



Study on the Effect of Maternal Haemoglobin on Birth Weight of Newborn Babies

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Abstract

Background: Anemia is a very common condition found in pregnant women, which has a deleterious effect on foetal wellbeing including weight gain of fetus. Studies indicate that anemia in pregnancy is a risk factor low birth weight and possibly for inferior neonatal health. The present study is done to determine the effect of the maternal hemoglobin on birth weight.

Methods: An observational cross-sectional study was carried out at a tertiary care hospital in Mumbai. All pregnant females with single live pregnancy were included in this study. After the selection criteria was satisfied, all term babies born to pregnant females with single live pregnancy were examined and birth weight was recovered on a digital weighing scale.

Results: Among the anemic mothers, 39 (27.3%) had mild anemia (Hb: 10 – 10.9), 32 (22.4%) had moderate anemia (Hb: 7 – 9.9) and 9 (6.3%) had severe anemia (Hb: <7). Of the 143 newborns born to those mothers, 74 (51.7%) weighed between 2500 – 3500 grams, 56 (39.2%) were low birth weight (<2500g) babies and only 13 (9.1%) were above 3500 grams.

Conclusions: According to our study, anemic mothers delivered babies with low birth weight than non-anemic mothers. Present study showed prevalence of low-birth-weight babies to be 39.2%. Interventions to reduce low birth weight should be specific for specific populations. Approaches to improve the health of the women are needed to reduce the low-birth-weight problem in India.

Keywords: Maternal haemoglobin, Anemia, Low birth weight.

Introduction

Anaemia in pregnancy is a significant public health problem in developing countries. Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary

by age, sex, altitude, smoking, and pregnancy status.^[1] According to WHO, hemoglobin level below 11 gm/dl in pregnant women constitutes anemia and hemoglobin below 7 gm/dl is severe anemia.^[2]

Among the various causes of anaemia in women, iron deficiency is the most common cause, primarily due to poor supply of iron in the diet.^[3]

Anemia in pregnancy has several deleterious effects on the health of the mother as well as the fetus. Maternal anemia is an important risk factor for low-birth-weight babies and preterm babies.

During pregnancy anemia is common due to increased demand of iron for the growing fetus and placenta and increased red blood cell mass, which is further aggravated with other factors such as childbearing at an early age, repeated pregnancies, short intervals between pregnancies and poor access to antenatal care and supplementation. The consequences of iron deficiency anemia during gestation include increased risks of preterm delivery, lower birth weight and perinatal mortality. Reduced level of hemoglobin favour changes in placental angiogenesis. Thereby causing decreased availability of oxygen to the fetus which results in intrauterine growth restriction and low birth weight.

According to National Family Health Survey (NFHS)-(V) more than half of women in India (57%) have anemia, and 52.2% pregnant women are anemic (Hb< 11g/dl). In India 26 million newborn infants are born every year. The current NMR 2020 is 20 per 1000 live births and the current IMR 2023 is 27.6 per 1000 live births in India. One of the most important causes of NMR is low birth weight and prematurity.^[5] Surveys in different parts of India indicate that about 50%-60% of women belonging to low socioeconomic group are anemic during pregnancy. The major etiological factors being iron and folic acid deficiencies. It is well known that anemia per se is associated with high incidence of premature birth and low birth weight.^[6] Current knowledge indicates that iron deficiency anemia in pregnancy is a risk factor for preterm delivery and subsequent low birth weight, and possibly for inferior neonatal health.

The present study is done to determine the effect of the maternal hemoglobin on birth weight.

Materials and Methods

Study design and setting: This observational cross-sectional study was conducted for 4 months duration from November 2023 to February 2024 in Department of Paediatrics in a Government hospital in Mumbai.

Study participants and sampling:

Inclusion Criteria:

All term babies (completed > 37 weeks of gestational age) and babies born to woman of age 18 – 35 years, delivered in CAMA and Albess Hospital, Mumbai.

Exclusion Criteria:

Maternal:

- Systemic illnesses like Gestational Diabetes Mellitus, Pregnancy Induced Hypertension, Renal diseases, Cardiac diseases.
- Antenatal infection e.g., TORCH infections.
- History of addiction (Tobacco, alcohol).
- Pregnant women on any drugs affecting fetal growth.
- Multiple pregnancies.

