

# A COMPARATIVE STUDY OF MACROSCOPIC MORPHOLOGY OF PLACENTA AMONG NORMAL AND COMPLICATED PREGNANCIES

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## ABSTRACT

**Background:** The placenta being a foetal organ, undergoes the same stress and strain to which the foetus is exposed. Common yet life threatening complications of Pregnancy like Gestational Diabetes, Hypertension, Anaemia and Intra uterine growth retardation result in both macroscopic as well as microscopic changes in the placenta. Hence study of the placenta will give a valuable insight in cases of adverse foetal outcome.

**Materials and Methods:** The present study was conducted on a total of two hundred and ninety two freshly delivered placentae with umbilical cord obtained from the labour rooms and operating theatres of the Department of Obstetrics & Gynaecology. Exclusion criteria was multiple pregnancy. Inclusion criteria's were normal uncomplicated primigravida and multigravida and pathological factors complicating pregnancy like Anaemia, Gestational Diabetes mellitus, Pregnancy induced Hypertension and prematurity. The 292 placentae were divided into four categories according to the risk factors and clinical diagnosis of pregnant women namely normal patients(147), patients with Pregnancy induced hypertension(15), Gestational Diabetes mellitus(30), anaemia(65) and preterm(35).

**Results:** The circular type of placenta is the common shape of placenta. The diameter of the placenta is increased in anaemia, gestational diabetes and decreased in prematurity. The weight of the placenta is increased in gestational diabetes mellitus, anaemia and decreased in prematurity. The number of maternal cotyledons is decreased in prematurity and increased in gestational diabetes mellitus. The eccentric type of cord attachment is the most common type in complicated pregnancies.

**Conclusion:** The diagnosis of such risk factors in pregnancies during antenatal period and early intervention will improve the perinatal outcome.

**KEY WORDS:** Placenta, Macroscopic Morphology, Complicated Pregnancies.

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## INTRODUCTION

Placenta is a vital organ for maintaining pregnancy and promoting normal foetal development. The placenta being a foetal organ, undergoes the same stress and strain to which the foetus is exposed. Thus any disease process that affects the mother and foetus has a great impact on the placenta also[1]. So study of the

placenta will give a valuable insight in cases of adverse foetal outcome. Hence it can be seen that one of the common methods of investigation to determine the factors endangering the foetus and newborn is the examination of placenta.

The placenta is a characteristic feature of eutherian mammals. The word placenta comes from

the Greek word for cake, "Plakoenta/ Plakounta. The human placenta is a villous haemochorial structure which is of critical importance in maternal and foetal transfer and plays a fundamental role in the immunological acceptance of the foetal allograft [2].

The growth of the foetus depends upon the location, functional capacity and integrity of the placental attachment [3]. The structure of placenta has a basal plate which is formed by a part of the compact and spongy layer of Decidua basalis, Nitabuch layer, cytotrophoblastic shell and Syncytiotrophoblast. The basal plate is perforated by the spiral branches of the uterine vessels for the entry of maternal blood into inter-villous space. Placental septa are found projecting from the basal plate into inter-villous space. These septa divide the inter-villous space incompletely because they fail to reach the chorionic plate. The areas between the septa are called Cotyledons. The chorionic plate forms the roof of the placenta and it consists of Primitive mesenchymal tissue with branches of umbilical vessels, Cytotrophoblast and Syncytiotrophoblast. The stem villi actually arise from this plate. Numerous branch villi project into the intervillous space and constitute the main content of the choriodecidual inter-villous space. The placenta is thus limited between the chorionic plate on the foetal side and by the decidua and basal plate on the maternal side, with the choriodecidual space lying in between [4].

The placenta serves as an organ for the interchange of material between foetal and maternal blood streams without mixing or physical contact between the two blood streams. Placenta sub serves the purpose of gas exchange and supply of nutrients until sufficient maturation of the foetus which enables its survival in the extra uterine environment. It also acts as an endocrine gland producing several types of hormones such as lactogen, Human chorionic gonadotrophins (HCG) and relaxin [5].

As placenta reflects the intra uterine status of the foetus, study of the placenta will give an accurate record of the foetal condition [6]. Common yet life threatening complications of Pregnancy like Gestational Diabetes, Hypertension, Anaemia and Intra uterine growth retardation result in both macroscopic as well

as microscopic changes in the placenta [7,8].

