

# Study of correlation between new born size and maternal first trimester haemoglobin concentration

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## Abstract

**Background:** India has reported high prevalence of anemia in. **Methods:** Prospective observational study, included 150 mothers registered for antenatal care (ANC) and willing to continue till confinement were recruited, and subjected to completed hemogram and red cell indices. We followed up these mothers till delivery and looked into the gestation and newborn anthropometry. Statistical analysis was done using Students t-test and chi x-test. **Observation and Analysis:** In study of 150 cases, 54% were anemic. In first trimester, prevalence of anemia was 68/150 cases (45.34%). In anemic mothers, low birth weight babies were 25/37 (67.56%) while in non-anemic mothers low birth weight babies were 12/37 (32.43%)( $p < 0.010$ ) **Conclusion:** Increased incidence of low birth weight and preterm babies is seen if the mother is anemic in her first trimester

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## INTRODUCTION

Anemia is one of the most frequently observed nutritional deficiency disease in the world today. It is major public health problem worldwide. Iron deficiency starts in childhood, worsens in adolescence and gets aggravated in pregnancy. The global prevalence of anemia during pregnancy is estimated by the World Health Organization is 47.4%. It is present among women in reproductive age group, particularly during pregnancy, and often become a contributory cause for maternal death (WHO, 1992). Anemia being one of the major contributory factors for maternal morbidity and mortality. Every Second women is anemic (55%). Evidence from stable-isotope studies suggest that the percentage of non-heme iron absorbed from food during normal pregnancy increases from 7% at 12 weeks of gestation to 36% at 24 weeks and 66% at 36

wks. These dramatic changes enable the healthy pregnant woman to cope with the extra demands of pregnancy without becoming anemic<sup>1</sup>, but only if there is adequate iron in her diet.<sup>1</sup> Prevalence of anemia in South Asian countries is the highest in the world. WHO estimates that even among the South Asian countries, India has the highest prevalence of anemia.<sup>2</sup> NNMB (National Nutrition Monitoring Bureau), DLHS (District Level Household Survey) and ICMR (Indian Council of Medical Research) surveys showed that over 87% of pregnant women suffer from anemia and about 10% have severe anemia.<sup>2</sup> The importance of adequate plasma volume expansion in allowing adequate fetal growth is attested by several studies that showed an increased incidence of low birth weight in association with either a high maternal hemoglobin concentration<sup>3,4,5</sup> or high hematocrit.<sup>6</sup> Maternal blood is supplied to the intervillous space of the placenta by spiral arteries, which provides low pressure flow. Failure of the plasma volume to expand (and of the hemoglobin concentration to drop) is associated with a  $\leq 3$ -fold increase in the incidence of preeclampsia in pregnancy.<sup>7</sup> It has been suggested that a high blood viscosity may reduce the perfusion of the placenta, which may lead to intrauterine growth restriction. There are some controversial reports about the association between maternal hematocrit and adverse outcome of pregnancy<sup>8,9</sup>

## MATERIALS AND METHODS

Prospective observational study, conducted in department of Obstetrics, Dr V.M.M.C Solapur India, during June 2018 to June 2019 after ethical committee approval, included 200 mothers registered for antenatal care (ANC) and willing to continue till confinement were recruited after written informed consent as per routine protocol. In this study, cases with hemoglobin >11 gm% and <11 gm% were classified as normal and anemia respectively in first trimester of pregnancy.

### INCLUSION CRITERIA

1. All pregnant women registered to our institute for ANC till deliveries were included in the Study.
2. Cases of all types of anemia including hemolytic anemia.
3. Singleton pregnancy
4. Having had a USG in first trimester to accurately confirm / adjust dates and assign gestational age accordingly

### EXCLUSION CRITERIA

Pregnant women with one of the following at booking were excluded:

1. Diabetes mellitus.
2. Hypertension (including pregnancy-induced hypertension).

3. Toxoplasmosis, Rubella, Cytomegalovirus, Herpes infection.
4. Diagnosed renal or cardiac illness.
5. Smoker or alcoholic.
6. Multiple gestation.

### THE INVESTIGATIONS DONE WERE

#### 1. Blood-

- a) Measurement of hemoglobin concentration was done by cyanomethemoglobin method (Analyzer-Coulter).
- b) Complete blood picture- MCV, MCH, MCHC, RDW.
- c) Hematocrit (Hct).
- d) Peripheral smear for typing of anemia.
- e) Hemoglobin electrophoresis whenever required.

Birth weight was recorded in grams using a digital scale with a scale of 1 gram. As per weight of newborns categorization was done as normal if birth weight is above 2.5 kg and low birth weight if less than 2.5 kg.