Neonatal:

- Twin babies
- Gross congenital anomalies
- Sick neonates (neonates with RDS, MAS, TTNB, sepsis, hypoglycaemia, seizures)

Sample size:

The sample size was calculated to be 143 with a confidence interval of 95% and a margin of error of 7% by using the formula: $4PQ/L^2$ taking 24% prevalence of low birth from a recent study from Southern India.

Data collection tool and technique:

All singleton live born babies born in CAMA and Albess Hospital were examined. Babies were examined to assess sex, perinatal complications, full systemic examinations, and birth weight was recorded in kilograms using a digital scale. The

pregnant women’s second trimester haemoglobin was measured during pregnancy.

Statistical Analysis

The collected data is entered in the Microsoft Excel 2021 and analysed statistically. Descriptive statistics was carried out in Microsoft Excel. Results on categorical measurements are presented in number (%). The Statistical software, SPSS 26.0 was used to perform inferential statistics. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for Qualitative data analysis. A p value of less than 0.05 was considered statistically significant.

Results

Out of the 143 pregnant women included in the study, majority 102 (71.3%) were between 20 – 30 years, 26 (18.2%) were more than 30 years and 15 (10.5%) were less than 20 years. In the present study 86 (60.1%) participants belonged to urban area and 57 (39.9%) belonged to rural area. A significant proportion of them (42%) were graduates and above while 14.7% were illiterates. Hindus and Muslims contributed to about 76.3% of the total study population. Of the 143 subjects, 62 (43.4%) were primi and 81 (56.6%) were multigravida. Vaginal delivery (54.5%) was the most common mode of delivery followed by LSCS (34.3%).

Table 1: Demographic profile of subjects (n = 143)

Variables		Number of subjects (N)	Percentage (%)
Age of mother (in years)	< 20	15	10.5
	20 - 30	102	71.3
	> 30	26	18.2
Residence	Rural	57	39.9
	Urban	86	60.1
Education	Illiterate	21	14.7
	Primary school	34	23.8
	Up to 12th Std	41	28.7
	Graduate & above	47	32.9
Religion	Hindu	61	42.7
	Muslim	48	33.6
	Christian	28	19.6
	Others	6	4.2
Gravida	Primi	62	43.4
	Multi	81	56.6
Mode of delivery	Vaginal	78	54.5
	LSCS	49	34.3
	Instrumental	16	11.2
Maternal Hemoglobin (g/dl)	<7	9	6.3
	7 - 9.9	32	22.4
	10 - 10.9	39	27.3
	≥11	63	44.1
Birth weight (g)	< 2500	56	39.2
	2500 - 3500	74	51.7
	>3500	13	9.1
Sex of the baby	Male	69	48.3
	Female	74	51.7

The present study included 80 anemic and 63 non anemic pregnant women. Among the anemic mothers, 39 (27.3%) had mild anemia (Hb: 10 – 10.9), 32 (22.4%) had moderate anemia (Hb: 7 – 9.9) and 9 (6.3%) had severe anemia (Hb: <7). Of

the 143 newborns born to those mothers, 74 (51.7%) weighed between 2500 – 3500 grams, 56 (39.2%) were low birth weight (<2500g) babies and only 13 (9.1%) were above 3500 grams.

Table 2: The relation of maternal hemoglobin with birth weight of newborns

Pregnant women Hb in g/dl	Birth weight (g)			Fisher's exact test	p value*
	< 2500	2500 - 3500	> 3500		
Severe Anemia (Hb < 7)	5	3	1	16.47	0.011
Moderate Anemia (Hb 7 - 9.9)	18	12	2		
Mild Anemia (Hb 10 - 10.9)	7	30	2		
No Anemia (Hb ≥11)	26	29	8		

*p value less than 0.05 being statistically significant.

The maternal hemoglobin and birth weight of the newborns were compared, and Fisher's exact test was applied. Of the 9 severe anemic pregnant women, 5 of them delivered low birth weight babies. In 32 moderate anemic women, 18 turned out to be low birth weight babies, 12 between

2500-3500 grams and 2 of them were above 3500 grams. Of the 39 mild anemic mothers, only 7 gave birth to low birth weight babies whereas out of 63 non anemic mothers, 37 of them had babies of more than 2500 grams showing significant statistical difference (p value – 0.011).

