

**Original Article****A Study correlating Hemoglobin levels in Expectant Mother during third Trimester Gestation with Cord Blood Haemoglobin and Reticulocyte count****Karthiyanee Kutty**

Professor, Department of Physiology, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, India.

**Abstract**

**Background:** It is estimated by WHO that 87% of the Indian pregnant women are anaemic and it is significantly high in third trimester of pregnancy. **Aim:** To correlate the maternal haemoglobin levels in third trimester expectant pregnant women to cord blood haemoglobin levels and cord blood reticulocyte count. **Material and Methods:** After obtaining ethical clearance and with informed consent the subjects were recruited based on various inclusion and exclusion criteria from a medical college hospital in Kolar. One hundred healthy third trimester gestational expectant mothers in labour were selected. **Results:** Descriptive statistical analysis was carried out on this data. The level of significance was fixed at  $p < 0.01$ . To estimate the relationship quantitatively between three variables, maternal haemoglobin, cord blood haemoglobin and cord blood reticulocyte count, Pearson's correlation co-efficient was estimated. Conclusions are drawn based on the outcome of this statistical treatment. **Conclusions:** 1. There is significant correlation between maternal haemoglobin level and cord blood haemoglobin level. 2. There is a correlation between maternal haemoglobin and foetal cord blood reticulocyte count but significant.

**Key-words:** Hemoglobin, cord blood sample, reticulocyte, third trimester gestation, expectant mother**Introduction**

Anaemia is a global health problem affecting both developing and developed countries.<sup>[1]</sup> It is estimated by WHO that 87% of the Indian pregnant women are anaemic and it is significantly high in third trimester of pregnancy. Interestingly, anaemia in pregnant women has multiple effects on pregnancy and foetal growth. As per WHO, anaemia is considered to exist when haemoglobin level is below 11gm/dl in pregnant women.<sup>[2]</sup> Anaemia in pregnant women has deleterious effects on pregnancy and foetal growth due to micronutrient related issues also occur in the third trimester.<sup>[3]</sup> The reticulocyte count is one of the most common haematological tests to monitor the treatment of different types of anaemia and to determine the bone marrow function.<sup>[4]</sup> The Reticulocyte Maturity Index

increased gradually from 2 trimester of pregnancy and peaked in third trimester.<sup>[5]</sup> A previous study on foetal hematologic parameters has shown a significant relationship with gestational age and revealed that in term infants the reticulocyte count and haemoglobin content decreased significantly as the gestational age increased.<sup>[6]</sup> Reticulocytes are non-nucleated immature red blood cells in peripheral blood, containing residual RNA.<sup>[7]</sup> The manual method for reticulocyte counts is the most commonly based on microscopic observation of residual ribosomal RNA by supravital staining.<sup>[8]</sup> The objective of the study is to correlate the maternal haemoglobin levels in third trimester expectant pregnant women to cord blood haemoglobin levels and cord blood reticulocyte count.

**Material and Methods**

Hundred pregnant women admitted for labour in a medical college hospital at Kolar were studied after obtaining informed consent and institutional ethical clearance. During vaginal delivery in the labour room the foetal cord blood samples were collected before the placenta was delivered. Women

**\*Corresponding Author**

Dr. Karthiyanee Kutty  
Professor, Department of Physiology,  
Sri Devaraj Urs Medical College, Tamaka, Kolar.  
E-mail: Karthiyaneekutty@gmail.com  
Received 10<sup>th</sup> Oct 2015, Accepted 11<sup>th</sup> Dec 2015

with a known history or detected during pregnancy of diabetes, hypertension, thyroid diseases, TB and obesity were not included for the study. The haemoglobin values of the mothers of the third trimester recorded in the antenatal card were considered for correlation with the cord blood haemoglobin and cord blood reticulocyte count. The haemoglobin levels of <11 gms% of the mother was categorized as anaemia. Pearson's correlation coefficient was estimated to find the relationship between these three variables.  $p < 0.01$  was considered to be significant statistically.

**Results**

There is significant correlation between maternal haemoglobin levels and foetal cord blood haemoglobin levels. As the maternal haemoglobin levels increases, cord blood haemoglobin levels also increases. Two tailed Pearson's test showed significant correlation of .000 ( $p < 0.01$ ).

**Table 1.** Distribution of maternal and foetal cord blood haemoglobin levels

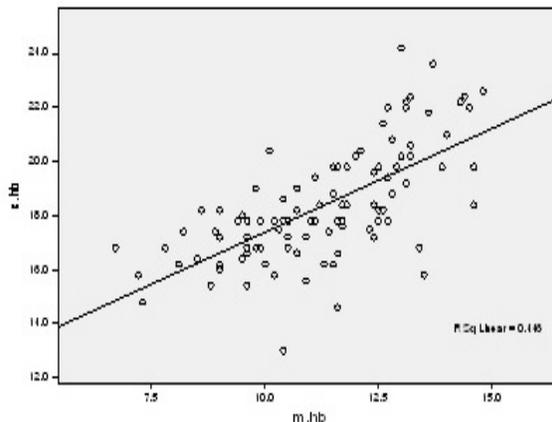
Maternal groups	Hb levels of mothers in 3 <sup>rd</sup> trimester (mean ± SD)	Foetal cord blood Hb levels (mean ± SD)
Anaemia in pregnancy (Hb <11gms%)	9.52 ± 1.02	15.13 ± 0.91
No anaemia in pregnancy (Hb ≥ 11gms%)	12.60 ± 1.02	18.65 ± 1.92

