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## Original Research Article

# Second trimester placental thickness: its' correlation with gestational age, femur length and biparietal diameter

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### ABSTRACT

**Background:** Placental thickness (PT) is the easiest placental dimension to measure, yet little is known about the normal PT. The aim of this study was to determine the normal, sonographically measured PT in millimetre (mm) in the second trimester and to determine if this measurement can be adjusted for gestational age for that time and evaluate its relationship with femur length and biparietal diameter of the fetus.

**Methods:** The study was a cross sectional observational study, recruiting 100 consecutive, singleton pregnancies, reporting for ultrasonography (USG) between 14 weeks and 24 weeks of gestation, having undergone at least one ultrasonogram in the first trimester, with known last menstrual period (LMP). The placental thickness was measured perpendicular to the uterine wall, through the placenta at the site of cord insertion.

**Results:** The average age of study population was 24.96 with a standard deviation (SD) of 2.70 years with the minimum age being 18 years and maximum age being 32 years. Regression analysis yielded the following mathematical relationships between PT, Gestational age (GA), Biparietal diameter (BPD) and Femur length (FL) in the second trimester.  $Y(PT) = 0.9366x(\text{Gestation age}) + 1.655$ ,  $R^2 = 0.7332$ ;  $Y(PT) = 0.2872x(\text{BPD}) + 6.9578$ ,  $R^2 = 0.7314$ ;  $Y(PT) = 0.2995x(\text{FL}) + 10.03$ ,  $R^2 = 0.6186$

**Conclusions:** PT in present study showed a positive linear correlation with gestational age, FL and BPD in second trimester. Also, it can be concluded that PT may be used as a predictor of GA in women with unknown LMP.

**Keywords:** Biparietal diameter, Femur length, Gestational age, Placental thickness

### INTRODUCTION

Placenta formation begins in the later half of the 2<sup>nd</sup> month of pregnancy, is usually completed by 4<sup>th</sup> month and reaches its maximum growth at term,<sup>1</sup> when it is discoid in shape with a diameter of 15 to 25 cm and approximately 3 cm thick and weighs about 500 to 600 g.<sup>2</sup> Placenta is a fetal organ with important metabolic, endocrine and immunologic functions besides being responsible for nutrition, respiration and excretion of

fetus. Last but not least, it has a role in protecting the fetus from noxious agents.<sup>3</sup>

The in utero environment and its impact on neonatal health have been postulated to have a direct bearing on the health of an individual during later years.<sup>4,5</sup> Research has shown a direct link between placental insufficiency and birth weight and its co-relation with development of the so called metabolic syndrome: hypertension, diabetes and coronary heart disease in later life.<sup>6</sup> Placenta is the

first organ to manifest changes of disease in pregnancy and therefore, screening of placenta may have a role in screening for diseases of pregnancy. Placenta and its functioning are known to influence the fetal birth weight and therefore, abnormalities if any in the placenta, would precede the abnormalities in fetal growth.<sup>7</sup>

Placental thickness (PT) is the easiest placental dimension to measure, yet little is known about the normal PT, measured by the second trimester sonography.<sup>8</sup> The PT tends to gradually increase with gestational age in a linear fashion. Sonographically, it has been seen to be at about 1 mm per week.<sup>9</sup> The maximum thickness of a normal placenta at any point during pregnancy is considered to be 4 cm and anything more than 4 cm is considered abnormal<sup>10</sup> and associated with poor outcomes.<sup>11</sup> A PT of less than 2.5 cm is usually associated with intra uterine growth restriction.<sup>12</sup> There is not enough supporting literature for these cut off values, with the PT tending to vary according to its site of insertion, further casting a doubt on the cut off values.

Small and large, both placentae are associated with abnormalities, therefore second trimester screening of placentae could help in screening of potential complications. For this though, we need to establish what is normal first. To find out normal development of placenta, PT justifies as a good forecaster for fetal growth and birth weight, especially in the second trimester.<sup>13</sup>

The aim of this study was to determine the normal, sonographically measured PT in millimetre (mm) in the second trimester and to determine if this measurement can be adjusted for gestational age for that time and evaluate its relationship with femur length and biparietal diameter of the fetus.

## METHODS

The study was a cross sectional observational study, recruiting 100 consecutive, singleton pregnancies, reporting for ultrasonography (USG) between 14 weeks and 24 weeks of gestation, having undergone at least one ultrasonogram in the first trimester, with known last menstrual period (LMP).

Patients with diabetes, hypertension, anaemia, fetal anomalies, multiple pregnancies, placenta previa, posterior placenta, IUGR and unknown LMP were excluded from the study. The study was approved by Institutions Ethics Committee and a written informed consent was obtained from all patients.

The placental thickness was measured perpendicular to the uterine wall, through the placenta at the site of cord insertion. To maintain consistency, measurements were taken by a single operator. Along with placental thickness, biparietal diameter (BPD) and Femur length (FL) were also recorded.