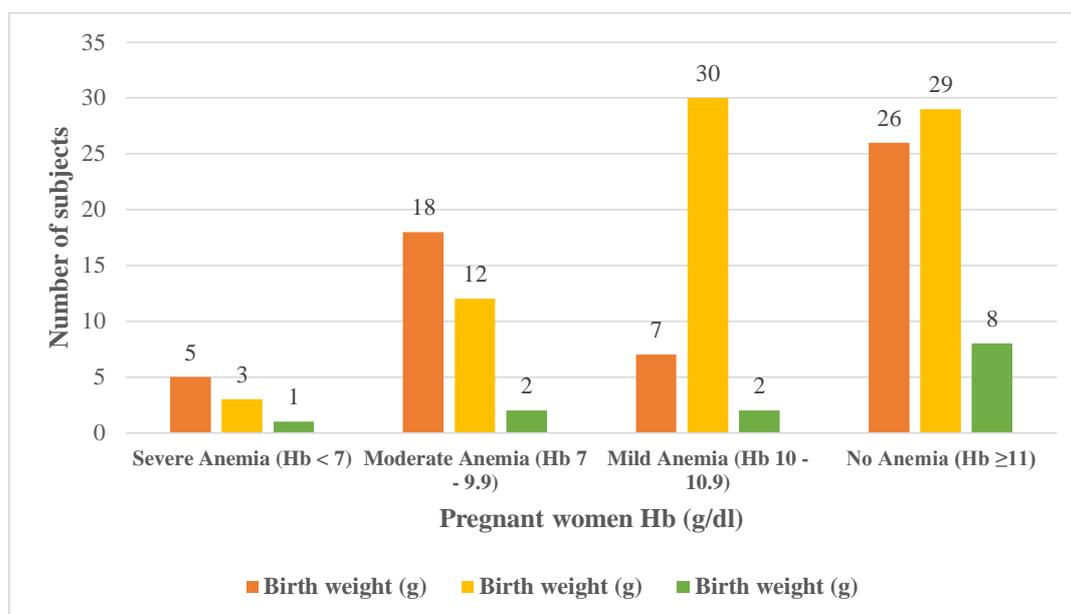


Figure 1: Maternal Hemoglobin and birth weight of the newborn

Discussion

This study was done to compare maternal hemoglobin with birth weight of the newborn. Present study included 143 mothers and their newborn, delivered at CAMA and Albess Hospital, Mumbai. As the present study was conducted in urban area, majority of the population is urban (60.1%), compared to rural population (39.9%).

Different studies have revealed that significantly associated risk factors for the birth weight of a newborn may vary according to the geographical location and the study population. Present study

tells us that the prevalence of maternal anemia is 55.9% in our study population. In 2008, Milman N described that in tropical countries, the incidence of anemia in pregnancy is about 40-80%.⁷ In 2019, Gnanasekaran S described that the prevalence of maternal anemia is 48.75% in a rural population in a southern state in India.⁸ In this study, 39.2% were low birth weight babies and 60.8% were born above 2500 grams. The study done by H.S.Ramya in 2019 also showed 30.1% low birth weight babies born to anemic and non anemic mothers.⁹ Anemia in pregnancy may be a result of physiological anemia of pregnancy,

where increase in plasma volume is greater than red cell concentration.

The main finding of our study showed that maternal anemia is directly related to birth weight of the newborn. The proportion of the low birth weight babies increased as the grade of anemia increased. Our findings matched those of Figueiredo et al who found that maternal anemia was linked to low/insufficient birth weight, indicating that it was a risk factor for the gestational outcomes evaluated.¹⁰ Singla PN et al, stated that the birth weight was significantly reduced in the very severely anemic mothers and had direct relationship with the maternal haemoglobin levels.¹¹

Non anemic mothers in present study also had low birth weight babies (26) which may be due to multiple pregnancies, maternal causes like placenta previa, abruption placenta, and premature rupture of membranes.

Conclusion

An observational study consisting of 143 mothers and newborns from June to September 2023 concluded that maternal hemoglobin is directly related to birth weight of newborn. According to our study, anemic mothers delivered babies with low birth weight than non-anemic mothers. Present study showed prevalence of low-birth-weight babies to be 39.2%. Interventions to reduce low birth weight should be specific for specific populations. Approaches to improve the health of the women are needed to reduce the low-birth-weight problem in India.

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