Fetal Gestational Age Determination Using Ultrasound Placental Thickness in Primigravida versus in Multipara

Sayed Abd-Almonem Mahmoud[1], Aya Gamal Mohamed Helba[2*],
Noha Fathy Mohamou[1], Wael Gaber Eldamaty[1]
[1]Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University.
[2]Department of Obstetrics and Gynecology, Menouf General Hospital, Menoufia.
*Corresponding author: Aya Gamal Mohamed Helba.
Mobile: (+2) 01003637783, E-mail: Www.yoyo53@yahoo.com

ABSTRACT
Background: The placenta is an essential fetal organ that acts as a physiological link between a pregnant woman and her infant, secreting hormones and acting as a barrier against infection.
Objectives: The placental thickness at the umbilical cord insertion site in primigravida and multipara were measured sonographically. The results were compared to the gestational age, which was calculated by the last menstrual period (LMP) and other fetal growth parameters, like biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL). **Patients and Methods:** This prospective investigation has been carried out on 200 pregnant women at Menoufia University Hospital and Menouf General Hospital included singleton pregnancy and those in the 2nd or 3rd trimester.
Results: At gestational age from 31-40 weeks, there was a significant relation among age of pregnancy and placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm), P-value less than 0.05. There was insignificant variance among the primigravida and multipara groups in terms of placental thickness, BPD, HC, FL, AC, and other factors (p>0.05). **Conclusion:** We conclude that there was insignificant variance in placental thickness, BPD, HC, FL, and AC between primigravida and multigravida. However, gestational age significantly influenced these factors, with increased thickness observed in gestational age between 31-40 weeks, indicating that gestational age significantly influences placental thickness and other factors.
Keywords: Fetal Gestational Age, Ultrasound, Placental Thickness, Primigravida, Multipara.

INTRODUCTION

The placenta is a fetal organ that helps the absorption of nutrients and oxygen from the maternal circulation, in addition to the excretion of carbon dioxide and other waste products of metabolism. In addition, the placenta secretes hormones into the maternal circulation and acts as a protective barrier against the transmission of infection to the fetus [1]. The primary objective of placental evaluation was to detect its position or premature separation until recently. Nevertheless, the pregnancy result is additionally affected by the placenta's size and development pattern [2]. Quality obstetric care is contingent upon the precise determination of gestational age (GA). Biparietal diameter, fetal crown-rump length (CRL), femur length, head circumference (HC), and abdominal circumference are among the most frequently utilized sonographic variables to date pregnancy [3].

Due to the fact that it is influenced by the size and shape of the head of a fetus, the biparietal diameter is less accurate and less reliable throughout the 3rd trimester of gestation. The fetal head is highly malleable; consequently, BPD might be underestimated in breech presentations. Again, the HC measurement is frequently perceived as more technically challenging and entails a greater degree of observer bias. However, it might serve to mitigate these issues. The femur might appear foreshortened in certain cases, particularly in cases of excessive fetal motion, and the measurement of FL for dating at later phases of gestation is additionally deemed unreliable [4]. Moreover, dwarfism might affect the accuracy of the measurement. Placental growth is the consequence of the branching and multiplication of chorionic villi. The placenta grows throughout gestation, with the initial growth being much quicker compared to that of the fetus [5].

The objective of the research was to sonographically determine the placental thickness at the umbilical cord location in primigravida and multipara. The thickness was then correlated with the gestational age, which has been calculated by the last menstrual period, and other fetal growth variables (abdominal circumference, femur length and biparietal diameter).

PATIENTS AND METHODS

This prospective investigation has been performed on 200 pregnant females at Menoufia University Hospital and Menouf General Hospital.
Inclusion criteria: Singleton pregnancy, pregnant women at second or third trimester, females should be sure of their last menstrual period.
Exclusion criteria: Multifetal pregnancy, any medical disorder (hypertension, diabetes, etc.), women unsure of LMP, oligohydramnios, polyhydramnios, suspected intrauterine growth restriction (IUGR), placentas exhibiting morphological variations (e.g., bilobed, succenturiate, and placental membranacea), placentas with deviations in cord insertions (e.g., velamentous and marginal cord insertions), and any earlier uterine incisions other than cesarean section (e.g., myomectomy).

