

ORIGINAL ARTICLE

A COMPARATIVE STUDY ON OUTCOME OF NEONATES BORN TO ANEMIC MOTHERS VERSUS NON ANEMIC MOTHERSEkta Dalal¹, Jeegar Shah²**Authors Affiliation:** ¹Associate Professor, Department of Pediatric, GMERS Medical College, Gandhinagar;²Associate Professor, Department of Surgery, GRIDS**Correspondence:** Dr. Ekta Dalal, Email: drektadalal@gmail.com**ABSTRACT**

Introduction: Anemia is a very common hematological problem particularly among pregnant women, more important it also affects the neonate's health in various aspects. This study was conducted to assess mothers' anemia and its effects on the growth and hematological status of neonates.

Objective: The objective of this study is to assess the hematological profile and physical growth of neonates born to anemic mothers at birth and 3&1/2 months of age.

Methods: In present study 130 neonates born at tertiary care institute during 2009 were divided into two group according to their mothers' hemoglobin level (less than 10 gm % and 10 or more gm %). Both groups were compared for maturity, birth weight, hematological profile and physical growth at birth and 3&1/2 months of age.

Results: During this study period, total 6799 deliveries were conducted in tertiary care institute. Prevalence of anemia among mothers was 64.05%. Out of 130 neonates, 34 (26.15%) were preterm neonates delivered at birth, while 63 (48.46%) were low birth weight neonates. Preterm deliveries and low birth weight neonates were higher in anemic mothers ($p < 0.05$). Birth weight, head circumference and length were significantly compromised at birth in neonates born to anemic mothers ($p < 0.01$). Comparison of at birth and 3&1/2 month data indicated that weight gain and length gain is significantly better in infant of non anemic mothers ($p < 0.01$).

Conclusions: Proportion of Preterm and low birth weight baby were higher in anemic mother. Child born to anemic mother has significant lower Weight, head circumference and length. Even maternal anemic has deteriorating effect on weight and length gain in early infancy. This recapitulates importance of controlling maternal anemia.

Keywords: Hematological Profile, Maternal Anemia, Physical Growth, Neonatal anemia

INTRODUCTION

Anemia has been a subject of great interest throughout the world since long. It is a very common hematological problem in the developing and underdeveloped countries particularly among vulnerable groups such as infancy, childhood and in women of reproductive age group¹. More important is the fact, that it affects the neonate's health in various aspects. It may predispose to premature and low birth weight babies². It affects the hemoglobin status of neonate, which may not manifest at birth, but become evident by 2-3 months of life¹⁶. It predisposes the infant to serious infections

which increase the morbidity and ultimately decreases the efficacy and manpower of the country.

Severe anemia with hemoglobin level less than 6 gm/dl is associated with poor pregnancy outcome. Prematurity, spontaneous abortion, low birth weight, and fetal deaths are complications of severe maternal anemia³. Nevertheless a mild to moderate iron deficiency anemia does not appear to cause a significant effect on fetal hemoglobin. The hemoglobin level of 11gm/dl in the late first trimester and also of 10gm/dl in second and third trimesters are suggested as lower limits for hemoglobin concentration⁴.

The commonest cause of anemia in mothers is iron deficiency anemia. It is prevalent in 80% of Indian women⁵. This has encouraged me to study the hematological profile in mothers and its effects on the hematological status of neonates.

OBJECTIVE

The study aimed to assess the hematological profile and physical growth of neonates born to anemic mothers at birth and 3&1/2 months of age.

METHODS

Study was done at tertiary care institute during January 2009 to December 2009. There are 6799 deliveries were conducted in the hospital during the study period and 6478 babies were born alive. Considering the feasibility and time required for the study, it was decided to include one baby at every 50 babies born alive and thus 130 babies were selected for the study.

The selected neonates were traced retrospectively to know hemoglobin level of their mothers during third trimester. Hemoglobin level was obtained from the case sheet of the mothers. Based on the Hemoglobin level of mothers, neonates were divided in to two groups: Group one of neonates born to mother having Hb level less than 10 gm% and group two of neonates born to mothers having Hb 10 gm% or more.

Maturity, birth weight, hematological profile and physical growth assessment of all neonates were done at birth and 3&1/2 months of age and compared in both groups.

Data analysis was done by using Chi square test, Independent t-test in Epi info software.

RESULTS

During study period from 1st January 2009 to 31st December 2009, total 6799 deliveries were conducted in tertiary care institute. Prevalence of anemia among mothers was 64.05%.

All 130 neonates were divided in two groups according to their mothers' hemoglobin values (<10gm/dl and ≥10gm/dl).

