



# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare &amp; Pharmascope Foundation

Journal Home Page: <https://ijrps.com>

## Morphometric measurements of the placenta in low-risk singleton pregnancies among Kerala population and its clinical relevance

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### Article History:

Received on: 12.06.2018

Revised on: 18.12.2018

Accepted on: 20.12.2018

### Keywords:

Placenta,  
Morphology,  
Morphometry,  
Low-risk pregnancies

### ABSTRACT

The present study was undertaken to observe the morphometric measurements of the placenta in low-risk singleton pregnancies among Kerala population and its clinical relevance. The current study included Placentas from 46 singletons low-risk pregnancies on normal deliveries. Placental parameters were collected by standard methods in the literature. Out of 46 placentae, the shape of the placenta is round in 60.8% oval in 34.78% and irregular in 4.34% cases. The cord insertion is central in 47.82%, eccentric in 39.13%, marginal in 4.34%, velamentous in 4.34% and furcate in 4.34% cases. The mean birth weight of the neonate in this study Mean, and standard deviation of baby weight is  $2.87 \pm 0.47$ kg ranging from 1.42 – 3.85kg. The placental birth weight ratio (PBWR) was 16% and FP ratio 6:1. The mean birth weight of male babies are  $460.81 \pm 66.77$ g. The mean birth weight of male babies is  $478 \pm 65.66$  g. The present study was in accordance with the studies conducted in other parts of India. Ethnic differences were reported between the Asian and European population. The study recommends more detailed study in more samples in different population groups. Examination of the placenta is very important and should examine properly before discarding even though the baby is healthy because it can be a predictive tool for future health risks.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v10i1.1847>

Production and Hosted by

IJRPS | <https://ijrps.com>

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### INTRODUCTION

Fetal health, infant health and adult health were highly influenced by the intrauterine environment. The placenta is the organ which is the principal regulator of fetal growth and health. It serves as

the mirror of intrauterine experiences of developing human. It is the characteristic of higher mammals and connects the baby to mother via the umbilical cord. It helps to obtain proper nutrients, oxygen, and elimination of waste products, immunological support and also endocrine functions. Throughout gestation, placenta undergoes a lot of changes in its morphology and morphometry. Development of fetus mainly depends upon the normal placentation and proper functioning. The macroscopic and microscopic architecture of placenta greatly influences its efficiency. Morphological and morphometric measurements of the placenta will provide an insight into the aetiology of newborn and maternal complications. Various studies conducted in the different parts of Asia and developed countries suggest the significant role of placental

growth measures in fetal growth. Diseases of pregnancy and pathologic condition of the placenta are important contributors to the morbidity and mortality for both mother and child (Vinay Kumar *et al.*, 2013). Any pathology of the placenta will have a direct impact on the fetal outcome. If the baby appears normal without risk or complications, we assume the placenta is normally devoid of any pathology. By assuming the placenta is healthy and not observing and measuring its condition, we will be too late to alter fetal effectively- and longer-term outcomes once fetal signs and symptoms appear (Salafia 2016). Researchers emphasised the importance and benefits associated with the examination of the placenta is often disposed of soon after delivery, without proper examination. The present study was undertaken to observe the morphometric measurements of the placenta in low-risk singleton pregnancies among Kerala population and its clinical relevance.

## MATERIALS AND METHODS

**Study design:** Descriptive study

**Study setting:** Placenta were collected from the Department of Obstetrics and Gynaecology and the study conducted in the Department of Anatomy, of P. K. Das Institute of Medical Sciences Vaniamkulam, Ottapalam, Palakkad, Kerala.

**Participants, inclusion and exclusion criteria:**

The current study included Placentas from 46 normal singleton deliveries. Mothers of age group between 18 and 40, gestational age between 28 -40 who attended the antenatal clinic of the hospital regularly and delivered their babies in the same hospital were included. The study was approved by the institutional ethical committee. Informed consent was taken from mothers. Complete medical, social and obstetric history was taken. The mothers were examined clinically along with relevant investigation reports. The information obtained from the medical records were gestational age at delivery (in weeks), maternal age, parity, mode of delivery, birth weight, foetal gender and presence/absence of maternal medical diseases. The following inclusion, exclusion criteria were followed while recruiting the participants.

**Inclusion criteria:** Healthy pregnant woman in labour at 28 weeks and above, were randomly selected.

**Exclusion criteria:** Women have any other pathologies like hypertension, GDM endocrine disorders, cardiovascular diseases, respiratory diseases, renal diseases. Diabetes mellitus, anaemia was excluded.

