D:** The mean hemoglobin levels (in g/dl) of babies subject to delayed cord clamping (19.62±1.45) was significantly higher than the mean hemoglobin levels of babies in the early clamping group (17.19±1.86) with p value of 0.0001

**Table 5:** Hemoglobin at 48 hours in babies born to anemic mothers

Variable	Group	Mean	SD	F-value	p-value
Hemoglobin (g/dl) of babies at 48hours born to anemic Mothers (n=53), (HB<11g/dl)	Cord milking* (n=18)	19.71	1.18	13.04	0.000 *0.597
	Early clamping (n=20)	17.33	2.01		
	Delayed cord clamping* (n=15)	19.48	1.29		



**Fig 5:** The mean hemoglobin levels at 48hrs in babies delivered to *anemic mothers* were significantly higher in those subject to cord milking and to delay cord clamping compared to early clamping (p value of 0.000)

**Discussion**

Total of 165 term babies were included in the study, divided into three groups (early clamping, delayed cord clamping

and cord milking). There were 55 babies in each group. The mean haemoglobin at 48 hours of life was 17.192±1.86 g/dl in the early cord clamping group, 19.623±1.45 g/dl in

the delayed cord clamping group and  $19.635 \pm 1.45$  g/dl in the cord milking group which were similar to studies conducted by MI March *et al.* [9].

The mean haemoglobin levels of babies subjected to cord milking ( $19.635 \pm 1.45$ g/dl) and those subject to delayed cord clamping ( $19.623 \pm 1.45$ g/dl) were almost similar. Rabe *et al.* (2011) concluded that milking the cord four times achieved similar placenta-fetal blood transfusion as delaying clamping the cord [10].

Milking the umbilical cord four times before clamping and cutting the cord showed higher mean haemoglobin levels ( $19.635 \pm 1.45$  g/dl) at 48 hours of life compared to early clamping ( $17.192 \pm 1.86$  g/dl), the difference was found to be statistically significant (p value 0.0001). Similar results shown by Upadhyay *et al.* [11] and Ericson-Owen *et al.* [12] in their studies.

Delaying clamping of the cord by 60 seconds after delivery showed higher mean haemoglobin levels ( $19.623 \pm 1.45$  g/dl) at 48 hours of life compared to early clamping ( $17.192 \pm 1.86$  g/dl), the difference was found to be statistically significant, (p value 0.0001). Hutton and Hassan; [13] Andersson *et al.* [14] concluded the same in their studies.

Babies born to mothers with anemia, the mean hemoglobin at 48 hours in the early clamping group was 17.33g/dl which was significantly less than that in the delayed clamping ( $19.48$ g/dl) and cord milking group ( $19.71$ g/dl) which was similar to studies conducted by Upadhyay *et al.* and Gupta *et al.* [11, 15].

No differences were observed between the groups with regard to baseline variables (sex, birth weight, gestational age, APGAR scores of the new born babies, maternal age, parity, socioeconomic status, Mode of delivery, gestational diabetes and haemoglobin levels).

### Conclusions

We conclude that both delayed cord clamping and cord milking resulted in significantly higher neonatal hemoglobin at 48 hours of life as compared to early clamping with no adverse outcomes.

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