

## Placental Weight Fetal Weight and Fetoplacental Weight Ratio in Normotensive and Hypertensive Pregnancies

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### Abstract

Placenta develops and grows till 37th week of pregnancy. Any insult during its development such as PIH, a disease unique to pregnancy not only affects maternal health but also affects the placental development which in turn jeopardizes the fetal normalcy. Present study was carried out to know the effect of PIH on placental weight, fetal weight and fetoplacental weight ratio. A total of 100 placentae of which 50 placentae of normotensive (control group) and 50 placentae of hypertensive pregnancy (PIH group) were collected fresh from either the delivery room or operation theatre. Placentae were washed, dried and weighed. Fetus were also weighed on the same weighing machine. Fetoplacental weight ratio was calculated. It was found that the weight of placenta and weight of fetus were significantly decreased in PIH group as compared to control group. The mean Placental weight was found to be 439.8 grams in control group and 378.6 gram in PIH group. Fetal weight was also decreased significantly. The mean fetal weight in control group was 2677.6 grams and 2112.2 grams in PIH group. The study showed linear correlation between fetal weight and placental weight in control group and there was significant decrease in fetoplacental weight ratio in PIH group.

**Keywords:** Placental Weight; Fetal Weight; Fetoplacental Weight Ratio; Pregnancy Induced Hypertension (PIH).

### Introduction

Fetus is totally dependent on the Placenta for its nutrition and respiratory support hence a balance between fetus placenta and mother is required for the proper growth and development of fetus. Placenta not only determines fetal growth and well being but also an important factor in determining the health of the fetus in adulthood. Hence appropriate growth and development of the placenta is essential [1]. Placenta grows till 37th week of pregnancy and its morphology varies considerably during this short period.

A term placenta is discoid, its diameter 15 to 20 cms (6-8 inches) Thickness 2.5 to 3 cms at centre, and

weight is 500 to 600 grams.

The inability of placenta to transport nutrients to the fetus or small placenta may affect the wellbeing of fetus or can limit the intra uterine fetal growth [2]. As low weight of placenta is unable to meet fetal growth requirements.

Instead of considering it a waste and throwing it away placenta should be considered very important organ as it can give us an idea about the fetal journey. Placental weight is also very important parameter as several studies have shown the correlation between placental weight and future chronic diseases notably diabetes and hypertension [3].

Not only placenta but condition of mother during pregnancy also affects fetal growth and development. Pregnancy complications such as hypertension or gestational diabetes invariably causes structural changes in the placenta. It has been recorded that the maternal utero placental blood flow is decreased in pre-eclampsia because there is maternal vasospasm [4] the origin of Pre eclampsia, a disease unique to pregnancy is still matter of debate and numerous theories have been proposed.

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Preeclampsia develops after a partial disorder in the process of placental formation perhaps due to deficiency of trophoblastic invasion by its spiral arteries and acute atherosclerosis in its myometrial segments [5].

Present study is carried out to study how the PIH, a disease unique to pregnancy affects placenta, particularly to its weight which in turn affects fetal well being and Feto placental weight ratio which has become an important indicator to predict the future sufferings of fetus.

### Material and Methods

This was a prospective study carried out in our institute. Placentae were obtained from the department of Obstetrics and Gynecology where the mothers were delivered normally or by cesarean section in the labour room or in the operation theatre. A total of 100 placentae were collected in two groups.

#### Group I

This group included 50 placentae. These were collected from the mothers who had normal full term pregnancy, not suffering from PIH (Blood pressure was <140/90 mm Hg without edema or proteinuria), blood coagulopathies, respiratory or cardiac diseases or any other disease which can affect the blood pressure of mother or fetal outcome in any way. This group was labelled as control group/normotensive group.

#### Group II

This group consisted of the cases with blood pressure of 140/90 or above with edema or proteinuria or both. Some cases also had eclamptic fits with symptoms like blurring of vision, headache,

upper abdominal pain or oliguria. None of the cases had hypertension prior to pregnancy. A total of 50 placentae were collected in this group, and labelled as PIH group Hypertensive group.

