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Mervat Mohammed Ibrahim
Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

Doaa Fathy Mohammed
Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

Asmaa Hamdy Ismaiel Ahmed
Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt,
asmaahmdy1212@gmail.com

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ORIGINAL ARTICLE

Maternal Body Mass Index and Amniotic Fluid Index in Late Gestation

Mervat M. Ibrahim, Doaa F. mohammed, Asmaa H. I. Ahmed *

Department of Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***Complications during pregnancy and delivery, including gestational diabetes, perineal injuries, hypertensive disorders, and macrosomia, are linked to a maternal high body mass index (BMI). Clinical estimation of amniotic fluid by ultrasonography is used to screen for pregnancies at risk for a poor perinatal outcome and ensure the health of the developing baby.***

Aim and objectives: ***To study the relation between BMI and amniotic fluid Index (AFI) in pregnant women from 36-40 weeks.***

subjects and methods: This was cross-sectional observational research, was done on 80 pregnant women from 36-40 weeks at obstetrics and Gynecology department of Alzahraa University Hospital from six to eight months. Every case was subjected to General examination, Abdominal, and local clinical examination.

Result: ***There was a statistically positive significant variance between AFI BMI.***

Conclusion: ***AFI fitting curves were statistically significant variations between BMI groups during pregnancy. More extensive research is required to establish the statistical and clinical significance of the distinctions between the normative AFI curves.***

Keywords: Amniotic fluid index; BMI; Pregnancy outcome

1. Introduction

Obesity is an increasing global public health issue. Patients with obesity are at major risk for developing a range of comorbid conditions, including cardiovascular disease (CVD), gastrointestinal disorders, type 2 diabetes (T2D), joint and muscular disorders, respiratory problems, and psychological issues, which may significantly affect their daily lives as well as increasing mortality risks. [1]

Technically, ultrasound examinations of obese individuals are more challenging than those of individuals with a normal BMI. [2]

Semi-quantitatively analyzing AF volume, the AFI uses the linea nigra and a line drawn across the umbilicus perpendicular to the nigra to divide the mother's abdomen into four quadrants. [3]

At around 34–36 weeks, the volume peaks and gradually decreases until term. Having an AFI of fewer than 5cm or a single deepest pocket of fewer than two centimeters is considered to be indicative of oligo-hydramnios, which is linked to an increased risk of inducing labor, meconium-stained amniotic fluid, neonatal deaths, low Apgar scores, neonatal deaths & cesarean delivery for an un intrauterine growth restriction, settling fetal heart tracing.[4]

This study's primary goal was to investigate the correlation between BMI and AFI in pregnant cases who were between 36 and 40 weeks along in their pregnancies.

2. Patients and methods

This was a cross-sectional observational investigation performed in the obstetrics and Gynecology department of Al-Zahraa Hospital from January 2022 to September 2022 (nine months after committee approval).

All 80 pregnant women with gestational ages from 36 to 40 weeks were admitted to the obstetrics and Gynecology department of Al-Zahraa Hospital, Al-Azhar University.

2.1.Inclusion criteria: The research involved only women who met the following criteria: women with singleton pregnancy, aged 18 to 35, with accurate pregnancy dates (based on menstruation history and verified by sonography performed during the first trimester), and pregnant women between 36 and 40 weeks.

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* Corresponding author at: Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt. E-mail address: asmaahmdy1212@gmail.com (A. H. I. Ahmed).

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2.2.Exclusion criteria Were as follows: Cases with several gestations, patients with fetal anomalies, underweight cases with pre-pregnancy BMI<18.5 kg/m2 as the last three show high rate of oligo hydraminos, and Patients who suffered from chronic medical diseases like asthma, pregestational diabetes, chronic hypertension, and thyroid abnormalities were found.

2.3.Sample size: 80 pregnant women from 36-40 weeks.

Sample Size (n):-

$$\left(\frac{Z_{a/2} + Z_B}{P_1 - P_2}\right)^2 (p_1q_1 + p_2q_2)$$

Takazawa & Morita.[5]

n = sample size

Z a/2 (The critical value that divides the central 95% of the Z distribution)

ZB (The critical value that divides the central 20% of the Z distribution)

p1 = prevalence in case group

p2 = prevalence in the control group.

q = 1-p

Epi Info STATCALC was used to calculate the sample size, considering the following assumptions: 95% two-sided confidence level, with a power of 80% and an error of 5%. The final maximum sample size taken from the Epi Info output was 76. Thus, the sample size was increased to 80 cases to assume any dropout cases during follow-up.

2.4.Operational design: The technique will be explained to all of the women in the investigation. Before beginning the study, all participants were counseled on the potential risks and benefits, after which a signed consent form was requested.

