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Relationship between maternal anemia and perinatal outcome: Observational study from a tertiary care teaching hospital in eastern India

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Abstract
Maternal iron deficiency is a common issue in India. Maternal iron deficiency anemia (IDA) has significant negative effects on fetal outcome as low birth weight rates, Poor Intrauterine growth and increased risk of preterm birth. The goal of this study is to discover the effect of maternal anemia on perinatal outcome. This is a prospective observational study at a tertiary care teaching hospital in Eastern India, over a period of 18 months from January 2015 to June 2016. In this period, standard information of the mother admitted to obstetrics units were gathered. Total 430 mothers were selected. The pregnant mothers included in study were grouped into 2 categories, maternal anemia or no anemia group. Of these, 230 were anemic (hemoglobin <11 g/dl in labour and on two previous occasions in current pregnancy). A total of 200 women had haemoglobin >11 g/dl at all times in pregnancy and were labelled as non-anemic. Perinatal outcomes included preterm delivery, low birth weight (LBW) at delivery, intrauterine growth restriction, perinatal mortality, APGAR score at 1 and 5 min, intrauterine fetal demise (IUD). The danger of preterm delivery and LBW among anemic mothers was 4 and 2.0 times higher than the non-anemic mothers. Infants of anemic mothers had 1.8 times more risk of having an APGAR score of <5 at 1 min and the danger of IUD was 3.7 times higher for anemic ladies. Low maternal hemoglobin levels are related with risk of preterm delivery, LBW babies, APGAR score <5 at 1 min and IUD

Keywords: Perinatal morbidity, maternal anemia, IDA, neonate, IUGR, IUD

Introduction
Anaemia is a major public health problem throughout the world especially in developing countries like India and it is the most common nutritional deficiency disorder in the world [1]. High prevalence of anemia among pregnant women persists in India despite the availability of effective and low-cost interventions for prevention and treatment. World Health Organization (WHO) has estimated the prevalence of anaemia among pregnant population to be about 38% [2]. The prevalence of anaemia indicates the nutritional status of a community and it often goes untreated especially in pregnant women where it can be most dangerous [3]. In developing country it affecting 2/3rd of pregnant women and contributes to maternal morbidity and mortality and to low birth weight [4, 5]. Anaemia has hazardous influence on maternal and fetal outcome and increases risk of postpartum haemorrhage (PPH), infection, sepsis and risk for pre-term birth, low birth weight and small for gestational age babies thereby contributing to maternal and perinatal morbidity and sometimes mortality [6].
The pattern of anaemia in Asian countries shows a trend that appears to be one of the areas of public health that requires attention. Maternal iron deficiency is usually viewed as a hazard factor for poor pregnancy result [7]. A few examinations have shown a solid relationship between low hemoglobin before delivery and unfavourable results [8]. However, others have not discovered a huge affiliation. Along these lines, there is deficient data to survey the general unfavourable effect of anaemia during pregnancy. The aim of the study was to decide the link between maternal anaemia and perinatal outcome.

Material and Method
This was a hospital based prospective observational analytical study conducted in the Department of Neonatology and Department of Obstetrics of a tertiary care teaching hospital

in Odisha. All total 430 pregnant ladies, who attended the antenatal clinic of the hospital were included in the study and were followed up till delivery to look at the perinatal outcome. The study subjects were divided into 2 groups, maternal anemia or no anemia group. Of these, 230 were anemic (hemoglobin <11 g/dl in labour and on two previous occasions in current pregnancy). A total of 200 women had haemoglobin >11 g/dl at all times in pregnancy and were labelled as non-anemic. Study duration was one and half year from Jan 2015 to June 2016. A total number of 1100 women were delivered during the study period. Of these, all the women who fulfilled the inclusion criteria, i.e. attended outpatient care before 16 weeks of gestation; age 18 years and older; singleton pregnancy with a complete medical record, were included in the study. Women with a past history of preterm delivery, obstetrical complications or medical illnesses except anaemia were excluded in order to control for confounding factors. Only 430 women fulfilled the inclusion criteria. Most of the exclusions were women who had three or fewer antenatal visits and therefore only one haemoglobin test during their pregnancy.

