INTERNATIONAL JOURNAL OF MEDICAL AND APPLIED SCIENCES
E-ISSN:2320-3137

Research Article

STUDY OF PLACENTAL AND FOETAL WEIGHT RATIO IN NORMAL AND ANAEMIC INDIAN PREGNANT WOMEN.

SWAPNA SORTE PARATE*, J. V. DESHPANDE, MP PARCHAND, BHUPESH G. PARATE

1. ASSISTANT PROFESSOR. DEPT OF ANATOMY. D. Y. PATIL MEDICAL COLLEGE, NERUL, NAVI MUMBAI.

2. PROFESSOR AND HOD. DEPT OF ANATOMY. FATHIMA INSTT. OF MEDICAL SCIENCES, KADAPA.

3. PROFESSOR AND HOD. DEPT OF ANATOMY. IGMC NAGPUR.

4. ASSISTANT PROFESSOR. DEPT OF ANAESTHESIA. D. Y. PATIL MEDICAL COLLEGE, NERUL, NAVI MUMBAI.

Corresponding Author: DR SWAPNA PARATE.D-120, RAGHUNATH VIHAR, SECTOR 14, KHARGHAR, NAVI MUMBAI 410210

ABSTRACT

The aim of my study was to compare the placental- foetal weight ratio in Non anaemic pregnancies (control group) and Anaemic pregnancies (Study group). Both groups were compared for same parameters attempt correlation between grading of anaemia with placental abnormalities and foetal outcome. The material consisted of 280 term placentae collected after the normal delivery or caecarian section of women. Anaemic pregnancies which were diagnosed as nutritional anaemia (iron deficiency anaemia most common). This study group included 140 cases. This requires haematological examination which includes estimation of 1) Haemoglobin 2) Total red blood cell count (in severe anaemia) and 3) Peripheral blood smear.

Normal uncomplicated pregnancies as control group included 140 cases. After examination of placenta, Birth weight of babies, placental weight, placental foetal weight ratio in different grades of anaemia compared with control by ANOVA Test i.e. Analysis of Variance. Multiple comparisons done by Bonferroni's test. Categorical data was analysed by chi square statistics. $P < 0.05$ was considered as statistical significance. In the present study, 1) the mean birth weight of baby in CONTROL group is measured as 2605.36 366.67gm and the mean birth weight of baby in STUDY group is measured as 2285.71 389.53 gm. 2) In CONTROL group the mean placental weight is found to be 409.64 52.39 gm and in study group measured as 482.43 111.04 gm. 3) The mean placental foetal weight ratio in non anaemic pregnancy was found to be 0.16 0.015 and in anaemic pregnancies as 0.21 0.03 and it is increased according to severity of anaemia. Foetus of the women having nutritional deficiency anaemia weighed less than that of the non anaemic women and birth weight of baby decreases as per severity of anaemia.

KEY WORDS: Placenta, morphometry of placenta, foeto¬- placental ratio, placental coefficient.

INTRODUCTION

The placenta is an amazing, unique organ. It grows with the baby from the very first cell divisions, so it can begin its important work of providing nourishment as soon as possible. It is the direct physical link between the mother and child, and as such, may even provide comfort to the baby.

Placenta', the term was derived from Greek word 'Plakuos' meaning 'Flat cake' was coined for the first time by **'Realdus Columbus'** in 1559 [1]. As per the meaning of the word, it is

circular, discoid organ, the growth of which is directly influenced by the maternal health conditions and accordingly it affects the intra-uterine status of the foetus.

The placenta and baby grow together, entwined and connected in the womb. It is a structure where maternal and foetal tissues come in direct contact without rejection, suggesting immunological acceptance of foetal graft by the mother. It is a vital organ for maintaining pregnancy and for promoting normal foetal development.

Iron deficiency is thought to be the most common cause of anaemia globally, but other nutritional deficiency (including folate, vitamin B12 and vitamin A), acute and chronic inflammation, parasitic infestation and inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival can cause anaemia According to standard laid down by WHO, anaemia in pregnancy is present when the haemoglobin concentration in the peripheral blood is 11gm/100ml or less [2]. The World Health Organization (WHO) has estimated that prevalence of anaemia in developed and developing countries in pregnant women is 14 per cent in developed and 51 per cent in developing countries and 65-75 percent in India [3].

During pregnancy plasma volume expands (maximum around 32weeks) resulting in haemoglobin dilution resulting in physiological anaemia of pregnancy. For this reason, haemoglobin level below 10 gm/dl at any time during pregnancy is considered as anaemia in developing countries [WHO and US Center for Disease Control (CDC)]. Hemoglobin level at or below 9gm/dl requires detail investigations and appropriate treatment [2].

Anaemia is a widely prevalent condition in India, especially in women of child-bearing age. Surveys carried out in different parts of India indicate that, more than 50% women have nutritional anaemia in later months of pregnancy **[4]**.

Nutritional deficiency is most common cause of anaemia of pregnancy in India. Among them iron deficiency anaemia is commonest. Anaemia during pregnancy not only increases maternal morbidity but also foetal morbidity. The maternal anaemia adversely affects the growth of the placenta. These placental abnormalities ultimately result in reduction of birth weight of baby. Therefore it is our humble attempt to correlate and compare the placentae of normal and anaemic pregnancies in the respect of birth weight of baby and weight of placenta and placental- foetal weight ratio.