## Statistical analysis

Demographic data was presented as mean ( $\pm$ standard deviation), median (25<sup>th</sup> to 75<sup>th</sup> percentiles) and number (percentage) according to distribution. Pearson's correlation analysis was used to establish degree of relationship between PT, FL and BPD. Mathematical relationships between PT, Gestational age (GA), FL and BPD were derived by regression analysis and the best fit model was used to plot the linear graphs of relationship between PT with GA, FL and BPD. The values were expressed as mean $\pm$ standard deviation. Statistical tests were two tailed with p value <0.01 to indicate statistical significance. Data was analysed using SPSS software v.20.0 and Microsoft excel.

## RESULTS

We observed a total of 100 patients, whose placental thickness was measured in their second trimester of pregnancy. The demographic details are presented in Table 1.

**Table 1: Patient demographics (n= 100).**

Characteristic	Mean (SD) Value
Age, yrs	24.96 (2.70)
Height, cms	158.8 (3.17)
Weight, kg	62 (57-68)
Body mass index, kg/m <sup>2</sup>	25 (23-27)
Gestation, d	144 (20.8)
Gestation, wk	20.5 (2.9)
Gravida	1.27 (1-2)
Parity	0.22 (0-1)
Biparietal diameter	44.34 (9.3)
Femur length	32.27 (8.24)

The average age of study population was 24.96 with a standard deviation (SD) of 2.70 years with the minimum age being 18 years and maximum age being 32 years. Maximum number of patients belonged to 12 to 25 years age group with an average BMI of 25 kg/m<sup>2</sup>.

**Table 2: Placental thickness for each week of gestation.**

Gestation in weeks+days	Placental thickness			
	n	Mean	Standard deviation	95% Confidence intervals
14- 14+6	3	14.70	2.25	29.4 (9.1- 20.2)
15-15+6	8	15.57	1.53	31.1 (14.2-16.8)
16-16+6	13	16.29	1.84	32.5 (15.1-17.4)
17-17+6	11	17.36	1.67	34.7 (16.2-18.4)
18-18+6	11	19.26	1.55	38.5 (18.2-20.3)
19-19+6	3	20.53	1.27	41.0 (17.3- 23.6)
20-20+6	2	18.75	1.20	37.5 (7.9-29.5)
21-21+6	16	21.88	1.04	43.7 (21.3-22.4)
22-22+6	21	21.94	1.63	43.8 (21.2- 22.6)
23-23+6	12	22.98	1.92	45.9 (21.7-24.2)

Maximum patients belonged to gestational age of 22 weeks to 22 weeks 6 days and minimum number of patients belonged to 20 weeks to 22 +6 weeks.

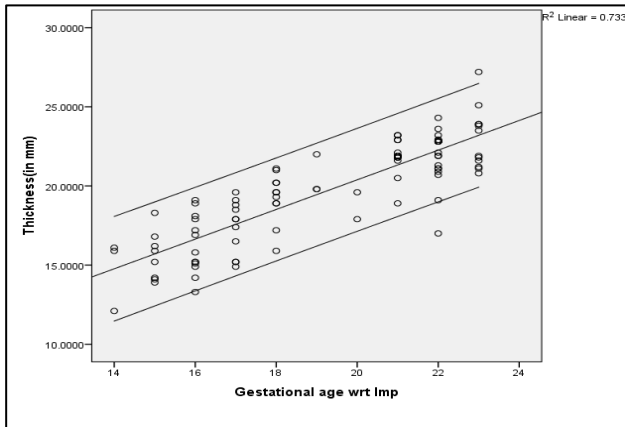
The result of present study showed a fairly linear increase in PT with gestational age (Table 2).

There was a significant positive correlation between PT, GA, BPD and FL in the second trimester, with a 2 tailed Pearson's correlation returning a significance of 0.001.

Regression analysis yielded the following mathematical relationships between PT, GA, BPD and FL in the second trimester.

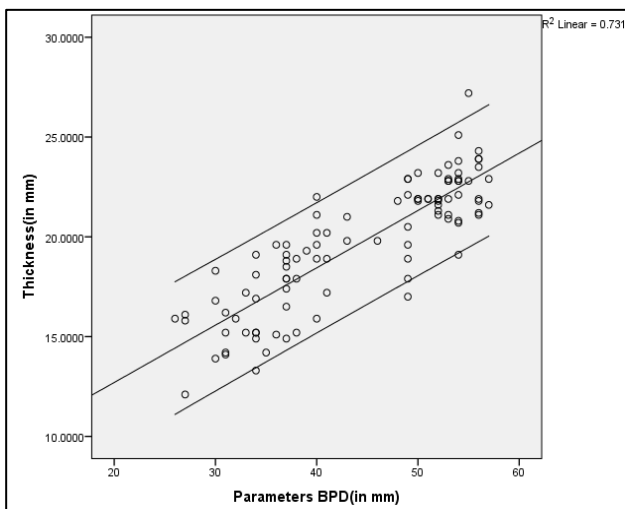
- $Y(PT) = 0.9366x(\text{Gestation age}) + 1.655$ ,  $R^2 = 0.7332$
- $Y(PT) = 0.2872x(\text{BPD}) + 6.9578$ ,  $R^2 = 0.7314$
- $Y(PT) = 0.2995x(\text{FL}) + 10.03$ ,  $R^2 = 0.6186$

The scatter plots for the same are depicted in Figure 1, Figure 2 and Figure 3 respectively.



