

# Comparative Study on Macroscopic Anatomy of Human Placenta in Term and Post Term Pregnancy

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**Objectives:** We aimed to compare the macroscopic anatomy of human placenta in term and post-term pregnancy. **Methods:** This maternity hospital-based comparative study was carried out in Mongolia, in the year 2017-2018. For study purposes, placentae were collected from 1061 women between 17-44 years of age with live birth only. Term: 38 weeks to 40 weeks gestational period, and post-term: beyond 41 weeks gestational period. The macroscopic features of the placentae were measured as a standard protocol that is approved Department of Anatomy, Mongolian National University of Medical Sciences. **Results:** A total of rounded shapes was found in 72% of cases and oval in 26.3% cases, irregular shape in 1.7% cases of the three shape groups. The width and the weight of the placenta ( $t = 7.20$ ,  $t = 13.27$  respectively) were compared between groups term and post-term found to be significant ( $p < 0.001$ ). **Conclusions:** We conclude that irrespective of term or post-term placentae, most of the placentae were round in shape. The averages of placental morphometric parameters of both of term or post-term placentae are in the normal limit. This study concludes that as the gestational period increases length, width, thickness, and weight of placenta increases in different.

**Keywords:** Placenta, Macroscopic Anatomy, Pregnancy, Post-term.

## Introduction

The placenta is a temporary organ that connects the developing fetus via the umbilical cord to the uterine wall. The placenta has both embryonic and maternal components. The placenta is considered as a leading cause of maternal and perinatal mortality and an important factor affecting fetal growth which is generally associated with placental insufficiency [1]. The size of the placenta of term and post-term pregnancy are different. Post-term pregnancy is a pregnancy that lasts longer than 42 weeks of gestation. The incidence of post-term pregnancy is 6 percent of all birth in our country, while 2 percent of all birth in the western region of Mongolia [2, 3]. The researchers found that stillbirths steadily rose with gestational age, from 0.11 per thousand births at 37 weeks to 3.18 per thousand at 42 weeks. After 40 weeks of pregnancy, the risk of stillbirth rises [4, 5]. After 37 weeks of pregnancy, the placenta reaches its maximum size and its functions begin to reduce. The placentae in case of post-term deliveries are affected. In pregnancy beyond 43 weeks of gestation, placentae are heavier than the normal placentae attributed to compensatory hyperplasia of the villi [6]. Pathogenesis of post-term pregnancy to a large extent determined by changes in the placenta [7]. Placental insufficiency, also known as uteroplacental vascular insufficiency, occurs when the placenta fails to deliver adequate oxygen and nutrients to the infant [8]. Here, we observed the macroscopic features such as shapes, the width, the length, and the weight of the placenta of Mongolian women and compared the data in term and post-term period.

In this study, we aimed to compare the macroscopic anatomy of human placenta in term and post-term pregnancy.

## Materials and Methods

### Study subjects

This maternity hospital-based comparative study was carried out in Mongolia, in the year 2017-2018. This study was done on placentae which were collected from women who were delivered at the National center of maternal and child health, Urguu, Huree, and Amgalan maternity hospital. For study purposes, placentae were collected from women between 17-44 years of age including term and post-term pregnancy with live birth only. Women with placental morbidity were excluded.

Thus 1061 placentae from each of the following two groups were measured. The term is indicated 38 weeks to 40 weeks gestational period, post-term is indicated beyond 41 weeks gestational period (Table 1).

### Macroscopic analysis

At first, the placenta was gently washed with water to remove excess blood clots and amniotic debris. The placenta was examined macroscopically for shape, length, width, and thickness, weight according to previously described [9]. The weight of the placenta was taken on an electronic weight machine. The length and width of the placenta were determined by measuring tape and recorded in centimeters. The placenta was placed in a flat tray after born. At first, the length such as maximum measurement was measured. Then the width such as minimum measurement was measured. The measured means of the placenta are expressed in centimeters. The thickness of the placenta was measured at the center with the help of an iron ruler. The shape of the placenta was defined as following: if the difference between the length and the width of the placenta is lesser than 2 cm, is a round-shaped; if the difference is greater than 2 cm, is an oval-shaped; if the distances to each side from the umbilical cord are different, is an irregular shaped.