Ethical considerations:
The data that were collected from participants were confidential. The research participants weren't identified by name in any publication or report that addressed this research. The nature and goal of the

research, as well as the risk-benefit evaluation, have been explained to the participants prior to their admission to this study. Informed consent has been obtained from each participant. Approval of Ethics committees of Menoufia University Hospital and Menouf General Hospital was obtained. The Helsinki Declaration was followed throughout the study's conduct.

All patients have been subjected to the following:

I- Complete history taking: Personal history, maternal age, body weight and height to estimate the body mass index (BMI), LMP to estimate the gestational age, complaint and its duration, present history, past Medical history and past surgical history. **General examination, Obstetric examination:** Fundal height, fetal heart rate, Uterine size, weight gain, maternal diet, and overall well-being, with GA estimation depend on the LMP.

II- Vaginal examinations

A vaginal examination is an internal physical examination that is conducted by a midwife or physician. Vaginal examination has been typically performed in a supine, semi-recumbent, or lateral position, although it could also be performed in a forward-leaning position, as it is an intrusive procedure. The healthcare practitioner utilized appropriate infection control techniques and then gingerly inserted 2 fingers into the vagina to conduct the evaluation. The procedure primarily evaluated the extent to which the uterine cervix has thinned and dilated, as well as the extent to which the fetal presenting part has descended into the maternal pelvis, the fetal membranes were intact, the degree to which they have been applied to the fetal presenting part, the extent to which they come under pressure during a contraction, and the position and degree of flexion of the fetal presenting part in regard to the maternal pelvis.

Vaginal examination included all of the following:

The cervix, the fetal presenting part and state of the amnion.

III- Radiological investigation

The obstetrics solography has been conducted using an ultrasound scanner with a Doppler function and a transducer operating at 3.8–5.0 megahertz. In the supine position, each case has been scanned with a moderately distended urinary bladder. The abdominopelvic region was sufficiently exposed, and an acoustic gel was implemented. The fetal lie and presentation have been determined through scanning in longitudinal, transverse, and oblique planes. The **crown rump length (CRL)** has been used to evaluate the gestational age from eleven to twelve weeks of gestation, while measuring other fetal variables, including head circumference, femoral length, abdominal circumference and biparietal diameter, has been utilized to determine the gestational age from thirteen to forty weeks of gestation.

Statistical analysis

The IBM Statistical Package for the Social Sciences (SPSS) software version 22.0 has been utilized to statistically analyze and present all of the data that were gathered in tables. Means, standard deviations, and percentages were computed as descriptive statistics. The means of data were compared using independent t-tests for continuous parameters. Statistical significance was defined as a P value that is less than 0.05 and P-value less than 0.01 was considered highly significant.

RESULTS

There was statistically insignificant variance among the primigravida group and the multigravida group with regard to age, height, weight, BMI and GA (Table 1).

Table 1. Distribution of patient characteristic data among the investigated groups.

	Primigravida group Number=one hundred		Multigravida group Number= one hundred		P-value
	Mean	SD	Mean	SD	
Age (years)	24.3	2.6	25	3	0.07
Weight (kg)	67.3	6.8	69	7	0.08
Height (cm)	161.0	4.7	161.3	4.6	0.64
BMI (kg/m²)	26.0	3.1	26.7	3.1	0.11
GA (weeks)	30.9	7.6	29	7.3	0.07

SD: standard deviation, BMI: body mass index, GA: Gestational age.

There was statistically insignificant variance among the primigravida group and the multigravida group regarding NVD and CS p<0.05. (Table 2).

Table 2. Distribution of mode of delivery among the investigated groups.

	Multigravida group Number= one hundred		Primigravida group Number= one hundred		P-value
	N	%	N	%	
NVD	50	50	45	45	1
CS	50	50	55	55	0.4

NVD= normal vaginal delivery, CS= caesarian section

There was statistically insignificant variance among the primigravida group and the multigravida group regarding placental thickness, "BPD" and "HC" p<0.05. (Table 3).

Table 3. Distribution of placental thickness, BPD and HC among the studied groups.

	Primigravida group Number= one hundred		Multigravida group Number= one hundred		P-value
	Mean	SD	Mean	SD	
Placental thickness mm	32.6	5.6	31.4	5.5	0.13
BPD in weeks	31.3	7.5	29.8	6.7	0.14
BPD in mm	76.3	17.4	73.5	15.9	0.23
HC in weeks	31.3	7.6	29.5	6.8	0.08
HC in mm	281.4	63.0	268.6	58.5	0.14

BPD: Borderline personality disorder. HC: Head Circumference

There was statistically insignificant variance among primigravida group and multigravida group regarding FL (Table 4).