**Outcome measures:** All placentae were collected after delivery. Fetal membranes were trimmed,

and the umbilical cord was cut 10 cm away from the insertion site. Blood clots were removed by thoroughly washing under running tap water. Placenta weight was recorded by using a weighing scale. Shape, cord insertion, attachment of membranes, presence or absence of additional lobes was noted. The diameter of placenta was calculated by taking the average of two diameters (long and short diameter). The diameter was measured by using a metallic scale graduated in cms. Surface area was calculated by formula  $\pi \times d_1 \times d_2 / 4$  assuming placenta as elliptical (Pryse DJ; 1973). The circumference was calculated by using formula  $\pi d$ . Volume was calculated by using formula  $\pi r^2 h$ . Thickness was measured by using graduated knitting needle inserted at centre and expressed in cms. The weight of the newborn babies was recorded to the nearest kilogram using the standard weighing machine. Sex of the baby noted. The placental-birth weight ratio (PBWR) was calculated as the ratio of placental weight to neonatal weight multiplied by 100 and FP ratio calculated as the ratio of fetal weight to placental weight.

**Ethical consideration:** The study protocol was approved by the institutional ethical committee. (CRF/CRL/P11-1/Ph.D). Informed consent was obtained from all the participants. Confidentiality of the data was maintained.

**Data Analysis:** Data was analysed by SPSS 20.0. Data were presented as mean and standard error and frequency percentages.

## RESULTS

**Table 1: Classification of pregnant lady according to their gravida status**

Gravida	Number	Frequency
1	25	58.34%
2	11	23.9%
3	6	13.04%
4	2	4.34%
5	2	4.34%
Total	46	100%

**Table 2: Classification of pregnant lady according to parity**

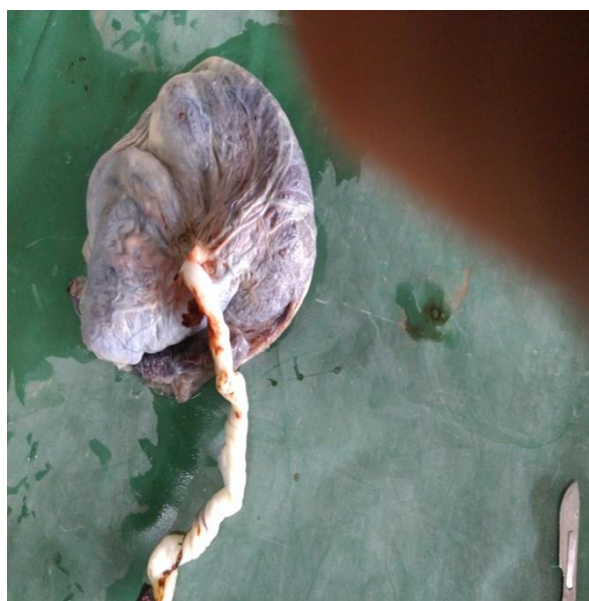
Parity	Number	Frequency
Primi	27	58.69%
Multi	19	41.31%

The age of pregnant ladies varies from 18 to 38 and mean, and the standard deviation was  $25.15 \pm 4.28$ . Table 1 shows the gravid status of women in this present study. Table 2 presents the parity of women. Table 3 presents the distribution of Shape, cord insertion, attachment of membrane among the study population. Out of 46 placentas the shape of the placenta is round in 60.8%, oval in 34.78% and irregular in 4.34% cases (fig 1), one bilobed

placenta also observed (fig 2). The cord insertion is central in 47.82%, eccentric in 39.13%, marginal in 4.34%, velamentous in 4.34% and furcate in 4.34% cases. Normal membrane attachment showed in 75.6%, circummarginate in 15.1%, circumvallate in 9.3% cases (fig 3). Table 4 shows Morphometric measurements of placenta in this present study, Mean placenta diameter obtained is  $474.89 \pm 47.21$  cm, Mean surface area sq.cm is  $208.9 \pm 43.78$  circumference  $50.95 \pm 5.5$  Volume  $545.75 \pm 147.07$  cu cms, thickness  $2.63 \pm 0.41$  cms. The mean birth weight of the neonate in this study Mean, and standard deviation of baby weight is  $2.87 \pm 0.47$  kg ranging from 1.42 – 3.85 kg. The placental birth weight ratio (PBWR) was 16% and FP ratio 6:1. The mean birth weight of male babies are  $460.81 \pm 66.77$  g. The mean birth weight of male babies is  $478 \pm 65.66$  g.

**Table 3: Distribution of Shape, cord insertion, attachment of membrane among the study population**

Parameter	Type	No.	Percentage
Shape of placenta	Round	28	60.8%
	Oval	16	34.78%
	Triangle	0	0%
	Irregular	2	4.34%
	Marginal	2	4.34%
Cord Insertion	Central	22	47.82%
	Eccentric	18	39.13%
	Velamentous	2	4.34%
	Furcate	2	4.34%
	Normal	39	75.6%
Membrane	Circum marginal	6	15.1%
	Circumvallate	1	9.3%



**Figure 1: Irregularly shaped placenta**



**Figure 2: Bilobed placenta**



**Figure 3: Circumvallate insertion of membranes**

**Table 4: Placental morphometry in the present study**

Parameters	Mean $\pm$ std deviation (range)
Placental weight	$474.89 \pm 47.21$ (270-550)gms
Diameter	$16.22 \pm 1.75$ (10.5-20)cms
Thickness	$2.63 \pm 0.41$ (2-3.7)cms
Circumference	$50.95 \pm 5.5$ (32.98 – 62.8)
Surface Area	$208.9 \pm 43.78$ (87-314)
Volume	$545.75 \pm 147.07$ (260-994)

