www.jmscr.igmpublication.org
Impact Factor (SJIF): 6.379
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v6i3.120

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Assessing the correlation of placental thickness with fetal weight in second and third trimester

Authors
Karami Rasoul*, Borji Soheila, Soltani Mohammad, Memari Behzad, Faghihzadeh Soghrat, Masoumkhani Fatemeh
*MD, Radiology Resident of Radiology Department, Zanjan University of Medical Science ,Zanjan, Iran, Mousavi Hospital, Gavazang Road, Tel:+982433130001, Email: *drrasoulkarami@yahoo.com*
Corresponding Author
Borji Soheila, MD
Assistant Professor of Radiology Department, Zanjan University of Medical Science ,Zanjan, Iran, Mousavi Hospital, Gavazang road, Zanjan, Tel:+982433130001, Email: *Soheila_2731@yahoo.com*

Abstract
Background: *Many of the problems with childhood and adolescence are related to birth weight, which varies depending on the birth weight of the newborn. One of the most important factors affecting birth weight can be attributed to the adequacy of the placenta and the environment in the uterus. The placental thickness is one of the characteristics of the placenta, which indicates the adequacy of the villous tree arrangement in placenta and the available blood volume of the fetus; therefore, we decided to study the correlation between the placental thickness and the fetal weight in the second and third trimester of pregnancy to introduce an auxiliary, simple, inexpensive, and available method for assessing the weight of the fetus.*
Method: *Cross-sectional study was randomly selected on 214 pregnant women aged 15-45 years who were referred to the Zanjan University of Medical Sciences clinic in Zanjan during the second and third trimester of pregnancy from April 2017 to September 2017, performed. All pregnant women received written consent for participation in the program. Exclusion criteria included any systemic diseases or genetic disorders such as diabetes, hypertension, etc. Using Philips affinity 50G ultrasound device, the mean age of fetus and fetal weight was measured by measuring the biparietal diameter (BPD), head circumference (HC), femoral length (FL) and abdominal circumference (AC), and placental thickness was measured in attachment point the umbilical cord; then, the data were analyzed by multiple regression analysis.*
Results: *According to the analysis of statistical data, a significant correlation was found between the placental thickness in the second and third trimester of pregnancy with fetal weight at these times (r=0.539,p=0.005 ;r=0.541,p=0.005), per 100 g of fetus gain in the second and 250 g in third trimester of pregnancy, the placental thickness increased of 1 millimeter in the second and 0.4 mm in the third trimester of pregnancy; Also, there was a significant correlation between the placental thickness in the second and third trimester of pregnancy with the fetal age at these times (r=0.602,p=0.005 ;r=0.536,p=0.005), for each 1 week increase in the age of the fetus in the second and third trimester of pregnancy, the thickness of placenta increase 0.89 mm in the second trimester and 0.81 mm in the third trimester of pregnancy; however, no significant correlation was found between the placental thickness and the fetal gender.*
Conclusion: *According to the results of the study, a higher sample size study is recommended to determine a nomogram to use the placental thickness as an auxiliary tool along with other methods to determine the gestational age and fetal weight in ultrasonography and the related software is designed and use in ultrasound devices.*

Introduction

Many of the problems with childhood and adolescence are related to birth weight, which varies depending on the birth weight of the newborn[1]. The inappropriateness of fetal weight with gestational age in the second and third trimesters can determine important cases such as (small for gestational age) SGA and insufficient growth and other fetal disorders.[2] If you want to briefly describe the effects of low fetal weights during pregnancy, we will have the following:

-These newborns are more susceptible to coronary and vascular malformations after birth than AGA (Appropriate for Gestational Age) babies, and more are going to reduce cardiac function and morphologic changes in the right and left ventricles.[3]

-Newborns with SGA during pregnancy have a high risk of developing pulmonary diseases, especially asthma during childhood and adolescence.[4]

-fetuses with SGA have a high risk of mortality to fetuses with appropriate gestational age.[5]

- Infants who have had been SGA during pregnancy are more likely to be malnutrished in their childhood.[6]

- In addition to the above, many other complications can also occur, so early intervention in fetal period can have many socio-economic benefits.

