

## EFFECT OF MATERNAL IRON DEFICIENCY ANEMIA ON PLACENTAL WEIGHT TO BIRTH WEIGHT RATIO IN TERM INFANTS

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### ABSTRACT

**Background:** A well-functioning placenta is important for fetal growth and its weight indicates whether it is functioning well or not. High and low placenta to birth weight ratio is found to have adverse fetal outcome. Placental to birth weight ratio can act as an indicator of low maternal hemoglobin concentrations in pregnancy.

**Objectives:** To determine the frequency of iron deficiency anemia in pregnant women and to compare the mean ratio of placenta to birth weight in women with iron deficiency anemia versus non-anemic women.

**Methods:** It is a descriptive, cross-sectional study conducted at department of Obstetrics & Gynecology, Ganga Ram Hospital, Lahore over a period of 6 months, from October 2019 to March 2020. A total of 93 women with singleton pregnancy of cephalic presentation, having low hemoglobin were included. Patients with multiple pregnancy, Chronic Liver Disease and Chronic Renal Failure were excluded. In all women 5 milliliters (ml.) blood sample was sent to institutional laboratory for ferritin levels and iron deficiency anemia was noted. After this, placental to birth weight ratio was measured.

**Results:** The age range of participants was from 18 to 40 years in this study, the mean of age was  $30.48 \pm 4.27$  years. Most of the patients i.e., 52 (55.91%) were multipara. In this study, the haemoglobin (Hb)  $< 9$  gm/dl and serum Ferritin level  $< 15$  ng/ml was taken as positive for iron deficiency anaemia. The frequency of iron deficiency anemia in pregnant women was found to be (43.01%). Mean ratio of placenta weight to fetal weight in women with iron deficiency anemia versus non-anemic women was found to be  $0.20 \pm 0.02$  versus  $0.20 \pm 0.01$  (p value = 0.804).

**Conclusion:** This study concluded that frequency of iron deficiency anemia in pregnant women is quite high with no significant difference of mean placenta to fetal weight ratio in women with iron deficiency anemia as compared to non-anemic women.

**Keywords:** iron deficiency anemia, pregnancy, placental to birth weight ratio.

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### INTRODUCTION

Anemia is defined as a decreased concentration of blood Hemoglobin and it affects more than 1 billion people of this world.<sup>1</sup> It is a major health issue of young and old ages with its highest prevalence

among children under five years of age and pregnant women. The World Health Organization reported that in European countries 14% of pregnant women are anemic, whereas it is as high as 51% in the African and Asian countries.<sup>2</sup> In South Asian countries maternal deaths due to complications of anemia account for half of the total maternal deaths worldwide.<sup>3</sup>

Anemia is most commonly due to Iron deficiency (ID) and it's prevalent mostly in expectant mothers. A local study has shown the overall prevalence rate

of anemia in pregnancy as 75%.<sup>4</sup> In another study, the frequency of anemia in pregnant women was calculated to be 57%.<sup>5</sup> Prevalence of anemia in women of reproductive age is 30% and in pregnant women is 40%. Maternal iron deficiency anemia results in fetal growth restriction, preterm delivery and neonatal anemia. The children of anemic mothers' show impair intelligence, slow mile stones achievement and behavioral problems.<sup>6</sup>

The placenta is sole source of oxygen and nutrition to the fetus, it's important for fetal growth that placenta should function well. In literature the average weight of a healthy placental is given as 508 g and the placenta weight and birth weight ratio is 1:6. There is a correlation between maternal hemoglobin, placental weight and infant weight at birth as given in literature. Low hemoglobin levels (6-10 g/dL) might cause placental hypertrophy during the pregnancy resulting in increased placental weight and placental/ birth weight ratio. High placenta weight is associated with a poor perinatal outcome, a low Apgar score, respiratory distress syndrome and perinatal death; whereas a low placental weight is associated with medical complications in the mother.<sup>7-9</sup>

Various maternal factors contribute to the development and functioning of a normal placenta. The women who have anemia, malnutrition or drug abuse in pregnancy can have abnormal placental weight and fetal weight.<sup>10-12</sup>

No local data was found on this topic in the literature search, so this study was formed to determine the mean placental to birth weight ratio in women with iron deficiency anemia in local population. Based on these results, public awareness can be created regarding this major public health issue among pregnant women as well as giving clinicians a guideline to reduce adverse maternal and perinatal outcomes.

## METHODS

It is a descriptive, cross-sectional study conducted at department of Obstetrics & Gynecology, Ganga Ram Hospital, Lahore over a period of 6 months, from October 2019 to March 2020.

Sample size calculated as 93 by using WHO calculator and taking level of significance as 5%, margin of error as 10% and taking iron deficiency anemia in pregnant women as 40%.

