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Original article

Effect of Maternal Body Mass Index on The Accuracy of Sonographic Estimation of Foetal Weight in Late Gestation

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Abstract

Background: Pre-eclampsia, gestational hypertension, macrosomia, induction of labor, and cesarean sections are all connected with higher risk for both lean and obese women.

Aim of the Work: The aim of this study was to determine the effect of maternal body mass index (BMI) on the accuracy of sonographic estimated fetal weight (EFW) above 37 weeks' gestation. **Methods:** This is a prospective Cohort study and was conducted at Obstetrics and Gynecology department at Beni-Suef General hospital starting from July 2019 till February 2020, on 300 pregnant women. According to their body mass index (BMI) they categorized into 6 groups (27 underweight, 63 average, 102 overweight, 51 obese class I, 42 obese class II and 15 obese class III), Ultrasonographic estimation of fetal body weight was done using Hadlock 3 formula. Also, amniotic fluid index was measured by ultrasonography. **Results:** There was a statistically significant difference between the studied groups as regard fetal biometrics "BPD, HC, AC and FL", estimated fetal weight and actual birth weight between the six groups. There was no significant difference between the different groups of the study absolute error of change and mean percentage error of change between EFW and AFW. According to AFI, 21 (7.0%) of our participants were having oligohydramnios, 272 (90.7%) were having normal AFI and 7 (2.3%) were having polyhydramnios.**Conclusion:** There was a statistically significant relationship between mother body mass index and infant birth weight. The correlation between BMI and estimated and actual birth weight was positive. There is a strong correlation between maternal obesity and having a baby that is big for its gestational age. Furthermore, extremes in amniotic fluid content may influence sonographic assessment of baby weight in late pregnancy.

1. Introduction:

Weight in kilograms divided by the square of height in meters gives the body mass index (BMI), a basic measure of weight-for-height.[1]. Pre-eclampsia, gestational hypertension, macrosomia, induction of labor, and caesarean sections are all connected with maternal obesity. This is true for both thin and overweight women.[2].

Based on their body mass index (BMI), women were divided into five categories (according to WHO and NIH recommendations from 2006) [3]. Some research has linked being underweight to an increased chance of having a baby born prematurely, a low birth weight, and anemia, and a lower risk of developing preeclampsia, gestational diabetes, requiring obstetric intervention, or bleeding after giving birth. As has been well reported, obesity is related with an increased risk of maternal morbidity and death.[4]. Gestational diabetes, pregnancy-induced hypertension and pre-eclampsia, sepsis, venous thromboembolism, and spontaneous abortion are all serious maternal problems.[5]. Obesity contributes to the deaths of more than a quarter of pregnant women in the United Kingdom. It is more common for obese mothers to need medical intervention during labor and delivery, and these women also have a higher risk of problems during labor and delivery.[6].

Pregnancy weight at 20 weeks is a known risk factor for complications. Obstetric sonography (US) results might be affected by a mother's weight. This secondary analysis of data from the PORTO study aimed to evaluate the impact of maternal obesity on the precision of US in estimating fetal weight (EFW) and the perinatal outcome of pregnancies affected by fetal growth restriction (FGR) [7].

Obesity poses serious challenges to the quality and accuracy of obstetrical imaging, which plays a crucial role in the evaluation and therapy of these issues. In the context of maternal obesity, this review focuses on the most pressing issues for both expectant mothers and their healthcare professionals.[8]. So, the aim of this study was to determine the effect of maternal body mass index (BMI) on the accuracy of sonographic estimated fetal weight (EFW) above 37 weeks' gestation in Egyptian women.

2. Subjects & Methods:

Setting Study design:

This was a prospective cohort study and was conducted at Obstetrics and Gynecology department at Beni-Suef General hospital starting from July 2019 till February 2020.