## DISCUSSION

This study was conducted to determine the effect of ethnicity on placental indices and the birth weight of the baby. Little is known of the variability

of these placental parameters in low-risk populations; their association with maternal, pregnancy, and neonatal characteristics. The results of the present study were in accordance with the other Indian studies (Sirpurkar M *et al.*, 2015; Karmakar MK *et al.*, 2018; Panuganti PK *et al.*, 2012; Sabitha S & Gugapriya TS., 2014). Placental surface area, placental weight and placental volume of Indians were lower than Malays and Chinese population ( $P < 0.05$ ). Indian babies weight and length were less than Chinese babies (Sivarao *et al.*, 2002). Placental weight is higher in African Americans and lowers in those of Asian ethnicity when compared to all other ethnic groups (Baptiste-Roberts K *et al.*, 2002; Cunningham FG *et al.*, 2005). Placental weight and birth weight of the neonate are widely available measures. The ratio of these two variables is a useful marker of foetal nutrition and uteroplacental function (Barker DJ., 1990). The mean placental weight of in this study is  $474.89 \pm 47.21$ g which is lower than 643 and 630 g reported in western Europe and eastern Nigeria and 590g in northwestern part of Nigeria respectively (Adinma JI & Agbai AO 1995; Perry IJ *et al.*, 1995). However, it is more than 470 g reported in Ukraine, respectively (Little RE *et al.*, 2003; Leary SD., 2003). It has also been reported that ethnicity and some unknown factors may affect the placental weight (Lurie S *et al.*, 1999). The mean birth weight of the neonate in this study Mean and standard deviation of baby weight is  $2.87 \pm 0.47$ g ranging from 1.42 – 3.85g is lower than 3.27g, 3.42g, 3.38g, and 3.40 g reported in northwest Nigeria, Ukraine, western Europe, and eastern Nigeria respectively; but in accordance with the other studies in Asia and Afro-Caribbean region (Barker DJ., 1990; Adinma JI & Agbai AO 1995; Perry IJ *et al.*, 1995; Little RE *et al.*, 2003; Leary SD., 2003; Lurie S *et al.*, 1999). These differences in mean birth weight may be due to altitude; maternal nutrition and maternal diseases (Njokanma OF & Sule-Odu OA., 1998; Onankpa BO *et al.*, 2006). The mean PBWR 15 % of 18.2% in this study is lower than 18.2%, 20.0% and 19.5%, 17.8% reported in Africa, western Europe, other parts of Asia and Thailand but less than in Thailand and Ukraine, respectively (Barker DJ., 1990; Adinma JI & Agbai AO 1995; Perry IJ *et al.*, 1995; Little RE *et al.*, 2003; Leary SD., 2003 *et al.*; Adesina KT., 2016). The parameters of this present study were in accordance with the studies conducted by the other researchers in Madhyapradesh, eastern India, Andhra Pradesh and Tamilnadu. (Sirpurkar M *et al.*, 2015; Karmakar MK *et al.*, 2018; Panuganti PK *et al.*, 2012; Sabitha S & Gugapriya TS., 2014).

The typical placental shape is round with central insertion of the umbilical cord, but other shapes

like oval irregular, bilobate or multilobate and irregular placentas depend upon the vascular architecture. Abnormal shapes were the result of vascular pathology and led to placental insufficiency. Quantification of the irregularities in shape and growth will help to detect and prevent diseases in the early phase of pregnancy. vascular density of chorionic plate and thickness of the placenta influenced by the cord insertion. If eccentricity of cord insertion increases or increased placental disk thickness can be associated with decreased placental efficiency (salafia 2016). Placental weight is a summary of placental growth and fetoplacental-metabolism throughout pregnancy. Reduced placental weight and surface area also associated with hypertension in later life. a. small placentas, reduced placental weight, the reduced surface area will be seen in trisomies, hypertension and hypertension in a future life. Large placentas will be associated with maternal diabetes mellitus, Maternal anaemia and malnutrition. This is a compensatory mechanism (Naeye RL., 1987; Molteni RA *et al.*, 1978; Robertson CM., 2002; Fox GE *et al.*, 1991; Eriksson J., 2000). Barker (1990) noted the increased weight of placenta associated with risk of hypertension in adults between 46 and 56 years of age and altered growth of placenta is also predictive of maternal diseases such as cardiovascular diseases, hypertension, and diabetes mellitus (Cunningham *et al.*, 2005). The Placental growth determines the fetal growth (Kinare AS *et al.*, 2000). Placental measures are predictive of maternal disease, obstetric outcome, perinatal morbidity and mortality, childhood growth and development. Socioeconomic status also effects the placental weight (Perry IJ *et al.*, 1995). The examination of the placenta and its measurements will be helpful to the obstetricians and paediatricians in clinical practice. This information will be helpful in the immediate and later management of mother and infant.

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