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Maternal Anemia and Poor Diet during Pregnancy is An Independent Risk Factor for Low Birth Weight and Preterm Delivery

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Abstract: ***The present study was designed to investigate the outcome of pregnancy and delivery in patients with anemia with poor dietary intake. 300 mothers admitted in a Tertiary health centre for delivery were recruited for the study. Hemoglobin, gestational age of delivery and birth weight of the babies was noted. Statistical analysis was done using SPSS version 16. More than 66 % mothers were anemic at some point of time during their pregnancy. Only 34.7% patients had intake of extra diet during pregnancy. Mean birth weight of babies born to anemic mothers was 2.39 ±0.5 kg which was significantly lower compared to that of babies born to non anemic mothers 3.04 ±0.47 kg (p value = 0.001). Only 28.3% of the anemic patients took extra diet during pregnancy among whom 35% mothers had LBW babies. 71.7% patients did not take extra calorie diet which resulted in 45% LBW babies. The mean gestational age at delivery for mothers who were anemic was 36.40±2.9 weeks compared to non anemic group - 38.33±1.8 weeks. The incidence of low birth weight babies and preterm deliveries were significantly more in mothers who were anemic with a poor diet intake. Occurred more frequently in mothers.***

Keywords: Anemia, Low Birth Weight, Hemoglobin

1. Introduction

Anemia has been a very important nutritional disorder in the world. India has reported high prevalence of anemia in pregnancy. In one of the studies conducted on a large population, it was estimated that 87% of the Indian pregnant women are anemic (1). It substantially contributes to poor outcome in both mother and child. Its effects on maternal health include reduction of immune response, danger of heart failure, and aggravation of the risks of childbirth (2, 3). Worldwide nearly 600, 000 women between the ages of 15 and 49 die each year as a result of complications arising from pregnancy and childbirth, more than 95% of these maternal deaths being in developing countries. The proportion of maternal deaths due to anaemia has been estimated for countries with reliable data: India (16%), Kenya (11%), Nigeria (9%) and Malawi (8%) (4).

Maternal anemia during pregnancy may lead to poor fetal outcome through growth retardation or perinatal death, while the risks of infant morbidity and mortality are also increased (4 - 8). Similarly, little knowledge is available on the relation between pregnancy outcome and severity of anemia, gestational age at onset or duration of anemia, although anemia in early pregnancy seems to be associated with an increased risk of low birth-weight or preterm birth (9, 10).

This study analyzes the effect of severe anemia in pregnancy (Hb 11g/dl) on fetus. Controversy exists in the literature regarding the influence of maternal anemia on pregnancy outcome. Several studies, performed in developing as well as developed countries, documented sub-optimal fetal outcome, in particular low birth weight and preterm delivery (11). Other investigators however, did not find any association between maternal anemia and adverse pregnancy outcome (12). We aimed at comparing the gestation and birth weight of the babies who were born to mothers with and without anemia at different trimesters.

2. Methods

Study Design

A retrospective population-based study comparing all singleton pregnancies of patients with and without anemia was performed. Maternal anemia was defined as hemoglobin concentration lower than 11 g/dl during pregnancy.

Study Setting

The study was conducted at Department of Pediatrics and Obstetrics and Gynecology, Sir Sunderlal Hospital, Varanasi, India. This is a tertiary center with annual delivery rate of approximately 2000.

a) **Inclusion criteria:** All pregnant women who came for delivery in our institute were included.

b) **Exclusion criteria:** Pregnant women with one of the following at booking were excluded: Diabetes mellitus, Hypertension (including pregnancy-induced hypertension), Toxoplasmosis, Rubella, Cytomegalovirus, Herpes infection, Diagnosed renal or cardiac illness, Smoker or alcoholic,

Hemoglobinopathies (e.g. thalassemia), multiple gestation, Thrombophilia and Antepartum hemorrhage.

Sampling

This study was done over a period of 1 year. After obtaining consent, pregnant mothers were included provisionally into the study. They were initially interviewed and their antenatal record was checked. If they met any one of the exclusion criteria, they were excluded. A total of 300 mothers were included for the study.

Intervention

Measurement of Hb was done by cyanmethemoglobin method (Analyzer–Coulter). Measurement was done in all the three trimesters when they arrived for antenatal checkup. Rest of the management was as per the standards practiced in antenatal care. Birth weight was recorded in kilograms using a digital scale. Gestation assessment was done using last menstrual period and if possible correlated with first trimester dating scan. This was complemented by obstetric assessment and postnatal assessment using modified Ballard scoring.