Studies have shown that a decrease in the amount of some of the fetal cytokines can be affected in the event of this phenomenon. For example, reduction of G-CSF, IL-12p40 and IL-8 can lead to SGA and IUGR.[7] There are many ways to check the presence of SGA during pregnancy, which we briefly refer to:

1) Pregnant women with a percentile PAPP-A <10 have a high incidence of SGA[8]
2) Free carnitine<40 and free carnitine / total carnitine<0.7 can represent a very low birth weight fetus[9]
3) Reducing Insulin Growth Factor-I in umbilical cord blood can predict the presence of an SGA fetus or with a severe growth limitation[10]
4) Placental Protein 13 (PP13) is one of the best and most accurate predictive markers of the SGA in the first trimester[11]
5) A small placenta can also represent a SGA[12]
6) The low levels of adiponectin in the blood-stained spot of the newborn have shown that it can be a good indicator of SGA prediction.[13]

One of the most important factors affecting birth weight can be attributed to the adequacy of the placenta and the environment in the uterus.[1] Since the function of the placenta is supply of oxygen and food for the embryo, the proper growth of the fetus and, consequently, the proper weight at the birth of the fetus depends on the adequacy of the placenta and its function. Therefore, any defect in the natural evolution of the placenta will affect the growth and development of the fetus and the prognosis of pregnancy.[14] The placental thickness is one of the characteristics of the placenta, which indicates the suitability of the villous tree arrangement in placenta and the available blood volume of the fetus.[2] Considering that in a very few past studies, the relationship between placenta specimens and fetal weight has been investigated, and in some cases the relation between the weight of the fetus and the volume of the placenta has been investigated, which is a three-dimensional characteristic of the placenta and its measurement requires skill and certain devices;therefore, it is necessary to find a reliable auxiliary index to find out which, of course, is easy and inexpensive and can be done in most centers in two-dimensional format with simpler devices. In this regard, it seems that by finding the correlation between the thickness of the placenta and fetal weight in the second and third trimester of pregnancy, a simple, inexpensive and available method can be introduced.

Materials and methods

In order to implement the plan of 214 single pregnancy 15-45 years old pregnant women referring to the radiology department of Mousavi Hospital in Zanjan from April 2017 to December 2017, we randomly selected them on condition that they are either in the second or third trimester of pregnancy and exclusion criteria were any systemic diseases or genetic disorders such as anemia, diabetes, hypertension, morbid obesity, smoking, alcohol consumption, previous history of fetal or neonatal anomalies, history of IUGR, pregnancy over single fetus, and lack of consent of the pregnant mother to participate in study. Then, using a Philips affinity 50G ultrasonography device made in the USA, we measured the biometric parameters of the fetuses including biparietal diameter(BPD), head circumference (HC), abdominal circumference (AC) and femoral length (FL), and the mean age of pregnancy and the fetal weight is based on the above four criteria ;also fetal sex determined. Using the same ultrasonography device, we measured the thickness of the placenta at the cord entry point to the placenta.Then the statistical data were analyzed by using the SPSS 16.0 statistical software package (SPSS Inc., Chicago, IL, USA) using One-way ANOVA test. Pearson's correlation analysis was used to establish the degree of relationship between placental thickness and birth and placental weights. P values of less than 0.05 were considered statistically significant.

Results

In this study, according to Table 1, the mean age of mothers was 27.1 with a standard deviation of 6.2 years. The mean number of pregnancies was 1.91 with a standard deviation of 0.97. Of 214 mothers referred, 13 patients (6.1%) under 18 years of age, 179 (83.6%) were between 18 and 35 years old and 22 (10.3%) were more than 35 years old. For sex, 120 (56.1%) fetuses were male and 94 of the cases (43.9%) were girls.

90 (42.1%) of pregnant mothers had single pregnancy, 70 (32.7%) two pregnancies, 40 (18.7%) three pregnancies, 11 (5.1%) four pregnancies and 3 (1.4%) had 5 pregnancies.

The Kolmogorov-Smirnov test was performed to examine the normality of the placental thickness and the age of the fetus, and the distribution of these two variables was normal

Table 1: mean and standard deviation of study variables

variables	category	number	percent
Maternal age(year)	< 18	13	6.1
	18-35	179	83.6
	> 35	22	10.3
Fetal gender	male	120	56.1
	female	94	43.9
Fetal age(week)	Second trimester	91	42.5
	Third trimester	123	57.5
Number of pregnancy	one	90	42.1
	two	70	32.7
	three	40	18.7
	four	11	5.1
	five	3	1.4

According to the results of Table 2, the average thickness of the placenta in the second trimester was 21.9 with a standard deviation of 4.7 and in the third trimester, 34.8 with a standard deviation of 4.3 units. The mean of fetal weight in the second trimester was 426.88 with a standard deviation of 263.35 grams and in the third trimester, 344.5 with a standard deviation of 611.4 g. Also, the mean age of the fetus in the second trimester was 20.7 with a standard deviation of 3.2 weeks and in the third trimester 33.8 with a standard deviation of 2.8 weeks.

