ORIGINAL ARTICLE

The impact of body mass index on neonatal outcome in cases of pregnancy with IUGR

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Abstract

Background: ***A major public health concern with far-reaching consequences, including in the field of obstetrics, obesity has arisen as a worldwide epidemic of the modern period. The correlation between obesity and negative pregnancy outcomes has grown stronger in recent years, along with the rising obesity rate among reproductive-age women. The effects of maternal obesity on the health of the baby during pregnancies involving intrauterine growth restriction (IUGR) are especially worrisome.***

Aim and objectives: ***Specifically, we want to know how IUGR affects a mother's body mass index (BMI) and how it relates to her baby's health.***

Subjects and methods: ***This prospective study was carried out on 100-patients selected from attendee of Obstetrics and Gynecology Department El-Hossein Hospital in the duration from January 2022 to January 2024.***

Results: ***Obese individuals had a considerably older age than both normal weight and overweight patients, although there was no statistically significant difference between the two groups. Patients who were overweight or obese had a substantially increased risk of developing hypertension, deep vein thrombosis, and parity compared to patients who were of normal weight. Obese patients had much longer labors and more complicated delivery methods than normal and overweight patients.***

Conclusion: ***Maternal obesity significantly impacts neonatal outcomes and maternal health. Obese women had higher parity, incidence of DVT, hypertension, NICU admissions, and birth weights compared to normal-weight women. Additionally, delivery timing and mode were significantly affected, while Apgar scores at 1 and 5 minutes were notably lower in obese patients, emphasizing the need for targeted management in pregnancies with IUGR and elevated BMI.***

Keywords: Body mass index; Neonatal outcome; IUGR; Pregnancy

1. Introduction

Obesity is typically characterized as having a Body Mass Index (BMI) of 30 Kg/m² or greater. In essence, it signifies an augmentation in the body's

adipose tissue mass. Yet, in practical terms, directly quantifying this increase

can be challenging. Consequently, healthcare professionals often rely on two

prevalent clinical approaches to gauge obesity: BMI, which assesses overall

body mass relative to height, and the waist-hip ratio, which examines the

distribution of fat throughout the body.[1]

One way to find a person's body mass index (BMI) is to divide their weight in kilograms by the square of their height in meters. This ratio is expressed as kg/m2. Unfavorable pregnancy outcomes can happen to women of any weight. A higher body mass index is linked to a higher risk of complications during pregnancy, including preeclampsia, gestational hypertension, macrosomia, interventions to induce labor, and cesarean sections.[2]

Previous research on the effects of obesity on pregnancy and the newborn has shown that being overweight increases the risk of hypertension, gestational diabetes, and other complications throughout pregnancy and the first few months of a baby's life.[3]

Preterm births, low birth weight, and anemia are more common among underweight individuals (defined as a body mass index (BMI) of less than 19.9 kg/m2), but preeclampsia, gestational diabetes, obstetric intervention, and post-partum hemorrhage are less common in this weight category.[4]

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Fetal growth under the 10th percentile of gestational age (IUGR) is a major cause for worry in obstetric care because it is linked to negative consequences for the newborn. It poses a unique challenge for clinicians, as the underlying causes of IUGR can be multifactorial, including maternal, placental, and fetal factors. One crucial factor that has garnered increasing attention in recent years is the maternal BMI and its potential impact on neonatal outcomes in cases of pregnancies complicated by IUGR.[5]

This study sought to establish a stronger relationship between maternal BMI and IUGR-related adverse newborn outcomes.

2. Patients and methods

Following approval from the Local Ethics Committee, a prospective study was conducted on 100 patients who were randomly selected from the Obstetrics and Gynecology Department at El-Hossein Hospital between January 2022 and January 2024. A waiver of liability was signed.

Inclusion criteria:

Pregnant females aged between 20 and 40 years, GA between 24 and 40 weeks, pregnant individuals who have been diagnosed with IUGR, and single living fetus.

Exclusion criteria:

The following situations are not appropriate for this study: pregnancies with multiples (twins, triplets, or higher-order), pregnant women with certain medical conditions (such as diabetes mellitus, chronic hypertension, renal disease, or autoimmune disorders), situations where intrauterine growth restriction (IUGR) is linked to chromosomal abnormalities or congenital fetal defects, pregnant women with a history of substance abuse (such as smoking or illicit drug use), women who refuse to participate.