The objective of this study was to compare the various morphological characteristics of the placenta in pregnancy complicating conditions like Pregnancy induced Hypertension, Gestational Diabetes, Anaemia and prematurity with placentas of uncomplicated pregnancies.

## MATERIALS AND METHODS

The present study was conducted on a total of two hundred and ninety two freshly delivered placentae with umbilical cord obtained from the labour rooms and operating theatres of the Department of Obstetrics & Gynaecology, Mahatma Gandhi Memorial Hospital and received at the Department Of Anatomy, KAPV Government Medical College, Trichy. Exclusion criteria was multiple pregnancy. Inclusion criteria's were normal uncomplicated primigravida and multigravida and pathological factors complicating pregnancy like Anaemia, Gestational Diabetes mellitus, Pregnancy induced Hypertension and prematurity.

147 specimens of placentae were from Normal uncomplicated primigravida and multigravida cases contributing to 85 male conceptus and 62 female conceptus.

145 specimens of placenta were from foetus of mothers affected with factors complicating pregnancies of which 80 were male conceptus and 65 female conceptus. Among these, 65 placentae (45 males and 20 females) were from anaemia complicating pregnancy; 30 placentae (5 male and 25 females) were from mothers suffering from Gestational Diabetes Mellitus; 15 placentae (10 males and 5 females) were from mothers with pregnancy induced Hypertension and 35 placentae (20 males and 15 females) from mothers who delivered prematurely.

The placentae were washed thoroughly in running water after trimming the membranes and draining the residual blood. The membranes were examined. Blood clots were removed. The water in the specimen was allowed to drain. The shape of the placenta was recorded as circular, oval or triangular. The site of attachment of umbilical cord was noted as central, eccentric, marginal and velamentous as per standard descriptions. The weight of the placenta was

measured with the weighing scale in grams. The maternal surface of the placentas were examined for number of cotyledons and abnormalities like calcifications and infarcts .The diameter of the placenta was measured with a measuring scale. Maximum diameter was first measured with a scale and then a second measurement was taken at right angles to the first . The mean of the two was noted as the placental diameter.

The 292 placentae were divided into four categories according to the risk factors and clinical diagnosis of pregnant women namely Normal patients(n=147), patients with Pregnancy induced hypertension(n=15), Gestational Diabetes mellitus(n=30) , anaemia(n=65) and preterm(n=35). The categorical variables were expressed as percentages.

**RESULTS & DISCUSSION**

Placenta is the most accurate record of infant’s prenatal experiences, so study of placenta and umbilical cord gives valuable clues in cases of adverse fetal outcome [1].

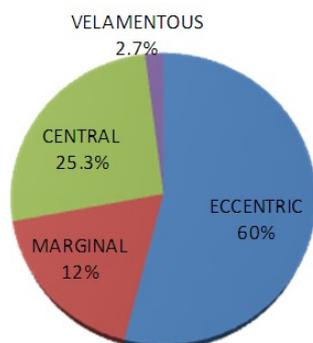
**Table 1:** Shape of the placenta.

Shape Of Placenta	Number Of Placenta(n=292)				
	Normal (n=147)	Anaemia n=65	Hypertension n=15	GDM n=30	Prematurity n=35
Circular	84	37	15	22	26
Oval	60	23	Nil	8	9
Triangular	3	5	Nil	Nil	Nil

**Table 2:** Attachment of cord

Type Of Attachment	Number Of Placentae(n=292)				
	Normal (n=147)	Anaemia	HT	GDM	Prematurity
Central	39	18	-	4	13
Eccentric	75	42	15	26	17
Marginal	30	5	-	-	-
Velamentous	3	-	-	-	5

**Fig. 1:** Frequency of site of attachment of cord.



**Table 3:** Number of maternal cotyledons.

S.No	Number of maternal cotyledons	Number of Placentas(n=292)				
		Normal	Anaemia	HT	GDM	Prematurity
1	12	3	13	-	-	18
2	14	21	12	5	-	13
3	15	20	14	-	-	4
4	16	27	15	7	-	-
5	17	34	5	3	-	-
6	18	28	6	-	13	-
7	20	14	-	-	17	-

**Table 4:** Weight of placenta.

S.no	Weight of Placenta (in grams)	Number of Placentas(n=292)				
		Normal	Anaemia	HT	GDM	Prematurity
1	<450	32	-	-	-	35
2	450- 475	31	16	-	-	-
3	476- 500	30	49	-	-	-
4	501- 525	31	-	15	13	-
5	526-550	Nil	-	-	-	-
6	551-575	23	-	-	17	-