### Statistical analysis

We used SPSS 23.0 for Windows in our study. Qualitative data compared by the Chi-Square test in Table 1 and Table 2. We carried out a t-test to test the mean values between term and post-term groups in Table 3. For significance, p value < 0.05 was accepted as significant.

### Ethical statements

The present study was approved by the Ethics and Research Committees of the Mongolian National University of Medical Sciences (№17/3-08).

## Results

### Shape of placenta

The typical placental shape is round or oval with a centrally inserted umbilical cord. In this study, the shapes of placenta were almost found round in 73.52% cases, oval in 25.17% cases and irregular shape in 1.29% cases distributed in term

placentae and the shapes of placenta were almost found round in 69.4% cases, oval in 28.42% cases and irregular shape in 2.18% cases distributed in post-term placentae in this study.

**Table 1.** Comparisons of the groups according to age, marital status, maternity status, complications, and delivery ways (mean ± SD)

Characteristics	Term pregnancy		Post-term pregnancy		p-value
	N	%	N	%	
Age					0.013
<20	31	4.5	11	3	
20-30	446	65.2	250	68.3	
31-40	212	30.5	101	27.6	
>40	6	0.9	4	1	
Marital status					n.s
Married	675	97.1	350	95.6	
Not married	20	2.9	16	4.4	
Maternity status					n.s
First	107	15.4	89	24.3	
2-3	351	50.5	169	46.2	
>4	237	34.1	108	29.5	
Complications					
Maternal complications	116	16.7	131	35.8	0.051
Child complications	77	11.1	148	40.4	0.001
Birth complications	104	15	146	39.9	0.001
Delivery way					
Vaginal birth	626	90.1	253	69.1	0.001
Vacuum-assisted	3	0.4	6	1.6	n.s
C-section	66	9.5	107	29.2	0.001
Total	695	100	366	100	

A total of rounded shapes was found in 72% of cases and oval in 26.3% cases, irregular shape in 1.7% cases of the three shape groups (Figure 1, Table 2). A Chi-square test was used to compare the shape of human placentae between term and post-term groups. There was no significant difference observed (p = 0.275).



**Figure 1.** Shapes of placentae. Photograph of placentae views from the maternal side.

**Table 2.** Shape of placentae

Shape	Term		Post-term		Total		p-value <sup>a</sup>
	number	%	number	%	number	%	
Round	510	73.52	254	69.4	764	72.0	0.275
Oval	176	25.17	104	28.42	279	26.3	
Irregular	9	1.29	8	2.18	17	1.7	
Total	695	100	366	100	1061	100	

<sup>a</sup>Pearson Chi-Square test

**Length of placenta**

The length in placentae of term cases was found to range between 14.0 - 23.0 cm with the mean length being 18.52 ± 1.47 cm. And in the post-term placenta was found to be 14.0 - 25.0 cm. The mean length was 19.485 ± 1.82 cm. (Table 3). When the length of the placenta was compared between groups it was found that difference of length between term and post-term categories was found to be significant (t = 8.75), (p < 0.001).

**Width of placenta**

The width in the placentae of the term cases was found to range between 12.0 - 23.0 cm with the mean width being 18.15 ± 1.56 cm. And post-term placenta was found to be 13.0-25.0cm. The mean width was 18.98 ± 1.89 cm. (Table 3). When the width of the placenta was compared between groups it was found that difference of width between term and post-term categories was found to be significant (t=7.20), (p<0.001).

**Length of placenta**

The length in placentae of term cases was found to range between 14.0 - 23.0 cm with the mean length being 18.52 ± 1.47 cm. And in the post-term placenta was found to be 14.0

- 25.0 cm. The mean length was 19.485 ± 1.82 cm. (Table 3). When the length of the placenta was compared between groups it was found that difference of length between term and post-term categories was found to be significant (t = 8.75), (p < 0.001).

**Thickness of placenta**

The thickness in the placenta of term cases was found to range between 0.8-4.0 cm with the mean thickness being 1.99 ± 0.38 cm. And in the post-term placenta was found to be 1.0-4.0 cm. The mean thickness was 2.01 ± 0.43 cm. (Table 3). When the thickness of the placenta was compared between groups it was not found that difference of thickness between term and post-term categories was found to be significant (t = 0.30).