Table 4. Distribution of FL and AC among the studied groups.

	Primigravida group Number=one hundred		Multigravida group Number=100		P-value
	Mean	SD	Mean	SD	
FL in weeks.	31.0	7.5	29.4	6.8	**<0.001**
FL in mm	57.3	15.9	54.2	14.2	**0.03***
AC in weeks	30.9	7.5	29.2	6.8	0.2
AC in mm	277.3	67.8	261.8	65.9	0.1

FL: Follicular   AC: abdominal circumference

A significant relation has been observed among GA and placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm) in which placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm) increased in gestational age of 31-40 week. (Table 5).

Table 5. Relation between gestational age and US finding in primigravida group.

	Gestational age						P value
	<20 weeks N=12		20-30 weeks N=34		31-40 weeks N=54		
	Mean	SD	Mean	SD	Mean	SD	
Placental thickness (mm)	23.0	2.4	29.3	3.3	36.9	2.1	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
BPD (week)	18.0	1.5	26.5	3.5	37.3	2.6	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
BPD (mm)	43.2	2.6	68.1	10.2	84.6	21.2	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
HC (week)	17.9	1.5	26.5	3.4	37.2	2.4	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
HC (mm)	184.1	32.3	245.7	54.1	325.5	20.7	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
FL (week)	17.4	1.4	26.2	3.5	37.0	2.6	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
FL (mm)	30.4	4.8	47.5	9.6	69.5	6.0	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
AC (week)	17.6	1.3	26.2	3.2	36.9	2.7	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
AC (mm)	160.8	14.0	248.0	38.0	321.6	45.0	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**

BPD: Borderline personality disorder   HC: Head Circumference   FL: Follicular   AC: abdominal circumference P1:Group 1 vs Group 2 P2:Group 1 vs Group 3   P3:Group 2 vs Group 3.

A significant relation has been detected among GA and placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm). in which Placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm) increased in gestational age of 31-40, P-value less than 0.05 (Table 6).

Table 6. Relation among gestational age and US finding in multigravida group.

	Gestational age						P value
	<20 Number=16		20-30 Number=50		31-40 Number=34		
	Mean	SD	Mean	SD	Mean	SD	
Placental thickness (mm)	22.4	4.7	28.7	2.9	35.8	2	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
BPD (week)	17.3	4.7	26.4	2.6	35.5	2.6	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
BPD (mm)	42.4	3.5	64.1	15	83.4	15.3	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
HC (week)	17.1	1.9	26.3	2.6	35.4	2.6	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
HC (mm)	152.6	16.6	247.9	25.8	314.8	18.1	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
FL (week)	16.9	1.8	26.1	2.6	35.2	2.7	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
FL (mm)	28.8	2.3	47.8	7.5	66.5	4.5	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
AC (week)	16.9	1.8	26.3	2.6	35.2	2.8	**<0.001 P1=<0.001 P2=<0.001 P3=<0.001**
AC (mm)	130.9	36.7	180.5	88.4	276	34	**<0.001 P1=0.03 P2=<0.001 P3=<0.001**

BPD: Borderline personality disorder   HC: Head Circumference   FL: Follicular   AC: abdominal circumference P1:Group 1 vs Group 2   P2:Group 1 vs Group 3   P3:Group 2 vs Group 3.

DISCUSSION

Placental growth is the consequence of the branching and multiplication of chorionic villi. During gestation, the placenta experiences increased growth, with the initial phase being significantly quicker compared to that of the fetus [6]. GA is of the uttermost importance in the interpretation of biochemical screening tests for the risk evaluation of a variety of anomalies in fetus. Knowledge of gestational age is essential for even clinical decisions, such as elective induction of labor and caesarean section [7].

The goal of this investigation was to relate the placental thickness at the umbilical cord site of insertion in multipara and primigravida with the gestational age assessed by the last menstrual period and other fetal growth variables (abdominal circumference, biparietal diameter, femur length) through sonographic measurement.