**Table 5:** Diameter of placenta.

S.No	Diameter Of Placenta (In Cm)	Number Of Placenta(n=292)				
		Normal	Anaemia	HT	GDM	Prematurity
1	< 15	-	-	-	-	10
2	15.1- 17	59	-	15	-	25
3	17.1-19	87	9	-	3	-
4	>19	1	56	-	27	-

**Shape of the placenta:** The common placental shape is round with the umbilical cord inserted at the centre. The shape of the placenta is considered to be influenced by the site of implantation, localised variations in the decidua and variations in the maternal vascular supply. Earlier onset of placental pathology affects the placental vascular branching pattern which in turn affects the shape of the placenta [7]. Thus abnormal shapes are associated with reduced placental efficiency reflecting on the placental vascular architecture either maternal uteroplacental or foetoplacental which in turn is associated with decreased functional efficiency. Deviation of shape with diagnosis of vascular pathology represents either a severe disease process or a long standing disease process. So including the shape deviation as a clinical diagnostic tool will improve the diagnostic specificity [8].

As can be observed from Table:1 ,In the present study of 292 specimens, 184 circular shaped

placentas were observed. Among these, 84 circular placentae were found in uncomplicated pregnancies and 100 circular shaped placentas were observed in complicating pregnancies. The incidence of circular placentae of 63% is similar to Sarojamma(57%) [9] and varies from Gunapriya R(93%) [10].

100 oval shaped placentae were noted, of which 60 were observed in uncomplicated pregnancies and 40 from complicated pregnancies. 34.25% percentage of oval placenta coincides with findings of Sarojamma(36%) [9] and greater than that of Gunapriya R(7%) [10,11]

Among the 8 triangular placentae observed, 03 were from uncomplicated pregnancies and five from complicated pregnancies. The percentage of triangular placenta in the present study was 2.75%. This value is less than that of Sarojamma (7%)[9].

#### **Attachment of the umbilical cord to placenta:**

The site of attachment of cord in the placenta was observed as follows:(Table:2/Fig:1)) Central type of cord insertion was observed in 74 specimens (25.3%). This value coincides with Earn.A.A(28%)[12] and more than that of Gunapriya(5%)[10], Shanklin D.R(11%)[13] and Eastman N.J and Hellman LM(18%)[14] Its less compared with Sarojamma.(40%)[9].

Eccentric type of cord insertion was observed in 175 specimens(60%). This finding is less than that of Shanklin D.R(89%)[13], Gunapriya R(86%) [10]and Eastman N.J and Hellman LM(73%)[14] and more than that of Sarojamma(53%)[9] and Earn.A.A.(56%)[12].

Marginal type of cord insertion was observed in 35 specimens(12%).The above finding coincides with Earn A.A(15%)[12] and more than that of Sarojamma(2%)[9], Gunapriya(9%)[10], Shanklin (1.9%)[13], Eastman N.J(7%) [14], Uyanwah et al[15] and Scott JS[16].

Velamentous type of cord insertion was observed in 08 specimens(2.7%). This finding is more than Eastman N.J and Hellman LM(1.25%) [14], Uyanwah et al[15], Scott JS(1.5%)[16] and Shanklin.D.R(0.77%)[13] and less than observed by Sarojamma(4%)[9]. The eccentric attachment of cord is more in complicated pregnancies thus reflecting on the vascular architecture.

**Number of cotyledons:** The range of number of cotyledons in the present study was 12 – 20. This finding coincides with K.Benirschke et al[7], J.D.Boyd and W.J.Hamilton[17] and Gunapriya. R[11]. The number of maternal cotyledons were in the range of 12-14 in thirty of thirtyfive preterm deliveries.(85%). In diabetes complicating pregnancy almost all placentae contained 18-20 cotyledons. (Table:3)The cotyledon number is reduced in Prematurity. The number is increased in pregnancies complicated by gestational diabetes.

**Weight of Placenta:** In the present study, the average weight of the placenta was 477 grams. In 147 uncomplicated pregnancies the average weight of the placenta was 482.68 grams. The weight of the placenta was less than 450grams in all 35 premature deliveries. It was in the range of 450-500 grams in anaemia complicating pregnancies This finding is similar to Henry Gray[18] and Majumdar et al[19]. This finding is greater than Wong T.C and J.A.P.Lartour[20] and less than Kucuz M Doymaz.F[21].The weight of placenta in all diabetes complicating pregnancies were in the range of 551-575 grams and in pregnancy induced hypertension weight of the placentae were in the range of 501-525grams (Table:4). This finding is less than that of S.P.Gupta[22], Williams et al[23], Hamilton Boyd[17] and Batnagar[2].