Study methodology:

A full detailed medical history was taken including the following:

Information on the patient's background was collected, including demographics, medical history, and prenatal care visits to an outpatient clinic. Current and historical medical conditions, as well as drug use, were recorded. There was a history of systemic illness and birth defects in the family. Age at menarche, cycle regularity, cycle length, last menstrual period, number of pregnancies, number of live births, projected date of delivery, and occurrence of pregnancy complications were all noted. Vital statistics, including heart rate, blood pressure, temperature, and respiration rate, were also recorded as part of the general examination. The abdomen was felt for sensitivity or stiffness and for signs of discomfort, prior scarring, a suprapubic protrusion, and the presence of any anomalies in pigmentation, texture, or size.

Fundal level to correlate with GA; obstetric grip (fundal grip, umbilical grip, first pelvic grip; second pelvic grip); obstetric Ultrasound to check viability; obstetric Ultrasound to check fetal biometry; obstetric Ultrasound to check presentation and position; and a vaginal exam to check for viability and other complications.

According to specific indications, further laboratory tests were performed, such as a complete blood count, blood grouping, random blood glucose, and testing for HBs Ag, HCV antibodies, coagulation profile, and kidney function. The biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) of the fetus were measured during the ultrasound examination.

The aim of this study was to determine the effect of maternal body mass index (BMI) and AFI on the accuracy of sonographic estimated fetal weight (EFW) above 37 weeks' gestation. In order to achieve this aim, we conduct a cohort study on 300 pregnant women with gestational age ≥ 37 weeks with singleton pregnancy. Full medical and obstetric history were obtained from all selected women, and they were subjected to full clinical examination, BMI were calculated to all of them. Ultrasound examination was done to all participants in order to detect proper fetal age and estimation of fetal weight detection by estimation of fetal anthropometric measures including Bi-partial diameter "BPD", Abdominal circumference "AC", head circumference "HC" and femur length "FL"). Estimated fetal weight was calculated using Hadlock C formula **[9].** Ultrasonographic examination of amniotic fluid and estimation of amniotic fluid index "AFI".

Subjects:

This study was conducted on 300 pregnant women who were attending the Obstetrics and Gynecology outpatient antenatal clinic of Obstetrics and Gynecology department at Beni-Suef General hospital and were admitted to delivery either by cesarean section or normal vaginal delivery and were selected according to the following criteria:

Inclusion Criteria Pregnant women with singleton gestations with gestational ages >37 weeks and documented BMI and sonographic EFW and concurrently, within 7 days of delivery.

Exclusion Criteria Pregnant women with gestational age < 37 weeks. Pregnant women with multiple pregnancies. Pregnant abnormal fetal growth women with pattern and ultrasonographical detected fetal growth malformations. Chronic medical conditions: e.g., Hypertension, preeclampsia, cardiac, renal or liver diseases, epilepsy and unexplained anemia. Patients who refused to complete the study.

Data Collection and Statistical analysis of the data:

IBM-SPSS version 23 was used to do the coding, data entry, and analysis of the data gathered in a master spreadsheet. For quantitative data, we used Mean Standard Deviation and for qualitative data, we used number and percentage. Chi-square tests and odds ratios (OR) with confidence intervals (CIs) excluding 1 were deemed significant at the P0.05 level. The Chi-square test is a statistical significance test for comparing three or more proportions using categorical data. In order to determine whether there was a statistically significant difference between the means of the two research groups, a Student T Test was performed. The statistical significance of a difference in a non-parametric variable between the two research groups was determined using the Mann Whitney Test (U test). The statistical significance of the difference between the means recorded twice for the same research group was determined using a paired t-test. The significance level for each of these tests was set at the 5 percent level using the student t-test (t) and the probability (P value): If the p-value is more than 0.05, the findings are not significant. When the probability level is less than 5%, the findings are considered to be significant. Results are statistically significant if the P value is less than 0.01.

Ethical considerations:

The Beni-Suef University School of Medicine Research Ethics Committee (FMBSUREC/05032019/ Mohammed) gave its stamp of approval to the study's methods.