Material and Method

The material consisted of 280 term placenta collected from the labour room and operation theatre of the department of obstetrics and gynaecology, Govt. Medical College and Hospital Nagpur, India, over the period of three years**.**

All placentae were included in the study, all from the full term deliveries (38-42 weeks of gestation) because placental weight approach term values at an earlier stage of gestation than do birth weight, it follows that the ratio of placental weight to birth weight increases with increasing degree of fetal immaturity.

All cases were divided into two main groups.

CONTROL GROUP (Group 1):

Non anaemic pregnant cases were taken as control group and their respective placentae. This group included 140 cases.

STUDY GROUP (Group 2):

Anaemic pregnancies which were diagnosed as nutritional anaemia (iron deficiency anaemia most common). This group included 140 cases. This requires haematological examination which includes estimation of

1) Haemoglobin
2) Total red blood cell count (in severe anaemia) and
3) Peripheral blood smear.

Arbitrary grading of anaemia was done according to the level of haemoglobin. **Dutta D.C.[5]**

1) Severe : less than 7 gm/dl
2) Moderate : less than 8 to 7 gm/dl
3) Mild : between 8 to 10 gm/dl

Inclusion criteria for the control Group:

The cases with hemoglobin level of 10 gm/dl or above at delivery and preferably throughout the pregnancy. Therefore it was taken as the sole criterion for inclusion in the control series.

Inclusion criteria for the study Group

The cases having hemoglobin level below 10gm /dl, one or more occasions before delivery.

The study group included both booked & non- booked patients who presented for the first time in labour and also patients in whom anaemia had been detected and treated early in pregnancy

Exclusion criteria for both study and control group

1. Patients with ante partum hemorrhage
2. Multiple pregnancy
3. Preterm delivery
4. Toxaemia of pregnancy

Instruments used for the study:

1. Weighing machine for weighing placenta and foetus (fig no. 1).
2. Forceps to remove the membranes.
3. White enamal tray.
4. Magnifying lens.

METHOD:

The placentae with cord and membranes were collected immediately after delivery from the labour rooms or an operation theatre. Abnormalities of the cord and membrane were noted. In all the cases, the amnion and chorion were trimmed from the placenta. The umbilical cord was cut at a distance of 5 cm from the site of insertion. Foetal blood were allowed to drain out from the cord and adherent blood clots were removed from maternal surface of placenta.

Then, the placentae were washed in running tap water, dried with the help of blotting paper weighed in the weighing machine. The weights of the placentae were noted in grams.

The maternal surface of the placenta was observed by placing the placenta on the dorsum of the hand and number of cotyledons was measured and whether any abnormality in the form of infarction and fibrosis were examined on the both surfaces by magnifying lens. Then the attachment of the umbilical cord to the foetal surface was noted, whether it is central or marginal. Also both surfaces were examined for presence of foci of infarction.

After examination of placenta, birth weight of the newborn baby was measured and compare with placental weight

All these values were noted in the control group as well as in the study group and the comparison between the two groups was done.

Statistical Analysis: Continuous variables were presented as mean± standard deviation. Categorical variables were expressed in percentages. Birth weight of babies, placental weight, placental foetal weight ratio in different grades of anaemia compared with control by ANOVA Test i.e. Analysis of Variance. Multiple comparisons done by Bonferroni's test. Categorical data was analysed by chi square statistics. $P < 0.05$ was considered as statistical significance. Data was analysed on statistical software STATA version 10.0.

RESULTS

The present study was carried out with a view to study the placental changes in pregnancy anaemia and to correlate foetal outcome with various parameters of the placenta and the maternal profile.

The cases were divided into two groups

Control group: Non-anaemic pregnant women and respective placentae (n=140).

Study group: Pregnant cases diagnosed as nutritional anaemia, and respective placentae (n=140).

Table No1: **Number of patients studied according to haemoglobin level (gm/dl) in two groups**

	Haemoglobin level Gm/dl	Number of patients
CONTROL	More than 10	140
STUDY		
Mild Anaemia	Between 8 to 10	95(67.86%)
Moderate Anaemia	7 to less than 8	26(18.57%)
Severe Anaemia	Less than 7	19(13.57%)

From the above table, it is clear that out of 140 patients of nutritional anaemia,