#### Collection of Placentae

Placentae were collected immediately after the delivery. Blood was allowed to drain out by keeping it flat on a tray. Then it was washed under running tap water and dried with blotting paper. Umbilical cord was cut 5 cm away from its insertion.

1. Weight of placenta along with the membranes and 5 cm of cord was recorded on the scientific weighing machine.
2. Fetal surface and the membranes were examined for their glossiness, translucency and colour.

#### Fetal Weight

The weight of baby was measured in grams on the same weighing machine on which the placental weight was recorded. A note was made about congenital anomalies if any. Feto placental weight ratio was calculated in both the normotensive and hypertensive group.

### Results/Observations

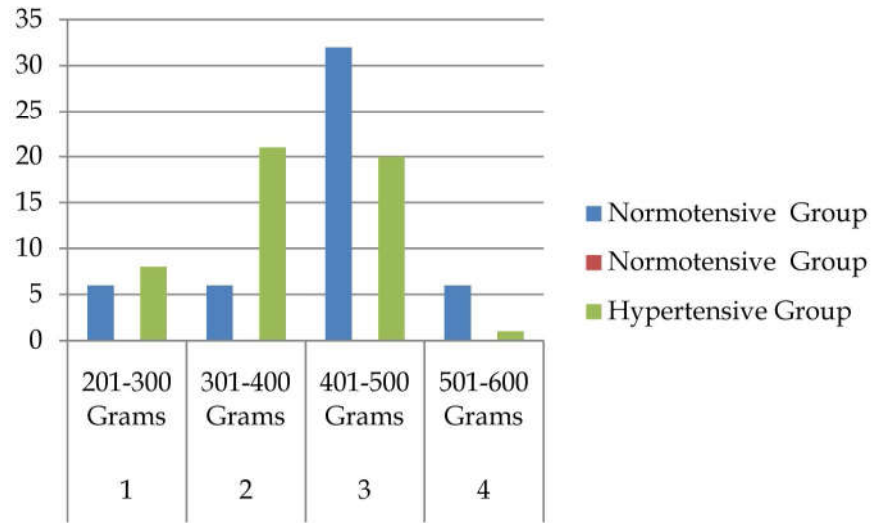
The mean Placental weight in Hypertensive group was 387.6 gms. ± 79.73 gms as compared to 439.8 gms ± 78.75 gms in Normotensive group. In PIH the weight of Placenta was found to be less as compared to normotensive group. Values less than 250 grams were found in Hypertensive group only. The difference in the weight of Placenta in both the groups was found to be statistically significant (P value < 0.05).

Table 1: Weight of placenta

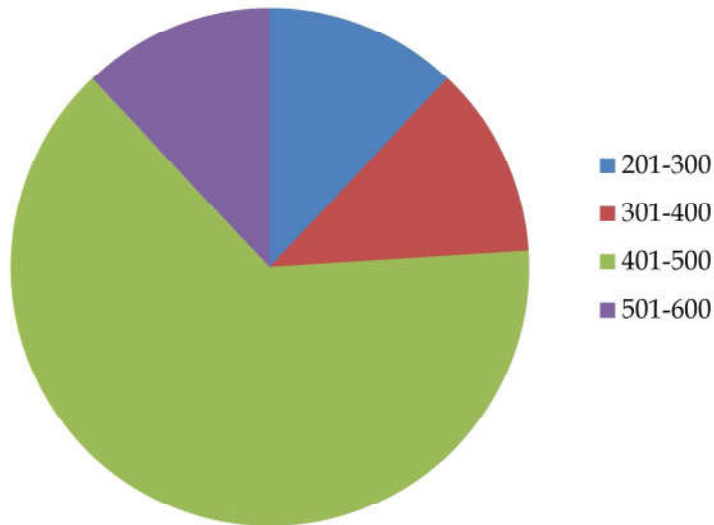
Sr. No.	Weight in GMS.	No. of Cases			
		Normotensive group	%	Hypertensive group	%
1	201-300	6	12%	8	16%
2	301-400	6	12%	21	42%
3	401-500	32	64%	20	40%
4	501-600	6	12%	1	2%

Table 2:

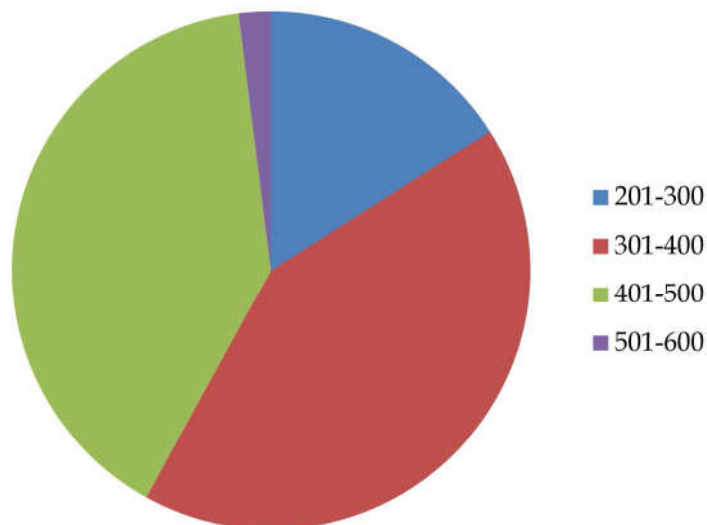
	Normotensive Group	Hypertensive Group
Mean Placental weight	439.8 gms	387.6 gms.
Max. Placental weight	570 gms.	510 gms.
Min. Placental weight	250 gms.	210 gms.
S.D.	78.75	79.73
Coe. of variation	18.23	20.57



Bar Diagram 1: Weight of Placenta



Pie Chart 1: Weight of Placenta (in grams) in Normotensive Group



Pie Chart 2: Weight of Placenta (in grams) in Hypertensive Group.

*Fetal Weight*

Present study showed that there was a significant decrease in the Fetal weight in Hypertensive group as compared to Normotensive group. The mean foetal weight in Hypertensive group was 2112.2 gms.  $\pm$  511.23 gms. as compared to 2677.6 gms.

$\pm$  520.6 in Normotensive group.

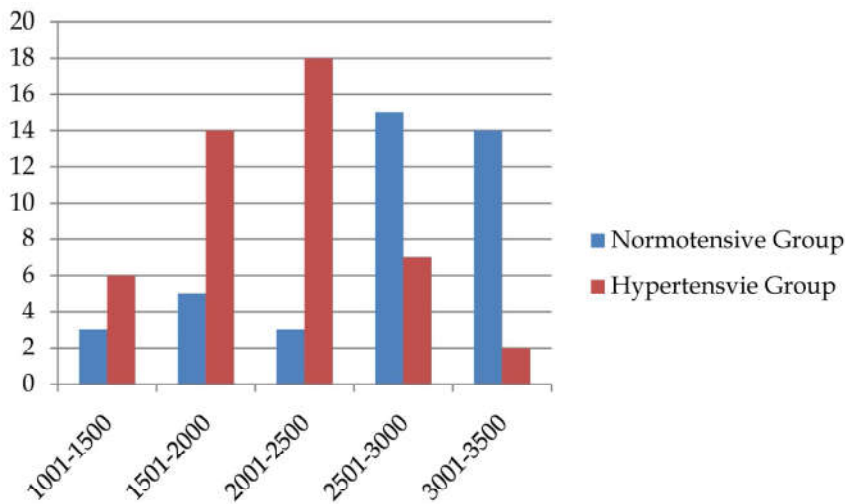
Moreover the foetal weight showed more variability in Hypertensive group.(Coe.of Variation = 24.20) as compared to Normotensive group (Coe. of variation = 19.44).

**Table 3:** Showing Fetal Weight

Sr. No.	Weight in GMS.	No. of cases			
		Normotensive group	%	Hypertensive group	%
1	1001-1500 gms.	3	6%	6	12%
2	1501-2000 gms.	5	10%	17	34%
3	2001-2500 gms.	3	6%	18	36%
4	2501-3000 gms.	15	30%	7	14%
5	3001-3500 gms.	14	28%	2	4%