Out of 130 neonates, 34 (26.15%) were preterm neonates and 96 (73.85%) were full term delivered at birth. If we compare both groups, P value is 0.023 which is statistically significant. Present study suggests that number of preterm deliveries is higher in anemic mothers.

Table 1: Major Study Findings (from 1st January 2009 to 31st December 2009)

Deliveries	Frequency (n=6799)
Live births	6478 (95.28%)
Anemic mothers	4355 (64.05%)
Preterm neonates	1570 (23.09%)
NICU admission	2246 (33.03%)

Table 2: Effect of Maternal Hemoglobin on Maturity and Birth Weight of Neonates

Neonatal Outcome	Mother's Hemoglobin		P value*
	<10 g/dl (N=71)	≥ 10 g/dl (N=59)	
Maturity of Neonate			
Preterm neonates	24 (33.80%)	10 (16.95%)	0.023
Full term neonates	47(66.20%)	49(83.05%)	
Birth Weight			
<2500gm	52(73.24%)	11(18.64%)	<0.001
≥2500gm	19(26.76%)	48(81.36%)	

*Chi square test is applied

Table 3: Effect of Maternal Hemoglobin on Physical Growth & Hematological Profile of Neonates at birth

Neonatal Outcome	Mother's Hemoglobin		P value*
	<10 g/dl (N=71)	≥ 10 g/dl (N=59)	
Physical Growth [Mean (SD)]			
Birth weight in kg	2.29 (0.12)	2.6 (0.142)	<0.001
Head circumf. (cm)	32.05 (0.147)	32.4 (0.034)	<0.001
Total length (cm)	44.91 (1.465)	47.65 (1.778)	<0.001
Hematological Profile [Mean (SD)]			
Hb in gm/ dl	15.22 (1.5)	14.99 (2.1)	0.48
MCV in fl	88.62 (4.23)	88.46 (3.11)	0.8
MCH in pg	33.03 (3.18)	33.10 (1.97)	0.88
MCHC in %	36.33 (2.88)	36.65 (2.78)	0.52

* Independent t-test is applied

Table 4: Effect of Maternal Hemoglobin on Physical Growth & Hematological Profile of Neonates at 3&1/2 months of age

Neonatal Outcome	Mother's Hemoglobin		P value*
	<10 g/dl (N=71)	≥ 10 g/dl (N=59)	
Physical Growth [Mean (SD)]			
Weight (kg)	3.65 (0.16)	4.26 (0.147)	<0.001
Head circumf. (cm)	38.06 (1.51)	38.88 (4.5)	0.151
Total length (cm)	52.76 (1.467)	56.36 (1.781)	<0.001
Hematological Profile [Mean (SD)]			
Hb in gm/ dl	11.34 (1.6)	11.89 (2.4)	0.121
MCV in fl	81.37 (5.27)	80.17 (2.11)	0.103
MCH in pg	30.05 (2.28)	29.41 (2.97)	0.167
MCHC in %	30.33 (6.85)	32.30 (4.98)	0.068

* Independent t-test is applied

Total 63 (48.46%) were low birth weight neonates and 67 (51.54%) were non low birth weight. If we compare both, P value is <0.001 which is highly significant, suggests that low birth weight neonates are more common in anemic mothers.

Mean weight, head circumference and total length are significantly compromised at birth in neonates born to anemic mothers (P<0.001) in the study.

In present study maternal hemoglobin(Hb) has no effect on neonatal Hb, mean corpuscular volume, mean corpuscular Hb and mean corpuscular Hb concentration at birth (P>0.05).

Present study suggests that mean weight and total length are significantly compromised at 3&1/2 months of age in neonates born to anemic mothers (P<0.001), while difference in head circumference at 3&1/2 months of age in neonates born to anemic and non anemic mothers is statistically not significant (P>0.05).

In present study maternal hemoglobin has no effect on neonatal hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration at 3&1/2 months of age (P>0.05).

Table 5: Comparison of Physical Growth & Hematological Profile of Neonates between birth and 3&1/2 months of age