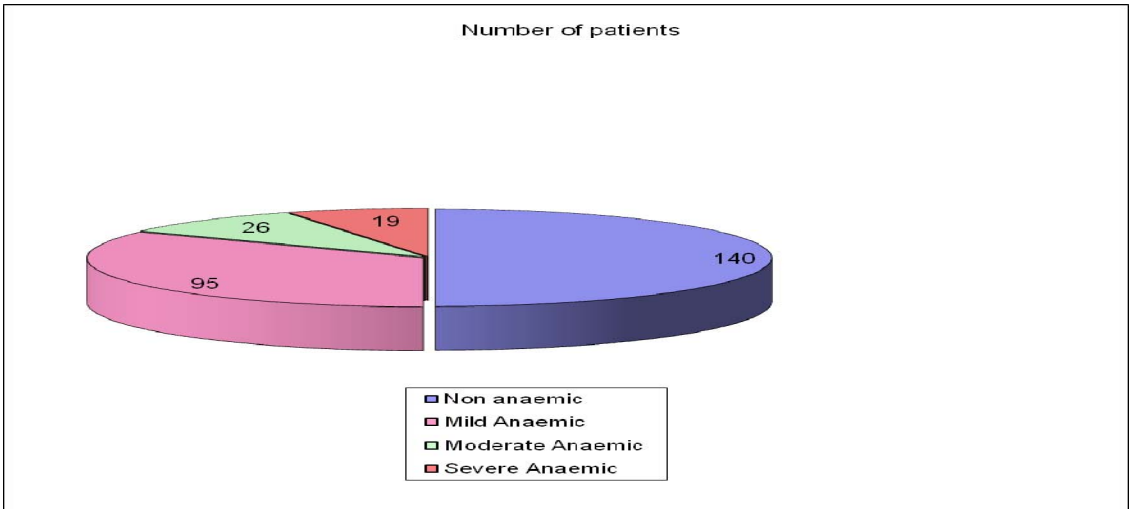
95 patients (i.e., 67.86%) have mild anaemia,

26 patients (i.e., 18.57%) have moderate anaemia and

19 patients (i.e., 13.57%) have severe anaemia.

As shown in pie diagram 1.

The mean haemoglobin level for the control group is 10.81 ± 0.43 and study group is 8.06 ± 0.99. The difference is found to be highly significant in between two groups ($p<0.001$).



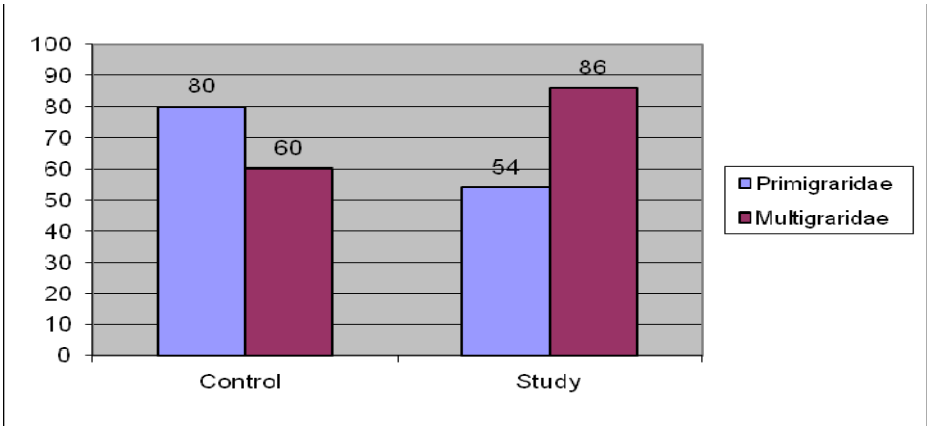
Graph 1 pie diagram

Table No. 2: Distribution of patients according to gravidity (n=280)

Parity	Control Group	Study Group	
Primi gravidae	80 (57.14%)	54 (38.57%)	Pearson chi^2 = 9.67 d.f. = 1 p = 0.002,S*
Multi gravidae	60 (42.86%)	86 (61.43%)	
Total	140	140	

*S- Significant (p<0.05).

Above table shows that out of 140 cases of anaemic pregnancy, 54 cases (i.e., 38.57%) are primigravidae (carrying first pregnancy) while 86 mothers (i.e., 61.43%) are multigravidae (second or more pregnancy), as shown in graph 2. Thus above table suggests that "maternal anaemia is more common in multigravidae than primigravidae".



graph 2

Table No. 3: Study of birth weight and placental weight

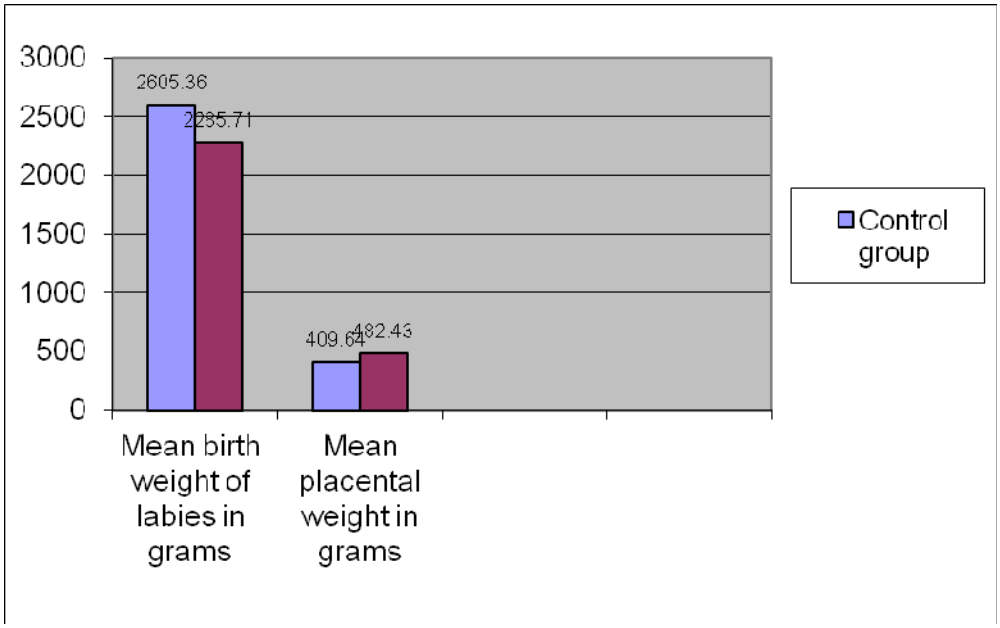
	Control (n = 140)	Study (n = 140)	p value
Mean birth weight of babies in grams	2605.36 ± 366.67	2285.71 ± 389.53	p = 0.0000, *HS
Mean placental weight in grams	409.64 ± 52.39	482.43 ± 111.04	p = 0.0000, *HS