Table 2: Frequency, mean and standard deviation of variables based on fetal age

variables	fetal age	number	mean	Standard deviation
Placental thickness(mm)	Second trimester	91	21.9	4.7
	Third trimester	123	34.8	4.3
Fetal weight (mg)	Second trimester	91	426.8	265.3
	Third trimester	123	2344.5	611.4

In this study, the thickness of placenta had a normal distribution. According to Table 3, the linear relationship between two variables of placental thickness and fetal weight in the second trimester of pregnancy was investigated using linear regression and the relationship was statistically significant (P = 0.005). In other words, for 100mg fetus weighing, the average thickness of the placenta is increased to 1 mm. Regarding the correlation coefficient between the two variables, there is a direct linear relationship, with the increase in the weight of the fetus, the thickness of the placenta also increases. The determination coefficient was 29.1%, which means that changes in the thickness of the placenta in 29.1% of the cases were due to changes in the weight of the fetus.

Also in this study, linear correlation between two variables of placental thickness and fetal weight in the third trimester of pregnancy was investigated using linear regression (P = 0.005).). In other words, for 250 mg fetus weighing, the average thickness of the placenta is increased to 0.4 mm. Regarding to the correlation coefficient between the two variables, there is a direct linear relationship, with the increase in the weight of the fetus, the thickness of the placenta also increases. The determination coefficient is 28.7%, which means that the thickness of the pairs in 28.7% of cases is due to changes in the weight of the fetus.

Table 3: The linear relationship between the thickness of the placenta and the fetal weight in the second and third trimester

Variables	Estimated Coefficient	Standard Deviation	Correlation Coefficient	Coefficient of Determination	p-value
Second trimester	0.01	0.002	0.539	29.1	0.005
Third trimester	0.004	0.001	0.541	28.7	0.005

In this study, fetal age was normal distribution. According to Table 4, the linear relationship between the two variables of placental thickness with the fetal age was investigated in the second trimester of pregnancy using linear regression and the relationship was statistically significant (P = 0.005). In other words, for an embryonic age increase unit (one week), the average thickness of the placenta is increased 0.89 mm. The linear relationship between the two variables is direct, with the increase in the age of the fetus, the thickness of the placenta also increases. The determination coefficient was determined to be 36.2%, which means that changes in the thickness of the placenta in 36.2% of the cases are due to changes in the age of the fetus.

Also, in this study, the linear relationship between two variables of placental thickness and fetal age in the third trimester of pregnancy was investigated using linear regression. The relationship was statistically significant (P = 0.005). In other words, for a fetal age increase unit (one week), the average placental thickness is increased to 0.81 mm. Regarding to the correlation coefficient, the linear relationship between variables is direct, that is, with increasing age of the fetus, the thickness of the placenta also increases. The determination coefficient was 28.28%, which means that changes in the thickness of the pairs in 28.2% of the cases were due to changes in the fetal age.

Table 4: Linear relationship of the thickness of the placenta with fetal age in second and third trimester

Variables	Estimated Coefficient	Standard Deviation	Correlation Coefficient	Coefficient of Determination	p-value
Second trimester	0.89	0.13	0.602	36.2	0.005
Third trimester	0.81	0.12	0.536	28.2	0.005

According to the t-test and the results of the Table 5, in both gestational age, the difference in mean placental thickness between male and female is not statistically significant.

Table 5: Frequency distribution, mean and standard deviation of placental thickness basedon fetal gender and fetal age

Fetal age	Fetal gender	number	mean	Standard Deviation	P-Value
Second trimester	female	46	21.2	3.7	0.115
	male	45	22.7	5.5	
Third trimester	female	48	34.2	4.5	0.248
	male	75	35.1	4.1	

Discussion

Based on our research findingsa significant correlation was found between the placental thickness in the second and third trimester of pregnancy with fetal weight at these times (r=0.539, p=0.005 ; r=0.541,p=0.005), for 100 g of fetus gain in the second and 250 g in third trimester of pregnancy, the placental thickness increased 1 millimeter in the second and 0.4 mm in the third trimester of pregnancy; An explanation of why in the third trimester the increase in the placental thickness was less than the second trimester, with the assumption that the growth of the placentain the second trimester is more than the third trimester, and also in the third trimester, with the increase in the gestational age and the approaching end of the pregnancy period, the placenta undergoes degenerative changes, can be explained.

