Original Article

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Pathology Section

Anaemia in Pregnant Women in Labour and its Correlation with Newborn Birth Weight-How Far we have Reached?

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ABSTRACT

Introduction: Maternal anaemia is one of the important preventable causes of low birth weight in newborn leading to maternal and fetal morbidity and mortality. Maternal complications and poor perinatal outcome are highly associated with non-utilization of antenatal and delivery care services with poorer outcomes in unbooked than booked patients.

Aim: To assess the haemoglobin level and type of anaemia in unbooked pregnant women i.e., without any antenatal visit and to identify if there is any correlation between maternal anaemia with fetal weight. Also to compare these findings with booked pregnant women i.e., who had at least 3 antenatal visits to see whether utilization of antenatal services affect fetal outcome.

Materials and Methods: This was a cross-sectional analytical study. Booked and unbooked pregnant women attending labour ward of a tertiary care hospital catering rural population with sample size of 60 in booked cases as control and 30 cases as test group without any co-morbid conditions except anaemia. Blood collected in EDTA was analysed on automatic hematoanalyzer for Complete Blood Count (CBC), haemoglobin level and Hematocrit values were noted. Also, newborn birth weight was noted in labour ward in kilograms.

Results: Age and parity parameter showed no statistical significance in unbooked or booked group while comparing haemoglobin levels and newborn weight. Correlation between level of haemoglobin of pregnant mother and birth weight of newborn babies showed statistical significance ($p<0.001$) in unbooked cases. Also, in this group, 85% showed anaemia, with majority showing moderate grade of anaemia and iron deficiency anaemia being the commonest. Similarly, in unbooked group, intra group correlation between different grades of anaemia and mean newborn weight in each group showed significant ($p<0.001$). In comparative study between newborn weight, Low Birth Weight (LBW) accounted for 15% in booked group whereas in unbooked it accounted for 56.6%, the difference was found to be statistically significant ($p<0.001$).

Conclusion: Thus, though the incidence of unbooked cases is less at our institute but there is a significant correlation between anaemia and LBW in unbooked cases which needs to be addressed to reduce maternal and fetal morbidity and mortality. Also, moderate anaemia in booked group indicates poor compliance in spite of regular utilization of ANC services.

Keywords: Antenatal care, Fetal outcome, Maternal anaemia, Unbooked pregnancy

INTRODUCTION

Anaemia in pregnant women is one of the commonest preventable causes of maternal morbidity leading to preterm and LBW in newborn babies. It is estimated that more than half of the pregnant women in developing countries suffer from anaemia [1]. Adverse maternal and poor perinatal outcome are highly associated with non-utilization of antenatal and delivery care services with poorer outcomes in unbooked than booked patients [2].Therefore, antenatal care is one of the key strategies in maintaining safe motherhood. Adequate prenatal care is recognized as an important factor in the reduction of maternal and newborn deaths [3]. In maternal anaemia, poor nutrition and lack of iron and folic acid supplementation are the leading cause of anaemia. To prevent these common causes of anaemia, WHO has recommended supplementation of all pregnant women with daily dose of 60mg of elemental iron and 5mg of folate during antenatal period [4].The World Health Organization definition of Low Birth Weight (LBW) is birth weight less than 2500g [5]. Several studies have shown that anaemia is one of the important causes of low birth weight in newborn babies [6]. Therefore, our study was focused on relationship of low haemoglobin level in pregnant women coming in labour in our hospital which is a tertiary healthcare provider catering rural population and utilizing antenatal services with newborn birth weight.

MATERIALS AND METHODS

This was a cross-sectional study conducted between the period of March to September 2016. The study was

conducted after obtaining ethical clearance from Institutional human ethical committee of our institute. The study population included booked and unbooked pregnant women attending labour ward in Mahatma Gandhi Medical College and Research Institute, Pondicherry, India, which is a tertiary care hospital catering rural population. The haematological investigations were carried out in pathology section, Central laboratory of our institute. Sixty booked pregnant women in labour was the sample size for controls, while 30 unbooked pregnant women in labour was sample size for the test group. Pregnant women, who had no antenatal visit, were referred to as unbooked, while those who had 3 antenatal visits were referred to as booked and were included in the study. Booked and unbooked pregnant women with any associated comorbid conditions like gestational diabetes, eclampsia, twin pregnancy, etc., except anaemia was excluded from the study.