Methods:

Here is what all patients went through:

Thorough patient history taking, including vital signs (temperature, blood pressure, height, and BMI), a thorough physical examination (including vital signs such as pulse, respiration rate, and blood pressure), and standard laboratory testing, as well as obstetric palpation (Maneuvers of Leopold).

Ultrasound:

In order to evaluate the biophysical profile (BPP), which comprises the following vital signs: fetal movement, fetal tone, respiration, and amniotic fluid index (AFI), fetuses were counted (not including multiple pregnancies). Position of the placenta, biometry, GA, presentation (at term). To determine IUGR, normal growth, and macrosomia, the estimated fetal weight is determined using the Hadlock formula, which depends on BPD, AC, and FL. Doppler flowmetry of the umbilical artery is used for fetal health evaluation.

The end of a pregnancy might occur by a cesarean section or a vaginal delivery. Apgar scores should be monitored by a skilled pediatrician at 1 and 5 minutes after birth as part of the neonatal evaluation. The newborn's weight and ICU hospitalization at birth.

The body mass index (BMI) was determined by dividing the average weight in kilograms by the square of the height in meters. According to the guidelines set out by the World Health Organization (WHO), adults of Asian descent were categorized as either underweight (BMI<18.5 kg/m2), normal (BMI 18.50-24.99 kg/m2), overweight (BMI 25-29.99 kg/m 2), or obese (BMI>30 kg/m 2) Gudipally et al.,[6] Post-partum hemorrhage, puerperal sepsis and Venous thromboembolism were assessed.

APGAR score of the neonates: Cnattingius et al.,[7]

The Apgar score is taken at one minute and five minutes following the delivery of the baby. The newborn's general health can be determined in this short amount of time. The following five parameters are evaluated: pulse, respiration rate, color, reflex response (the Babinski reflex is examined), and muscular tone (the baby's palm is touched).

We assign a score between 0 and 2 to each characteristic that we see. Worry should ensue if the Apgar score is five or lower. A higher score on the second Apgar test should show progress. For each of the five categories, the infant was given a score ranging from zero to two. Ten is the maximum APGAR score that can be achieved. A newborn usually needs to see a doctor right away if their APGAR score is six or lower.

Sample size:

In order to determine the sample size, Epi Info STATCALC took into account the following assumptions, which were derived from the study conducted by Abenhaim et al.8: The level of confidence is 95% on both sides, while the power is 80%. there is a 5% margin of error. From the Epi Info output, a final maximum sample size of 100 was obtained.

Data analysis:

Statistics were performed using SPSS v26, which was developed by IBM Inc. and is based in Chicago, IL, USA. The data distribution was checked for normality using the Shapiro-Wilks test and histograms. We used the mean and standard deviation (SD) to display quantitative parametric data. The median and interquartile range (IQR) were used to display quantitative, non-parametric data. Qualitative factors were displayed using percentages and frequency counts.

3. Results

Table 1. Demographic data of the studied patients.

		N=100
AGE (YEARS)	Mean±SD	30.12±5.03
	Range	22-39
WEIGHT (KG)	Mean±SD	75.9±7.3
	Range	67-97
HEIGHT (CM)	Mean±SD	171.85±5.79
	Range	158-179
BMI (KG/M^2)	Mean±SD	25.8±3.47
	Range	23-37.3
PARITY	1	62(62%)
	2	20(20%)
	3	15(15%)
	4	3(3%)

BMI:Body mass index.

The age ranged between 22-39 years with a mean value (±SD) of 30.12 (±5.03) years. The weight ranged between 67-97 kg with a mean value (±SD) of 75.9 (±7.3) kg. The height ranged between 158-179 cm with a mean value (±SD) of 171.85 (±5.79) cm.

The BMI ranged between 23-37.3 kg/m2 with a mean value (±SD) of 25.8 (±3.47) kg/m2. Parity was 1 in 62(62%) patients, 2 in 20(20%) patients, 3 in 15(15%) patients and 4 in 3(3%) patients, (table 1; figure 1).

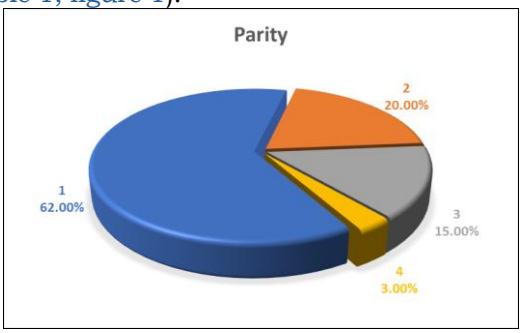

Figure 1. Parity of the studied patients.