Statistical Analysis

Statistical analysis was performed using the SPSS-16 package (SPSS, Chicago, IL). Statistical significance was ascertained using the *x*2-test for differences in qualitative variables and the t-test for differences in continuous variables. Comparison of means was done using Student's *t*-test.

Ethical committee approval

The medical college ethical committee had approved this study.

Consent

The details of the study were explained to the pregnant mothers. Informed consent was taken from them before recruitment.

3. Results

Demographic Profile

The mean age group was 25.4 years with a Standard Deviation of 4.26. 64.3% patients were educated. 69.3 % of the patients stayed in the villages around Eastern Uttar Pradesh and Bihar. The mean Hemoglobin of the patients was 9.4 gm/dl with a standard deviation of 3.54. The mean birth weight was 2.61 (standard deviation – 2.98). The mean gestation age was 37.3 with standard deviation of 2.73. The average number of antenatal visits was 4.76. The patients took Iron Tablets for 4.76 months. Results are as shown in the Table 1.

Anemia

More than 66 % mothers were anemic at some point of time during their pregnancy. Less than 30% of the mothers were non-anemic throughout. Prevalence of anemia in First trimester was 80%, Second – 75.8% and third was 74%. Higher percentage of anemia was seen in the first trimester and was lowest in the third trimester. There were only 40 mothers (13.3%) who could be categorized as having severe anemia (Hb < 7gm/dl). Twenty two of them were in the third trimester, fourteen in the second trimester, and only four were in the third trimester. The mean Hemoglobin of all the mothers was 9.2 in the first trimester showed an improving trend to 9.6 in third trimester as seen in Table 2. There was a significant difference in Hemoglobin levels when we divided the patients into two groups according to each trimester as seen in Table 3.

Intake of Iron tablets and Extra Diet

Iron tablets were consumed on an average of 6.9 months by the non anemic patients which was significantly higher compared to only 3.91 months by the anemic patients (p= 0.001). Only 34.7% of the anemic patients had intake of extra diet during pregnancy. Among the patients in the Anemic group only 18.6 %% took extra diet. Results are shown in Table 4.

Birth weight and Gestation

Mean birth weight and gestation of the babies in both the groups of anemic and non anemic mothers were in clinical normal range irrespective of the trimester Table 4. There was marginal but "statistically significant" difference between both the groups in all the parameters studied. Babies born to the anemic mothers remained lighter compared to their counterparts. The difference got accentuated if babies of all trimester anemia mothers were compared with the babies of all trimester non anemic mothers as seen in Table 5.

The mean gestation of the babies born to anemic mothers was lesser compared to babies born to non anemic mothers. Figure 2 shows the dramatic deviation in the direction of the curves. The difference remained even when all trimester anemia group was compared with all trimester no anemia group.

4. Discussion

Traditionally, anemia was associated with sub-optimal pregnancy outcome mainly due to lower birth weight and preterm delivery. Our study showed 66% of the mothers were anemic to start with. Similar figures are quoted in other studies as well [10]. The trend in Hemoglobin level is quite interesting. The mid-trimester drop seen in non anemic mothers was not seen in anemic mothers. This indicates that mid-trimester drop is a very essential physiological arrangement. However, in anemic mothers, as the mean Hemoglobin in the mid-trimester was below that in non anemic mothers, no drop phenomenon was seen. This suggests that there may be a narrow range of what the Hemoglobin should be in order to have good outcome.

The comparison of mean birth weight and gestation in the two groups shows that both the parameters were lower in the anemic group than in the non anemic group. Table 4 reveals "statistically significant" difference. Swain *et al*. have reported an inverse relation between the second trimester Hb and birth weight [11]. The analysis of qualitative variables in our data has revealed noteworthy clinically relevant results. Many studies have reported significant association between low birth weight and maternal anemia[11-14]. Most of these studies have considered the Hb levels in the third trimester or at delivery for comparison [12-14]. This could well suggest that third trimester Hb is an important factor in determining birth weight. It is well known that rapid growth of fetus occurs in the third trimester. Iron and other micronutrient accretion rates are the highest in the same trimester as well. This physiology explains the association of third trimester Hb and low birth weight. In contrast to the above, association of preterm delivery with maternal anemia is quite striking. Except for the first trimester, anemia in other trimesters has shown significantly increased incidence of preterm delivery. This association appears strongest in the third trimester. There are many studies showing similar association [12-14].

5. Conclusion

The prevalence of anemia in our country is high. Anemia in pregnancy has a recognizable association with fetal outcome. Increased incidence of preterm deliveries and low birth weight babies is seen if the mother is anemic. Supplementing iron earlier and maintaining optimal Hb (11–12 g/dl) throughout gestation has better overall outcome regarding premature deliveries and low birth weight babies. Patients should be educated to take extra diet of 300 kcal everyday throughout their pregnancy.