This result of our study is consistent with other studies; In the Ahn Kstudy (2014), the ratio of the placenta / fetal weight to assess SGA and low birth weight can be used, which shows the value of placenta for SGA[15], study byJeelani H (2015) found that the thickness of the placenta in pregnant mothers with diabetes, which has a higher fetal weight is more than healthy pregnant mothers, is consistent with our study results[16] .There was also a significant positive correlation between the thickness of the placenta and the weight of the fetus in the second and third trimester of pregnancy in the study of Afrakhteh M(2013)[17], Ademola AA (2015)[25], Khairy SI(2016)[19], Sumit G (2017)[24], Noor N (2018) [14]; It was concluded that the thickness of the placenta can be used to estimate the fetal weight .

In the study of Ali YAH (2015), in addition to having a significant relationship between the thickness of the placenta in the second and third trimester with the fetal weight at these times, the coefficient of estimation was obtained which, in their study, per one millimeter, increased the thickness of the placenta in the Second and third trimester, the weight of the fetus was increased by 126 g[21]. In our study, this figure varies in the second and third trimester, which in the second trimester increased by one mm for placental thickness, the fetal weight increase was 100 g, and in the third trimester 250 grams; Due to the slow pace of placental growth in the third trimester compared to the second trimester, the result of our study seems more reasonable as the fetal weight gain in the third trimester is more than the second trimester per millimeter of placental growth.

Also in our study there was a significant correlation between the placental thickness in the second and third trimester of pregnancy with the fetal age at these times (r=0.602,p=0.005 ; r=0.536,p=0.005), for each 1 week increase in the age of the fetus in the second and third trimester

of pregnancy, the thickness of placenta increase 0.89 mm in the second trimester and 0.81 mm in the third trimester of pregnancy. This result of our study is consistent with other studies too; In the study Preeti B (2014)[20], Khairy SI (2016)[19] and Pasty V (2017)[22], there was a significant positive correlation between the thickness of the placenta and the age of the fetus , but in the Pasty V study, it was shown that there is no relationshipbetween the thickness of the placenta and the age of the fetus over 32 weeks of gestational age, which contradicts our study results and other studies.

In the study of Arafa A (2014)[23], this association was also investigated in the third trimester, which showed a significant correlation between the thickness of the placenta and the fetal age ultrasound criteria (BPD, FL, AC), and they noted that the placental thickness is an auxiliary parameter in the estimation of the gestational age In the third trimester, which is also contrary to the results of the Pasty V study.

No significant correlation was found between the placental thickness and the fetal gender; this finding of our study, the effect of fetal gender on the thickness of the placenta, has not been studied in any of the previous studies ever before.

According to the results of the study, a higher sample size study is recommended to determine a nomogram to use the placental thickness as an auxiliary tool along with other methods to determine the gestational age and fetal weight in ultrasonography and the related software is designed and use in ultrasound devices.

References

1. Salafia CM, Zhang J, Charles AK, Bresnahan M, Shrout P, Sun W, Maas EM. Placental characteristics and birthweight. Paediatric and perinatal epidemiology. 2008;22(3):229-39.
2. Voskamp BJ. Prenatal detection of small for gestational age pregnancies2014.
3. Faienza MF, Brunetti G, Delvecchio M, Zito A, De Palma F, Cortese F, et al. Vascular function and myocardial performance indices in children born small for gestational age. Circulation Journal. 2016.(0)
4. Herman T, Sonnenschein-van der Voort AM, de Jongste JC, Anessi-Maesano I, Arshad SH, Barros H, et al. Early growth characteristics and the risk of reduced lung function and asthma: A meta-analysis of 25,000 children. Journal of Allergy and Clinical Immunology. 2016;137(4):1026-35.
5. Katz J, Lee ACC ,Kozuki N, Lawn JE, Cousens S, Blencowe H, et al. Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: a pooled country analysis. The Lancet.382(9890):417-25.
6. Christian P, Lee SE, Donahue Angel M, Adair LS, Arifeen SE, Ashorn P, et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. International Journal of Epidemiology. 2013;42(5):1340-55.
7. Lindner U, Tutdibi E, Binot S, Monz D, Hilgendorff A, Gortner L. Levels of cytokines in umbilical cord blood in small for gestational age preterm infants. Klinische Padiatrie. 2013;225(2):70-4.
8. Baer RJ, Lyell DJ, Norton ME, Currier RJ, Jelliffe-Pawlowski LL. First trimester pregnancy-associated plasma protein-A and birth weight. European journal of obstetrics, gynecology, and reproductive biology. 2016; 198:1-6.
9. Sanchez-Pintos P, Perez-Munuzuri A, Cocho JA, Fernandez-Lorenzo JR, Fraga JM, Couce ML. Evaluation of carnitine deficit in very low birth weight preterm newborns small for their gestational age. The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the