Table 2. Neonatal outcome of the studied patients

		N=100
BIRTH WEIGHT (KG)	Mean±SD	2.78±0.78
	Range	1.4-4.6
APGAR SCORE AT 1 MIN	Mean±SD	7.45±1.74
	Range	4-10
APGAR SCORE AT 5 MIN	Mean±SD	7.85±1.64
	Range	4-10
ADMISSION TO NICU		8(8%)

NICU:Neonatal intensive care unit.

The birth weight ranged between 1.4-4.6 kg with a mean value (±SD) of 2.78 (±0.78) kg. Apgar score at 1 min ranged between 4-10 with a mean value (±SD) of 7.45 (±1.74). Apgar score at 5 min ranged between 4-10 with a mean value (±SD) of 7.85 (±1.64). 8(8%) patients needed to NICU admission, (table 2; figure 2).

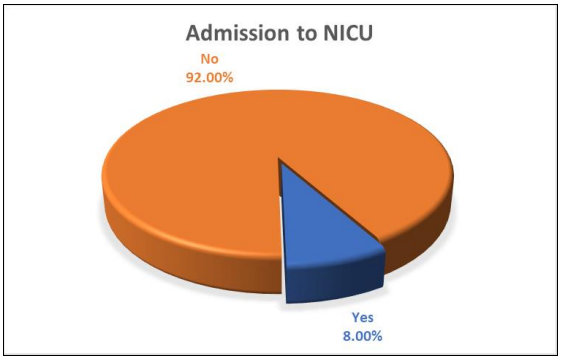

Figure 2. Admission to NICU of the studied patients.

Table 3. Relation between BMI and (age, parity, deep venous thrombosis, development of HTN, development of DM, time and mode of delivery).

		NORMAL WEIGHT (N=80)	OVERWEIGHT (N=9)	OBESE (N=11)	P-VALUE	POST HOC
AGE (YEARS)	Mean±SD	29.6±5.07	30.2±4.63	33.6±3.8	<0.00*	P1=0.358
	Range	22-39	22-39	26-38		P2<0.001*
						P3<0.001*
PARITY	1	52(65%)	6(66.67%)	4(36.36%)	0.001*	
	2	15(18.75%)	2(22.22%)	3(27.27%)		
	3	13 (16.25%)	1(11.11%)	1(9.09%)		
	4	0(0%)	0(0%)	3(27.27%)		
DEEP VENOUS THROMBOSIS	Yes	0(0%)	1(11.11%)	2(18.18%)	0.001*	
	No	80(100%)	8(88.89%)	9(81.82%)		
DEVELOPMENT OF HTN	Yes	7(8.75%)	2(22.22%)	5(45.45%)	0.003*	
	No	73(91.25%)	7(77.78%)	6(54.55%)		
DEVELOPMENT OF DM	Yes	6(7.5%)	2(22.22%)	3(27.27%)	0.077	
	No	74(92.5%)	7(77.78%)	8(72.73%)		
TIME TO DELIVERY	<37 weeks	9(11.25%)	2(22.22%)	6(54.55%)	0.001*	
	37-40 weeks	71(88.75%)	7(77.78%)	5(45.45%)		
MODE OF DELIVERY	Vaginal delivery	70(87.5%)	7(77.78%)	4(36.36%)	<0.001*	
	Cesarean	10(12.5%)	2(22.22%)	7(63.64%)		

HTN:hypertension, P1:P-value between normal weight and overweight, P2:P-value between normal weight and obese, P3:P-value between overweight and obese,*:Significant as P-value<0.05.

Age was insignificantly different between normal weight patients and overweight patients and was significantly higher in obese patients than (normal weight patients and overweight patients) (P-value<0.001).

Development of DM were insignificantly different among the three groups. Parity, deep venous thrombosis and development of HTN were significantly higher in obese patient and overweight patients than normal weight patients (P-value=0.001and 0.003 respectively).

Time to delivery and mode of delivery were significantly higher in obese patient than (normal patient and overweight) (P-value<0.001), (table 3;

figure 3).