3. Results:

This study included 300 women with mean age 32.3 ± 3.0 years and the mean gestational age 39.3 ± 1.1 weeks, maternal body mass index 27.6 ± 7.4 Kg/m2, the mean gravidity 2.7 ± 0.7, about half of the studied women underwent section (51.3%) **(Table1).**

Table (1): Basic demographic and obstetric characteristics of the study group:

Variable	Mean ± SD	Range
Maternal Age (years):	32.3 ± 3.0	30 – 38
GA (weeks):	39.3 ± 1.1	37 – 42
Maternal Weight (Kg):	68.7 ± 18.5	41 – 120
Maternal Height (m):	1.6 ± 0.1	1.5 – 1.7
BMI (Kg/m2):	27.6 ± 7.4	18.2 – 44.1

Gravidity:	2.7 ± 0.7	1 – 4.4
Parity:	2.6 ± 0.4	1 – 4.4
Mode of delivery:	No	Percent
CS	154	51.3 %
NVD	146	48.7 %
AFI		
Oligohydramnios (< 5)	21	7.0 %
Normal (5 – 24.9)	272	90.7 %
Polyhydramnios (>25)	7	2.3 %

GA: Gestational age; BMI: Body mass index; CS: cesarean section; NVD: normal vaginal delivery; AFI: Amniotic fluid index

BMI category:

According to our participants BMI, they were classified into 6 groups; underweight group included 27 (9.0%) women with mean BMI: 18.8 ± 0.9. Average weight group included 63 (21.0%) women with mean BMI: 21.2 ± 1.3. Overweight group included 102 (34.0%) women with mean BMI: 29.0 ± 3.3. Obese class I group included 51 (17.0%) women with mean BMI: 31.2 ± 1.0. Obese class II group included 42 (14.0%) women with mean BMI: 21.2 ± 1.3. Obese class III weight group included 15 (5.0%) women with mean BMI: 42.0 ± 1.1. According to their BMI, we classified our study population into 6 groups. 27/300 (9.0%) were underweight "BMI: < 18 kg/m2", 63/300 (21.0%) were average weight "BMI: 18 – 25 kg/m2", 102/300 (34.0%) were overweight "BMI: >25 – <30 kg/m2", 51/300 (17.0%) were suffering from obesity class I, 42/300 (14.0%) were suffering from obesity class II and 15/300 (5.0%) were suffering from obesity class III.

There was statistically significant difference between the studied groups as regard maternal age, while there was no statistically significant difference regarding gravidity, parity, GA, Mode of delivery, and AFI **(Table 2).**

Table (2): Comparison of basic characteristics between studied patients groups (according to their BMI category):

Variable	Underweight (N=27)	Normal (N=63)	Overweight (N=102)	Obese class I (N=51)	Obese class II (N=42)	Obese class III (N=15)	f-value	p-value
Age (years) Mean ± SD	312. ± .23	32.1 ± 4.0	34.6 ± 3.7	35.5 ± 3.7	36.3 ± 4.5	35.9 ± 5.1	3.113	0.009*
GA (weeks):Mean ± SD	39.7 ± 1.3	39.3 ± 1.1	39.4 ± 1.2	39.2 ± 1.2	39.2 ± 1.0	39.0 ± 0.9	1.117	0.351
Gravidity Mean ± SD	2.7 ± .08	2.5 ± 0.7	2.7 ± 0.7	2.6 ± 0.7	2.7 ± 0.8	2.8 ± 0.7	0.692	0.630
Parity Mean ± SD	1.4 ± 0.7	1.4 ± 0.6	1.6 ± 0.6	1.5 ± 0.6	1.4 ± 0.6	1.6 ± 0.5	1.243	0.289
Mode of delivery								
CS	15 (55.6%)	21 (50.0%)	54 (52.9%)	30 (58.8%)	27 (64.3%)	8 (53.3%)	3.55	0.470
NVD	12 (44.4%)	21 (50.0%)	48 (47.1%)	21 (41.2%)	15 (35.7%)	7 (46.7%)		
AFI								
< 5	6 (22.2%)	9 (14.3%)	14 (13.7%)	6 (11.8%)	9 (21.4%)	1 (6.7%)	0.124	0.324
5 – 24.9	21 (77.8%)	53 (84.1%)	82 (80.4%)	42 (82.4%)	33 (78.6%)	12 (80.0%)		
> 25	0 (0.0%	1 (1.6%)	6 (5.9%)	3 (5.9%)	0 (0.0%)	2 (13.3%)		