Clinical details regarding age, parity, clinical features, co-morbid conditions of booked and unbooked pregnant women, weight of newborn were obtained from labour ward through medical records, case papers.

After obtaining patient's consent, blood samples were collected in EDTA vacutainer and sent to Central Lab of our institute for CBC for the assessment of anaemia for haemoglobin estimation, Red Blood Cell (RBC) count, Haematocrit values or blood indices i.e., Mean Corpuscular Volume (MCV), Mean haemoglobin Concentration (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) for further typing of anaemia on 8 part hemato-Autoanalyzer. Further typing of anaemia was confirmed by peripheral smear study of Leishman stained slide by pathologist.The definition of anaemia recommended by the Centre for Disease Control and Prevention is a haemoglobin (Hb) or Haematocrit (Hct) value less than the fifth percentile of the distribution of Hgb or Hct in a healthy reference population based on the stage of pregnancy - Hb (g/dl) levels below 11 g/dl in the first trimester; 10.5 g/dl in the second trimester; and 11 g/dl in the third trimester. Our study followed ICMR classification for severity of anaemia which was agreed upon by expert group and published in December 2011 under good clinical practice recommendations for Iron Deficiency Anaemia in Pregnancy (IDA) in pregnancy in India as follows [7] [Table/Fig-1].

Grade	Haemoglobin Levels (Range in g/dl)
Mild Anaemia	10.0-10.9
Moderate Anaemia	7.0-9.9
Severe Anaemia	4- 6.9
Very Severe	less than 4.0 gm/dl

[Table/Fig-1]: Grades of anaemia in pregnancy.

STATISTICAL ANALYSIS

Data was analyzed by using statistical tests like mean, standard deviation and percentage along with pie charts and bar diagrams. Karl Pearson's correlation was used to note intergroup differences. One-way-ANOVA was applied when more than two groups were compared. Chi-square test, independent 't'- test was used for numerical data and p-value < 0.05 was considered as significant.

RESULTS

In the study period, total 819 deliveries occurred in our institute in which unbooked accounted for 30 cases (3.7%). Two controls were taken per test population.

Age

Mean age was 25 years in both unbooked and booked cases and peak incidence was seen in age range of 21-30 years. In unbooked cases, minimum age was 18 years where as in booked cases it was 20 years and above. Maximum age in both unbooked and booked cases was 35 years.

Parity

Parity was independent variable in booked and unbooked cases and there was no correlation between hemoglobin level and newborn weight with parity. In unbooked and booked cases, mean haemoglobin level in primi and multipara showed no significance (p=0.696 and p=0.847 respectively). Also, mean birth weight in primi and multipara showed no statistical significance in both unbooked and booked cases (p=0.210 and p=0.858 respectively) [Table/Fig-2,3].

	Mean Haemoglobin (g/dl)	Mean Newborn Weight (kg)
Primigravida (n=19)	9.2017	2.394
Multipara (n=11)	9.208	2.385
p-value	0.696	0.210

[Table/Fig-2]: Correlation of parity, mean haemoglobin level and newborn birth weight in unbooked cases (n=30).

	Mean Haemoglobin (g/dl)	Mean Newborn Weight (kg)
Primigravida (n=32)	11.445	2.9431
Multipara (n=28)	11.331	2.9433
p-value	0.847	0.858

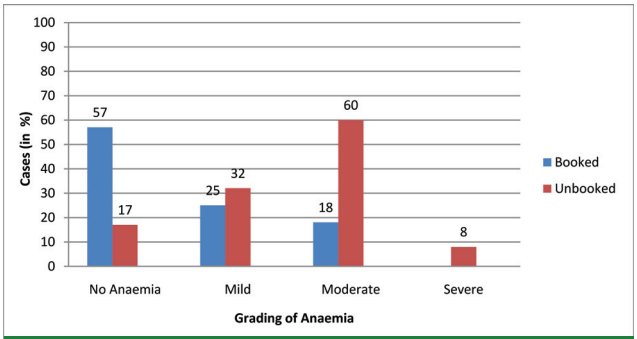
[Table/Fig-3]: Correlation of parity, mean haemoglobin level and mean newborn birth weight in booked cases (n=60).