*HS – Highly Significant (p <0.001)

Above table shows that mean birth weight of babies in control group is 2605.36± 366.67 while in Study group are 2285.71± 389.53. Mean placental weight in control and study group 409.64 ± 52.39, 482.43 ±111.04 respectively, as shown in graph 3.

Out of the 140 cases of anaemic pregnancies, 11 cases were delivered as stillbirths with babies having weights ranging between 1000gms to 1700 gms. Thus, it is noted that in anaemic pregnancies, mean birth weight of babies is lower than in control group. Mean birth weight of babies between two groups differs and the difference is highly significant (p=0.0000).

Mean placental weight in the two groups differs and the difference is highly significant (p=0.0000).



graph 3

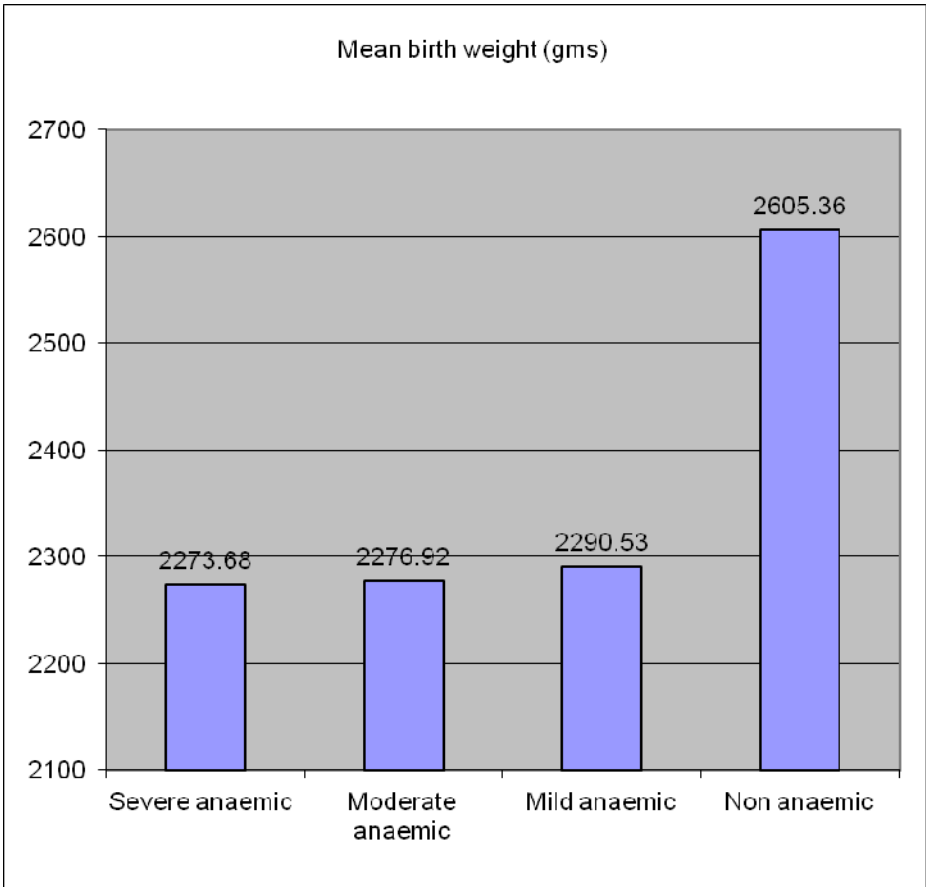
Table No. 4: Birth weight of babies according to Haemoglobin level in gm/dl

Haemoglobin (gm/dl)	Number of patients	Mean birth weight of baby (gms)
Severe-anaemic (<7)	19	2273.68 ± 651.36
Moderate-anaemic (7-<8)	26	2276.92 ± 433.87
Mild-anaemic (8-10)	95	2290.53 ± 304.95
Non-anaemic (>10)	140	2605.36 ± 366.67
ANOVA, F = 13.80, p = 0.0000 *		
Multiple comparison by Bonferroni test. Severe Vs Non-anaemic p = 0.004** Moderate Vs Non-anaemic p = 0.001** Mild Vs Non-anaemic P = 0.0000*		
Correlation coefficient, r = 0.1347, p = 0.1127***		

*HS- Highly Significant (p< 0.001)
**S- Significant (p<0.05)
***NS –Not Significant (P>0.05)

ANOVA test is applied. Analysis is made between mean birth weight of babies in different grades of anaemic (mild, moderate and severe) pregnancies with non-anaemic pregnancies (control group) & mean birth weight values presented in graph 4 and difference found to be highly significant (p=0.0000).