2.5.Methods

All cases were subjected to Informed written consent: - After they had been made aware of the purpose of the study. Menstrual history involving the age of menarche, menstrual disruption, dysmenorrhea, and symptoms; Personal history involving name, age, marital status, and address; Obstetric history: parity and mechanism of delivery; chronic diseases & medication; history of HTN, DM, and family history of similar condition or diabetes; history of allergy to any medication; and surgical history: laparoscopic interference, operation, and laser hirsutism treatment.

Examination: The General Examination: Measurements of weight, height, BMI, as well as an abdominal and regional clinical examination: Bimanual pelvic examination of adnexa & uterus for detecting any abnormality of female genitalia, routine trans vaginal examination, ultrasound examination, and examination for any visible lesions or secretions, assessment of gestational age and fundal level, scar of previous surgery, tenderness, mass or rigidity & clinically evident disease in the abdomen or pelvic region.

2.6.Procedure

The body mass index (BMI) Is a method that considers both your height and weight to determine your ideal weight. The BMI of an adult may be estimated by dividing that person's weight in kilograms by the square of their height in meters. A BMI of 25 indicates that a person weighs 25 kilograms per square meter.

BMI ranges: BMIs between 18.5 and 24.9 are healthy for most people. When determining a kid or adolescent's BMI, it is important to consider their height, weight, age, and gender. Consistent with the World Health Organization's guidelines, the cases were classified into five categories based on their BMI during pregnancy: normal weight (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2), class I obesity (30.0-34.9 kg/m2), class II obesity (35.0-39.9 kg/m2) & class III obesity (40.0kg/m2).

Screening for health risks with BMI: Conditions like those listed below may be more likely to manifest in those with a BMI below 18.5 (underweight). Malnutrition, anemia, a lowered immune system (which might result in a greater frequency of infections and diseases), osteoporosis, and infertility are all possible outcomes of a lack of nutrition.

If you are underweight, your doctor may conduct a variety of tests to determine whether you are malnourished.

Quantitative assessment of the amniotic fluid volume: Sonography was used to evaluate the quantitative amount of amniotic fluid present. The abdominal area was sectioned off into quadrants in both cases. The right and left halves were determined based on the location of the umbilicus and the linea nigra, respectively. The transducer was set up with its long axis perpendicular to the ground's surface. Color Doppler imaging was used to quantify the depth of the single deepest pocket in each of the four quadrants that did not contain the umbilical cord or other fetal components, and the total of these four measures was the AFI.

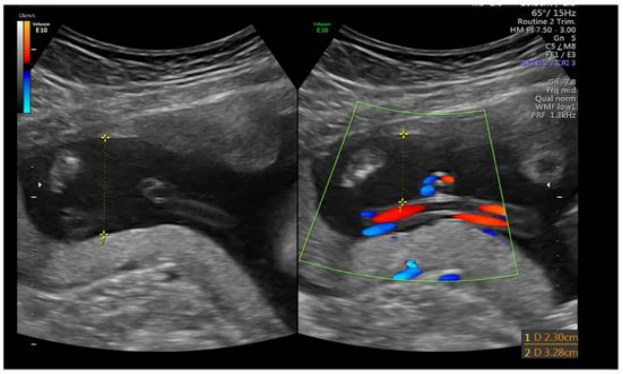

Figure (1): Example A of the evaluation of the volume of amniotic fluid by utilizing color Doppler on the R side of the screen and gray scale on the L side of the screen for determining the amniotic fluid pocket.

In certain cases, the amount of amniotic fluid might indicate the health of the fetus. As may be observed in Figure 2, a typical AFI ranges from 8 to 18. Oligohydramnios is defined as an AFI of <5-6, as seen in Figure 2. According to Figure 2, polyhydramnios is diagnosed when the AFI is more than 24-25

Figure 2. AFI—level

2.7.Ethical Consideration: The Institution Research Board of the Department of medicine at Al Azhar University has been presented with the study protocol for consideration and approval. Each subject who participated in the study gave their informed verbal consent. At every investigation stage, participants' rights to privacy and confidentiality were protected.

Data Management and Statistical Analysis: The data were coded, entered, and analyzed utilizing Microsoft Excel software. The data were collected during the history, basic clinical examination, and outcome measurements. After that, the data were loaded into an updated version of the Statistical Package for the Social Sciences program, known as SPSS version 20.0, so that it could be analyzed. The data were gathered and then sent off for statistical analysis. We employed the statistical tests and parameters that are listed below.