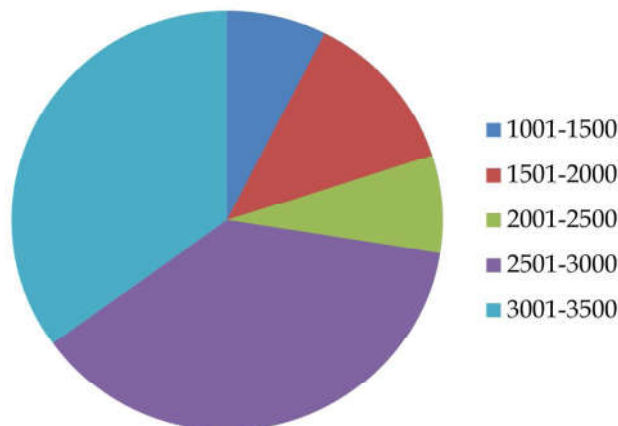
**Table 4:**

	Normotensive Group	Hypertensive Group
Mean Fetal weight	2677.6 gms	2112.2 gms.
Min. Fetal weight	3400 gms.	3200 gms.
S.D.	520.6	511.23
Coe. .of variation	19.44	24.2



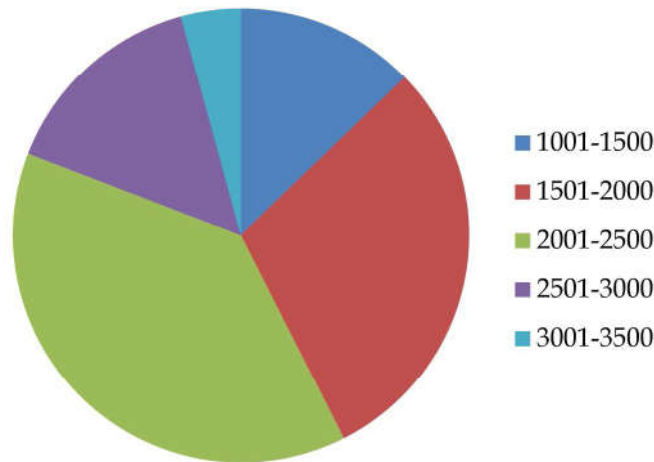
**Bar Diagram 2:** Fetal Weight (in Grams)

**Normotensive Group**



**Pie Chart 3:** Fetal Weight in Normotensive Group (In Grams)

### Hypertensive Group



**Pie Chart 4:** Fetal Weight in Hypertensive Group (In Grams)

Feto placental weight ratio was calculated in both the normotensive and hypertensive group.

The mean fetoplacental weight ratio was found to be 6.07 in Normotensive group and 5.42 in Hypertensive group.

#### Discussion

Placenta is the most important organ for maintaining and continuing healthy pregnancy. It transfers and exchanges oxygen and nutrition needed for fetus. The examination of placenta would demonstrate important information about whatever has happened to fetus.

It plays a vital role in normal fetal development

and failure of placenta to gain weight and insufficiency of its function can result in fetal disorders [6]. As placenta is the only gateway to the fetus any lesion, insufficiency or abnormality can affect the outcome of the fetus. Placenta is developing till 37th week of gestation. Weight of placenta is regarded by many as an appropriate marker of the balance between fetal and placental growth. A term placenta of a single full term pregnancy is 500 to 600 grams [2]. As noted by Burkhardt [3] mode of delivery also affects placental weight which he found to be higher in caesarean section than in Vaginal deliveries. Kevin V Blake [7] has stated that mother's own birth weight is statistically significant predictor of placental weight. Sitti Patimah [8] stated that maternal age has significant effect on placental weight.

**Table 5:** Comparison of Placental Weight (Weight in Grams)

	Normotensive Group	Hypertensive Group
Nobis & Das (1991)	368	359
Udania & Jain (2001)	495	403.53
Majumdar, S. (2005)	485.85±47.31	399.10±90.31
Prabjyot Kour (2013)	458.28±42.13	375.95±67.195
Present Study	439.8 ±78.75	387.6±9.73

Our study shows that there was significant decrease in Placental weight in the Hypertensive group. Values less than 250 gms. were found in Hypertensive group only. These values are comparable with study of Prabjyot Kour [9] who found the Placental weight of 458.28±42.13 in Normotensive group and 375.95±67.195 grams in Hypertensive group.