Sample technique was non-probability, consecutive sampling. All women with singleton pregnancy of cephalic presentation, gestational age between 37 to 41 weeks, age range between 18-40 years and parity 0-5 were included in the study. Females with multiple pregnancy, Patients with h/o chronic liver disease (serum bilirubin >2.0 mg/dl), women having chronic renal

disease (serum creatinine >1.5 mg/dl), asthmatic patients (assessed on history) and women with pregnancy induced hypertension and gestational diabetes mellitus were excluded from the study.

A total of 93 women presented to the labour room of Obstetrics & Gynecology, Ganga Ram Hospital, Lahore, were selected after taking the informed written consent from each woman. Approval from institutional ethical review committee was taken. In all women 5 ml blood sample was sent to institutional laboratory and iron deficiency anemia was noted if Hb <9 gm/dl and Serum Ferritin level <15ng/ml was found. After deliver, the complete placentas with membranes and umbilical cord were weighted, according to Norwegian standards. Newborn was also weighted after delivery and birth weight was recorded in grams. The placenta to birth weight ratio was calculated as placenta weight/birth weight. All the data (age, gestational age, parity, place of living, gestational diabetes mellitus, pregnancy induced hypertension, BMI, smoking, anemia (yes/no) and mean placental to birth weight ratio) was recorded on the predesigned proforma.

Data was entered and analyzed using computer program SPSS version 20.0. Age of the patients, gestational age, parity, BMI, Hemoglobin levels and placental to birth weight ratio were presented as mean and standard deviation. Anemia status (anemic/non-anemic) was presented as frequency and percentage. The mean placental to birth weight ratio was compared between anemic and non-anemic women. Independent 't' test was used and P value  $\leq 0.05$  was taken as significant.

The Chi square test was applied post stratification on effect modifiers like age, gestational age, and parity. P-value  $\leq 0.05$  was taken as significant.

## RESULTS

The age of the participants in this study was from 18 to 40 years (mean  $30.48 \pm 4.27$ ). More than half of the patients 52 (55.91%) were between 31 to 40 years of age. While 41 (44.09 %) patients were between 18-30 years as shown in Table 1.

Mean gestational age was  $38.58 \pm 1.28$  weeks. 79.57% (74) of the patients were between 37-39 weeks of gestation. 20.43% (19) of the patients were between 40-41 weeks of gestation. (Table 2).

Mean parity was  $3.15 \pm 0.99$ . 63.4 % (59) of patients had parity between 0-3 and 36.65% (34) had parity between 4-5 (Table 3)

In this study, frequency of iron deficiency anemia in pregnant women was found to be 40 (43.01%).

Mean placental to birth weight ratio in women with iron deficiency anemia versus non-anemic women was found to be  $0.20 \pm 0.02$  versus  $0.20 \pm 0.01$  (p

value = 0.804) as shown in Table 4. Stratification of iron deficiency anemia with respect to age and gestational age and parity are shown in Table 5 & 6 and 7 respectively.

Table-1: Age of the patients (n=93).

Age (in years)	No. of Patients	%Age
18-30	41	44.09
31-40	52	55.91
Total	93	100.0

Mean  $\pm$  SD = 30.48  $\pm$  4.27 years

Table-2: Gestational age of the patients (n=93).

Gestational Age (in weeks)	No. of Patients	%Age
37-39	74	79.57
40-41	19	20.43
Total	93	100.0

Mean  $\pm$  SD = 38.58  $\pm$  1.28 weeks

Table-3: Parity of the patients (n=93)

Parity	No. of Patients	%Age
0-3	59	63.44
4-5	34	36.56
Total	93	100.0

Mean  $\pm$  SD = 3.15  $\pm$  0.99

Table 4: Comparison of the mean placental to birth weight ratio in women with iron deficiency anemia versus non-anemic women.

Anemia status	placental to birth weight ratio		p-value
	Mean	SD	
Anemic	0.20	0.02	0.804
Non-anemic	0.20	0.01	

Table 5: Stratification of iron deficiency anemia with age, gestational age, parity

	Iron deficiency anemia		p-value
	Present	Absent	
Age (years)			
18-30	16	25	0.491
31-40	24	28	
GA (weeks)			
37-39	32	42	0.929
40-41	08	11	
Parity			
0-3	28	31	0.254
4-5	12	22	

## DISCUSSION

Iron deficiency anemia is the most common presenting complaint seen in pregnant women, and low maternal Hemoglobin is a causative factor of

low birth weight in their neonates. A healthy placenta is important for nutrition and oxygenation of growing fetus. Low maternal Hemoglobin concentrations seem to cause high placental weight as opposite to low fetal weight, but the evidence is conflicting. Few studies have compared effects of low and high maternal haemoglobin with placental weight.<sup>13-14</sup> If Placental weight is measured and compared to birth weight it can be used to show normal or abnormal functioning of the placenta, as adverse pregnancy outcome has been seen with both high and low placental to birth weight ratio.<sup>15-16.</sup>