3. Results

Table 1. Distribution of examined sample as regard patient's age

AGE (YEARS)	NUMBER	PERCENT
≤20	20	25.0
21 – 30	52	65.0
>30	8	10.0
RANGE	18-35	
MEAN±S.D.	24.30±4.359	

This Table showed that age distribution of the examined group and it was varied from 18-35 years with a mean value of 24.30±4.359 years.

Table 2. Distribution of examined sample regarding patient's gestational age, weight and height

	MIN. – MAX.	MEAN±S.D.
GESTATIONAL AGE	36 – 40	37.58±1.456
WEIGHT	52 – 130	81.23±17.563
HEIGHT	150 – 171	160.50±5.470

This Table showed that Gestational age was vared from 36 – 40 weeks with a mean value of 37.58±1.456 weeks. Patient's weight was ranged from 52 – 130 kg with a mean value of 81.23±17.563 kg. Patient's height was ranged from 150 – 171 cm with mean value 160.50±5.470 cm.

Table 3. Distribution of examined sample as regard patient's BMI.

BMI	NUMBER	PERCENT
NORMAL WEIGHT (18.5–24.9 KG/M²)	10	12.5
OVERWEIGHT (25.0–29.9 KG/M²)	32	40.0
CLASS I OBESITY (30.0–34.9 KG/M²)	12	15.0
CLASS II OBESITY (35.0–39.9 KG/M²)	14	17.5
CLASS III OBESITY (>40.0 KG/M²)	12	15.0
RANGE	20.83-44.46	
MEAN±S.D.	31.45±6.199	

This Table showed that BMI distribution of the examined group and it was ranged from 20.83-44.46 kg/m2 with a mean value of 31.45±6.199 kg/m2.

Table 4. Distribution of examined sample concerning patient's Duration of ventilation

	MIN. – MAX.	MEAN±S.D.
AFI	2 – 21	9.33±4.494

This Table showed that AFI was vared from 2 – 21 with a mean value of 9.33±4.494.

Table 5. Relation between AFI and BMI.

AFI	BMI					P VALUE
	Normal weight	Overweight	Obesity			
			Class I	Class II	Class III	
MIN. – MAX.	2 – 15.6	2 – 21	2 – 10	6.5 – 14	8 – 16.6	0.004*
MEAN±S.D.	9.82±5.446	8.95±4.754	6.17±3.158	9.43±2.578	13.00±3.606	

This Table showed that relation between AFI and BMI and it show statistically significant difference between them.

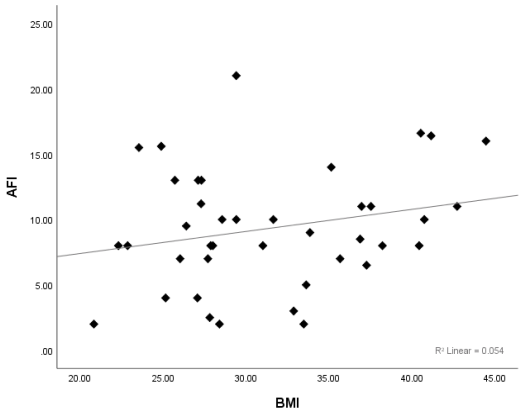

Figure 3. Relationship amongst BMI and AFI

This figure showed that correlation between BMI and AFI and it show positive significant correlation between them

4. Discussion

The objective of this research was to study the correlation between pregnant women's BMI and AFI at weeks 36 and 40.

Eighty patients hospitalized at the gynecology and obstetrics unit at Al-Zahra University were the subjects of this cross-sectional observational research.

The present research involved women ages 18-43, with a mean age of 24.68±5.463.

In agreement with our results is an investigation by Wafa et al. six that compared the accuracy of sonographically estimated fetal weight (EFW) amongst normal weight, overweight, and class I, class II, and class III obese groups in the third trimester, just beforehand labor. The age range of the cases examined was 18–35, and the Mean SD was 23.57±4.16 years old.[6]

Similarly, Fuchs et al.[7] set out to determine whether or not there was a relationship among the amount of amniotic fluid as measured by one of three methods (subjective method [SM], deepest vertical pocket [DVP], and AFI) and the EFW (expressed as a percentile or Z-score) afterward controlling for maternal and fetal factors. Over two weeks, 65 technologists conducted 1667 ultrasound scans that were involved in the analysis. The average mother's age was 31.6 (range: 18-46) years old.[6]

Women's ages were found to vary from 18 to 43 in research by Taoudi et al. 8; the 25-34 age group was the most common, accounting for 47.4 percent of the total.[8]

A total of 258 people contributed to the research by Adeyekun and Awosanya,[9], and underwent sonographic examination. Subjects' ages averaged 29.1 ± 4.9 years, with average parity ranging from 0 to 7. Maternal averages for weight and height were 71.4 ± 13.6 kg and 1.6 ± 0.5 m, respectively.[9]

In the current study, Gravidity ranged between 1 and 5, with a mean value of 1.75±1.049. Parity was ranged between 0-7 with a mean value of 0.83±1.290. Abortion was ranged between 0-5 with a mean value of 0.25±0.864.