### STATISTICAL ANALYSIS

The correlation between hemoglobin concentration and birth weight and other anthropometric parameters was measured by using chi test and students-t test. P value was considered significant if it was below 0.05 and highly significant in case <0.001

## OBSERVATION AND RESULTS

**Table 1:** Percentage of severity of anemia in our study as per severity assessment by WHO classification

| Haemoglobin level   | First Trimester(n=200) |
|---------------------|------------------------|
| Normal(>11.1 gm%)   | 112(56%)               |
| Mild(9.1-11 gm%)    | 68(34%)                |
| Moderate(7.1-9 gm%) | 20(10%)                |
| Severe(4.1-7 gm%)   | 0(0%)                  |
| <b>Total</b>        | <b>200</b>             |

**Table 2:** First trimester hemoglobin concentration and outcome in the form of birth weight of baby and maturity

| Hb%                          | <7.0 gm%<br>(n=0) | 7.1-9.0 gm%<br>(n=20) | 9.1-11 gm%<br>(68) | 11.1-13 gm%<br>(n=92) | >13 gm%<br>(n=20)     |
|------------------------------|-------------------|-----------------------|--------------------|-----------------------|-----------------------|
| Mean birth weight in gm      | -                 | 8.12±0.48             | 10.12±0.15         | 11.82±0.51            | 13.52±0.72            |
| Birth wt <2500 gms<br>(n=58) | -                 | 2248±123.32           | 2775±399.52        | 2872±371.52           | 2651±213.12           |
| Birth wt >2500 gm<br>(n=142) | -                 | 3140±1.02<br>(n=5)    | 2945±195<br>(62)   | 2972±275.86<br>(n=72) | 27.01±151.42<br>(n=3) |
| Preterm(n=39)                | --                | 6                     | 17                 | 13                    | 3                     |
| Term(n=161)                  |                   | 12                    | 61                 | 76                    | 12                    |

Out of 200 pregnant women enrolled in study after their consent, 146(73%) of them belongs to the age group of 21-30 years, elderly primigravida cases were 12, (6%), 154(77%) were primiparous and remaining 34(17%) case were multiparous. The correlation between hemoglobin concentration and birth weight and other anthropometric parameters was measured by using chi square test and student's t-test. P-value was considered significant if it was below and highly significant in case <0.001.

## DISCUSSION

Effect of first trimester hemoglobin percentage on newborn size and pregnancy outcome-In first trimester

prevalence of anemia i.e. Hb <11 gm% were 44% (88 cases) and normal range Hb> 11gm% (non-anemic) were 56% (112 cases). In anemic mothers low birth weight

babies were 42 out of total 58. While in non-anemic mothers low birth weight babies were 16 of 58 i.e.27.58%, statistically significant difference noted ( $p<0.01$ ). Of total 142 normal birth weight babies, born in anemic and non-anemic mothers were 67(33.5%) and 75 (66.50%) respectively, difference is statistically significant ( $p<0.01$ ). Out of 39 preterm babies, 23 babies (58.97%) born to anemic mothers and 16 babies (41.03%) born to non-anemic mothers, difference is statistically significant ( $p<0.01$ ) In our study, we observed that as hemoglobin percentage of mother increases, birth weight of baby increases ( $p<0.001$ ). In cases with Hb between 7.1 to 9 gm% (moderate anemia) mean birth weight of LBW babies were  $2181\pm 205$ gms, and that of normal babies was  $3140\pm 0.0$ gms ( $p<0.001$ ). In cases with hemoglobin between 9.1 to 11 gm% (mild anemia) mean birth weight of LBW and normal babies were  $2212\pm 142$ gms and  $2930\pm 292$ gms respectively ( $p<0.001$ ). Ronnenberg AG *et al*<sup>10</sup> 2004 (China) observed that both mild and moderate anemia were significantly associated with lower birth weight. In cases with hemoglobin between 11.1gm% to 13gm% mean birth weight of LBW and normal babies were  $2280\pm 111$ gms and  $2962\pm 311$ gms respectively ( $P<0.001$ ). In cases with hemoglobin above 13.0 gm% mean birth weight of LBW babies and of normal babies were  $2270\pm 210$ gms and  $2707\pm 210$ gms respectively

( $p<0.002$ ). Murphy JF *et al*<sup>7</sup> studied relation of hemoglobin levels in first and second trimesters to outcome of pregnancy and found both high (greater than 13.2 g/dl) and low (less than 10.4 g/dl) hemoglobin values were associated with an adverse outcome. The frequencies of perinatal death, low birth weight, and preterm delivery were greater with high than with intermediate hemoglobin. Blankson ML *et al*<sup>9</sup> and Rasmussen *et al*<sup>11</sup> observed correlation with high hemoglobin