*GA: Gestational age; BMI: Body mass index; CS: cesarean section; NVD: normal vaginal delivery; X2: chi-square test *P-value is significant*

There was a statistically significant difference between the studied groups as regard fetal biometrics "BPD, HC, AC and FL", estimated fetal weight and actual birth weight as shown in **(Table 3) .**

Table (3): Comparison of intrauterine fetal anthropometric measurements between studied groups (according to their BMI category):

Variable	Underweight	Normal	Overweight	Obese class I	Obese class II	Obese class III	f-value	p-value
BPD (mm)								
- Mean ± SD	9.2 ± 0.1	9.1 ± 0.2	9.5 ± 0.2	9.5 ± 0.2	9.6 ± 0.2	9.8 ± 0.1	56.05	<0.001*
HC (mm)								
- Mean ± SD	33.9 ± 0.5	33.2 ± 0.6	34.5 ± 0.6	35.0 ± 0.9	35.1 ± 0.8	35.4 ± 0.9	50.81	<0.001*
AC (mm)								
- Mean ± SD	34.1 ± 0.7	33.5 ± 1.0	34.7 ± 0.9	35.1 ± .08	35.1 ± 0.7	35.7 ± 0.8	27.58	<0.001*
FL (mm)								
- Mean ± SD	7.5 ± 0.1	7.4 ± 0.2	7.6 ± 0.2	7.6 ± 0.2	7.8 ± 0.2	7.8 ± 0.1	23.75	<0.001*
EFW (grams)								
- Mean ± SD	3211.6 ± 125.8	3408 ± 269.5	3581.7 ± 262.0	3742.4 ± 251.3	3863.4 ± 221.6	3988.4 ± 209.8	36.21	<0.001*
ABW (grams)								
- Mean ± SD	3146.1 ± 168.6	3301.4 ± 267.4	3503.0 ± 246.2	3668.5 ± 250.8	3763.1 ± 168.8	3826.2 ± 170.6	40.66	<0.001*

*BPD: Bi-partial diameter; HC: Head circumference; AC: Abdominal circumference; FL: Femur length; EFW: Expected fetal weight; ABW: actual birth weight. *P-value is significant*

There was no significant difference between the different groups of the study absolute error of change and mean percentage error of change between EFW and AFW**.** Showed in **(Table 4).**

Table (4): Change in fetal weight between EFW and birth weight between studied patients' groups (according to their BMI category):

Variable	Underweight	Normal	Overweight	Obese class I	Obese class II	Obese class III	Kruskal-Wallis	p-value
Simple Error (g): Mean ± SD	65.4 ± 88.1	106.6 ± 94.0	78.7 ± 103.1	73.9 ± 107.5	40.2 ± 142.9	162.2 ± 116.5	0.508	0.770
Absolute Error (g): Mean ± SD	101.0 ± 33.2	125.7 ± 63.7	109.4 ± 68.8	105.3 ± 74.6	122.4 ± 77.7	181.5 ± 80.4	3.658	0.003
Mean percentage error: Mean ± SD	3.2 ± 1.1	3.8 ± 2.0	3.2 ± 2.0	2.9 ± 2.2	3.3 ± 2.2	4.8 ± 2.2	2.629	0.024

Simple (Absolute) error *equals absolute value of estimated fetal weight minus actual birth weight,* ***Mean percentage error:*** *sum of Absolute percent error.,* ***Absolute percent error:*** *equals (absolute error divided by birth weight) times 100. *P-value is significant*

There was a significant difference between EFW and ABW among different groups of the study. Showed in **(Table 5).**

Table (5): Comparison between EFW and ABW among the study groups:

Variable	Underweight	Normal	Overweight	Obesity Class (I)	Obesity Class (II)	Obesity Class (III)
EFW (g): - Mean ± SD	3211.6 ± 125.8	3408 ± 269.5	3581.7 ± 262.0	3742.4 ± 251.3	3863.4 ± 221.6	3988.4 ± 209.8
Birth Wight (g): - Mean ± SD	3146.1 ± 168.6	3301.4 ± 267.4	3503.0 ± 246.2	3668.5 ± 250.8	3763.1 ± 168.8	3826.2 ± 170.6
t-value	-4.0174	-7.635	-7.747	-5.011	-4.573	-5.389
p-value	< 0.001*	< 0.001*	< 0.001*	<0.001*	<0.001*	<0.001*

**P-value is significant*

There was significant difference between EFW and ABW among different groups of the study shown in **(Table 6).**

Table (6): Comparison between EFW and ABW among the study groups:

Variable	Oligohydramnios	Normal	Polyhydramnios
EFW (g): **- Mean ± SD**	3431.5 ± 205.9	3637.2 ± 315.0	3716.9 ± 281.1
Birth Wight (g): **- Mean ± SD**	3428.6 ± 204.5	3624.9 ± 311.0	3428.7 ± 260.8
t-value	0.002	0.210	3.954
p-value	0.964	0.647	0.070

EFW: Estimated fetal weight

4. Discussion:

The birth weight of a child reflects the mother's intrauterine environment, genetics, diet, socioeconomic background, and level of education. The prenatal care of pregnant women may be greatly influenced by sonographic measurement of estimated fetal weight (EFW) in late gestation. Accurate sonographic EFW evaluation is crucial for many essential clinical choices [10, 11].

Obesity in pregnancy is clinically significant because of the accompanying obstetric problems. Maternal obesity is associated with a number of adverse outcomes during pregnancy, and this includes difficulties in obtaining high-quality photographs of the fetus that may be utilized for clinical interpretation. Images of obese people with a lot of subcutaneous fat will be of lesser quality than those of leaner patients. Adipose tissue's negative effects on sound wave propagation make ultrasound imaging of obese people difficult [11]. The results of the estimate directly affect whether or not an assisted vaginal birth may be attempted without resorting to a cesarean section [12].

Amniotic fluid volume, especially in polyhydramnios and oligohydramnios, is another contributor. Studies have shown both oligohydramnios and polyhydramnios can alter the precision of EFW, with the former leading to underestimations and the latter leading to overestimations [13].

Regarding basic demographic data, our results showed that the ages of our participants ranged between 30 – 38 years with mean age of 32.3 ± 3.0 years, their BMI was ranging between 18.2 – 44.1 kg/m2 with mean BMI of 27.6 ± 7.4 kg/m2. Regarding their obstetric findings our results showed that the GA of our participants was ranging between 37 – 42 weeks with mean GA of 39.3 ± 1.1 weeks. 154/300 (51.3%) were delivered by CS while the other 146/300 (48.7%) were delivered by normal vaginal delivery. 272/300 (90.7%) of them had normal AFI values while 21/300 (7.0%) were having oligohydramnios and only 7/300 (2.3%) were having polyhydramnios.

In the study done by Hou et al., (2020) on all deliveries in 39 hospitals in China, they reported that oligohydramnios complicated 3954 (4.4%) of the 89,050 pregnancies [14]. Moreover, this finding was supported by a previous literature [15]. While in the study done by Locatelli et al., in 2004 [16] on 3049 pregnant women that 341 (11%) of them were suffering from oligohydramnios.

Polyhydramnios has a reported frequency of between 0.2% and 1.6% of all pregnancies.[17]. In the study done by Blitz et al., in 2018 [18] on 1000 pregnancies, they reported that 124 (12.4%) participants were having normal weight, 41.7% were over weighted, 28.7% were obese class I, 12.4% were obese class II and 4.8% were obese class III. While in the study done by Gonzalez et al., (2017) on a total of 403 pregnant women the reported that Forty patients (9.9%) were of a normal weight; 145 (36.0%) were overweight; 88 (21.8%) had class 1 obesity, 52 (12.9%) had class 2 obesity; and 78 (19.4%) had class 3 obesity [12].