**Weight of placenta**

The weight in placentae of term cases was found to range between 310.0-880.0 g with the mean weight being 628.45 ± 86.298 g. And in the post-term placenta was found to be 330.0-1000.0 g. The mean weight was 721.21 ± 118.166 g. (Table 3). When the weight of the placenta was compared between groups it was found that difference of weight between term and post-term categories was found to be significant (t = 13.27), (p < 0.001).

**Table 3.** Placental morphometric parameters

Placental parameters	Term pregnancy N=695 (Mean ± SD)	Post-term pregnancy N=366 (Mean ± SD)	p- value <sup>a</sup>
Length (cm)	18.519 ± 1.46	19.485 ± 1.82	0.001
Width (cm)	18.150 ± 1.56	18.982 ± 1.89	0.001
Thickness (cm)	1.997 ± 0.38	2.005 ± 0.43	0.382
Weight (g)	628.45 ± 86.29	721.21 ± 118.16	0.001

<sup>a</sup>t-test

## Discussion

The typical placental shape is round or oval with a centrally inserted umbilical cord [10]. However, the types of normal placental shapes occur varies. Previous studies indicated that 42.3-93 percent placentae were round, 37.5-44.17 percent placentae were oval, 0-20.19 percent were of irregular shape in different ethnic populations including Caucasian, Indian, and African [6, 11, 12]. In the present study, we observed that the shapes of the placenta were almost found round in 72 percent of cases, oval in 26.3 percent of cases, and irregular shape in 1.7 percent of cases distributed in Mongolian. The shape of the placenta has been thought to the pattern of vascular growth [13]. The umbilical cord inserts typically into the placenta near its center or pericenter area [14]. Previously published data indicated that about 7 percent of umbilical insertions occur at the placental margin [9]. However, in this study, the marginal insertions of the umbilical cord were not found. Those variant results depending on the ethnic population.

Furthermore, the incident of the round shapes of placenta decreased whereas the oval and irregular shapes were increased in post-term placentae compare to term placentae. In the post-term, the hyperplastic changes occurred in the placentae [6]. The increasing of the irregular shape in the post-term may be associated particularly with hyperplasia [10, 15]. Most researchers have determined the size of the placenta significantly increasing in the post-term than term. In our study, the length average of the term placenta was  $18.519 \pm 0.056$  cm, and of the post-term placenta was  $19.485 \pm 0.095$  cm. The width of the term placenta average was  $18.150 \pm 0.059$  cm, and of the post-term placenta was  $18.982 \pm 0.099$  cm in this study. Some researchers have determined the size of the placenta, such as diameter, by the average of length and width. Soni, et al found the diameter of the term placenta to range between 15-25cm [16] and Sherin, et al stated it as 15.07cm. The diameter of the post-term placenta was found mean diameter to be 19.67 cm [17].

Placental weight of the term and post-term pregnancy are widely available measures [11, 18]. In our study, the weight average of the term placenta was  $628.45 \pm 3.273$ g, and of the post-term placenta was  $721.21 \pm 6.177$ g. These were relatively heavier in term and post-term placenta than other nations' placenta. In 2017, Soni, et al found the average weight of term placenta as 468.4g, ranging from 342-568g. Sherin, et al found it to be 513.38g. Zaidi, et al (2013) stated it as 513.16g [17, 19, 20]. In the present study, we

compared the macroscopic anatomy of human placenta in term and post-term pregnancy. The risk factor for anatomical features of the human placenta was out of the objective. The previous publication indicated that the variations in the mean weight of the placenta may be due to variations in the methodology of preparing and weighing the placenta together with cord clamping time [21]. It has also been reported that ethnicity and some unknown factors may affect the placental weight [17].

There are some limitations to the present study. We compared some macroscopic features of human placentae in term and post-term period. Future studies should investigate the comparison of histologic and molecular levels in term and post-term period.

It was concluded in this study that irrespective of term or post-term placentae, most of the placentae were round in shape. The averages of placental morphometric parameters of both of term or post-term placentae are in the normal limit.

## Conclusions

We conclude that irrespective of term or post-term placentae, most of the placentae were round in shape. The averages of placental morphometric parameters of both of term or post-term placentae are in the normal limit. This study concludes that as the gestational period increases length, width, thickness, and weight of placenta increases in different.

## Conflict of Interest

The authors state no conflict of interest.