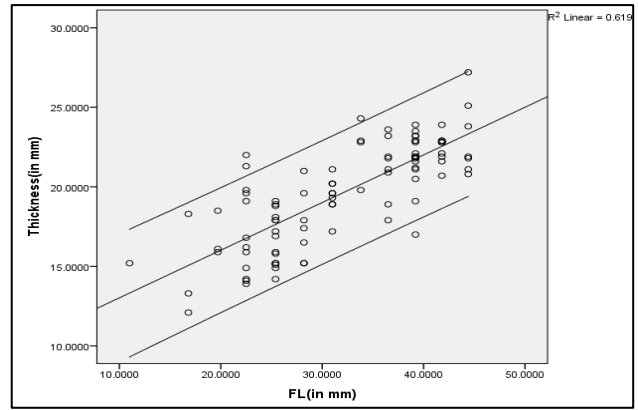
$y = 0.9366x + 1.655$ ;  $R^2 = 0.7332$

**Figure 1: Scatter plot of PT versus gestational age.**



$y = 0.2872x + 6.9578$ ;  $R^2 = 0.7314$

**Figure 2: Scatter plot of PT versus BPD.**



$y = 0.2995x + 10.03$ ;  $R^2 = 0.6186$

**Figure 3: Scatter plot of PT versus FL.**

## DISCUSSION

In the present study the mean age of patients presenting in the second trimester was 24.96 years whereas in a study by Maryam et al the mean age was 26.4 years.<sup>14</sup> In another study by Lee et al the average age was found to be 33.2 years which was higher than present study.<sup>8</sup> This can be explained by the fact that in this part of the world, marriages at early age followed by early conception are a norm. Patients with average BMI of 25 kg/m<sup>2</sup> presented in present study.

As evident from Table 2, the mean gestational age along with SD corresponded to the PT and a linear increase was evident. Study by Karthikeyan T et al showed a similar linear increase. From 14<sup>th</sup> to 19<sup>th</sup> week, the increase in PT was about 5mm. In the 19<sup>th</sup> and 20<sup>th</sup> week the PT decreased by about 2mm. From 19<sup>th</sup> to 24<sup>th</sup> week there was an increase of about 3mm.<sup>15</sup> These findings were consistent with study conducted by Ohagwu et al.<sup>16</sup> At no point did we find a patient with placental thickness of more than 4cm, thus the fact that PT more than 4cm is associated with abnormality could not be assessed and thus cannot be refuted.

In the present study, positive correlation between PT, FL and BPD in the second trimester was observed, which correlates with similar results from other studies also. Study conducted by Suresh K has similar observations.<sup>13</sup> Another study conducted by Adhikari R et al, observed a positive significant correlation between PT, FL and BPD in second and third trimester.<sup>17</sup> Ohagawu et al studied a significant correlation between PT and FL, BPD, AC and HC.<sup>16</sup>

The present study showed a positive correlation between PT and BPD. In present study PT did not correspond to gestational ages at 18, 19 and 20 weeks. Mittal P et al reported comparable observation, that PT was higher by 1 to 4 mm between 10 to 21 weeks of gestation.<sup>18</sup> In present study in the 18<sup>th</sup> week and 19<sup>th</sup> weeks, it was 1.25mm and 2 mm higher respectively and in the 20<sup>th</sup> week, it was 1.25 mm lesser. Jain et al also observed

placental thickness was higher than gestational age by 1 to 5 mm between 10 to 25 weeks of gestation.<sup>3</sup> Tiwari A et al showed PT was higher by 1 to 4 mm up to 21 weeks and after 22 weeks it was lower by 1 to 2 mm.<sup>19</sup> Present study observed linear correlation of PT with gestational age and also its positive significant relationship with FL and BPD in the second trimester.

Limitation of present study was that it was a cross sectional study and authors measured PT only once in each subject during the study. The sample size was small. Position of the placenta was not taken into account. PT might vary with the ethnicity of the data set and more sample sizes and from different ethnicity are required to test the efficacy of PT being used as a marker for fetal gestational age estimation.

## CONCLUSION

PT in present study showed a positive linear correlation with gestational age, also its correlation with FL and BPD in second trimester was also linear. Also, it can be concluded that PT may be used as a predictor of GA in women with unknown LMP. In patients with abnormal parameters like BPD in hydrocephalus and FL in skeletal dysplasias, PT can be substituted for these parameters for gestational age estimation. In patients with abnormal PT for the corresponding gestational age, the underlying disease leading to increase or decrease of PT should be taken into account and rectified.

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