MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.3.356.361

OPEN ACCESS

Key Words
Maternal hemoglobin, cord blood hemoglobin, birth weight and term pregnancy

Corresponding Author
Madhumanti Basu,
Department of Gynecology and Obstetrics, K.P.C Medical College and hospital, Jadavpur, Kolkata, West Bengal 700032, India

Author Designation
[1,2]Senior Resident
[3]Assistant Professor
[4]Consultant
[5]Post Graduate Trainee

Received: 2 May 2024
Accepted: 18 May 2024
Published: 22 May 2024

Citation: Madhumanti Basu, Barnali Sarkar, Supriyo Halder, Sohini Roy and Zarrin Tasneem Shaikh, 2024. Study of Correlation of Maternal Hemoglobin at Term with Cord Blood Hemoglobin and Birth – Weight. Res. J. Med. Sci., 18: 356-361, doi: 10.59218/makrjms. 2024.3.356.361

Study of Correlation of Maternal Hemoglobin at Term with Cord Blood Hemoglobin and Birth – Weight

[1]Madhumanti Basu, [2]Barnali Sarkar, [3]Supriyo Halder, [4]Sohini Roy and [5]Zarrin Tasneem Shaikh

[1-3,5]Department of Gynecology and Obstetrics, K.P.C Medical College and hospital, Jadavpur, Kolkata, West Bengal 700032, India
[4]Department of Gynecology and Obstetrics, ARC Fertility Hospitals, Naskarhat, Kasba, Kolkata, West Bengal 700039, India

ABSTRACT
The World Health Organization defines anemia as hemoglobin levels <11g/dl. It is the primary cause of disability worldwide and is considered the most important public health issue impacting both industrialized and developing nations, especially among reproductive age groups. To measure the Cord blood hemoglobin and determine their association with maternal hemoglobin. To study significant correlation between maternal anemia and birth weight of neonates. This study employed a prospective case control design. This study was carried out for a year at the Nilratan Sircar Medical College in Kolkata's department of obstetrics and gynecology. This investigation involved 400 patients in all. A total of 400 women were included in this one year period from April 2017 to March 2018. Among them, 192 (48%) were anemic and 208 (52%) were non-anemic. Depending on their Hb level, the anemic moms were divided into three groups. Of the 192 moms who suffered from anemia, 49% had mild anemia, 43% had moderate anemia and 8% had severe anemia. Cord blood Hb was estimated for all the cases. We conclude that maternal anemia affects the cord hemoglobin of neonates. According to our research, newborns born to anemic moms had lower hemoglobin levels than babies born to non-anemic mothers. We have discovered a linear correlation between the neonates' cord blood hemoglobin and the mother's hemoglobin. We also found that anemic mothers were more likely to deliver babies with low birth-weight than the non-anemic mothers. Overall neonatal survival outcome may also be increased.

INTRODUCTION

The World Health Organization defines anemia as hemoglobin levels <11 g/dL. It is the primary cause of disability worldwide and is considered the most important public health issue impacting both industrialized and developing nations, especially among reproductive age groups.

The world's greatest prevalence of anemia is seen in South Asian nations. According to WHO estimations, India has the greatest rate of anemia even among South Asian nations. India accounts for around 80% of the maternal mortality in South Asia caused by anemia, which accounts for roughly half of all maternal deaths worldwide[1]. It is evident that India contributes more than its population would have us believe, both in terms of the incidence of anemia during pregnancy and the number of maternal anemia fatalities. Anemia frequency varies greatly by area of the nation, ranging from 33% to 89% among pregnant women and over 60% among teenage girls.

Iron deficiency anemia is thought to affect about 30% of people on the planet. IDA is the third most common cause of disability according to World Health Organization (WHO) statistics. These days, the most prevalent dietary issue affecting expectant mothers is iron deficiency anemia. It is concerning that many pregnant women in underdeveloped nations have high rates of iron and vitamin deficiencies and maternal anemia continues to be a major contributor to perinatal morbidity and death.

Unfavorable obstetric outcomes, such as spontaneous miscarriage, premature labor, low birth weight infants (LBW) and fetal growth restriction (FGR), can be caused by anemia. Anemia in India is a condition that predates pregnancy and is made worse by increased blood requirements during pregnancy, blood loss after delivery, infection during the prenatal and postnatal phases and the early onset of subsequent pregnancies. According to surveys conducted by the NNMB, DLHS and ICMR, anemia affects over 87% of pregnant women, with 10% experiencing severe anemia[2].