The average weight of the placenta in pregnancies with prematurity is decreased.

Out of the 292 placenta, the weight of the placenta varied from 405 to 575 grams. The maximum weight of 575 grams was observed in 7% of cases. The least weight of 405grams was observed in 3.4% of cases.

**Diameter of Placenta:** In the present study, the average diameter of the placentae was 17.8cms in uncomplicated pregnancies. The diameter of the placenta was more than 19 cms in anaemia complicating pregnancies(56 cases) and diabetes complicating pregnancies(26 cases). On the contrary the diameter was less than 15 cms in 10 cases and 15-17 cms in 25 cases in premature deliveries. The diameter was in the range of 15.1-17 cms in pregnancy induced hypertension patients .The least diameter was observed in preterm delivered placenta(14.60cm) and the maximum diameter

was in the range of 15.1-17 cms in pregnancy induced hypertension patients. The least diameter was observed in preterm delivered placenta (14.60cm) and the maximum diameter were noted in anaemia complicating pregnancy (20.90cm). (Table 5) In the present study, the average diameter is similar to Leslie.B.Arey[24] and Gunapriya[10] and is less than Henry Gray[18], J.D.Boyd and W.J.Hamilton [17] and Richard.S.Snell[25].

Out of the 292 placentas the diameter varied from a minimum diameter of 14.60 cms to a maximum diameter of 20.90 cms similar to that reported by Gray[18], Keith Moore [5] and Gunapriya[10].

Gestational Diabetes Mellitus is a common metabolic problem that complicates approximately 2-4% of pregnancies where the placenta is exposed to the regulatory influence of hormones present in the circulation. Placenta undergoes an adaptive response by change in weight, structure, volume and shape to function through gestation to support the prenatal life [26].

Thomson (1969) observed that the placenta of diabetic women tends to be heavier and paler due to villous oedema [27]. According to Gauster et al[28], the placenta of poorly controlled diabetic women is enlarged, thick, and plethoric. Fox [29] had shown that placentae from diabetic mothers might be expected to weigh about 600 – 900 grams. The placental weight may become the single most important factor in determining foetal growth. The increased placental weight is due to complementary hyperplasia throughout gestation under the endocrine effect of hyperinsulinemia [30]. The number of cotyledons is also increased in GDM. The weight gain in placentae of diabetic mothers is attributed to macrosomia and compensatory hyperplasia. Similar findings in diabetic placentae was observed by Pankaj saini et al[31], Saha et al[32] and Ashfaq et al[33].

Hypertensive disorders complicating pregnancy are common and form one of the deadly triad along with haemorrhage and infection that results not only in large numbers of maternal deaths but also foetal deaths. As severity of hypertension increases placental weight

decreases [1].

The reduced placental weight in hypertensive group may be attributed to reduced blood flow due to ischaemic changes in the vessels[34]. Reduced placental weight and birth weight in PIH group was noted by Anjankar et al[35], Londhe Pradeep S and Mane Abhay B [36], Majumdar et al[19], Udania & Jain[1].

In preeclampsia placental changes reflect in the form of low birth weight, prematurity and stillbirth. There was a reduction in placental weight in PIH group (398 gm) and increased placental weight in anaemia and diabetes groups. The possible explanation can be hypoxia due to anaemia and compensatory increase in blood flow which leads to increase in placental weight in anaemia [31].

A significant increase in intrauterine growth retardation (IUGR) and low birth weight is associated with decreased placental weight. Diameter of placenta is on an average of 17-18cms. The diameter is decreased for IUGR below 10<sup>th</sup> percentile. The prediction rate is 33.3%. It helps to identify patients at increased risk of low birth weight below 10<sup>th</sup> percentile [37]. Impaired placentation underlies most cases of IUGR with hypoxia and reperfusion damage caused by impaired remodelling of spiral arteries. The gross and microscopic measurements of a placenta are more objective and seem to offer a good way to get proper information about IUGR. All IUGR fetuses must be considered at risk for poor placental circulation and hypoxia along with compromised nutrition [38]. Placenta of IUGR newborns are smaller.