Neonatal Outcome	Groups according to Mother's Hemoglobin				Difference between Hb at birth & 3½ months of age		P value*
	<10 g/dl gr (N=71)		≥ 10 g/dl gr (N=59)		<10 g/dl gr (N=71)	≥ 10 g/dl gr (N=59)	
	At birth	At 3½months	At birth	At 3½months			
Physical Growth							
Weight (kg)	2.29 (0.12)	3.65 (0.16)	2.6 (0.142)	4.26 (0.147)	1.36(0.14)	1.66(0.44)	<0.001
Head circum.(cm)	32.05 (0.15)	38.06 (1.51)	32.4 (0.03)	38.88 (4.5)	6.01(0.83)	6.48(2.27)	0.107
Total length(cm)	44.91 (1.46)	52.76 (1.47)	47.65 (1.78)	56.36 (1.78)	7.85(1.47)	8.71(1.78)	0.003
Hematological Profile							
Hb (gm/ dl)	15.22 (1.5)	11.34 (1.6)	14.99 (2.1)	11.89 (2.4)	-3.88(1.55)	-3.1(2.25)	0.021
MCV in fl	88.62 (4.23)	81.37 (5.27)	88.46 (3.11)	80.17 (2.11)	-7.25(4.75)	-8.29(2.61)	0.135
MCH in pg	33.03 (3.18)	30.05 (2.28)	33.10 (1.97)	29.41 (2.97)	-2.98(2.73)	-3.69(2.47)	0.125
MCHC in %	36.33 (2.88)	30.33 (6.85)	36.65 (2.78)	32.30 (4.98)	-6(4.87)	-4.35(3.88)	0.037

All value in Mean (SD) format; *Independent t-test is applied

Present study suggests that improvement in mean weight and total length in neonates born to anemic mothers than the non anemic mothers is significantly low at 3½ months of age (P<0.001), while difference in head circumference at 3&1/2 months of age in neonates born to anemic and non anemic mothers is statistically not significant (P>0.05).

In this study neonatal hemoglobin and mean corpuscular hemoglobin concentration is significantly decreased in neonates born to anemic mothers than the non anemic mothers at 3&1/2 months of age (P<0.05), while difference in mean corpuscular volume and mean corpuscular hemoglobin at 3&1/2 months of age is not significant in neonates born to anemic and non anemic mothers (P>0.05).

DISCUSSION

In present study preterm birth rate in neonates was higher in severely anemic mothers. Other studies like Klebanoff et al⁶ and Erdem et al have also obtained similar results. The results of several studies are consistent with an association between maternal iron deficiency anemia in early pregnancy and a

greater risk of preterm delivery. The apparent loss of this association in the third trimester is probably because a higher hemoglobin concentration at this time may reflect poor plasma volume expansion and an inability to discriminate between low hemoglobin caused by iron deficiency from that caused by plasma volume expansion.

In present study maternal anemia was significantly associated with low birth weight in neonates. Other studies Madan et al⁸, Singla et al⁹ and Agrawal et al¹⁰ have obtained similar results. In several studies, a U-shaped association was observed between maternal hemoglobin concentrations and birth weight¹³. Abnormally high hemoglobin concentrations usually indicate poor plasma volume expansion, which is also a risk for low birth weight^{12,14}. Lower birth weights in anemic women have been reported in several studies^{9,10,15}. Some investigators reported a negative association between maternal serum ferritin and birth weight and a positive association with preterm delivery. These findings probably indicate the presence of infection, which elevates serum ferritin.

In present study maternal hemoglobin has significant association with physical growth of neonate, while no effect on mean hemoglobin level of neonates at birth. Other studies like Heidari et al¹¹, Singla et al⁹ and Agrawal et al⁷ have also obtained similar results. In 102 Indian women in the first stage of labor, higher maternal hemoglobin concentrations were correlated with better Apgar scores and with a lower risk of birth asphyxia. When pregnant women were treated with iron or a placebo in Niger, Apgar scores were significantly higher in those infants whose mothers received iron (31). A higher risk of premature birth is an additional concern related to the effect of maternal iron deficiency on infant health; preterm infants are likely to have more perinatal complications, to be growth-stunted, and to have low stores of iron and other nutrients. It is known that the ability to produce a large increase in plasma volume between the first and the second pregnancy trimester is one of the hallmarks of successful pregnancy as it is probably linked with correct uterine perfusion. Failure to produce this expansion may lead to insufficient uterine perfusion and thus to preeclampsia and intra uterine growth restriction.

Fall in hemoglobin level of all neonates during first few months of life in this study may be because of physiological anemia. Similar result has been found in a study done by Ronald Strauss in 2010¹⁶.

CONCLUSION

From the present study we conclude that; anemic mother had higher chances of delivering preterm and low birth weight baby. Child born to Anemic mother has significant lower Weight, head circumference and length. This reiterates importance of controlling maternal anemia not only for mothers but also for the health of baby. Maternal anemia affects the hematological status of neonate, which may not manifest at birth, but becomes evident by 2-3 months of life. This reiterates importance of controlling maternal anemia not only for mothers but also for the health of baby.

RECOMMENDATIONS

To improve pregnancy outcome in context of maturity and birth weight of baby maternal anemia should also be given priority along with other interventions. During antenatal period strategies need to be planned and to be implemented to improve hemoglobin level of pregnant women.

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