

## ORIGINAL RESEARCH

# A cross-sectional study to evaluate association between maternal hemoglobin level and poor pregnancy outcomes

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### ABSTRACT

**Background:** Anaemia is one of the most important factors influencing maternal morbidity and mortality and also the health of the newborn. It is a global health issue affecting nearly half of pregnant women. This study aimed to assess the association of maternal hemoglobin level with poor pregnancy outcomes. **Methods:** It was a cross-sectional study that included 2 study centers. As per inclusion/exclusion criteria, this study included 650 post-partum mothers. Using Stratified random sampling study participants were enrolled. Data were collected and analyzed in SPSS 23. Using statistical tests i.e., Chi-square, etc data was analyzed. **Results:** Anaemic mothers had a statistically significant association with low birth weight ( $\chi^2$ -19.921, p-0.000) and babies born dead ( $\chi^2$ -123.759, p-0.000). using multivariate logistic regression analysis mother having low hemoglobin level having higher odds of having low birth weight (OR-1.453, p-0.000, CI-1.212-1.741) and a baby born dead (OR-0.354, p-0.000, CI-0.239-0.524). **Conclusions:** Improving anemic status during pregnancy can reduce the burden of poor pregnancy outcomes.

**Keywords:** Maternal hemoglobin level, Poor pregnancy outcome, Low birth weight, Small gestational age, born dead.

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### INTRODUCTION

Normal physiologic changes in pregnancy affect the hemoglobin (Hb), and there is a relative or absolute reduction in Hb concentration. Anemia is one of the well-known and most prevalent health problems globally. The World Health Organization (WHO) estimates that over 2 billion people, roughly 30% of the world's population, are affected by anemia and at least 50% of pregnant women are anemic.<sup>1</sup>The prevalence of anemia during pregnancy is highest in South Asia and central and west Africa. (2) In India, acc, to NHFS 5 survey, the percentage of pregnant women having hemoglobin level below 11 g/dl were found to be 52.2% with the urban and rural percentage of 45.7% and 54.3% respectively. (3) Acc to NHFS 5 survey, in Madhya Pradesh, 52.9% of pregnant women were having hemoglobin levels below 11g/dl. Out of the total percentage, 54.9% of pregnant women from the rural parts of Madhya Pradesh were having anemia. Only 23.5% of pregnant women consumed

iron and folic acid supplements for 100 or more days. (4) Iron deficiency anemia is most prevalent among pregnant women. Iron deficiency anemia during pregnancy is a known risk factor for preterm birth, low birth weight, and small-for-gestational-age babies and increases the risk of postpartum hemorrhage (PPH).(5)

Physiologically, plasma volume expands by 25–80% of pre-pregnancy volumes between the second trimester and the middle of the third trimester of pregnancy [6,7]. This induces a modest decrease in Hb levels during pregnancy.

Anemia is a common medical condition affecting pregnancy, especially in low/middle-income countries, understanding the impact that various levels of anemia have on pregnant women and their newborns is of supreme importance. This study aims to evaluate the association of maternal hemoglobin level with pregnancy outcomes.

## METHOD

This study was conducted among women who delivered in two hospitals Chandrikaben Rashmikant Gardi Hospital (CRGH) and Charak hospital (District Mother and Child Hospital), Ujjain. MP during the data collection period. Charak hospital is a 450 bedded hospital and about 800-900 deliveries are being conducted in a month and CRGH is 820 bedded tertiary care hospital and about 150-200 deliveries are being conducted in a month. Anemia was classified based on the WHO criteria; HB concentration of <11 g/dl was considered as anemia. HB concentration of 10–10.9 g/dl, 7–9.9 g/dl, and <7 g/dl was considered as mild, moderate, and severe anemia, respectively

Study design and study population  
The study was conducted using a cross-sectional design. The study population included women who delivered in these two hospitals during the data collection period. Those admitted in ICU or those not present on the bed at the time of visit or with incomplete information were excluded from the study. Sample size and sampling technique: A sample of 629 was calculated using the sample size formula for a single proportion. A total of 650 postpartum mothers were enrolled. Stratified random sampling was used for the selection of participants from 2 centers along with simple random sampling. Data collection: Data was collected after getting permission from the institute's ethical committee. The duration of the study was one and a half years. A pre-designed pre-tested questionnaire was used to collect data from postpartum mothers. Written consent was obtained after explaining the need and importance of the study to the participant. Most of the details were obtained by interview, however, some of the details like investigation etc were taken from mother and child protection card (MCP card)/ inpatient file. Statistical analysis: Data were analyzed using IBM statistical