The circular type of placenta is the common shape of placenta. Weight and the diameter of the placenta is increased in anaemia. The weight of the placenta and the diameter of the placenta is increased with increased number of maternal cotyledons in gestational diabetes mellitus. The weight and diameter of the placenta is decreased and there are fewer maternal cotyledons in prematurity. The eccentric type of cord attachment is the most common type in complicated pregnancies. Thus the morphological study of the placenta after the delivery of the baby gives us valuable informa-

tion with respect to maternal and fetal health conditions.

## CONCLUSION

The presence of risk factors in the form of pregnancy induced hypertension, anaemia or diabetes complicates the pregnancy and also affects the perinatal outcomes. It can be seen that placental parameters are also altered along with foetal parameters. The altered shape and site of attachment of umbilical cord is significant in the development of the vascular tree which in turn has a effect on the development of the foetus. So the diagnosis of such risk factors in pregnancies during antenatal period and early intervention will improve the perinatal outcome.

## ABBREVIATIONS

**HT-** Hypertension complicating pregnancy.

**GDM-** Gestational diabetes complicating pregnancy.

**Conflicts of Interests: None**

## REFERENCES

- [1]. Udania A and Jain ML. Morphological study of placenta in pregnancy induced hypertension with its clinical relevance. *J Anat Soc India*, 2001; 50(1): 24-27.
- [2]. Batnagar S.M, Kotari M.L, Lopa A. Mahata. *Essential of Human Embryology*. 3<sup>rd</sup> edition, Orient Longman, Hyderabad, 2000; 47-52.
- [3]. Crawford. *Vascular Anatomy of Human Placenta*. *Am.J.Obstet.Gynec*, 1962;84:1543-1567.
- [4]. Susan Standring. *Implantation and placentation*. In: *Gray's Anatomy- The Anatomical basis of clinical practice*, 40th ed, Churchill Livingstone, Spain, 2008; 176-180.
- [5]. Keith L Moore and Persaud T.V.N. *Placenta and membranes*. In: *The Developing Human- Clinically oriented Embryology*. 7th ed, Saunders, Philadelphia, 2005; 120-131.
- [6]. Manik Sirpurkar, Vaibhav Prakash Anjankar. Study of correlation between placental morphology and adverse perinatal outcome in different conditions affecting pregnancy. *Int J Reprod Contracept Obstet Gynecol*. 2015;4(4):1165-1168.
- [7]. Benirschke.K, Kaufmann.P, Baergen R. *Pathology of the Human Placenta*. 5th edition, Vol.Chapter.7 Architecture of normal villous trees, New York. Springer Verlag. 2006:121-159.
- [8]. Carolyn M. Salafia, Michael Yampolsky, Dawn P Misra, Oleksander Shlakhter, Danielle Haas, Barbara Eucker, and John Thorp. *Placental surface shape, function, and effects of maternal and fetal vascular pathology*. *Placenta*. 2010;31(11): 958-962.
- [9]. Sarojamma. *Morphology and Histology study of Placenta*. 1986;75-78.
- [10]. Gunapriya R. *The morphology, morphometric study of placenta and umbilical cord with vascular pattern and clinical correlation*. 2001;28-43.
- [11]. Gunapriya Raghunath, Vijayalakshmi and Varsha Shenoy. *A study on morphology and morphometry of human placenta and its clinical relevance in a population in Tamilnadu*. *JCDR*, 2011;5(2):282-286.
- [12]. Earn.A.A: *The effect of congenital abnormalities of the umbilical cord and placenta on the new born and mother: A survey on 5676 consecutive deliveries*. *J. Obs.Gynaecol.Brit Emp*.58:456-459
- [13]. Shanklin D.R. *The Human Placenta: a clinicopathological study*. *J obst Gynec*, 1958;13:325-336.
- [14]. Eastman N.J. and Hellmann L.M: *Williams obstetrics*, 12th ed, Appleton, New York, 1971; 612-638.
- [15]. Uyanwah, Akpono P.O and Fox .H ; *The clinical significance of marginal or velamentous insertion of cord*. *Brit.J. Obstet Gynaecol*, 1977;84:941-943
- [16]. Scott .J.S. *Placenta extrachorialis (Placenta marginata and Placenta circumvalata);-A factor in Antepartum Hemorrhage*. *J. Obst. Gynaecol Brit. Emp*, 1960;67(6):904-918.
- [17]. Boyd.J.D, Hamilton W.J. *Development and structure of the human placenta from the end of the 3rd month of gestation..J obs Gynaecol Bri commonwealth*, 1967;74(2):161-226.
- [18]. Sharmila Bhanu P, Devi Sankar K, Sujatha Kiran, Subhadra Devi V. *Gross morphological study of gestational diabetes mellitus placenta from south Indian mothers compared with control placenta*. *Int J Anat Res*, 2017;5(1):3521-3526.
- [19]. Majumdar S, Dasgupta H, Bhattacharya K and Bhattacharya A. *A study of placenta in normal and hypertensive pregnancies*. *J Anat Soc India*, 2005;54(2):34-38.
- [20]. Wong T.C, Lartour J.P.A. *Microscopic measurement of the placental components in an attempt to assess the malnourished newborn infants* *Am J Obs.Gynaec*, 1966; 9:942.
- [21]. Kucuz, M, Doymary F. *Placental weight and Placental weight to birth weight ratio are increased in diet and exercise treated gestational diabetes mellitus subjects but not in one abnormal value on 100gram oral glucose tolerance test*. *J. Diabetes complication*, 2008;
- [22]. Gupta S.P, Bahl L, Dikshit S.K. *A study of Placenta in relation to birth weight and gestational age*. *Indian J Paediatrics*, 1972;39(9):281-285.
- [23]. William P.L., Wendell Smith C.P., Treadgold. S *Basic Human Embryology*, 2<sup>nd</sup> edition ; Lippincott Philadelphia, 1969;
- [24]. Leslie B Arey. *Developmental Anatomy*, 7th ed, WB.Saunders, Philadelphia 1974; 138.
- [25]. Richard S Snell. *Structure of placenta*. In: *Clinical Anatomy by regions*, 9th ed, Lippincott Williams & Wilkins, 2008; 293-294.