Correlation coefficient revealed that positive correlation in haemoglobin level and birth weight of babies (r=0.1347) and it is statistically found to be not significant (p>0.05).



graph 4

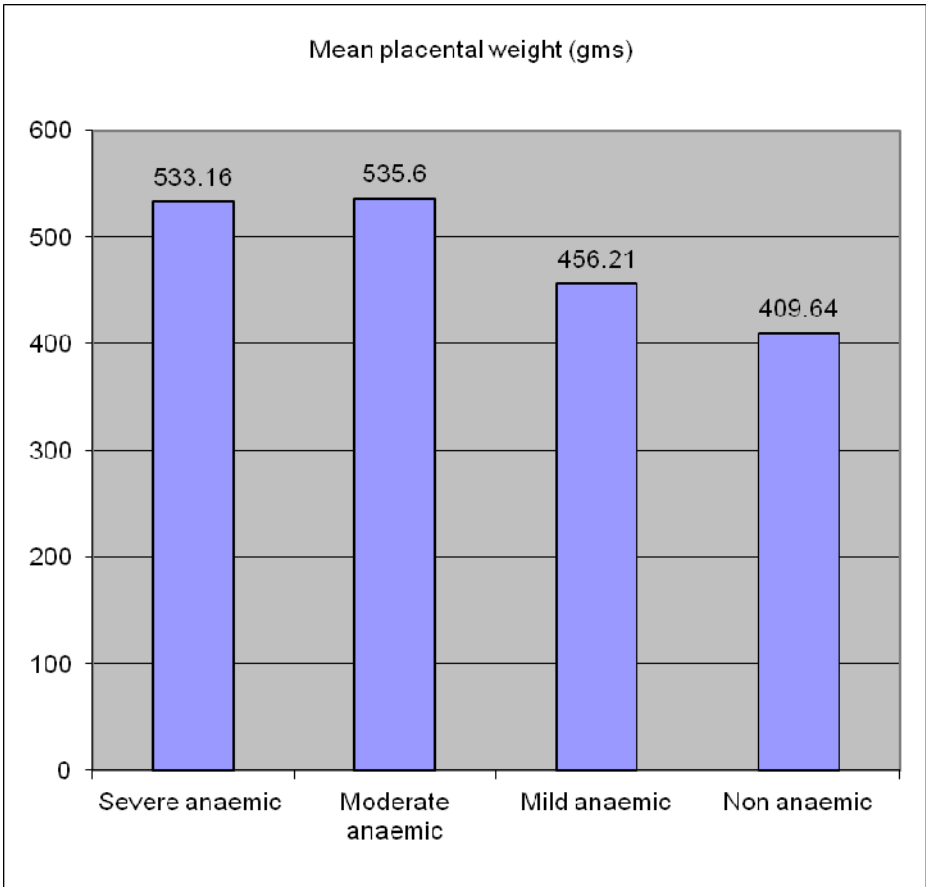
Table No 5 Placental weight in gram according to Haemoglobin level in gm/dl

Haemoglobin (gm/dl)	Number of patients	Mean placental weight (gms)
Severe-anaemic (<7)	19	533.16 ± 193.36
Moderate-anaemic (7-<8)	26	535.6 ± 110.76
Mild-anaemic (8-10)	95	456.21 ± 71.61
Non-anaemic (>10)	140	409.64 ± 52.39
ANOVA, F = 28.40, p = 0.0000 *HS		
Multiple comparison by Bonferroni test. Severe Vs Non-anaemic P = 0.0000 *HS Moderate Vs Non-anaemic P = 0.0000 *HS Mild Vs Non-anaemic P = 0.0000 *HS		
Correlation coefficient, r = - 0.2556, p = 0.0023 **S		

*HS- highly significant (p<0.001)
**S- Significant (p<0.05)

ANOVA test is applied. Analysis is made between mean placental weight in mild, moderate and severe anaemic patients with non anaemic patients (control group) & mean placental weight values presented in graph 5. The difference found to be highly significant.(p=0.0000)

Correlation coefficient shows negative correlation in haemoglobin level and weight of placenta (r=-0.2556) and it is statistically significant (p=0.0023, significant p<0.05).