Anaemia

Out of 30 unbooked cases, 25 (83%) showed anaemia. In these cases, majority (60%) showed moderate anaemia. [Table/Fig-4]. Predominant morphological type of anaemia was microcytic hypochromic indicating iron deficiency anaemia being predominant type of anaemia followed by dimorphic anaemia. [Table/Fig-5].

Typing of Anaemia

In 30 unbooked cases, majority (64%) cases showed iron deficiency anaemia irrespective of severity of anaemia,



[Table/Fig-4]: Comparison between levels of anaemia in booked and unbooked cases.

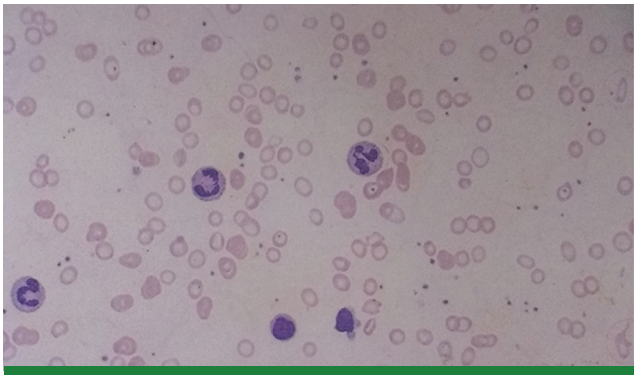
Anaemia grading	Normal MCV (82-100fl) Normo-chromic normocytic	Iron Deficiency (MCV<82fl) Hypo-chromic microcytic	Megalo-blastic (MCV >100fl) Normo-chromic macrocytic	Dimorphic (hypo-chromic microcytic + macro-cytic)
Mild (n=8)	02 (25%)	05 (62.5%)	-	01 (12.5%)
Moderate (n=15)	-	11 (73.3%)	01 (6.7%)	03 (20.0%)
Severe (n=2)	-	-	-	02 (100%)
Total (25)	02 (8.0%)	16 (64.0%)	01 (4.0%)	07 (28.0%)

[Table/Fig-5]: Distribution of types of anaemia according to MCV values and Peripheral blood smear study and its correlation with grading of Anaemia in unbooked cases.
MCV = Mean corpuscular volume

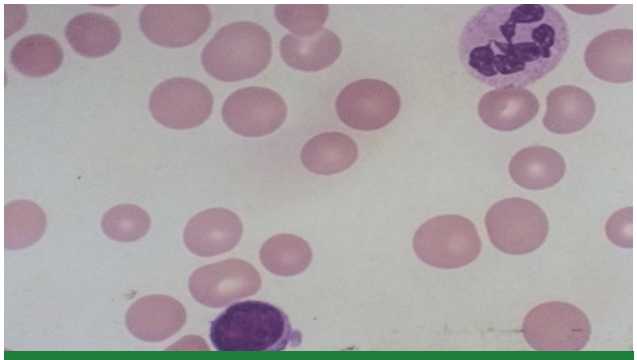
followed by cases of dimorphic anaemia (28%) which showed features of iron deficiency and megaloblastic as well [Table/Fig-6&7]. Also, severely anaemic cases showed predominantly dimorphic morphology on peripheral smear indicating deficiency of iron and folic acid in ANC period.

Newborn Weight

In the present study, in booked cases 9 (15%) out of 60 newborn babies showed LBW i.e., below 2.5kg whereas, in unbooked cases it accounted for 56.6% (17 cases) leading to statistically significant p-value of <0.001 (Chi-square value=16.9020).



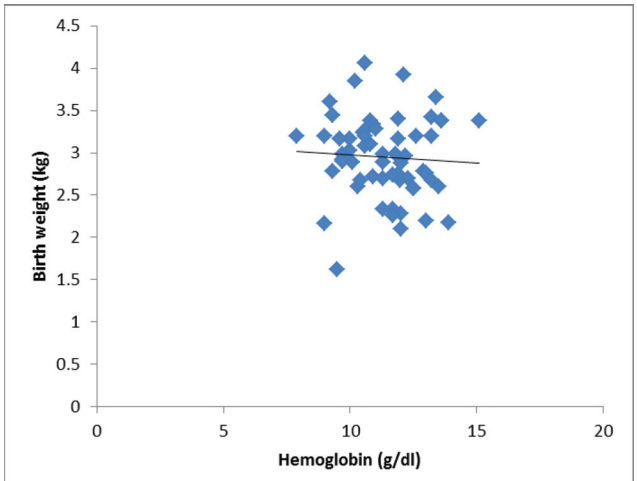
[Table/Fig-6]: Peripheral blood smear showing hypochromic microcytic RBCs of Iron deficiency anaemia (Leishman stain 40X).