Raghvendra and Colleagues (2014) [4] in their study also found decreased Placental weight in all

grades of PIH. Majumdar (2005) [10], Udania and Jain (2001) [11] and Nobis Das (1991) [12] also found decreased placental weight in Hypertensive group as compared to Normotensive group as shown in Table 5. Das B et al (1996) [13] correlates decrease in placental weight in PIH with the duration of hypertension. M. Asgharria (2006) [6] in his study has mentioned that there were more low weight placenta in pre eclamptic mothers. Kalpana Chhetri (2015) [14] has found that decreasing Placental weight with

increasing gestational age was observed only in pre eclamptic mothers with the maximum at 31(0.2) weeks and minimum(0.16) at 38 weeks.This shows that the

placental growth peak was delayed in pre eclamptic mothers.

**Table 6:** Comparission of Fetal weight (Weight in Grams)

	Normotensiv Group	Hypertensive Group
Nobis & Das (1991)	2840	2660
Udania & Jain (2001)	2640	2265
Majumdar,S. (2005)	2800±0.32	2040±0.48
Prabjyot Kour (2013)	28.78±305.53	2422±613.27
Present Study	2677.6	2112.2

The Mean fetal weight in our study was 2677.6 grams in control group 2112.2 grams in Hypertensive group. Prabjyot kour (2013)[9] found decreased fetal weight in Hypertensive group as compared to Normotensive group as shown in Table 6. Raghvendra A.Y(2014)[4] found that the mean birth weight in Hypertensive group is low and directly related with increasing grades of Hypertension. M. Asgharnia (2007)[6] has mentioned that low weight Placentae were associated with low birth weight fetuses. Our values are comparable with Udania and Jain (2001)[11] and Majumdar S (2005)[10] as shown in the Table 6. Rath, G. Garg K, and Sood M (2000)[15] also have mentioned the significant decrease in the fetal weight in Hypertensive group. Nobis and Das (1991)[12] also confirms the same but slightly higher value in both the groups in their study may be due to regional or socio economic difference in the two population groups. Kevin V. Blake [7] has established a significant inverse relationship between blood pressure and birth weight.He stated that this association may be the result of fetal adaptations to an adverse intrauterine enviornment.

The ratio between fetal weight and placental weight varies considerably throughout gestation and is affected by many factors as well.

The fetoplacental weight ratio in normal pregnancy is as under [16].

Month	Fetus:Placenta
1st Month	1:6
4th Month	1:1
At birth	6:1

The present study shows a linear co relation between fetal weight and placental weight with the fetoplacental weight ratio of 6.07 in control group. This observation is in conformity with A. Sedlis (1967)[17] and N.Vasudeva(1991)[18]who stated that there is linear co relation between fetal weight and placental weight in normal pregnancy. Moore (1999)[16] stated that fetal weight is 6 times the placental weight in normal pregnancy. B. Mukherjee (1983)[19] also found that there is significant relation between fetal weight, placental weight and diameter of Placenta in normal pregnancy, in last trimester.

In Hypertensive group The fetoplacental weight ratio in present study is 5.42. The significant decrease in fetoplacental weight ration in Hypertensive group is in conformity with Nobis and Das (1991)[12],who found that fetoplacental weight ratio is 7.72 in Normotensive group and 7.41 in Hypertensive group.Slightly higher values of fetoplacental weight ration in both the groups in his study are obvious due to lower values of placental weight. Our findings are also compareable with findings of Majumdar (2005)[10] who found that Fetoplacental weight ration was 6.23 in Normotensive group and 5.89 in Hypertensive group (Table 7). Rath G. , Garg. K and Sood. M (2000)[15] also found that the mean fetoplacental weight ratio of hypertensive group was low than Normotensive group.

**Conclusion**

As placenta is essential not only for fetal growth

**Table 7:** Comparission of fetoplacental weight ratio

	Normotensive Group	Hypertensive Group
Nobis & Das (1991)	7.72	7.41
Majumdar,S. (2005)	6.23	5.89
Present Study	6.07	5.42

and well being but also affects the health of the infant in future.