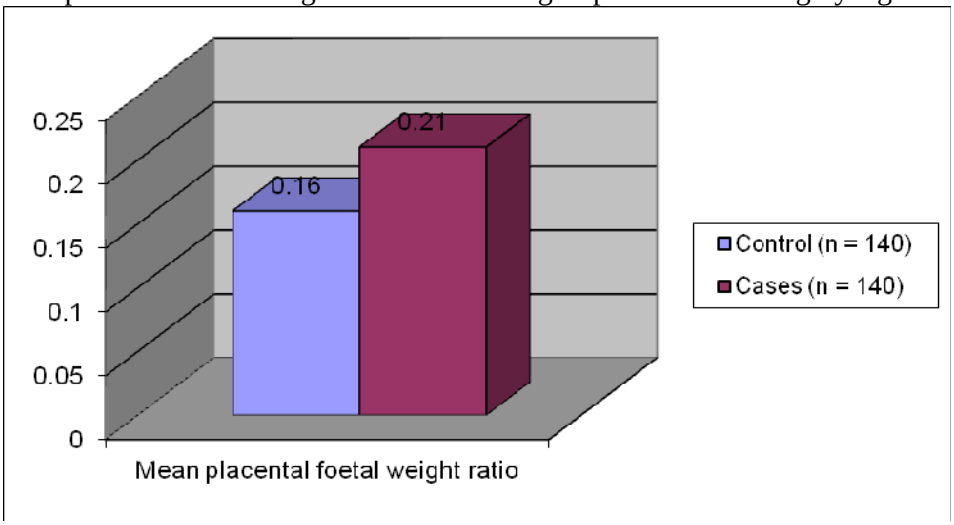
graph 5

Table No. 6: Mean placental foetal weight ratio

Control Group (n = 140)	Study Group (n = 140)	p value And significance
0.16 ± 0.015	0.21± 0.03	p = 0.0000 HS*

*HS- highly significant (p<0.001)

As per above table, on calculation of placental foetal weight ratio, it is observed that the mean placental foetal weight ratio in control group is 0.16±0.015 and in anaemic group is 0.21±0.03. Mean placental foetal weight ratio in the two groups found to be highly significant (p=0.0000).



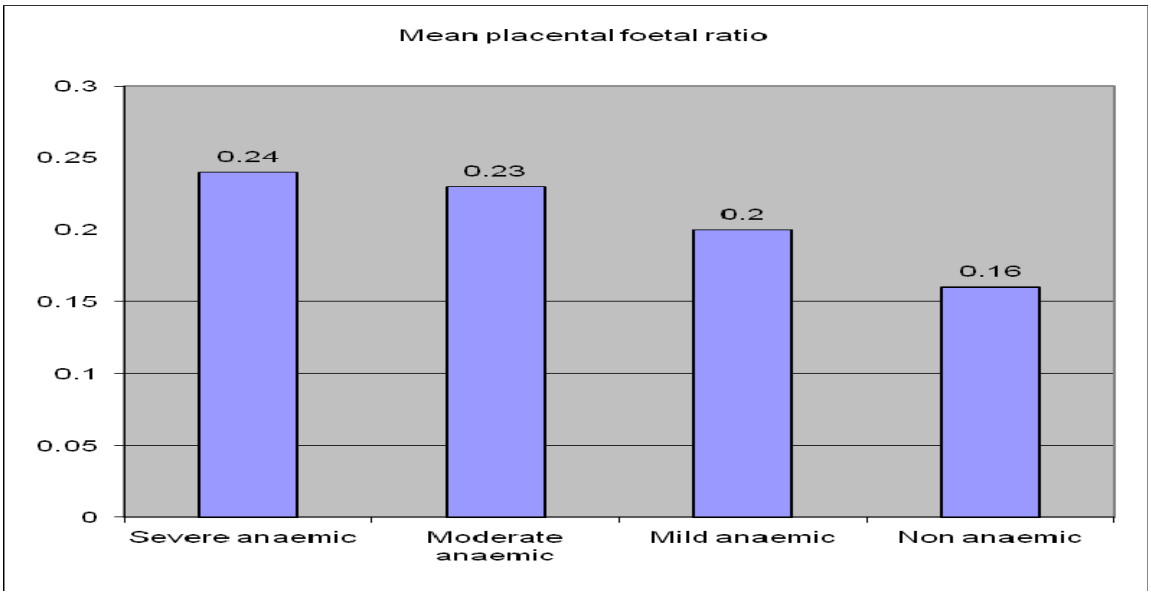
graph 6

Table No. 7
Placental foetal weight ratio according to Haemoglobin level in gm/dl

Haemoglobin (gm/dl)	Number of patients	Mean placental foetal weight ratio
Severe-anaemic (<7)	19	0.24 ± 0.03
Moderate-anaemic (7-<8)	26	0.23 ± 0.02
Mild-anaemic (8-10)	95	0.20 ± 0.02
Non-anaemic (>10)	140	0.16 ± 0.015
ANOVA, F = 153.91, p = 0.0000*HS		
Multiple comparison by Bonferroni test. Severe Vs Non-anaemic p = 0.0000 *HS Moderate Vs Non-anaemic p = 0.0000 *HS Mild Vs Non-anaemic P = 0.0000 *HS		
Correlation coefficient, r = - 0.5476, p = 0.0000*HS		

*HS- Highly Significant (p<0.001)

ANOVA test is applied. Analysis is made between mean placental foetal weight ratio in mild, moderate and severe anaemic patients and non-anaemic patients (control group) and mean placental foetal weight ratio values presented in graph 7. The difference found to be highly significant (p=0.0000). Correlation coefficient shows negative correlation in haemoglobin level and placental foetal weight ratio (r=-0.5476) and it is statistically highly significant
(p<0.001).



graph 7

Full term placenta in severe anaemia weighing 700gm is shown in figure number 3.