We compared the six groups and our results showed that regarding their ages, GA, gravidity, parity and mode of delivery. Regarding maternal ages, our results showed that there was a statistically significant difference between the studied groups with p-value was 0.009.

The results of our investigation corroborated those of Kritzer et al., 2014, who used data from 1177 women to determine whether or not an increase in maternal BMI affects the precision with which sonographic estimates of fetal weight may be made [19].

While against our findings was Manzanares et al., (2020) who reported in their prospective cross-sectional study on 1064 singleton pregnant women classified according to body mass index (BMI) into two categories: normal (n = 863) and obese (n = 201), that there was no statistically significant difference between women with normal BMI and those with increased BMI (obese) with p-value: 0.180 [20].

Regarding GA at time of delivery, our findings showed that there was no statistical significance difference between study groups regarding GA at time of delivery with p-value 0.351.

Our findings were in agreement with Al-Obaidly et al., (2015) who reported in their retrospective cohort study, that there was no statically significant difference between the three groups (Normal, Overweight, and Obese) [21].

Similar to these findings was Çintesun et al., (2021) who reported in their retrospective cross-sectional study that there was no statistically significant difference between their three groups (Low Body weight "BW", Normal BW and Macro BW) with p-value: 0.383 [22]. While in disagreement with our findings was Kritzer et al., (2014) who reported that there was a statistically significant difference between their 5 groups with p-value: <0.01 [19].

Regarding gravidity and parity, our results showed that there was no statistically significant difference between the 6 groups of the study with p-value: 0.630 and 0.289 respectively.

In line with our findings was Al-Obaidly et al., 2015 who reported that regarding parity there was no statically significant difference between the three groups [21]. Similar to these findings was Çintesun et al., (2021) who reported in their retrospective study that there was no statistically significant difference between their three groups (Low Body weight "BW", Normal BW and Macro BW) with p-value: 0.385 [22].

While in disagreement with our findings was Kritzer et al., (2014) who reported that regarding parity there was a statistically significant difference between their 5 groups with p-value: <0.01 [19]. Similarly, was Manzanares et al., (2020) who reported that there was a statistically significant difference between women with normal BMI and those with increased BMI (obese) with p-value: < 0.001 [20].

Regarding mode of delivery, our results showed that there was no statistically significant difference between mode of delivery with increased incidence of caesarean section delivery in obese women but with no significant difference.

In partial agreement with our findings was Pettersen-Dahl et al., (2018), who found a strong correlation between maternal BMI and the need for cesarean section, and who found that 64% of primiparous women with a normal BMI gave birth naturally, but only 53% of women with a BMI 30 and 43% of women in the obesity class II gave birth naturally, and who concluded that a higher maternal BMI before pregnancy is a significant and independent risk factor for delivery by cesarean section. In all subgroups of women, those with or without a history of cesarean delivery, the risk of CS was significantly higher among those with a BMI 30 compared to those with a normal weight [23].

Regarding fetal biometric measurements, our result showed that there a statistically significant difference between the 6 studied groups regarding the head circumference, abdominal circumference, bi-parietal diameter and femur length with p-value:<0.001 for each.

In consistency with our findings was O'Brien et al., (2020), who reported in there study that there was a statistical significant difference regarding BPD, HC, AC and FL between women who were overweight, and obese women of class 1, 2, and 3. Estimated fetal weight (EFW) was calculated by using Hadlock C formula, and our results showed that women with obesity class 1, 2 and 3 were having higher EFW in comparison with those who were underweight, average BW and overweight with p-value: <0.001. In addition, they were having actual birth weight (ABW) than those who were underweight, average BW and overweight with p-value: <0.001[24],

Our results were in consistency with Blitz et al., (2018), who reported that there was a statistically significant difference between the groups of the study regarding EFW and ABW with higher values in obese groups 1, 2, and 3 than those with overweight and average maternal BW [18]. Similar findings were reported by Kritzer et al., (2014) as they found that obese woman class 1, 2, and 3 were having significantly higher EFW and AFW than those were overweight and average BW [19].