PIH, one of the commonest problems affecting pregnancy, affects the placental development which in turn affects the fetus hence early diagnosis and proper management of PIH cases is required. At the same time evaluation and follow up of placental growth in early pregnancy, placental examination and recording its all parameters is important in improving the health of infant in future.

## References

- Pollack RN and Divon MY 1992. Intrauterine growth retardation: Definition, classification and etiology. *Clin Obstet Gynecol*; 1992;35:99-107.
- Dutta AK. *Essentials of Human Embryology*. 5th Ed. Kolkata; Current Book International. 2005:57-69.
- Burkhardt T, Schaffer L, Schneider C, Zimmermann R, Kurmanavicius J. Reference Values for the weight of freshly delivered term placentas and for the placental weight-birth weight ratios. *Eur J Obstet Gynecol reprod Biol*. 2006 Sep-Oct;128(1-2):248-252.
- Raghavendra A.V., Vinay K.V., Veena Pai. A study of Placental Weight and Fetal outcome in Different grades of Pregnancy Induced Hypertension. *International Journal of Anatomy and Research*. 2014, Dec;2(4):625-629.
- Romero Gutierrez G, Velasquez Maldonado HA, Mendez Sashida P, Horna Lopez A, Cortes Salim P, Ponce Ponce de Leon Al. Placental Histopathological changes in gestational hypertension. *Ginecol Obstet Mex*, 2008 Nov;76(11):673-8.
- M. Asgharnia, N Esmailpour, M Pwagherban, Z Atrakar Roshan. Placental weight and its association with maternal and neonatal characteristics. *Acta Medica Iranica*. 2008;46(6):467-471.
- Kevin V Blake, Lyle C Gerrin, Lawrence J. Beilin, Fiona J Stanley, Louis. I Landau, John P Newnham Placental weight and placental ratio as Prediction of later blood Pressure in childhood. *J. of Hypertension*. 2001; 19(4):697-702.
- Sitti Palimah, Yasmin Syauqui, Razak Thaha. The correlation between Placental weight and Birth weight. *International proceedings of Chemical, Biological and Environmental Engineering*. 2015;86(10):58-64.
- Prabhjot Kaur, Subhash Kaushal, Kuljit Singh, Ashish Sharma. Placental weight, birth weight, and fetal outcome in pre eclampsia and normotensive Pregnancies. *Inter. Journal of Plant, Animal and Environment Science*. 2013 Dec;3(4):30-34.
- Majumdar S, Dasgupta H, Bhattacharya K, Bhattacharya AA. Study of placenta in normal and hypertensive pregnancies. *Journal of Anatomical Society of India*. 2005;54(2):34-38.
- Udania A, Jain ML. Morphological study of Placenta in Pregnancy Induced Hypertension with its clinical relevance. *Journal of Anatomical society of India*. 2001;50(1):24-27.
- Nobis P, Das U. Placental morphology in hypertensive pregnancy. *Journal of Obs. and Gynecology of India*. 1991;41:166-169.
- Das B, Dutta D, Chakraborty S, Nath P. Placental morphology in hypertensive disorders of pregnancy and its co-relations with fetal outcome. *Journal of Obstet Gynecol India* 1996:40-6.
- Kalpna Chhetri. Evaluation of placental weight ratio in preterm birth and small for gestation age babies in pre eclampsia in sikkimese population. *International J. of Scientific Study*. 2015, Aug;3(5): 10-13.
- Rath G, Garg K, Sood M. Insertion of umbilical cord to the placenta in hypertensive mothers. *Journal of Anatomical Society of India* 2000;49(2):149-154.
- Moore LK, Persaud TVN. *The developing human* 6th ed. Harcourt Asia Pte. Ltd.; 1999.
- Sedlis A, Berendes H, Kim HS. et al. The Placental Weight-Birth weight relationship. *Interscience Journal*. 1967.
- N. Vasudeva, Choudhary R, Anand C. Weight of the Placenta, weight of the mother just before delivery and haemoglobin Concentration of Cord blood as an indicator to the weight of the new born. *Journal of Anatomical Society of India*. 1991;40:141.
- Mukerjee B, Lal R. Relation between foetal weight and placental size. *Journal of Anatomical Society of India*. 1983;32:124-126.