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## References

1. 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* 2017; 4(4): 1165-8
2. Mya KS, Laopaiboon M, Vogel JP, Cecatti JG, Souza JP, Gulmezoglu AM, et al. Management of pregnancy at and beyond 41 completed weeks of gestation in low-risk women:

- a secondary analysis of two who multi-country surveys on maternal and newborn health. *Reprod Health* 2017; 14(1): 141-53
3. Solongo T, Ulzii D, Gerelmaa Z, Burmaajav B. Causes and risk factors for early neonatal mortality in the western region of mongolia. *Cent Asian J Med Sc* 2015; 1(1): 28-32.
  4. Bakalar N. After 40 weeks of pregnancy, risk of stillbirth rises. 2019 [accessed on 20 April, 2020]. Available at: <https://www.nytimes.com/2019/07/11/well/family/after-40-weeks-of-pregnancy-risk-of-stillbirth-rises.html>.
  5. Marroun H, Zeegers M, Steegers EAP, Ende J, Schenk JJ, Hofman A, et al. Post-term birth and the risk of behavioural and emotional problems in early childhood. *Int J Epidemiol* 2012; 41(3): 773-81.
  6. Ghani N, Yadav K. Comparative study on macroscopic morphology of human placenta in preterm, term & post term pregnancy. *Int Multispec J Health* 2018; 4(4): 109–14.
  7. Burkitova AM, Polyakova VO, Bolotskikh VM, Kvetnoy IM. Features of the placenta structure in post-term pregnancy. *J Obst Women Dis* 2020; 68(6): 73-86.
  8. Briscoe D, Nguyen H, Mencer M, Gautam N, Kalb DB. Management of pregnancy beyond 40 weeks' gestation. *Am Fam Physician* 2005; 71(10): 1935-41.
  9. Yetter JF. Examination of the placenta. *Am Fam Physician* 1998; 57(5): 1045-54.
  10. Rathbun KM, Hildebrand JP. Placenta abnormalities. Treasure Island (FL), USA: StatPearls Publishing LLC; 2020. p 22 – 35.
  11. Afodun AM, Ajao MS, Enaibe BU. Placental anthropometric features: maternal and neonate characteristics in north central nigeria. *Adv in Anat* 2015: 790617.
  12. Raghunath G, Vijayalakshmi, Shenoy V. A study on the morphology and the morphometry of the human placenta and its clinical relevance in a population in tamilnadu. *J Clin Diagn Res* 2011; 5: 282-6.
  13. Yampolsky M, Salafia CM, Shlakhter O, Haas D, Eucker B, Thorp J. Modeling the variability of shapes of a human placenta. *Placenta* 2008; 29(9): 790-7.
  14. Pathak S, Hook E, Hackett G, Murdoch E, Sebire NJ, Jessop F, et al. Cord coiling, umbilical cord insertion and placental shape in an unselected cohort delivering at term: Relationship with common obstetric outcomes. *Placenta* 2010; 31(11): 963-8.
  15. Hatibaruah A. A study on macroscopic anatomy of human placenta. *J Evid Based Med Healthcare* 2015; 2: 3673-87.
  16. Ullberg U, Sandstedt B, Lingman G. Hyrtl's anastomosis, the only connection between the two umbilical arteries. A study in full term placentas from aga infants with normal umbilical artery blood flow. *Acta Obstet Gynecol Scand* 2001; 80: 1-6.
  17. Sherin F, Afzal E, Seema N. Gross morphological changes in premature and post mature human placentae. *J Ayub Med Coll Abbottabad* 2015; 27(2): 448-50.
  18. Cunningham F, Leveno K, Bloom S, Spong CY, Dashe J, Williams obstetrics. 24th Mcgraw-hill; 2014.
  19. Zaidi M, Arshad M, Vasenwala S, Faruqi N, Khan A, Khan S. Histomorphometry of preterm and term human placentas. *Int J Morphol* 2013; 31: 409-13.
  20. Sachin S, Kamal B, Shikky G, Sandeep K M. Study of arterial pattern of normal human placenta in reference to its shape, weight and hyrtl's anastomosis. *Int J Med Res Rev* 2017; 5(5): 455-61
  21. Yao AC, Moinian M, Lind J. Distribution of blood between infant and placenta after birth. *Lancet* 1969; 2(7626): 871-3.