[Table/Fig-7]: Peripheral blood smear showing macrocytic RBCs with hypersegmented neutrophils (Leishman stain 40 X).

Correlation of Severity of Anaemia with Newborn Weight

There was no correlation found between level of haemoglobin of mother and new born weight (p=0.654) in booked group, as shown in [Table/Fig-8].



Newborn Birth (Booked)		Weight
Hemoglobin	Pearson's Correlation	-0.059
	Sig. (2-tailed)	0.654
	N	60

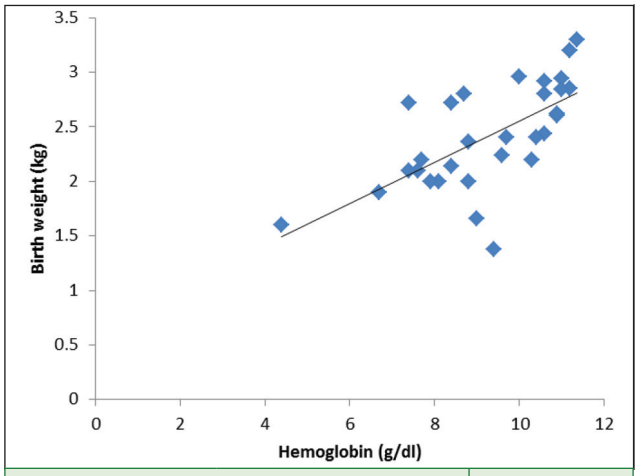
[Table/Fig-8]: Correlation between newborn birth weight and haemoglobin level in booked pregnancy cases.

In unbooked cases, in mild anaemia category, majority (75%) newborns were more than 2.5 kg where as in moderate grade anaemia, majority (60%) newborns weighed between 2-2.4kg. Similarly, severe anaemia cases showed weight of new born less than 2kg. Correlation between mean weight of newborn with severity of anaemia were shown in [Table/Fig-9].

There was correlation between level of haemoglobin of pregnant mother and birth weight of newborn babies (p<0.001) in case of unbooked cases, as shown in [Table/Fig-10].

Newborn Weight	Hb≥11g/dl (No Anemia) n=5	Hb 10-10.9 g/dl (Mild) N=8	Hb7-9.9 g/dl (Moderate) N=15	Hb4-6.9g/dl (Severe) N=2	<4g/dl (Very Severe)	Total
≥ 2.5 kg	5(100%)	6 (75%)	4 (26.7%)	0	0	15 (50%)
2-2.4 kg	0	2 (25%)	9 (60.0%)	0	0	11 (36.7%)
1.5-1.9 kg	0	0	2(13.3%)	2 (100%)	0	4(13.3%)
<1.5kg	0	0	0	0	0	0
Total	5(100%)	8 (100%)	15(100%)	2 (100%)	0	30(100%)

[Table/Fig-9]: Distribution of New-born weight according to severity of Anaemia in unbookedcases(n=30).



Newborn Birth (Unbooked)		Weight
Hemoglobin	Pearson's Correlation	0.654**
	Sig. (2-tailed)	<0.001
	N	30

[Table/Fig-10]: Correlation between newborn birth weight and haemoglobin level in unbooked pregnant cases.

Correlation of Severity of Anaemia and Mean Newborn Weight

[Table/Fig-11] showed intra group, inter group correlation between different haemoglobin levels and mean newborn weight in each group by one-way-ANOVA which showed significant p-value (<0.001) in unbooked cases where as in booked cases p- value was not significant (p=0.101)

Intergroup correlation between mean newborn weight in booked and unbooked cases was compared with each range of haemoglobin by Pearson's correlation which showed significant p-value of 0.002 and 0.001 in mild and moderate anaemia, whereas there was no significant correlation in mean birth weight and normal haemoglobin level (p=0.436).

DISCUSSION

Antenatal care is one of gateways for safe motherhood initiative, although its relative contribution is sometimes debated but its importance cannot be denied [8].There is considerable difference in utilization of ANC services in case of urban and rural population leading to large urban and rural difference with less than one-third pregnant women receiving antenatal care. Study from developing South east Asian country showed 17% of pregnant women in rural areas receive antenatal care whereas, in urban cities it was 71% [9].