International Society of Perinatal Obstet. 2016;29(6):933-7.

10. Tzschoppe A, Riedel C, von Kries R , Struwe E, Rascher W, Dorr HG, et al. Differential effects of low birthweight and intrauterine growth restriction on umbilical cord blood insulin-like growth factor concentrations. Clinical endocrinology. 2015;83(5):739-45.
11. Zhong Y, Zhu F, Ding Y. Serum screening in first trimester to predict pre-eclampsia, small for gestational age and preterm delivery: systematic review and meta-analysis. BMC pregnancy and childbirth. 2015;15:191.
12. Chisholm KM, Folkins AK. Placental and Clinical Characteristics of Term Small-for-Gestational-Age Neonates: A Case-Control Study. Pediatric and developmental pathology : the official journal of the Society for Pediatric Pathology and the Paediatric Pathology Society. 2016;19(1):37-46.
13. Yeung EH, McLain AC, Anderson N, Lawrence D, Boghossian NS, Druschel C, et al. Newborn Adipokines and Birth Outcomes. Paediatr Perinat Epidemiol. 2015;29(4):317-25.
14. Noor N,Akanksha J,Shazia p,Syed Manazir A.Ultrasonographic measurement of placental thickness and its correlation with estimated fetal weight.Int J Reprod Contraseptive Obstet Gynecol.2018 Jan;7(1):287-290 .
15. Ahn KH, Lee J, Cho GJ, Hong SC, Oh MJ, Kim HJ. P14. 19.Placental thickness to-estimated foetal weight ratios and small-for-gestational age infants at delivery. Journal of Obstetrics & Gynecology. 2017;37(7):883-887.
16. Jeelani H, Jabeen F, Qureshi A. GROSS MORPHOLOGICAL ALTERATIONS AND BIRTH WEIGHT IN GESTA-TIONAL DIABETES MELLITUS: A CASE-CONTROL STUDY. JK-Practitioner. 2015;20(1-2):17-20.
17. Afrakhteh M,Moeini A,Sanei TM,Haghighatkhah H R.Correlation between placental thickness in the second and third trimester and fetal weight.Rev Bras Ginecol Obstet.2013;35(7):317-22.
18. Ademola AA,Joyce EI.Relationship between two-dimensional ultrasound measurement of placental thickness and estimated fetal weight.Sahel Medical Journal.2015;18(1):4-8.
19. Khairy SI,Mahgoub AA,Kunna A,Elkheir HA, Mohamed SE,Taha U. Estimation of placental thickness in third trimester to determine fetal weight in Sudanese women 2016.Res Rep Gynaecol Obstet. 2017;1(2):8-11.
20. Preeti B, Vinita B, Rashmi P, Pomila S, Sonel O. Correlation of placental thickness estimated by-ultrasonography with gestational age and fetal outcome.IJNMR. 2015 Jul,3(3):19-24.
21. Ali YAH, Ahmed Y. Association of Placental Thickness and Estimated Fetal Weight in pregnant Sudanese Women: Sudan University of Science and Technology; 2015.
22. Pasty V, Lakshmi BS. Association between placental thickness and gestational age.JMSCR.2017 December;5 (12): 31788-31790.
23. Arafa A , Alrashid R , Hamid O , Ala AE, Amin E .The correlation between placental thickness and fetal age among the pregnants in Sudan.SJAMS.2014; 2(1D):395-398.
24. Sumit G, William M, Parul G . Correlation of ultrasonography estimate placental thickness age and fetal weight in late second and third trimester.AAI.2017 July-December; 3(2):49-51.