The current investigation demonstrated that a statistically significant distinction has been observed between the primigravida and multigravida groups regarding age, weight, height, BMI, and GA, as indicated by the general characteristics of the investigated groups (P-value more than 0.05). These findings were consistent with the outcomes of **Parveen et al.** [8], who illustrated that there was statistically insignificant distinction among the primigravida and multigravida groups in terms of gestational age, maternal BMI, and age (P-value more than 0.05). The mean (±SD) age of the participants was 22.67±2.94 years, and their ages varied from eighteen to thirty-three. The weight and height of the participants were 81.7±14.7 kg and 1.6±0.1 m, correspondingly, by mean (±SD). One hundred and eleven subjects (27.3 percent) were primigravida, 118 (29.1 percent) were primiparous women, 165 (40.6 percent) were multiparous, and 12 (3.0 percent) were grand multiparous.

We discovered that fifty percent of the multigravida group had NVD and fifty percent had CS, as indicated by the mode of delivery. Our outcomes are consistent with those of **Hamdy and Ali** [9] who determined that primigravida parity was 152 (38 percent), multigravida parity was 248 (62 percent), delivery with VD was 211 (52.8 percent), and delivery with CS was 189 (47.2 percent). We found statistically insignificant variation among the primigravida and multigravida groups in terms of placental thickness, BPD in weeks, BPD in mm, HC in weeks, and HC in millimeter in our research.

Olaleye et al. [10] conducted an independent samples t-test to compare placental thickness between primigravida and multiparous females. There was a statistically insignificant distinction in placental thickness between primigravida (Mean=31.0, SD=6.3) and multiparous (Mean=31.7, SD=8.6) females; P-value equal 0.27. This lack of variation in placental thickness might be attributed to the physiological similarities in placental function, maternal factors, gestational age,

investigation population characteristics, and individual variability in placental progression. Additionally, our findings were consistent with **Hamdy and Ali** [9], which found that there was statistically insignificant distinction among the primigravida and multigravida groups in terms of placental thickness, placental diameter, and biparietal diameter (P-value more than 0.05). In accordance with **Deshpande** [11] our results indicated that there was statistically insignificant distinction in placenta thickness among primigravida and multigravida (p-value equal 0.4) and insignificant variation in placenta diameter among primigravida and multigravida.

Our research demonstrated that there was statistically insignificant distinction among the primigravida and multigravida groups in terms of FL in weeks, femur length in mm, AC in weeks, and AC in mm. Our outcomes are in agreement with **Hamdy and Ali** [9] who observes statistically insignificant distinction among the primigravida and multigravida groups in terms of femur length and abdominal circumference.

Regarding the relation between gestational age and the US finding in the primigravida group, we reported that a significant relation has been observed among GA and placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm), in which placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm), increased in gestational age of 31-40.

In the same line, our results, which are consistent with those of **Chakrabarti et al.** [12], indicated a robust positive association among GA and placental thickness. The placenta's thickness raised as the GA raised. The investigation additionally found a strong correlation among the assessed gestational age by FL, biparietal diameter, and AC and the placental thickness. Additionally, **Njeze et al.** [13] demonstrated that placental thickness is indeed correlated with gestational age and has aa elevated degree of relation to GA. The gestational age, placental thickness, and diameter all increased in a linear fashion. The elevations become greater between the 38th and 40th weeks of gestation. The increasing thickness and diameter of the placenta might be a reflection of expanded vascularization and surface area, allowing for more efficient food and gas exchange among the mother and the fetus. The range of values for these measurements is from 205.0±1.4 to 215.0±1.4, with 43.00±0.0 being the lowest and 46.00±2.8 being the highest. The linearity of these rises may be essential for clinicians who follow up the development of babies.

Regarding the relation between gestational age and US findings in the multigravida group, we revealed that a significant relation has been observed between gestational age and placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL (mm), AC (week), and AC (mm), in which placental thickness, BPD (week), BPD (mm), HC (week), HC (mm), FL (week), FL

(mm), AC (week), and AC (mm) increased with gestational age of 31-40.

Our findings are consistent with those of **Ismail et al.** [14] who performed an investigation on the correlation between assessed fetal weight and placental thickness in the 3rd trimester of pregnancy. A total of 207 females comprised the research group. They illustrated that there was a linear correlation among average gestational age and placental thickness, as well as a strong positive correlation (r=0.743) with a p-value equals 0.01. These findings indicate that there is a clear, consistent relationship where increased gestational age corresponds with increased placental thickness. Additionally, our outcomes are consistent with those of **Vinchurkar et al.** [15], who demonstrated a strong association among placental thickness and gestational age (p-value less than 0.001), BPD (p-value less than 0.001), HC (p-value less than 0.001), FL (p-value less than 0.001), and AC (p-value less than 0.001) in both the 2nd and 3rd trimesters. The strong correlations suggest a meaningful relationship where placental thickness is an important indicator of fetal growth and development during pregnancy. These relationships highlight the placenta's role in ensuring adequate support for the growing fetus.