package for the social sciences (SPSS) version 23 for Windows 10. For Analysis descriptive statistics were calculated to summarize the sample characteristics. A Chi-square test was applied to all variables to see the association with all four poor pregnancy outcomes (born dead (stillbirth), LBW, preterm, and IUGR) and mode of delivery. Logistic regression was applied for predicting poor pregnancy outcomes. A p-value of less than 0.05 was considered to be statistically significant. Ethical consideration: Ethical approval was obtained from the institutional ethical committee of R. D. Gardi medical college, Ujjain. Confidentiality and data security were assured. Participation was made voluntary as each participant was at liberty to opt out at any point in the study.

## RESULT

### Frequency distribution of sociodemographic factors of study participants

Mothers' age ranges from 17 years to 40 years with a Mean age was 25.38 years. Only 31.2% of post-partum mothers had education more than high school. Only 19.1% of post-partum mothers belong to the socioeconomic class above III (i.e., class I & II of modified BG Prasad). It was observed that 64% of post-partum mothers belong to below poverty line (BPL) families. About 57.3% of post-partum mothers reside in rural areas. Parity distribution of postpartum mothers was 59.8% were multipara. About 70.8% of mothers were married before 20 years of age. It was found that 63.4% of post-partum mothers live in a joint or 3 generations family About 42.5% live in Kutcha houses. It was observed that 27.5% of study participants do not have access to toilet facilities at their homes. Similarly, 27.4% of study participants do not use toilet facility, rather they practice open field defecation as shown in table 1.

**Table 1: Frequency distribution of sociodemographic factors of study participants**

Factor	Category	Frequency	Percent	Factor	Category	Frequency	Percent
Mother's age group	<= 20 Years	66	10.2	Socio-economic class	Above class III	124	19.1
	21-30 years	499	76.8		Class III	147	22.6
	>30 years	85	13.1		Below class III	379	58.3
Place of Delivery	Ambulance	13	2.0	Housing	Kutcha	276	42.5
	Govt	480	73.8		Pucca	276	42.5
	Private	157	24.2		Kutcha-pucca	98	15.1
Mother's education	Illiterate	119	18.3	Father's education	Illiterate	70	10.8
	<High school	328	50.5		<high school	237	36.5
	>=High school	203	31.2		≤high school	343	52.8
Mother's occupation	Professional	10	1.5	Father's occupation	Professional	26	4.0
	Skilled	100	15.4		Skilled	309	47.5
	Semi-skilled	172	26.5		Semi-skilled	307	47.2
	Unemployed	368	56.6		Unemployed	8	1.2
Toilet facility at home	No	179	27.5	Use of Toilet During	No	178	27.4
	Yes	471	72.5		Yes	472	72.6

				<b>Pregnancy</b>			
Religion	Christian	4	0.6	<b>Caste</b>	General	128	19.7
	Hindu	422	64.9		OBC	288	44.3
	Jain	15	2.3		SC	161	24.8
	Muslim	195	30.0		ST	65	10.0
	Sikh	14	2.2		Others	8	1.2
Married at the age of	≤20 year	460	70.8	<b>Residence type</b>	Rural	349	53.7
	>20 year	190	29.2		Urban	301	46.3
Marital period	≤5 year	339	52.2	<b>No of rooms in the house</b>	≤5	607	93.4
	6-10 year	248	38.2		6-10	35	5.4
	>10 year	63	9.7		>10	8	1.2
Cash incentive	Received	54	8.3	<b>Poverty</b>	BPL	416	64.0
	Not received	596	91.7		APRIL	234	36.0
Parity	Multipara	389	59.8	<b>Type of Family</b>	Nuclear	238	36.6
	Primipara	261	40.2		Joint+3 generation	412	63.4

**Maternal anemia associated with poor pregnancy outcomes**

It was observed that 1 in 2 mothers of the study centers suffered from anemia. Anemia is one of the Significant factors for poor pregnancy outcomes. Mothers who were suffering from anemia at the time of admission had a higher proportion of babies born

dead (8.1%) than non-anemic mothers (3%). Similarly, a baby born to anemic mothers had a higher percentage of weight less than 2.5 kg (42.6%). The risk of newborns being born dead (OR-0.344) or having low birth weight (OR-1.61) increases in anemic mothers as shown in table 2.