Fig. No.1: Full term placenta of non-anaemic mother with membranes and cord showing foetal surface

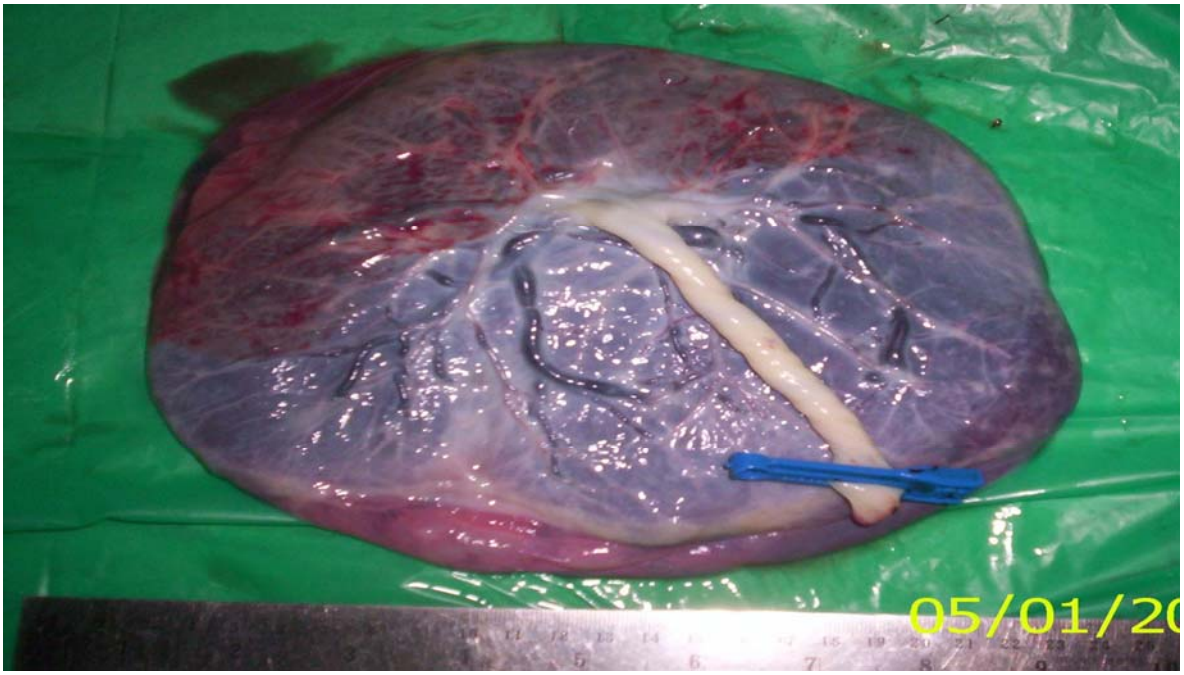


Fig. No.2: Full term placenta of anaemic mother with membrane and cord showing large size.

Fig. No.3: Full term placenta of anaemic mother weighing 700 gm.

DISCUSSION

In present study, out of 280 cases, 140 cases have been included in control group (non anaemic pregnancies) and 140 cases in study group (anaemic pregnancies), including full term pregnancies.

Study group consist of anaemic pregnancy having nutritional deficiency anaemia

Birth weight of baby

In the present study, the mean birth weight of baby in CONTROL group is measured as 2605.36 ± 366.67gm

Little W. A. (1960) in his study recorded the mean foetal weight in normal term pregnancy as 3,169±547 gm [6].

Beischer et al (1970) who recorded the average birth weight in non-anaemic Indian women as 2570gm [7].

Agboola A. (1975) recorded it as 3202.4 ±437.0gm [8].

Singla et al (1978) found it as 2,939±278gm [9].

Teasdale Francois (1980) who measured it as 3315± 244 gm [10].

A first finding in the present study has been the demonstration that the Indian newborn infants, regardless of sex or number of gestation, show a lesser weight than those from western countries. This could be attributed partly to the fact that, as we have seen, the weights and heights of the Indian mothers were less than those of the western mothers. Another factor worth mentioning relates to the socioeconomic levels.

In the present study, the mean birth weight of baby in STUDY group is measured as 2285.71±389.53 gm.

The mean birth weight in anaemic pregnancies according to **Beischer et al (1970)** as 2469 gm [7].

According to **Agboola A. (1975)** was found to be 3107.7 ± 381.3gm [8].

Mean birth weight of newborn baby in the present study is decreased in anaemic pregnancies; these findings are similar to above authors studies.

The possible cause behind decrease in birth weight can be nutritional deficiency in mothers and may be because of hypoxia. Here it is interesting to point out the work of **Naeye (1966)**, who has shown that mice kept in a hypoxic environment show a marked retardation in development [11].

.

Placental weight

Adair and Theelander (**1925)** found average weight of normal term placenta as 473 gm [12],

Little W. A. (1960) recorded it as 448 ± 93gm [6].

In the present study, in CONTROL group the mean placental weight is found to be 409.64± 52.39 gm and in study group measured as 482.43 ± 111.04 gm. Our finding are not in agreement with the finding of **Dhall U. (1994)** ,found placental weight 454.01± 90.93 gm in control group and 436.81± 88.12 gm in anaemic group[13].

