



Determinants of feto-placental ratio

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Abstract:

The dimension of delivered placentae mirrors the cumulative growth of the placenta from conception to parturition. Placental weight is the gross summary of fetal growth under the influence of many extrinsic and intrinsic factors. Hence, the present study evaluated the influence of gestation, sex of the newborn, and parity on feto-placental ratio. The study was conducted on 391 placentae of singleton newborn from a teaching hospital of North Karnataka, India. Data was collected from August 2012 to January 2013 by using standard operating procedures. The Mean and standard deviations of placental morphometry, weight and birth weight are $440 \pm 100\text{gm}$ and $2700 \pm 500\text{ gm}$ respectively. In gestational age 28 to 32 weeks, the feto-placental ratio was 5.61:1; this increased consistently up to 6.19:1 with increasing gestation group 37 weeks and above. Feto-placental ratio increased with increasing groups of gestational age. Feto-placental ratio in <37 weeks of gestation was in favor of primipara (6.0:1) whereas, the similar figures in term babies was more in multipara (6.3:1). The paritywise feto-placental ratio direction changed from preterm to term babies, but the differences were not statistically significant. However, irrespective of gestation, multipara had higher feto-placental ratio (6.2:1) as compared to primipara (6.1:1). However, irrespective of gestation, males had higher feto-placental ratio (6.2:1) as compared to females (6.1:1). Feto-placental ratio is influenced by variates of pregnancy like gestation, sex of the newborn and parity. Hence, variations in any of these factors lead to adverse pregnancy outcome by deviation of feto-placental ratio.

Key words: Feto-placental ratio, fetal weight, placental weight, gestation

Introduction:

The growth trajectory of the fetus is primarily determined by placental morphology and physiology i.e., its capacity to transfer nutrients, gases, waste products, heat, hormones, blood flow and other regulatory molecules. Apart from this, it checks the rejection of fetal allograft.^{1, 2, 3, 4}

Placental efficiency defines the ability of placenta to extract nutrients and oxygen, and transport them from the mother to the fetus. It is commonly defined as grams of fetus supported by each gram of placenta. The Placental Weight Ratio (PWR) is defined as the ratio between the placental weight and fetal weight and it changes

with gestational age as the placenta matures.^{5,6} Abnormally low and high PWR were associated with adverse pregnancy outcomes (10th and 90th percentiles).⁷

Recent studies indicate that the altered growth of the placenta is a predictor of adult onset of diseases like cardiovascular disease, hypertension and diabetes. A large placenta and a low birth weight were reported as strong independent risk factors of cardiovascular diseases in adulthood.⁸

Placental weight and thickness conveys different dimensions of growth like shape, number of blood vessels, cord insertion, and arborisation of villi, indicating nutritional transport across placenta. Early in the second trimester, the placenta

approximates the fetus in size and continues to grow until term. As pregnancy advances, it becomes relatively smaller and by term, the ratio of its weight to that of the fetus is about 1:6 to 1:7.^{9,10}

Materials & Methods:

The present study was conducted in the Department of Anatomy, Jawaharlal Nehru Medical College, Belgaum. Placentae were collected from Obstetrics and Gynecology Unit of Dr. Prabhakar Kore Charitable Hospital, Belgaum. Data was collected from August 2012 to January 2013. The study was conducted on 391 mothers and their singleton offspring. The study was approved by the KLE University Ethical Clearance Committee. Detailed information about the intended research work was given to the mothers and written consent was obtained from them. A pilot study was carried out before commencing the actual study. This was done to assess the feasibility and practicability of the whole research design. The subjects without antenatal check-up during first trimester and with history of pre-pregnancy systemic and chronic diseases were excluded. Placental morphometry and newborn parameters were recorded on predesigned and pretested proforma.

Methods of specimen collection, preparation, and assessment of placental morphometry¹¹

- Placentae were collected soon after separating the baby from the umbilical cord. The collected placentae were examined thoroughly and washed under running tap water; thereafter, membranes were trimmed.
- The specimens were tagged with numbers for identification, and were transported to the skill lab by placing in a 10% formalin container.
- The weight of each placenta was determined by the digital baby weighing scale CS-8316(CE certified) and recorded with accuracy of 1 gm.

Parameters of newborn baby assessed were:

- Gestational age, weight of the baby. The gestational age was recorded from last menstrual period (LMP) and further confirmed by Ultrasonography (USG); grouped as 28-34, 35-36, 37+ weeks (wk). Birth weight was measured by using Digital baby weighing scale CS-8316(CE certified) with accuracy of 10 gm.