- [26]. Thomson AM, Billewicz WZ and Hytten FE. The weight of the placenta in relation to birth weight. *J. Obst and Gynaecol.* 1969;76(10):865-872.
- [27]. Gauster M, Desoye G, Tötsch M, Hiden U. The placenta and gestational diabetes mellitus. *Curr Diab Rep*, 2012;12:16-23.
- [28]. Fox H. The morphological basis of placental insufficiency. *J Obs Gynaecol India.* 1975;25:441-450.
- [29]. Mayhew TM, Sisley I. Quantitative studies on the villi, trophoblast and intervillous pores of placentae from women with well-controlled diabetes mellitus. *Placenta*, 1998;19:371-377.
- [30]. Pankaj Saini, Jai Prakash Pankaj, Anjali Jain and Gyan Chand Agarwal. Effect of gestational diabetes mellitus on gross morphology of placenta: a comparative study. *Int J Anat Res* 2015;3(1):889-94.
- [31]. Saha S, Biswas S, Mitra D, Adhikari A and Saha C. Histologic and morphometric study of human placenta in gestational diabetes mellitus. *Ital J Anat Embryol.* 2014;119(1):1-9.
- [32]. Ashfaq M, Janjua MZ and Channa MA. Effect of gestational diabetes and maternal hypertension on gross morphology of placenta. *J Ayub Med Coll Abbottabad.* 2005;17(1):44.
- [33]. Sengupta K, Shamim A, Khandekar AR and Mahamuda B. Morphological changes of placenta in preeclampsia. *Bangladesh Journal of Anatomy.* 2009;7(1):49-54.
- [34]. Anjankar V, et al. Placental Morphometry in Toxaemia of Pregnancy. *Scholars Journal of Applied Medical Sciences.* 2014;2(1B):205-208.
- [35]. Londhe Pradeep S, Mane Abhay B. Morphometric study of placenta and its correlation in normal and hypertensive pregnancies. *International Journal of Pharma and Biosciences*, 2011;4(2):429-437.
- [36]. Sirpurkar M, Anjankar VP. Study of correlation between placental morphology and adverse perinatal outcome in different conditions affecting pregnancy. *Int J Reprod Contracept Obstet Gynecol* ,2015;4:1165-1168.
- [37]. Suneeta Singh, Arpitha Pemmaraju, Devendra Nema. Comparison of Placental Histopathology in IUGR and Normal Term Infants: A Cross-Sectional Study. *Journal of Dental and Medical Sciences*, 2017;16(1):36-40.

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