Singla et al (1978) recorded mean placental weight of normal term pregnancy as 402 ± 81gm as compared to 69 anaemic mothers with haemoglobin concentration ranging from <6gm to 11gm/dl reported that placental weight was lower in anaemic mothers [9]. So that, the finding of present study is not similar to this study.

But **Beischer et al (1970)** measured the average placental weight in non anaemic Indian women as 476gm and in 199 placentae from anaemic Indian women was found to be 521 gm [7].

Agboola A. (1975) noticed the mean placental weight of normal term placenta as 507.5 ± 75.6gm and in 25 anaemic placentae recorded it as 563.0± 102.5gm [8]. **Lao T.T. & Wong W.M. (1997)** have done retrospective study in 232 mothers with iron deficiency anaemia and 279 non anaemic mothers as controls. The iron deficiency group had higher placental weight (p=0.001) [14]. Similar observation at high altitudes by **Kruger & Arias- Stella (1970)**, suggested that placental hypoxia was possibly responsible for this hypertrophy [15].

A similar trend has found in present study as per above authors. The possible explanation can be hypoxia due to anemia and compensatory increase in blood flow which leads to increase in placental weight.

Placental Foetal weight ratio (Placental coefficient)

In the present study, the mean placental foetal weight ratio in the non anaemic pregnancies is found as 0.16 ± 0.015 and in an anaemic group measured as 0.21± 0.03.

Little W.A. (1960) recorded the placental coefficients in normal term pregnancies as 0.142 ± 0.028 [6] and **Singla et al (1978)** found as 0.14 ± 0.02 [9].

Beischer et al (1970) in Indian series recorded average placental birth-weight coefficient in non-anaemic pregnancies as 0.18 and in anaemic pregnancies as 0.21 [7]. While **Agboola A. (1975)** found it in control group as 0.158 and in anaemic group as 0.181 [8]. Thus, the mean placental foetal weight ratio was higher in an anaemic group than the control group.

Thus, placental foetal weight ratio is higher in the anaemic group than the control group which is in conformity with the finding of above authors.

Conclusion

Thus, from results of the present study, it can be concluded that:-

1. Nutritional deficiency anaemia is more commonly observed in multigravidae than in primigravidae, but there is no specific age group associated with the disease.
2. Foetus of the women having nutritional deficiency anaemia weighed less than that of the non anaemic women and birth weight of baby decreases as per severity of anaemia.
3. Placental weight in anaemic pregnancies is weighed more than that of non-anaemic pregnancies and it is increased as per severity of anaemia.
4. Placental-foetal weight ratio is more in the anaemic groups than the non anaemic group and it is also increased along with severity of anaemia.

REFERRENCES

[1] Boyd and Hamilton. The human placenta. Cambridge, England, W. Heffer & Sons; 1970.
[2] Assessing the iron status of populations: report of a joint World Health Organization/ Centers for Disease Control and Prevention technical consultation on the assessment of iron status at the population level, 2nd ed., Geneva, World Health Organization, 2007.
[3] DeMayer EM, Tegman A. Prevalence of anaemia in the World.*World Health Organ Qlty* 1998; *38* : 302-16.
[4] Das k. and Thomas M.(1993). Anaemia associated with pregnancy. Jr. Assoc. Physicians India, (Supple), 2; 31-36.
[5] Dutta D. C. Textbook of Obstetrics including perinatology and contraception, 6th ed., 2004.
[6] Little W. A. (1960). The significance of placental/ fetal weight ratios.Am. J. Obst. and Gynec;79(1): 134-137.
[7] Beischer N. A., Sivasamboo R., Vohra S., Silpisornkosal S. and Reid S. (1970). Placental hypertrophy in severe pregnancy anaemia. The Jr of Obstetric and Gynaecology The British Commonwealth. 77;398-409.
[8] Agboola A., (1975). Placental changes in patients with a low haematocrit. The British J. of Obst. and Gynec.82;225-227.
[9] Singla P. N., Chand S., Khanna S. and Agarwal K. N. (1978). Effect of maternal anaemia on the placenta and newborn infant.Acta Paediatr Scand; 67(5): 645-648.

[10] Teasdale Francois. Gestational changes in the functional structure of the human placenta in relation to foetal growth. A morphometric study. Am J. obstetric and Gynaecology, 1980 :137: 560-568.
[11] Naeye R. L.:Lab. Invest . 15:700, 1966
[12] Adair F. L. and Theelander H. (1925). A study of weight and dimensions of the human placenta in its relation to the weight of the newborn infant. Am. J. Obst. and Gyn.10; 172-205..
[13] Dhall U (1994). Histological changes in placenta in anaemia: a quantitative study. J. of the Anat. Soc. of India 43(1); 21-26.
[14] Lao T. T. and Wong W. M. (1997). Placental ratio: its relationship with mild maternal anaemia. Placenta; vol 18 :593-596.
[15] Kruger. H. and Arias- Stella J. (1970). The placenta and the newborn infant at high altitudes. Am. J. Obstetrics and Gynaecology. ;106(4) :586-591.