Results:

Figure I: Birth weight distribution of newborns

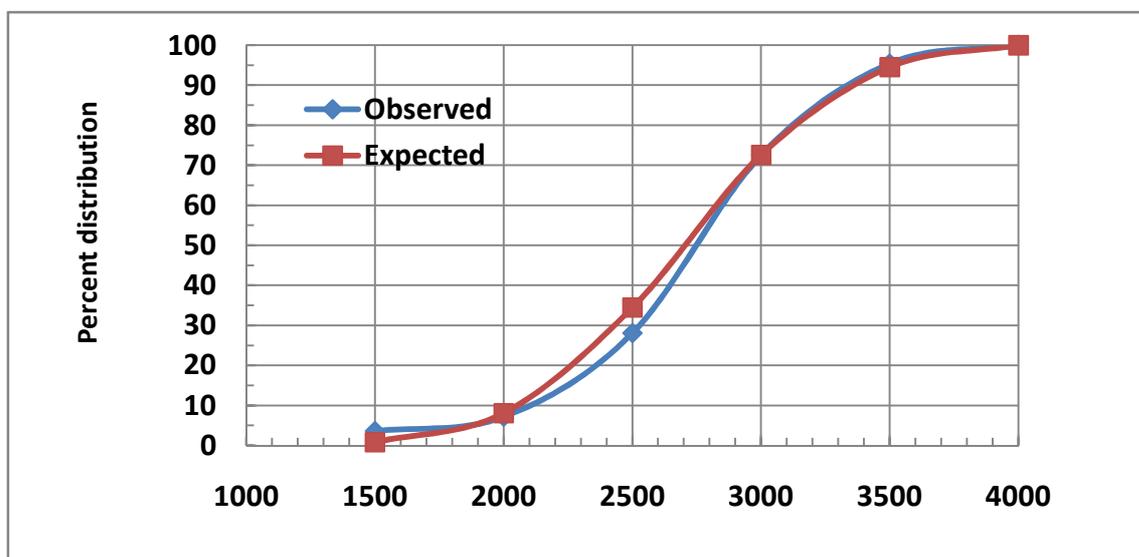


Figure II: Distribution of placental weight

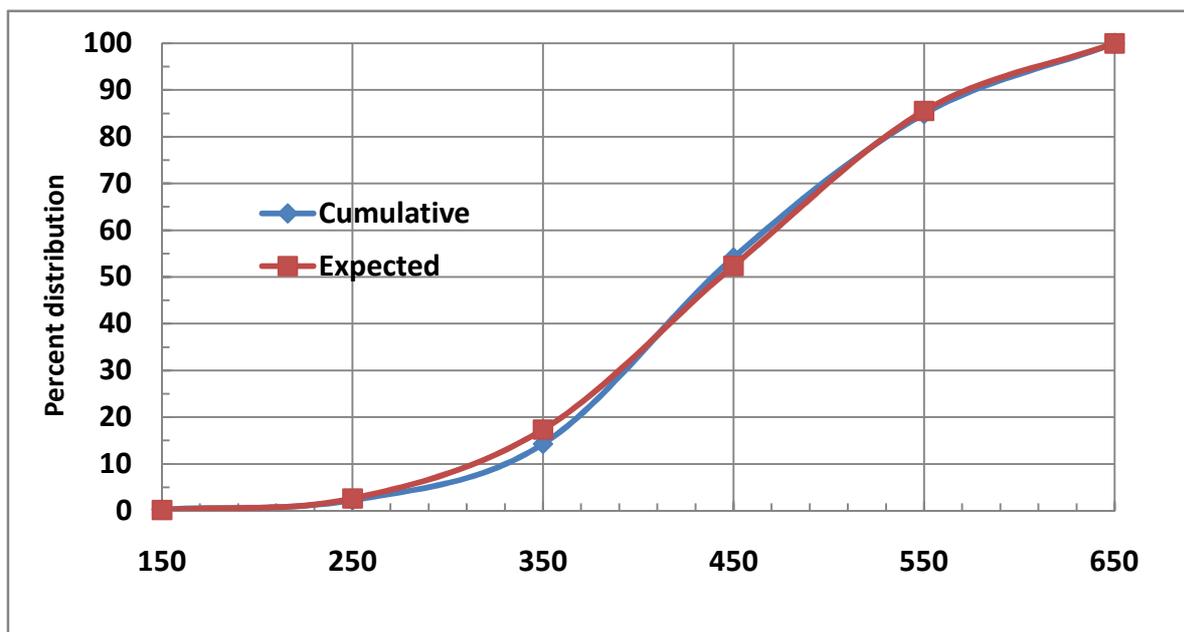


Table I: Association of feto-placental ratio with gestational age

Gestation	n	Percent	Mean	SD	SE	95% Confidence Interval	
						Lower Bound	Upper Bound
Feto-Placental Ratio							
28-32	16	4.1	5.61	2.40	0.60	4.33	6.89
33-36	42	10.7	5.98	1.38	0.21	5.55	6.41
37+	333	85.2	6.19	1.11	0.06	6.07	6.31
Total	391	100.0	6.15	1.22	0.06	6.03	6.27