### STUDIES CORRELATING EFFECT OF FIRST TRIMESTER HEMOGLOBIN PERCENTAGE

The mechanisms that operate by which poor iron status may affect birth weight and preterm births remains poorly understood. A few tested hypotheses are

- I. Poor iron status may affect immune function adversely and thus increase the host susceptibility to genital tract infections.
- II. Iron deficiency may increase the stress hormones norepinephrine and cortisol.
- III. Low hemoglobin concentration may cause chronic hypoxia, which can activate the body's stress response and thus increase circulating levels of corticotrophin releasing hormone, and
- IV. Iron deficiency may increase oxidative stress of the placenta.

| Author, Year  | Effect of Maternal Anemia on Newborn size and maturity  |
|---|---|
| In Present Study                                    | In anemic mothers low birth weight babies were 25 out of total 37 that is 67.56% while in non-anemic babies mothers low birth weight babies were 12 of 37 that is 32.43% statistically significant difference noted. ( $p<0.001$ ). |
| Alwan <i>et al</i> <sup>12</sup> 2011 U.K           | There was positive relationship between total iron intake, from food and supplements, in early pregnancy and birth weight.  |
| Muhamad Owais Ahmad <i>et al</i> <sup>13</sup> 2011 | The number of low birth weight infants (64%) was statistically very highly significantly more ( $p<0.001$ ) anemic  |

### OTHER IMPORTANT OBSERVATIONS

#### 1. Prevalence of anemia in study population.

Prevalence of anemia in our study in urban setting in tertiary care hospital in India, especially in pregnant women is 54%. The FOGSI- WHO25 has estimated that prevalence of anemia in developed and developing countries in pregnant women as 14% and 51% respectively. and 65-75 per cent in India. National Nutrition Monitoring Bureau (NNMB) 26 DLHS and ICMR surveys showed that over 70 per cent of pregnant women and adolescent girls in the country were anemic. Various studies conducted by Kalaivani K *et al*<sup>27</sup> and Patra, Puri and Trivedi *et al*<sup>17</sup> observed prevalence of anemia as 87% and 56.9% respectively.

#### National programme to give iron supplementation to all pregnant women.

Programme for prevention and management of anemia (NACP) 30 India was the first developing country to take

up a national programme to prevent anemia among pregnant women and children. The programme envisaged that all pregnant women will be screened for anemia. Non anemic women would get iron (100 mg) and folate (500 microgram) and those with anemia should get two tablets daily.

#### 1. Safe hemoglobin range, where no intervention is necessary.

We observed better neonatal outcome in the form of weight and anthropometry if maternal preconception hemoglobin is in range of 10 to 13 gm%. After extrapolating neonatal outcome in study group and available data from other studies, we recommend iron prophylaxis in this group and no treatment above this hemoglobin percentage.

#### 2. U shape correlation between hemoglobin concentration and newborn size-

In several studies, a U-shaped association was observed between maternal hemoglobin concentrations and birth weight. Abnormally high hemoglobin concentrations usually indicate poor plasma volume expansion, which is also a risk for low birth weight. Lower birth weights in anaemic women have been reported in several studies.<sup>7,15,21,31</sup> In our study, in first trimester clustering of normal birth weight was observed in hemoglobin (Hb) range of 9.0 to 13.0gm% and percentage of LBW was increased as hemoglobin drops below 9.0 gm% and also when hemoglobin is above 14 gm%. We also observed, high hemoglobin percentage above 14 gm% was not positively associated with proportionate increase in newborn size as noted with U shape correlation of maternal hemoglobin with newborn size and gestational age. Such correlation was unable to draw because sample number in our study was not sufficient enough to make meaningful conclusions.

## CONCLUSION

Anemia in pregnancy has a recognizable association with fetal outcome. Increased incidence of low birth weight babies is seen if the mother is anemic in her first trimester with significant association when hemoglobin is less than 8 gm%. Increased incidence of preterm deliveries is seen if the mother is anemic in her first trimester. We observed better neonatal outcome in the form of weight and anthropometry if maternal hemoglobin is in range of 10 to 13 gm%. Supplementing iron earlier during antenatal period and maintaining optimal hemoglobin concentration between 10 to 13 gm percent has overall better outcome regarding premature deliveries and low birth weight babies. Regular antenatal care from first trimester has a vital role in assessing and managing maternal anemia timely and it directly affects the perinatal outcome

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