This study was conducted to determine the frequency of iron deficiency anemia in pregnant women and to compare the mean placental to birth weight ratio in women with iron deficiency anemia versus non-anemic women. The age of the participants ranged from 18 to 40 years and the mean age was 30.48  $\pm$  4.27 years. More than half of the patients 52 (55.91%) were between 31 to 40 years of age. In this study, frequency of iron deficiency anemia in pregnant women was found to be 43.01%. Mean placental to birth weight ratio in women with iron deficiency anemia versus non-anemic women was found to be 0.20  $\pm$  0.02 versus 0.20  $\pm$  0.01 (p value = 0.804). In a study, mean placental to birth weight ratio was highest in pregnancies with maternal Hemoglobin (Hb) concentrations <9 g/dl (grams per deciliter) (0.203  $\pm$  0.036). Mean placental to birth weight ratio between pregnancies with Hemoglobin concentrations 9–13.5 gm/dl and >13.5 gm/dl (0.193  $\pm$  0.040) and (0.193  $\pm$  0.043), respectively.<sup>17</sup> In another study, 41.6% of antenatal women were found to have the Iron deficiency anemia. A local study has shown the overall prevalence rate of anemia in pregnancy as 75%. A large number of women, 340 found to be suffering from Iron deficiency anemia out of 403 (86.3%) in a study. Mild anemia (Hb 10-10.99 g/dl) found in 61 (15.14 %) women, moderate anemia (Hb 7- 9.9 gm/dl) was found in 228 (56.5%) women and severe anemia (Hb < 7gm/dl) in 51 (12.7%) women. Another study has shown the antenatal anemia to be present in 23.2% of women. One more study has shown the overall anemia (Hemoglobin < 11 gm/dl) in the pregnant women as 36.1% of which 58.5% were having mild, 35.7% moderate, and 5.8% severe anemic. A recent study has shown the overall prevalence of anemia using a cut off level of Hemoglobin <11 gm/dl (<33% Hematocrit) as 23.5%. Out of all anemic pregnant women about 59.7% were mildly anemic, 33.3% were moderately anemic and 7% were severely anemic.<sup>18-23.</sup>

In another local study, the prevalence of anemia was 90.5%, 75.0% of pregnant women had mild anemia

(Hb 9.0-10.9 mg/dl) and 14.8% had moderate anemia (Hb 7.0-8.9 gm/dl). Only 0.7% were severely anemic (Hb < 7.0 gm/dl). A Northern Tanzania study results showed 47.7% anemia in pregnant women with 74.5% having mild anemia, 20.9% having moderate anemia, and 4.5% severe form of anemia. In Gombe, North-Eastern Nigeria 51.8% pregnant women had anemia. Mild anemia was found in 67.4%, moderate anemia in 30.5% and severe anemia in 2.1% of study participants. A South Nigerian study among pregnant women coming for antenatal care in a mission hospital reported a prevalence of 32.3% of anemia in pregnancy at booking. It was a cross-sectional study and hematocrit of gravid women revealed anemia in 28% of the women but fortunately 94.6% were mildly anemic.<sup>24-25</sup>

Two large studies reported low Hemoglobin concentrations to be associated with high placental weight. Other studies, including less than 1000 pregnancies, suggest that low Hemoglobin concentrations are associated with low placental weight. Further, low Hemoglobin concentrations have been associated with high placental to birth weight ratio, but no association with placental to birth weight ratio have also been reported. A study done by Larsen indicated that placental weight decreased with increasing Hemoglobin. The high placental to birth weight ratio with low maternal Hb suggests differences in placental growth relative to fetal growth across maternal Hemoglobin concentrations.<sup>26-27</sup>

## CONCLUSION

This study concluded that frequency of iron deficiency anemia in pregnant women is quite high with no significant difference of mean placental to birth weight ratio in women with iron deficiency anemia versus non-anemic women. So, placental weight birth weight ratio should not be used as an indicator of adverse fetal outcome in women with Iron deficiency anemia.

## STRENGTHS OF THE STUDY

This is a study conducted on local population, on which very few studies are available.

## LIMITATIONS OF THE STUDY

The sample size is small, keeping in view the magnitude of the problem in our population.

**CONFLICTS OF INTERESTS:** None

**SOURCES OF FUNDING:** None

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#### AUTHOR'S CONTRIBUTIONS

**SIM:** Conception, Supervision, Proof reading

**SSF:** Data Collection, Data analysis

**MG:** Manuscript Writing