Table II: Feto-placental ratio by parity and sex in gestational groups

Gestation groups	Variable	Feto-placental ratio			Z
		n	Mean	SD	
1.Parity					
<37	Primi	25	6.02	2.29	0.48
	Multi	33	5.78	1.11	
	Total	58	5.88	1.71	-
37+	Primi	164	6.08	1.04	1.86
	Multi	169	6.30	1.16	
	Total	333	6.19	1.11	-
Total	Primi	189	6.07	1.27	1.19
	Multi	202	6.22	1.16	
	Total	391	6.15	1.22	-
2.Sex of newborn					
<37	Female	28	5.95	1.83	0.31
	Male	30	5.81	1.61	
	Total	58	5.88	1.71	-
37+	Female	149	6.07	1.03	1.83
	Male	184	6.29	1.16	
	Total	333	6.19	1.11	-
Total	Female	177	6.05	1.18	1.40
	Male	214	6.22	1.24	
	Total	391	6.15	1.22	-

Birth weight distribution in **Figure I** reveals that a maximum of 44.5 percent newborns were of birth weight 2500-2999 gm and 28.1 percent were less than 2,500 gm (LBW). Birth weight distribution was moderately normal with mean 2700 and standard deviation 500 gm.

Placental weight distribution in **Figure II** reveals that a maximum of 39.9 percent placentae were of weight 350-449 gm and 14.3 percent were less than 350 gm. Placental weight followed normal distribution with mean 440 gm and standard deviation 100.

Table I reveals that in gestational age 28 to 32 weeks, the feto-placental ratio was 5.61:1. This increased consistently to 6.19:1 in gestation group 37 weeks and above. Feto-placental ratio increased with increasing groups of gestational age.

Table II reveals that the feto-placental ratio in <37 weeks of gestation was in favor of primi (6.0:1) as compared to multipara (5.8:1), whereas, the similar figures in term babies as 6.1:1(primi) and 6.3:1(multi) respectively. The paritywise feto-placental ratio direction changed from preterm to term babies, but the differences were not statistically significant. However, irrespective of gestation, multipara had higher feto-placental ratio (6.2:1) as compared to primipara (6.1:1).

Feto-placental ratio by sex in gestational groups in **Table II** reveals that the feto-placental ratio in <37 weeks of gestation was in favor of females (6.0:1) as compared to males (5.8:1), whereas, the similar figures in term babies were 6.1:1 and 6.3:1 respectively i.e., in favor of males. However, irrespective of gestation, males had higher feto-placental ratio (6.2:1) as compared to females (6.1:1).

Discussion:

In the present study, the mean feto-placental weight ratio is 6.15:1. Another study has observed the mean feto-placental ratio of 5.85:1.¹² Hatti et al in their study have mentioned the feto-placental ratio in

primi 5.82:1 and 5.60:1 in multipara¹³, whereas, the present study feto-placental ratio in primi is 6.07:1 and 6.22:1 in multipara. Gunapriya et al (2011) has observed feto-placental ratio for males 5.4:1 and 5.3:1 for females¹⁴, whereas, in the present study feto-placental ratio in males 6.22:1 and 6.05:1 in females.

The feto-placental weight ratio changes with gestational age as the placenta matures¹⁵; similar findings were observed in present study. Higher feto-placental ratio is associated with abnormal maternal factors such as overweight, obesity, anemia, cigarette smoking, and lower socio-economic status. Infants born with abnormal feto-placental ratio are prone to the risk of perinatal mortality. The variation in feto-placental ratios are due to reduced placental reserves leading to asymmetrical IUGR babies.^{16, 17, 18, 19, 20}

Conclusions:

The study concludes that feto-placental ratio is the surrogate formula to assess the optimal growth of fetus. Feto-placental ratio is influenced by variates of pregnancy like gestation, sex of the newborn and parity. Hence, any variation in feto-placental ratio alarms the risk of adverse pregnancy outcome to health workers.

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