There are various factors for development of anaemia in pregnant women especially those who are living in rural areas like pre-pregnancy nutritional status,early marriage followed by early pregnancy before 21 years of age, lack of awareness regarding dietary supplementation, low socio-economic status, low literacy, gender discrimination, tendency to give less priority to their own health, non- availability of antenatal services in the vicinity or non-utilization of ANC services due to unawareness.

Though in India, there are National Programs directed at maternal and child health, especially for rural population and low socio-economic group, still maternal and fetal morbidity and mortality remains a challenge for achieving goal of health for all. One of the important issue needs to be addressed is not the availability of schemes but its under utilization by its stake-holders especially in rural areas.

As per the National Food Security Act, 2013, every pregnant woman and lactating mother shall be entitled to nutritional support and maternity benefit of not less than Rs.6,000 in instalments by Central Government. In Tamil Nadu, this benefit is extended through Dr. Muthu Lakshmi Reddy Maternity Benefit scheme with an objective of providing assistance to pregnant women below poverty line to meet the expenses on nutritious diet, to compensate the loss of income during motherhood and to avoid LBW of new-born babies upto two

	No Anaemia	Mild Anaemia	Moderate Anaemia	Severe Anaemia	p-value (One-way-ANOVA)
Mean newborn weight (kg) in unbooked cases	2.707917	2.781739	2.755526	2.59333	<0.001
Mean newborn weight (kg) in booked cases	2.7676	2.776875	2.772442	--	0.101
p-value (Pearson's correlation)	0.436	0.002	0.001	--	-

[Table/Fig-11]: Correlation between severity of anaemia and mean newborn weight in unbooked and booked cases.
There were no cases in severe anaemia category in booked cases.

deliveries. Under this scheme, from October 2012, benefit of sum of Rs. 12,000 is being disbursed directly to beneficiary account [10]. Because of these Government schemes to provide incentive to register, to promote regular ANC check-ups and hospital based deliveries, incidence of unbooked cases have come down at least in the region of Tamil Nadu and Pondicherry, India where maternal and infant mortality rate is lower than the national rate. This was reflected in our study where incidence of unbooked cases was found to be 3.7%. This was in contrast with study from developing African country of Nigeria where this frequency was found to be 29% [2]. In the study from neighbouring Pakistan, about 11% did not receive any antenatal care where as 89% did receive antenatal care [11].

In our study, mean age in both the groups was 25 years with peak incidence seen in between 20-30 years. Similar findings were noted by Nisar et al., with mean age of 29 years in both groups and Ganesh Kumar et al., with same age range of 20-29 years in both groups [8,12]. In another study, the mean age of booked women was 25.37 (SD 6.92) and 24.54 (SD 5.38) in unbooked women. In our study, in booked cases, all women were above 20 years whereas in 30 unbooked cases, two were below 20 years in which one was having severe anaemia (Hb=4.4g/dl) and newborn birth weight was 1.6 kg. Study on factors affecting low birth weight by Ganesh Kumar et al., mentioned that pre pregnancy maternal weight (kgs) (OR=7.02), anemia in pregnancy (OR=4.37) and maternal age less than 20 years (OR=3.96) were the significant risk factors of LBW of term babies [12].

In the present study, primigravida were more in unbooked than booked cases (63.3% vs 53.3%). In contrast, the study from Nigeria noted more multipara in unbooked than booked cases (12.5% vs 5.5%; p-value is less than 0.02) [2]. Mean haemoglobin level and mean newborn birth weight did not show statistical significance in primigravida and multipara in both groups.Thus, in present study, parity did not influence anaemia and newborn weight.

Pregnancy considerably increases iron needs in a mother and her fetus [13]. In our study, in booked cases 43% showed anaemia whereas, in unbooked cases it was 83%. Another study from neighboring Asian country Pakistan showed a positive correlation between unbooked mothers and increased risks of maternal and fetal adverse outcomes. They found prevalence of anaemia was 54.8% in booked cases as compared to 65.5% in unbooked cases. Similarly, in booked group 15.7% infants were LBW babies as compared to 23.6% in unbooked group [11].

Also, a population based study from Iran showed that anaemia (Hb<10 g/dl) was associated with a higher risk of LBW in women with anaemia [13].