In addition, Manzanares et al., (2020) reported that the average BW was 3318 g in normal weight mothers and 3446 g in obese women with statistically significant difference (p-value < 0.001) [20]. Also, Gonzalez et al., (2017) reported that both predicted and actual birth weight increased as the BMI increased [12].

According to amniotic fluid index, we classified our participants into three groups, group (1) included 21 (7.0%) women with oligohydramnios (AFI < 5), group (2) included 272 (90.7%) with average AFI (AFI: 5 – 24.9) and group (3) included 7 (2.3%) women with polyhydramnios (AFI ≥ 25).

Our findings regarding incidence of oligohaydramnios and polyhydramnios among our participants was in in similarity with Blitz et al., (2018), who reported that oligohydramnios and polyhydramnios were identified in 9.7% and 1.6% of pregnancies, respectively. Similarly, Blitz et al., (2017) [25] reported that incidence of oligohydramnios in their study was 11.3%. While Janas et al., (2019) reported in their study that the incidence of oligohydramnios was 12.5% [26].

We compared the groups regarding maternal age, gravidity, parity, BMI and GA age at time of delivery and our results showed that there was not a statistically significant difference between them.

Janas et al. (2019) obtained results that were consistent with ours; they found no statistically significant differences after controlling for factors including mother age, parity, number of pregnancies, body mass index, or gestational age [26].

Similarly, was Karahanoglu et al., (2017), who reported that, no statistically significant difference between those with oligohydramnios, polyhydramnios and those with average AFI was observed [13].

Regarding mode of delivery, our results showed that there were increases incidence of cesarean deliveries in those with polyhydramnios with no statistically significant difference.

Women with polyhydramnios were more likely to have cesarean sections performed throughout the pregnancy than women without the condition (p-value = 0.007 and p-value = 0.010, respectively), as reported by Suleiman and Salim (2017). Multiple logistic regression analysis identified polyhydramnios as a significant predictor of cesarean section birth.[27]. In disagreement with our findings was Günay et al., (2020), who reported in their study that there was no impact of AFI on mode of delivery but, a significant correlation between AFI and maternal body mass index (B equal −0.147; CI equal −0.27 to −0.02), gestational age (B equal −11.8; CI equal −12.5 to −11.4), estimated fetal weight (EFW) (B equal 0.05; CI equal 0.049– 0.053) and abdominal circumference (B equal 0.94; CI equal 0.95–1) was observed [28].

There was no correlation between AFI and other fetal biometric parameters. Regarding EFW and ABW, our results showed that there was a statically significant difference between the groups of the study with higher value in those with polyhydramnios and average AFI than in those with oligohydramnios.

Our results were in agreement with Blitz et al., (2018) who reported that those with polyhydramnios were having significantly higher EFW and ABW than those with oligohydramnios and average AFI. Also, those with average AFI had significantly higher values than those with oligohydramnios [18]. Similar findings were reported by Karahanoglu et al., (2017) [13, 11].

Regarding the difference between the EFW and ABW and a absolute error and mean percentage error. Our results showed that there was a statistically significant difference between the three groups. Our results were in agreement with Blitz et al., (2018) who reported that there was a statistically significant difference between the three groups as regard the difference between the EFW and ABW and absolute error [18].

Similar findings were reported by Ashwal et al., (2015) [11]. While against our finding was Janas et al., (2019) who found a statistically significant difference between those with oligohydramnios and those with average AFI regarding absolute error and absolute percentage error [26].

In conclusion of this study, Maternal body mass index was shown to have an impact on both EFW and ABW, with an increase in both being associated with a higher average birth weight. There is a strong correlation between maternal obesity and having a baby that is big for its gestational age. It's possible that extremes in amniotic fluid volume might impact sonographic estimates of fetal weight during later stages of pregnancy.

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