**Table 2.** Correlation between maternal Hb level and foetal cord blood Hb

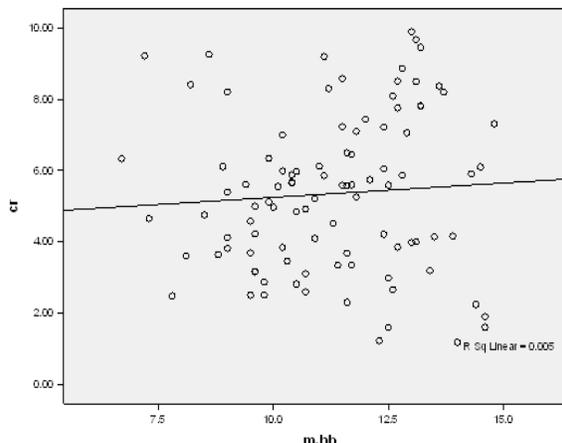
Variable	r	p
Maternal Hb	0.068	0.50

**Table 3.** Pearson correlation between maternal Hb Level and reticulocyte count

Variable	r	p
Maternal Hb level	0.668	0.000



**Fig 1.** Scatter plot graph showing a positive correlation between maternal Hb and cord blood Hb. As the maternal Hb increases the cord blood Hb also increased.



**Fig 2.** Simple scatter plot graph shows correlation. As the maternal Hb increases the cord blood reticulocyte count increases ( $p = NS$ )

**Discussion**

There is a correlation between maternal Hb levels at 3<sup>rd</sup> trimester of pregnancy and foetal cord Hb levels and reticulocyte counts. Anaemia in pregnant women and is a major cause of maternal mortality. [1] WHO recorded that anaemia was significantly high in the third trimester of pregnancy than in other two trimesters.[2] Also anaemia in pregnant women has multiple effects on pregnancy and foetal growth and most of the micronutrient related issues occur in the third trimester.[3] The reticulocyte count is one of the most common haematological tests to classify and monitor the treatment of different types of anaemia, as well as to determine whether the bone marrow is functional.[4] Hence the study was conducted to correlate third tri-

mester gestational haemoglobin levels with its outcome as umbilical cord blood Haemoglobin levels and reticulocyte count, which may be a part of investigation as early tool for detecting and preventing foetal morbidity and mortality due to anaemia. However our study is a correlative study, relating reticulocyte count and haemoglobin levels of foetal cord blood with that of maternal haemoglobin levels during labour (3<sup>rd</sup> trimester) which shows with increased level of maternal haemoglobin levels there is increased foetal haemoglobin levels also. Our study also states that as the increase in maternal haemoglobin, there is increase in cord blood reticulocyte count. The reason predicted may be that in more severe anaemia, the maturation time of reticulocytes in the medulla decreases and an increased number of immature reticulocytes are released into the peripheral blood.

The reticulocytes will remain more than 48 hours in the peripheral blood until they turn into red blood cells and therefore the immature reticulocyte count in the peripheral blood will be higher.<sup>[9]</sup> Hence we believe that the increase of immature reticulocytes may be due to decreased maternal hemoglobin.<sup>[8]</sup> And there are some plausible biological mechanisms linking maternal anaemia to IUGR, low haemoglobin levels restrict oxygen circulation in the body creating an environment of oxidative stress or chronic hypoxia, which could then cause restriction of haemoglobin production. Another possible mechanism with iron deficiency anaemia is an increased production of norepinephrine, which then stimulates production of corticotropin-releasing hormone and in turn possibly restricts foetal growth as well as foetal hemoglobin.<sup>[9]</sup> Maternal anaemia also causes preterm delivery, low birth weight, intrauterine foetal death, neonatal death, maternal mortality and infant mortality.<sup>[10]</sup> IUGR has been linked to major morbidities such as hypoglycaemia, hypocalcaemia, low Apgar scores, birth asphyxia, hyperbilirubinemia, reduced immunocompetence, lowered mental capacity, poor growth, and even morbidities well into adulthood.<sup>[9]</sup> Hence umbilical cord blood Haemoglobin levels and reticulocyte count, can be used as a part of investigation for detecting and preventing foetal morbidity and mortality due to anaemia.

## References

1. Melku M, Addis Z, Alem M, Enawgaw B. Prevalence and Predictors of Maternal Anemia during Pregnancy 2014; 108593.
2. Ivan AE. Evaluation of anemia in booked antenatal mothers during the last trimester 13;7 (11):2487-90.
3. Kumar KJ, Asha N, Murthy DS, Sujatha M, Manjunath V. Maternal anaemia in various trimesters and its effect on new-born weight and Maturity. International Journal of Preventive Medicine 2013;4(2):193-94.
4. Nascimento ML. Normocitose, Reticulocitopenia, reticulócitos imaturos e eritrograma 2004;63:178-90.
5. Choi JW, Pai SH. Change in erythropoiesis with gestational age during pregnancy 2001;80 (1):26-31.
6. Maconi M, Formisano D, Cavalca L, Rolfo A, Cardaropoli S, Danise P. Reticulocyte count and reticulocyte maturation profile in human umbilical cord blood from healthy newborns. 2010;16(1):3-7.
7. Danise P, Palma AD, Marchittiello R, Avino D, Atinaldi A, Clemente G. Comparative Study of the reticulocyte and erythrocyte parameters from the beckman coulter LH750 and Bayer ADVIA 120.2004;13:15.
8. Wollmann M, Gerzson BM, Schwert V, Figuera RW, de Oliveira Ritzel G. Reticulocyte maturity indices in iron deficiency anemia. 2014;36 (1):25-28.
9. Kozuki N, Lee AC, Katz J; Child Health Epidemiology Reference Group 2012 ;142(2):358-62.
10. Melku M, Addis Z, Alem M, Enawgaw B. Prevalence and Predictors of Maternal Anemia during Pregnancy in Gondar 2014:108593.