Anemia starts in childhood, becomes worse in females' teens and becomes worse during pregnancy. All states have high rates of anemia, yet the incidence of moderate and severe anemia varies greatly throughout them. Targeting a 25 percent anemia prevalence, the National Nutritional Anemia Prophylaxis Programme (NNAPP) was started. Inspite of NNAPP in action since 1970, the scenario has not much changed. Under the Child Survival and Safe Motherhood (CSSM) Program, the daily dosage of elemental iron for prophylaxis and treatment has been increased to 100 mg and 200 mg, respectively, since 1992. Launched on October 15, 1997, the Reproductive and Child Health Programme (RCH) strives to improve the spread of its services for the population of society that is most vulnerable, especially pregnant mothers. The primary causes of anemia in developing nations are haemorrhage during childbirth, heavy menstrual blood flow, closely spaced pregnancies, malaria, hookworm infestation, diarrhea, HIV/AIDS and other infections and genetic disorders like sickle cell and thalassemia.

The umbilical cord blood hemoglobin is an important haematological parameter in newborn[3]. In developing countries upto 50% of children become anemic by 12 months of age. Mothers who had anemia were more likely to deliver anemic babies[4].

Maternal anemia has several deleterious effects on the health of the mother and fetus. Approximately half of pregnant women do not have enough iron reserves. Because pregnancy requires more iron, the risk of anemia rises with the number of gestations. Reduced iron availability, an increasing fetus's need for iron and a rise in the mother's plasma volume can all contribute to maternal anemia[5].

According to WHO, hemoglobin level less than 11gm% is defined as maternal anemia during pregnancy[6]. Maternal anemia in pregnancy is classified as mild, moderate and severe anemia with Hb levels being 10 to 10.9 gm/dL, 7 to 9.9 gm/dL and <7 gm/dL, respectively.

MATERIALS AND METHODS

Study Area: Department of Obstetrics and Gynaecology, Nilratan Sircar Medical College, Kolkata

Study Period: 1 year (April 2017 to March 2018).

Study Population: Pregnant women at term >37 weeks with anemia Hb<11g/dL in NRS-MCH were taken as test group and women with Hb>11g/dL were taken as control group.

Inclusion Criteria:

- Singleton pregnancy
- At ≥37 weeks of gestation
- Delivered by vaginal route

Exclusion Criteria:

- Medical disorders like diabetes, hypertension, hypothyroid, heart disease, jaundice etc
- Pregnancy complications such as antepartum hemorrhage, Rh incompatibility
- Twin pregnancy
- Caesarian section deliveries

Study Design: Prospective case control study

Sample Size: A total of 400 pregnant women in labour were included in the study.

Sample Design: Continuous sampling.

Parameters to Be Studied:

- Detailed history and clinical examination
- Blood investigations- maternal Hb, Blood grouping and Rh typing, serology, cord blood Hb
- Neonatal birth weight
- Neonatal examination

RESULT

A total of 400 women were included in this one year period from April 2017 to March 2018 (Table 1). Among them, 192 (48%) were anemic and 208 (52%) were non-anemic. The anemic mothers were categorised into three groups depending upon the Hb level. Among the 192 anemic mothers, 49% had mild anemia, 43% had moderate anemia and 8% had severe anemia. Cord blood Hb was estimated for all the cases. In only 28 cases (7%), the cord blood Hb was <14 g/dL. Among the anemic mothers, 54% were from rural areas where 46% anemic mothers were from urban areas. And among non-anemic mothers 33% were from rural areas where 67% were from urban areas. The anemic and non-anemic groups were comparable in terms of age. The mean cord blood Hb among three groups (mild, moderate, severe anemia) were compared with mean cord blood Hb of the non anemic group. The difference between them were statistically significant. So as the severity of maternal anemia increases the cord blood Hb also decreases.

Table 1: Incidence of Anemia (n = 400), Grades of Anemia (n = 192) and Cord Blood Hemoglobin (n = 400)

Parameter	Number of People	Percentage
Presence Of Anemia		
Anemia	192	48
No Anemia	208	52
Total	400	100
Grades of anemia		
Mild	93	49
Moderate	83	43
Severe	16	8
Total	192	100
Cord blood Hemoglobin		
Hemoglobin <14	28	7
Hemoglobin 14	372	93
Total	400	100

Table 2: Comparison of demographic status between anemic and non-anemic mothers

Anemic status	Rural	Urban	Total
Non anemic	68 (32.6%)	140 (67.4%)	208
Anemic	103 (53.6%)	89 (46.4%)	192

Table 3: Comparison of age among anemic and non-anemic groups

	Age			
Anemic status	20-23	24-27	28-31	Total
Non-anemic	50 (24%)	101 (48.5%)	57 (27.5%)	208
Anemic	45 (23%)	96 (50%)	51 (27%)	192

Table 4: Showing relationship between maternal and cord blood Hb (n = 400)