All the information were recorded on a pre-designed questionnaire that recorded Body Mass Index (BMI), hemoglobin estimation at first antenatal visit, at 28-32 weeks, at 33-37 weeks and in labour, gestational age at delivery, perinatal outcome (live birth, stillbirth, intrauterine fetal demise, IUD), intrauterine growth restriction (IUGR) and the type of IUGR. Gestational age was calculated from first day of last menstrual period. IUGR was defined as the fetal growth less than the 10th centile for that gestational age. Preterm delivery was defined as delivery after 24 weeks and before 37 completed weeks of gestation. The weight of new-borns and their APGAR score at 1 and 5 min were recorded.

The data was analyzed in statistical software (SPSS version 16, Chicago, Illinois, USA). Frequencies were determined, Levene's test was applied to measure equality of variances and t-test was used to compare means. Univariate analysis was carried out. For further evaluation of data, multivariate analysis was done to control for confounding factors using multiple logistic regression for dependent variables. Results are expressed as means (Standard Deviation SD), adjusted relative risk and 95% confidence interval (95% CI).

Results

A total of 430 women fulfilled the inclusion criteria, 230 anemic and 200 non-anemic. Table 1 shows the demographic and socioeconomic characteristics of the two groups. The mean age of anemic women was 26.85 (SD = 4.77) years against 27.08 (SD = 4.65) years among non-anemic women.

Table 1: Comparison of the demographic and socioeconomic characteristics of the anemic and non-anemic female group

Variable	Anaemic group	Non-anemic group	'P' value
Age (mean ± SD)	26.85±4.77	27.08±4.65	0.005*
BMI (mean ± SD)	23.62(3.65)	24.15(3.89)	0.039*
Respondent's education, n (%)			0.006*
Up to grade 10	194(84.3)	182(91)	
Above grade 10	36(15.7)	18(9.0)	
Employment status, n (%)			0.584
Employed	195(84.7)	166(83.2)	
House wives	35(15.3)	34(16.8)	
Family structure n (%)			0.058
Joint	147(64.5)	116(58.2)	
Nuclear	83(35.1)	84(41.8)	
Monthly income in rupees, n (%)			0.004*
Up to 20 000	83 (36.4)	75 (37.3)	
20 000-30 000	73 (31.6)	74 (37.0)	
30 000-50 000	61 (26.2)	44 (22.2)	
>50 000	13 (5.8)	7 (3.5)	

*P< 0.005 shows the difference is statistically significant

The majority of the women (84.3% in the anemic group and 91% in the non anemic group) had attended school to grade 10 or less. More than 83% were working mothers in both groups. About 64.5% in the anemic group and 58.2% of non-anemic women lived in a joint family, i.e. with parents, grandparents and siblings in addition to husband and children. As the family income is divided among many people, the share of nutrition decreases accordingly. Household monthly income is also given. The results in the two groups (from statistical analysis) revealed that the two samples were well matched and there was no statistically significant difference among the two groups.

Table 2: Univariate analysis of perinatal outcomes among the two groups

Variable	Anemic group, n	Nonanemic group, n	Adjusted relative risk	95% Cl
Premature birth				
Yes	58	13	4.0	2.5-6.3
No	172	187	1.0	
Low birth weight				
Yes	31	12	2.2	1.3-3.7
No	199	188	1.0	
IUGR				
Yes	30	12	1.9	1.1-3.3
No	200	188	1.0	

Perinatal mortality				
Yes	4	1	3.2	0.7-14.6
No	226	199	1.0	
Low APGAR at 5min				
Yes	23	10	2.1	1.2-3.7
No	207	190	1.0	
IUD				
Yes	3.0	1.0	2.5	0.7-13.0
No	227	199	1.0	