In contrast to the results of Figueiredo et al., 10 stated that 26 percent of their pregnant patients were having their first child, 26.4 percent were nullipara, and 87 percent had no history of abortion. From a gravity scale of 1 to 6, the average was 3. Parity might be anywhere from 0 to 5, with two being the most common. There were zero to three abortions, with zero being the most common.[10]

However, research by Taoudi et al. 8 found that most cases were multiparous and had no history of abortion (75.4 percent) or fetal death (93.1 percent).[8]

The current research's gestational ages varied from 36 to 40 weeks, with a mean value of 37.58±1.456 weeks. In this study, case weights varied widely, from 52 to 130 kg, with a mean of 81.23±17.563 kg. The patient height distribution was between 150 and 171 centimeters, with a mean of 160.50±5.470 centimeters.

The mean gestational age at recruitment was 19.4 weeks, as stated by Cheney et al. [11]

The examined group's BMI varied from 20.83 to 44.46 kg/m2, with a mean of 31.45±6.199kg/m2.

Overweight women were 1.79 times as likely to gain extra weight during pregnancy as women with a healthy BMI before pregnancy (odds ratio [OR] 1.79; 95% confidence interval [95% CI] 1.42-2.25; p 0.005), and overweight cases were 2.0 times as expected to gain weight as women with a healthy BMI beforehand pregnancy (OR 2.0, 95% CI, 1.50-2.65). As stated by Cheney et al.[11]

In contrast, Mishra et al.[12] found a mean weight of 50.97 kg, with a statistically significant disparity amongst the weights of the various groups of pregnant women. Throughout the three trimesters of pregnancy, there was a large discrepancy in the average weight increases between the subgroups.

Normal weight (18.5 kg/m2-24.9 kg/m2), overweight (25.0 kg/m2-29.9 kg/m2), obese (30 kg/m2) were the three groups of women investigated by Chisholm et al. 13

The average AFI in this analysis was 9.33±4.494, with a range of 2.2-21.

Chisholm et al.[13] recorded 1744 AFI readings for the 500 pregnant cases in the research, with a range of 1-3 measurements per pregnancy (mean = 3.5, median = 2).

Mean AF1 and EFW were stated to be as follows in another investigation by Adeyekun and Awosanya[9] 172.1 mm and 1,250.2 g at 27-29

weeks; 170.3 mm and 1,648.0 g at 30-32 weeks; 162.3 mm and 2,273.5 g at 33-35 weeks; 144.09 mm & 2,906.1 g at 36-38 weeks; 125.0 mm & 3,222.6 g at 39-40 weeks. P > 0.05; r = 0.241) indicates no significant association among AFI and EFW.

According to a review by Guelinckx et al. [14], the rate at which pregnant women are becoming overweight varies from 1.8% to 25.3% among countries. The rate of overweight obesity amongst pregnant cases was reported to be 25% and 17.1%, respectively, in prior research by Bautista-Castan˜o et al. [15]

By analyzing AFI curves in India, Sing et al. [16] concluded that population-specific normative AFI curves ought to be utilized wherever feasible to more accurately identify high-risk pregnancies without increasing the likelihood of unnecessary maternal concern.[16]

AFI and maternal BMI have been the subject of very little research. The value of ultrasonography monitoring in the context of obesity has been investigated. As shown by Harper et al. 16, reliable estimates of amniotic fluid volume and fetal development anomalies in overweight mothers may be made after 32 weeks of pregnancy.[16]

However, this study believed that normal AFI levels were unrelated to BMI, although Blitz et al. 18 found no association between maternal BMI and oligohydramnios in late gestation. [18]

4. Conclusion

Differences in AFI curve fits throughout pregnancy by BMI group were statistically significant. More extensive research is required to evaluate whether or not the observed variations in normative AFI curves have any practical significance.

4.1.Recommendations

Further investigations, an enormous geological scale, and a bigger example size underline our decision. There needs to be a decrease in heftiness, whether during or after pregnancy. Prepregnancy dietary guidance, customary actual work, and a sound way of life could also assist in decreasing the rate of gestational corpulence and frequency of perinatal intricacies.

Disclosure

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Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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