	No. of cases (%)		
Maternal Hb (gm/dL)	Cord blood Hb<14	Cord blood Hb≥14	Total
>11	1 (0.4)	207 (99.6)	208 (100)
10-10.9	4 (4.3)	89 (95.7)	93 (100)
7-9.9	11 (13.2)	72 (86.8)	83 (100)
<7	12 (75)	4 (25)	16 (100)

DISCUSSION

In our study we compared the maternal hemoglobin with cord blood hemoglobin in order to find whether there is any relationship between the two parameters. We enrolled 400 mothers in the study and their pre delivery hemoglobin level was determined. Out of 400 mothers, 192 mothers (48%) had hemoglobin less than 11 g/dL (Anemic) and 208 mothers (52%) had hemoglobin more than equal to 11 g/dL (no Anemia) (Table 2). Debbarma *et al*.[9] has previously done a similar study in which they found out that, out of 100 cases, 55 were anaemic and 45 were non- anemic mothers. In the study by Alizadeh *et al*. they found out about 23.2% mothers were anemic, 58% had normal level of Hb (11-13.2 g/dL) and 18.8% had Hb >13.2 g/dL (Table 3).

Among the anemic mothers 93 (48.9%) had mild anemia (hemoglobin 10-10.9 g/dL), 83 (42.8%) mothers had moderate anemia (hemoglobin 7-9.9 g/dL) and only 16 (8.3%) mothers had severe anemia (hemoglobin less than 7 g/dL). In the study by Debbarma *et al*.[9] found out that, out of 100 cases, 55 were anaemic. Among them, 37 (67.27%) had mild anemia, 13 (23.6%) had moderate anemia and 5 (0.09%) had severe anemia. In the study by Timilisna *et al*.[7] they found out 45.61% of pregnant women had hemoglobin concentrations less than 10 g/dL and 0.8% with hemoglobin concentration less than 7 g/dL. Al-hilli *et al*. performed a similar study in which she found out that out of 90 mothers, 40 were non anemic and among the 50 anemic mothers; 35 (70%), 11 (22%) and 4 (8%) mothers had mild, moderate and severe anemia respectively (Table 4).

In our study, the mean maternal hemoglobin among non anemic mothers was 11.78±0.52. The mean maternal hemoglobin in mothers with mild anemia was 10.43±0.23 and the mean hemoglobin in mothers with moderate anemia was 9.03 0.85 and the mean hemoglobin in mothers with severe anemia was 6.6±0.23. Timilsina *et al*.[7] performed a similar study with 114 mothers. They found out that mean maternal hemoglobin among non anemic mothers was 12.17±0.81. The mean hemoglobin in mothers with mild and moderate anemia were 10.57±0.27 and 9.18 0.65 respectively. In their study population, only one mother had severe anemia. So this result is corroborating with our study result.

In our study population out of 400 mothers, 171 were from rural background (42.75%) and 229 were from urban background (57.25%). Among the 192 anemic mothers, 103 of them were from rural area which accounts to about 54% and 89 of them were from urban area which accounts to about 46%.

Out of 192 anemic mothers only 27 had cord blood hemoglobin less than 14 g/dL (14%), rest 165 had cord blood hemoglobin more than 14 g/dL (86%). Mamoury *et al*.[8] in their study70 found out that out of 170 neonates, 11.7% had an cord blood Hb<14 g/dL and the rest of the neonates (88.3%) had cord blood Hb 14 g/dL.

In the present study the mean cord blood hemoglobin among neonates of non anemic mothers was 16.37±0.85 and among the neonates of anemic mothers it was 15.03±1.04. The mean cord blood hemoglobin among the three groups (mild, moderate, severe anemia) were 15.54±0.77, 14.7±0.93 and 14.08±0.88 respectively. The mean cord blood hemoglobin between the anemic and non anemic groups was compared and the difference between the two groups was statistically significant with p value = 0.0348 (<0.05)

The mean cord hemoglobin among the three groups (mild, moderate, severe anemia) were compared with mean cord hemoglobin of the non anemic group and the difference was statistically significant with P value less than 0.05,0.01 and 0.05 respectively. It corroborates with the results of the study by Debbarma *et al*. in which the P value for three groups are less than 0.01, 0.01 and 0.05 respectively[9]. It also corrpborates with the study by Al hilli *et al*.

On comparing the cord blood hemoglobin with maternal hemoglobin we found that there was a linear relationship between the two parameters. Cord blood Hb was <14 gm% in 27 neonates in anemic group. 4.3%, 13.2% and 75% of babies of mild, moderate and severe anemic group had cord blood Hb less than 14 gm%. It was observed as that as mean maternal hemoglobin decreases, there was an increase in the incidence of neonatal anemia. This denotes that there is an impact of maternal anemia on cord blood hemoglobin. This observation was similar to the studies done by Debbarma et al, Al hilli et al which also showed a linear relationship between maternal hemoglobin and cord hemoglobin.