CONCLUSION

We conclude that there was a significant distinction among primigravida and multigravida in terms of placental thickness, BPD, HC, femur length, and abdominal circumference. Additionally, we discovered a significant positive association among GA and placental thickness, BPD, HC, FL, and AC. Specifically, placental thickness, biparietal diameter, HC, FL, and abdominal circumference all elevated in the range of thirty-one to forty weeks.

REFERENCES

1. **Järvholm K, Karlsson J, Olbers T et al. (2015):** Two-year trends in psychological outcomes after gastric bypass in adolescents with severe obesity. Obesity, 23(10): 1966-1972. https://doi.org/10.1002/oby.21188
2. **Azagidi A, Ibitoye B, Makinde O et al. (2019):** Fetal gestational age determination using ultrasound placental thickness. Journal of medical ultrasound, 28(1):17–23. https://doi.org/10.4103/JMU.JMU_127_18
3. **Jones T, Montero F (2022):** Chorionic Villus Sampling. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563301/
4. **Weerakkody R, Czosnyka M, Schuhmann M et al. (2011):** Clinical assessment of cerebrospinal fluid dynamics in hydrocephalus. Guide to interpretation based on observational study. Acta neurologica Scandinavica, 124(2): 85–98. https://doi.org/10.1111/j.1600-0404.2010.01467.x
5. **Sun X, Shen J, Wang L (2021):** Insights into the role of placenta thickness as a predictive marker of perinatal outcome. The Journal of International Medical Research, 49(2):300060521990969. https://doi.org/10.1177/0300060521990969
6. **Sergi C, Sergi C (2020):** Placenta, Abnormal Conception, and Prematurity. In book: Pathology of Childhood and Adolescence . DOI:10.1007/978-3-662-59169-7_18
7. **Sharami S, Milani F, Fallah Arzpeyma S** (2023): The relationship between placental thickness and gestational age in pregnant women: A cross-sectional study. Health science reports, 6(5): e1228. https://doi.org/10.1002/hsr2.1228
8. **Parveen K, Baloch H, Khurshid F et al. (2024):** Comparative analysis of pregnancy complications in primigravida versus multigravida. Journal of Health and Rehabilitation Research, 4(1): 1581-1586. https://doi.org/10.61919/jhrr.v4i1.691
9. **Hamdy A, Ali O (2020):** Role of measurement of placental thickness and diameter at the third trimester using two-dimensional ultrasound in determination of low birth weight. Al-Azhar International Medical Journal, 1(4):19-25. https://doi.org/10.21608/aimj.2020.21674.1041
10. **Olaleye O, Olatunji O, Jimoh K et al. (2022):** Ultrasound measurement of placental thickness: A reliable estimation of gestational age in normal singleton pregnancies in Nigerian women. Journal of the West African College of Surgeons, 12(1):17–22. https://doi.org/10.4103/jwas.jwas_72_22
11. **Deshpande S (2024):** A cross sectional study of morphology and morphometry of human placenta amongst women with pregnancy induced hypertension and without pregnancy induced hypertension. Int j acad med pharm., 6(3): 181-187. https://doi.org/10.47009/jamp.2024.6.3.40
12. **Chakrabarti S, Roy M, Naskar T (2023):** Ultrasonographic measurement of placental thickness and its correlation with gestational age. European Journal of Cardiovascular Medicine, 13(3):1824-1829
13. **Njeze N, Ogbochukwu J, Chinawa J (2020):** Correlation of ultrasound placental diameter & thickness with gestational age. Pakistan journal of medical sciences, 36(5):1058–1062. https://doi.org/10.12669/pjms.36.5.1938
14. **Ismail K, Mahgoub A, Abdulilah K (2017):** Estimation of placenta thickness in third trimester to determine fetal weight in Sudanese women. Res Rep Gynaecol Obstet., 1 (2): 1-11.
15. **Vinchurkar K, Aiyappan S, Prem Kumar C et al. (2023):** Correlation of placental thickness with gestational age in second and third trimester using ultrasonography. *Egyptian* Journal of Radiology and Nuclear Medicine, 54(164): 1-6. DOI:10.1186/s43055-023-01112-y.