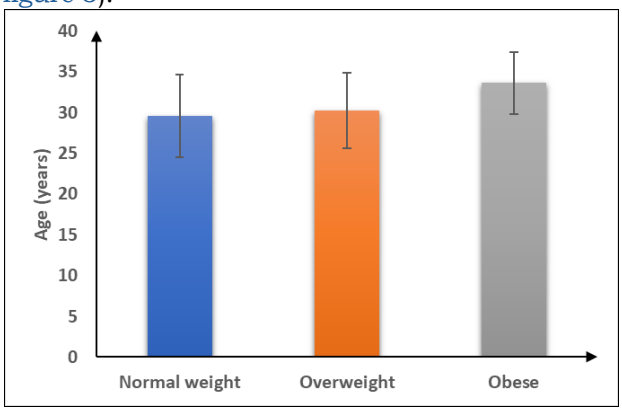

Figure 3. Relation between BMI and age.

Table 4. Relation between BMI and (admission to NICU, birth weight, Apgar score at 1 min and Apgar score at 5 min.)

		NORMAL WEIGHT (N=80)	OVERWEIGHT (N=9)	OBESE (N=11)	P-VALUE	POST HOC
ADMISSION TO NICU	Yes	4(5%)	1(11.11%)	3(27.27%)	0.036*	
	No	76(95%)	8(88.89%)	8(72.73%)		
BIRTH WEIGHT (KG)	Mean±SD	2.7±0.75	2.8±0.83	3.5±0.62	<0.001*	P1=0.887
	Range	1.4-4.1	2-4.3	2.7-4.6		P2=0.004
						P3=0.124
APGAR SCORE AT 1 MIN (KG)	Mean±SD	7.7±1.6	7.1±2.26	6.3±1.95	<0.001*	P1=0.338
	Range	4-10	4-10	4-9		P2=0.022
						P3=0.695
APGAR SCORE AT 5 MIN (KG)	Mean±SD	8±1.51	7.6±1.81	6.7±2	<0.001*	P1=0.392
	Range	4-10	5-10	4-9		P2=0.014
						P3=0.573

NICU:Neonatal intensive care unit, P1:P-value between normal weight and overweight, P2:P-value between normal weight and obese, P3:P-value between overweight and obese,*:Significant as P-value<0.05.

Admission to NICU was significantly higher in obese patient than normal weight patients and overweight patients (P-value=0.036).

Birth weight was insignificantly different between overweight patient and (normal weight and obese) patients and was significantly higher in obese patient than normal weight patient (P-value=0.004).

Apgar score at 1 min and 5 min were insignificantly different between overweight patient and (normal weight and obese) patients and was significantly lower in obese patient than normal weight patient (P-value=0.022 and 0.014 respectively), (table 4; figure 4).

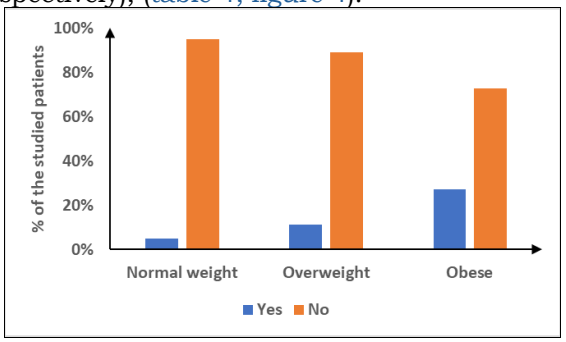

Figure 4. Relation between BMI and admission to NICU

4. Discussion

There is a worldwide epidemic of obesity. Obesity is more common among women than men across all age groups. In industrialized nations in particular, the prevalence of obesity during pregnancy is on the rise.[9]

People are categorized as overweight or obese if their body mass index (BMI) is 30 or higher. Obesity is defined as a body mass index (BMI) of 25±29.9 kg/m2 or above in adults. Obesity is associated with an increased risk of metabolic syndrome, diabetes mellitus, hypertension, preeclampsia, complications during labor and delivery (macrosomia, low APGAR score, neonatal intensive care unit admission), and placental pathological lesions.[10]

Both the mother and the child are at increased risk for complications when the woman is overweight while pregnant. Compared to women of average weight, obese women are more likely to experience difficulties during pregnancy, such as gestational diabetes mellitus, preeclampsia, high blood pressure throughout pregnancy, needing a cesarean section, bleeding after giving birth, and even stillbirth.[11]

The current study revealed that the age mean value (±SD) was 30.12(±5.03) years, weight was 75.9(±7.3) kg, height was 171.85(±5.79) cm and BMI was 25.8(±3.47) kg/m2. One in six patients had parity, two in twenty percent, three in fifteen

percent, and four in three percent of cases.