Anemia is a preventable cause of poor maternal and fetal outcome. It is recommended that in district hospitals in low income countries make prevention, early diagnosis and treatment of anemia in pregnancy a priority. This initiative should start at the grass root level as most women reach tertiary care centre only in labour. Future prospective studies should focus on the relationship between maternal anemia and pregnancy complications, especially preterm delivery and low birthweight and examine the biological reasoning for the increased rates of Cesarean deliveries.

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7. Footnotes

Source of Support: Nil

Conflict of Interest: None declared

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Table 1: Demographic Profile

Average Age	25.4 (S.D. -4.26)
Mean Hemoglobin	9.4 (S.D. – 3.54)
Mean Birth Weight	2.61 (S.D. – 2.98)
Mean Gestation	37.3 (S.D. - 2.73)
Average Number Of Antenatal Visits	4.76 (S.D - 2.719)
Average Number Of Months Of Iron Intake	4.93 (S.D - 2.67)
Intake Of Extra Diet	34.46%
Number Of Anemic Patients Throughout The Study Period	198/300 (66%)
Number Of Non Anemic Patients Throughout The Study Period	102/300 (34%)
Number Of Patients With Severe Anemia	40/300 (13.3%)

Table 2: Mean Hemoglobin in Pregnant Women Without Other Risk Factors

Mean HB in 1st Trimester	9.26
Mean HB in 2nd Trimester	9.5
Mean HB in 3rd Trimester	9.6

Table 3: Trend of Hemoglobin in the Three Trimesters

	Anemic Patients	Non Anemic Patients	p value
Mean HB in 1st Trimester	8.53	11.5	0.001
Mean HB in 2nd Trimester	8.56	11.05	0.001
Mean HB in 3rd Trimester	8.56	11.48	0.001

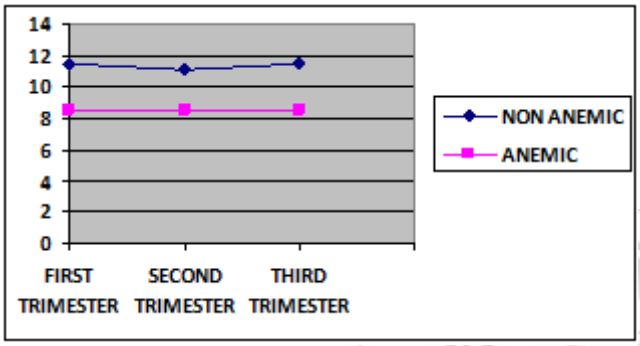

Figure 1

Table 4: Comparison between the Two Groups

Variables	Anemic	Non Anemic	t-value	p-value
Age	25.22±4.537	25.45±3.700	-.311	0.757
Months of Iron Intake	3.91±2.556	6.90±1.591	-7.629	0.001
Intake of Extra Diet	56/198 (18.6 %)	48/ 102 (16 %)		
Birth Weight	2.3899±0.50244	3.0431±0.47550	-7.680	0.001
Gestation Age at the Time of Delivery	36.90±2.978	38.33±1.873	-3.133	0.002

Table 5: Comparison of Birth Weight and Gestational Age between the Two Groups

	Anemic	Non Anemic
Mean Birth Weight in 1st Trimester	2.4	3.4
Mean Birth Weight in 2nd Trimester	2.4	3.1
Mean Birth Weight in 3rd Trimester	2.3	3.2
Mean Gestational Age in 1st Trimester	36.9	37.5
Mean Gestational Age in 2nd Trimester	36.9	39
Mean Gestational Age in 3rd Trimester	36.8	38.5

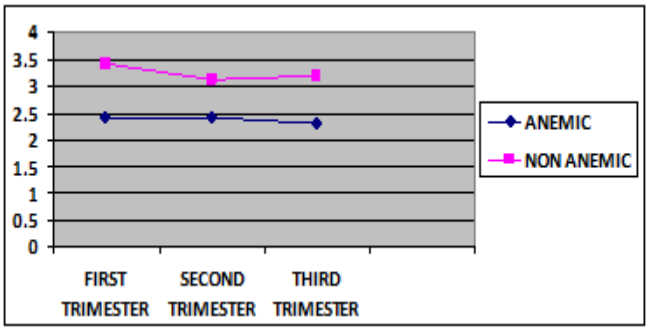

Figure 2: Trend of Birth Weight at Different Trimesters in Both Groups