**Table: 2 Maternal anemia and pregnancy outcomes**

Anemic	Pregnancy end results		Birth weight		Total
	Born live	Born dead	< 2.5 kg	≥ 2.5 kg	
Yes	317(91.9%)	28(8.1%)	147(42.6%)	198(57.4%)	345(100%)
No	296(97.0%)	9(3.0%)	96(31.5%)	209(68.5%)	305(100%)
		$\chi^2-8.045, p-0.005$		$\chi^2-8.572, p-0.003$	
		OR-0.344, p-0.006, CI-0.160-0.742		OR-1.616, p-0.004, CI-1.171-2.231	

\* $\chi^2$ - chi-square, OR -odd's ratio, 95% CI- confidence interval \*\* no association found between anemia and IUGR and preterm

**Hemoglobin level and pregnancy outcomes**

Hemoglobin level is inversely proportional to poor pregnancy outcomes. As seen in Table3 that as the hemoglobin level increases the percentage of having babies born dead and the percentage of babies born with low birth weight also decreases. It was revealed that hemoglobin level <7gm/dl had a higher proportion of having babies born dead (68.8%) and

low birth weight (75%). The risk of having Babies born dead and babies born with weight less than 2.5 kg increases by 0.354 times and 1.4 times with a decrease in hemoglobin level. It was observed that hemoglobin level at the time of delivery was highly significantly associated with pregnancy end results ( $\chi^2-123.756, p-0.000$ ) and low birth weight ( $\chi^2-19.921, p-0.000$ ) of newborns as shown in table 3.

**Table 3: Hemoglobin level and pregnancy outcome**

Hemoglobin level	Pregnancy end results		Birth weight		Total
	Born live	Born dead	< 2.5 kg	≥ 2.5 kg	
<7 g/dl (severe)	5(31.3%)	11(68.8%)	12(75.0%)	4(25.0%)	16(100%)
7.0-9.9 g/dl (moderate)	147(93.6%)	10(6.4%)	73(46.5%)	84(53.5%)	157(100%)
10.0-10.9 g/dl(mild)	165(95.9%)	7(4.1%)	62(36.0%)	110(64.0%)	172(100%)
≥11 g/dl (non anaemic)	296(97.0%)	9(3.0%)	96(31.5%)	209(68.5%)	305(100%)
		$\chi^2-123.759, p-0.000$		$\chi^2-19.921, p-0.000$	
		OR-0.354, p-0.000, CI-0.239-0.524		OR-1.453, p-0.000, CI-1.212-1.741	

\* $\chi^2$ - chi-square, OR -odd's ratio, 95% CI- confidence interval  
 \*\* no association found between hemoglobin level and IUGR and preterm

## DISCUSSION

Out of 650 pregnant women in this study, more than half (54.5%) of them were suffering from anemia. It is relevant to the previous study which stated that half population of pregnant women in the world is affected by anemia. (8) In this study, we found that maternal anemia is associated with poor pregnancy outcomes. Maternal hemoglobin concentration is inversely proportional to the risk of having poor pregnancy outcomes. Birth weight has a direct relationship with hemoglobin concentration. (9) Our study suggests that lower hemoglobin concentration increases the risk of having a baby born dead (stillbirth). Our study is not the first study to show an association between maternal anemia and baby born dead. Previous studies have shown a crude association between maternal anemia and a baby born dead (10-12) In our study we were not able to find any association with small for gestation age and preterm. Limitations: This was a cross-sectional hospital-based study. Many of the data on the study variable was collected from hospital records. Hemoglobin levels were not analyzed at different pregnancy trimesters. In some of our comparisons, the sample size may have limited our ability to detect a significant association. Conclusion: The study findings suggest a significant association between pregnancy outcome and hemoglobin levels during pregnancy. These issues need to be resolved to reduce the burden of poor pregnancy outcomes. Improving anemic status through compliance with medication and nutrition will reduce this burden. Recommendations: Since Anaemia is highly prevalent instead of so many government efforts. Compliance with IFA tablets needs to be assessed. Educating pregnant women and family members for availing antenatal care should be ensured especially their spouse for compliance if IFA tablets and proper nutrition. Adequate sleep and proper nutrition are to be pregnant women must be adhered to.

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**Conflict of interest:** None

**Ethical approval:** Ethical clearance for the study was taken from the institutional ethical committee of R.D. Gardi Medical College, Ujjain, Madhya Pradesh before starting the study. Ethical clearance number IEC Ref no-136

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