Terefe B et al in their study titled "Effect of Maternal Iron Deficiency Anemia on the Iron Store of Newborns "enrolled 21 anemic mothers and 78 non anemic mothers and found that newborns delivered from IDA mothers had a significantly lower concentration of hemoglobin than newborns from non anemic mother, which is correlating with the results of our stud[10]. In our study we found that incidence of neonatal anemia is 14% among anemic group and 0.4% among non anemic group.

Our observation made us to rethink the belief that fetus continues to extract iron from the mother regardless of her iron status. Previous studies also suggest that iron supply to the placenta and the fetus is affected in maternal anemia and the fetus takes iron in direct proportion to the levels available in the mother. Our study also demonstrated that the decrease in cord blood hemoglobin appears to be proportional to the degree of anemia. This suggests that placental iron transport mechanisms may not work at higher degrees of anemia and thereby it leads to a fall in cord hemoglobin.

In our study, out of 400 neonates, 86 (21.5%) were low birth weight (<2.5 Kg) and 314 (78.5%) had birth weight ≥2.5 Kg. In the study performed by Ahmad et alss, out of 100 neonates, 37 were low birth weight and 63 were having normal birth weight.

In our study, out of 192 anemic mothers, 51 (26.56%) gave birth to low birth weight babies. And in the non anemic group, out of 208 neonates, only 16.82% were low birth weight. Incidence of LBW babies (BW <2.5 kg) was 27.9%, 22.8%, 37.5% in mild, moderate and severe anemic groups. In the study by Sweet *et al*.[11] in their study had shown that mothers with iron deficiency anemia gave birth to newborn with low birth weight.

Maternal Hb and neonatal body weight were compared and the difference was found to be statistically significant with p = 0.0226(<0.05), so maternal Hb and neonatal birth weight are related. This result was similar to the studies done by Runi Debbarma *et al*.[9], Al hilli *et al*., Alizadeh *et al*. who showed a positive relationship between maternal Hb and neonatal birth- weight.

CONCLUSION

We conclude that maternal anemia affects the cord hemoglobin of neonates. Our study infers that anemic mothers deliver babies with lower hemoglobin compared to non-anemic mot hers. We have found a linear relationship between maternal hemoglobin and cord blood hemoglobin of the newborns. We also found that anemic mothers were more likely to deliver babies with low birth-weight than the non-anemic mothers. Overall neonatal survival outcome may also be increased.

REFERENCE

1. WHO., 1992. The prevalence of anemia in women: a tabulation of available information. 2nd Edn., Geneva: World Health Organization.
2. DeMayer, E.M. and A. Tegman, 1998. Prevalence of anemia in the World. World Health Organ Qlty, 38: 302-316.
3. Elgari, M.M. and H.A. Waggiallah, 2013. Assessment of haematological parameters of neonatal cord blood in anemic and non anemic mothers. J. Clin. Exp. Res., 1: 22-25.
4. Allen, L.H., 2000. Anemia and iron deficiency: Effects on pregnancy outcome. Am. J. Clin. Nutr., 71: 1280-1284.

5. Cohen, J.H. and H.D. Flass, 1999. Hemoglobin correction factors for estimating the prevalance of iron deficiency anemia in pregnant women residing at high altitudes in Bolivia, Rev. Panam. Salud Publica, 6: 392-399
6. Jaleel, R. and A. Khan, 2008. Severe anemia and adverse pregnancy outcome. J. Surge Pak., 13: 147-150.
7. Timilsina, S., S. Karki, A. Gautam, P. Bhusal, G. Paudel and D. Sharma, 2018. Correlation between maternal and umbilical cord blood in pregnant women of pokhara valley: A cross sectional study. BMC Pregnancy Childbirth, Vol. 18, No. 1. 10.1186/s12884-018-1697-1.
8. Mamoury, G.H., A.B. Hamedy and F. Akhiaghi, 2003. Cord Hemoglobin in Newborns in Correlation with Maternal Hemoglobin in Northeastern Iran. Iran J. Med. Sci., 28: 166-168.
9. Debbarma, R., B. Debbarma and A. Devi, 2024. Effect of Maternal Anemia on Cord Hemoglobin And Birth Weight of Newborns. IOSR J. Dental Med. Sci., 14: 19-21.
10. Srivastava, S., A. Shukla and G. Verma, 2019. Effect of maternal anemia on the status of iron stores in infants: A cohort study. J. Family Community Med., 26: 118-122.
11. Sweet, D.G., G. Savage, T.R.J. Tubman and T.R.J. Lappin, 2001. Study of maternal influences on fetal iron status at term using cord blood transferring receptors. Arch Dis. Child Fetal Neonatal Ed., 84: 40-43.