In the same line, Mohamed et al.,[12] recruited 150 pregnant women to participate in a randomized controlled experiment. Three major categories were used to classify them: Participants in Group B were overweight, whereas those in Group A were not. People who are overweight make up Group C. The results showed that all three groups had different average ages: 29.9 for the control group, 30.2 for the overweight group, and 30.6 for the obese group. Maternal mean BMI±SD in the control group was 21.7±1.5, in the obese group was 34.9±1.9, and in the overweight group was 27.45±1.12.

In the present study, 3% of patients suffered from deep venous thrombosis, 14% patients suffered from HTN, and 11% patients suffered from DM.

In the same line, Gudipally et al.,[13] showed that hypertensive disorder during pregnancy and labor was found in 7.3% patients and gestational DM in 1%.

According to our findings, the time to delivery was<37 weeks in 17% patients and 37-40 weeks in 83% patients. The mode of delivery was vaginal delivery in 81% patients and caesarean in 19% patients. The birth weight mean value (±SD) was 2.78(±0.78) kg, Apgar score at 1 min was 7.45(±1.74), and Apgar score at 5 min was 7.85(±1.64). 8% patients needed to be admitted to the NICU.

However, Eltayeb & Khalifa,[14] found that 73.3% gave birth via caesarean section and 27.7% via vaginal delivery as usual. This variation can be explained by different study designs or different demographic variables.

Our study found no statistically significant difference in age between patients with normal weight and those with overweight, but it was much greater in obese patients compared to both groups.

Consistent with our results, Choi et al.,[15] observed that the ladies classified as obese tended to be older than their normal-weight counterparts.

Our results showed that compared to normal-weight patients, those who were overweight or obese had a substantially increased risk of parity, deep venous thrombosis, and hypertension. Obese patients had longer labors and more frequent cesarean sections than normal and overweight patients.

It is backed by Liu et al.,[16] who illustrated that the incidence rate of gestational hypertension in high-weight-gain mothers was significantly higher than that of normal weight-gain mothers.

In the same manner, Saleh Yossef et al.,[17] found that individuals who were overweight or obese had a substantially increased risk of developing hypertension and deep venous thrombosis compared to patients who were of a normal weight. Additionally, compared to normal and overweight patients, obese patients were more likely to have a cesarean section during delivery.

This is supported by Eltayeb & Khalifa,[14] who discovered that weight gain was significantly more common in the obese population as parity increased. In addition, the probability of caesarean section birth increased among other groups and was higher among those who were obese.

Compared to patients who were normal weight or overweight, those who were obese had a substantially greater rate of admission to the neonatal intensive care unit (NICU). The birth weight of overweight patients did not differ significantly from that of normal weight and obese patients, although it was considerably greater for obese patients compared to normal weight patients.

Along with this, there was Mohamed et al.,[12] who disclosed that the birth weight of fat patients was substantially greater than that of normal-weight patients. Obese mothers were more likely to be admitted to the neonatal intensive care unit than their normal-weight or overweight counterparts.

Egwaila et al.,[17] found that there was significantly longer labor duration, especially the first and second stages, in obese women.

On the other hand, Yang et al.,[18] illustrated that obese women were significantly associated with very low birth weight. This difference may be attributed to the inclusion of a higher prevalence of complications like preterm birth or placental insufficiency.

Mohamed et al.,[12] , where it was found that the Apgar score at 5 minutes was noticeably lower in patients who were obese compared to those who were of normal weight.

In the same manner, Choi et al.,[15] demonstrated a statistically significant decrease in Apgar score between the normal weight and obese groups.

4. Conclusion

Maternal obesity significantly impacts neonatal outcomes and maternal health. Obese women had higher parity, incidence of DVT, hypertension, NICU admissions, and birth weights compared to normal-weight women. Additionally, delivery timing and mode were significantly affected, while Apgar scores at 1 and 5 minutes were notably lower in obese patients, emphasizing the need for targeted management in pregnancies with IUGR and elevated BMI.

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All authors have a substantial contribution to the article

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Conflicts of interest

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