Table 2 outlines the univariate analysis of perinatal outcome variables in the two groups. Risk of preterm delivery (<37 weeks) was four times higher among anemic women with a statistical significant association (95% CI = 2.5–6.3). There was a 2.2 times increased risk of LBW in the anemic group (95% CI = 1.3–3.7) and a 1.9 times increased risk among anemic women of giving birth to IUGR babies (95% CI = 1.1–3.3). The risk of Perinatal mortality (PNM) was 3.2 times higher among anemic women (95% CI = 0.7– 14.6). The risk of an APGAR score <5 at 1 min and <7 at 5 min was 2.1 and 1.7, respectively (95% CI = 1.2–3.7 and 1.0–3.1) for anemic women, which showed 2.5 times increased risk of IUD compared to the normal population (95% CI = 0.7–13.0).

Table 3: Multivariate analysis of perinatal outcomes among anaemic and non-anaemic groups

Variable	ARR	95% Cl
Premature birth		
Yes	4.0	2.5-6.3
No	1.0	
Low birth weight		
Yes	2.0	1.0-3.4
No	1.0	
Low APGAR at 1 min		
Yes	1.8	1.2-3.7
No	0.9	
IUD		
Yes	3.7	0.86-14.6
No	1.0	

Table 3 shows the multivariate analysis of the study population. Anemic women were at four times increased risk of preterm delivery (95% CI = 2.5–6.3). The risk of LBW in the anemic population was 2.0 times higher (95% CI =1.0–3.4).

Discussion

Anaemia in pregnancy is more prevalent and severe in the developing countries [6]. In India, there is high prevalence of anemia among non-pregnant population and they start pregnancy in anemic state which is further aggravated by increased requirements of pregnancy and blood loss at delivery. Infections in the antenatal and postnatal periods and early advent of next pregnancy increases risk of anemia. Maternal anaemia has been found to be associated with higher maternal mortality and morbidity and adverse perinatal outcome [9, 10].

The studies have demonstrated differences in outcomes between iron deficiency and physiological anaemia of pregnancy [11]. The risk of prematurity and LBW is higher in anemic women. In populations in which the rate of anaemia is low among non-pregnant women, the primary cause of anaemia during pregnancy is likely to be plasma volume expansion, and this anaemia is not associated with negative birth outcomes [12]. As it is estimated that about 7.3 million perinatal deaths occur annually in the world, most of these in developing countries especially Asia [13], one could assume many of these could be prevented by correcting maternal anaemia. Prematurity and birth asphyxia are the main causes of perinatal deaths in India. Severe anemia (<8 g/dl) is associated with birth weight values that are 200-400 g lower than in women with higher (>10 g/dl) hemoglobin values, but these studies generally have not excluded other factors that might also have contributed to both LBW and the severity of anaemia [15].

Anemia is considered one of the main nutritional deficiency disorders affecting a large fraction of the population not only in developing but also in developed countries. Poverty, gender bias and lack of education about the importance of intake of balanced and iron rich diet contribute to it, rendering anaemia a continuing challenge for change and intervention at an early age in women. The high prevalence of iron and other micro-nutrient deficiencies among women before and during pregnancy calls for interventions such as periodic supplementation [16]. This may help to reduce manifestation of iron deficiency, improve public health and thus reduce maternal morbidity and mortality.

Our study was conducted in a tertiary care hospital which is not a representative of the country. Studying the impact of maternal anaemia on quality of life could have strengthened the study and would have added more to our knowledge. Other nutritional deficiencies have also been proposed to have an impact on maternal and fetal outcome, e.g. niacin and zinc deficiency. These need to be studied in detail so that when further research is being done on iron deficiency anaemia, the effect of such confounders can be ameliorated.

Conclusion

The outcomes demonstrate the relationship of maternal iron deficiency in pregnancy with expanded danger of delivery of untimely and LBW babies, IUD, low APGAR score at 1 min and PNM. Additional studies on pregnant women are needed evaluating immune function in response to iron supplementation. Pregnant women should be counselled regarding the risks of adverse pregnancy outcomes with anaemia. Little is known concerning the effects of maternal iron status during pregnancy on the infant's subsequent health and development and on the quality of life of the mother.

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