Another study showed anaemia in 15.3% in control group and 36% in cases group [12]. In present study, majority of the booked anaemic cases belonged to mild anaemia whereas in unbooked group majority showed moderate anaemia. In 30 unbooked cases, majority (64%) cases showed iron deficiency anaemia irrespective of severity of anaemia highlighting need of iron supplementation and dietary advice on intake of iron rich foods through antenatal services in these vulnerable groups which are not utilizing ANC services. Nisar et al., in their study concluded that intake of meat, green leafy vegetables in diet to prevent anemia was significantly associated with utilization of antenatal services with odds ratio of 1.75 and 2.49 when compared between groups which received and not received. Also in the same study, in the final multivariate model, income and knowledge were found to be significant factors affecting the utilization of antenatal services [8].

The lack of health seeking behaviour in unbooked group was found to be linked to unawareness about registering for ANC services and institutional deliveries or lack of knowledge regarding different beneficial schemes available for pregnant women. Some registered through village health workers,few received hematinic through ANMs but did not went for ANC check-ups in ANC clinics.

In India, 30-35% babies are LBW and more than half of these LBW newborns are full term babies [14]. In our study, in booked cases, LBW babies accounted for 15% whereas, in unbooked, they accounted for 56.6%, the difference was found to be statistically significant (p<0.001). Similar findings were seen in other study wherein booked group there were 15.7% LBW babies and in unbooked group, 23.6% were LBW [11].

In our study, there was no correlation found between level of haemoglobin of mother and newborn weight (p=0.654) in booked group but there was correlation between level of haemoglobin of pregnant mother and birth weight of newborn babies (p<0.001) in case of unbooked cases. Sekhavat et al., in their study noted that maternal anaemia was associated with a significantly increased risk of LBW. The minimum incidence of LBW occurs in association with a haemoglobin concentration of 10-13g/dl [13]. Another study showed that 36% of the mothers with LBW were anaemic [12]. As shown in the [Table/Fig-12], maternal anaemia in unbooked cases in our study was seen in 83% cases, which was similar to study conducted by Vijayasree M. in Telengana, India [15]. However in our study, the percentage of newborn with LBW in unbooked was much higher as compared to two other Indian studies [15,16]. Thus, these studies underline the correlation between maternal anaemia and LBW of newborn. Also, low occurrence and severity of

Study	Maternal Anaemia in Booked	Maternal Anaemia in Unbooked	LBW in New born in Booked	LBW in New born in Unbooked
Present Study	43%	83%	15%	56.6%
Vijayasree M [15]	17.6%	83%	2.52%	13%
Saxena P et al., [16]	6.1%	11.1%	27.1%	35.7%

[Table/Fig-12]: Comparison of maternal anaemia and low birth weight in newborn in booked and unbooked cases.

anaemia and less frequency of LBW in booked group in our study highlights importance of seeking timely ANC services. But still, compliance regarding regular intake of haematinics and dietary advice to reduce number of moderate anaemia cases in booked group in our study needs to be addressed through motivation by counseling to improve compliance.

LIMITATIONS

Being the hospital based cross-sectional study, whether it reflects community based bigger picture is needs to be seen through further population based study to strengthen our conclusions.

CONCLUSION

From the above observations, it is concluded that the incidence of unbooked cases in our hospital based set-up is less probably due to better coverage of antenatal services in rural population of Tamil Nadu and Pondicherry under the State and Central government sponsored schemes for maternal and child health probably due to monetary, dietary benefits offered under the scheme. This study can act as a pilot study and further study needs to be done as a population based study by doing community based survey to know the bigger picture of this issue. Similarly, though the incidence of unbooked cases is less but there is a significant correlation between anaemia and LBW in unbooked cases which needs to be addressed to reduce maternal and fetal morbidity and mortality. Also, though severity of anaemia and LBW did not show correlation in booked cases in our study indicating benefits of utilizing antenatal services by booked mothers but the issue of compliance to regular intake of hematinic needs to be addressed to reduce severity of anaemia in booked cases which is preventable cause of anaemia and in turn LBW.

Also, the lack of nutrition in expecting mothers leads to anaemia and predisposes fetus for risk of LBW. Because iron and folate deficiencies are the common causes of anemia, its supplementation (through antenatal care), and regular monitoring (by hemoglobin estimation and blood indices) can improve maternal anemia and thus, fetal outcome in the form of LBW.

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