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Maternal Obesity and Adverse Pregnancy and Perinatal Outcomes

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Original Article

ABSTRACT

Background: *Maternal obesity has serious health consequences, contributing to increased morbidity and mortality for mother, fetus and newborns. Obesity enhances the chance of abortion, gestational hypertension, gestational diabetes mellitus, preeclampsia, and thromboembolism* ***Objective:*** *To assess the maternal and fetal outcomes among pregnant women with high body mass index (BMI).* ***Patients & Methods****: A prospective study that involved 270 pregnant women, later they were divided into two groups; group A 143 women with BMI (18.5 – 25 kg/m2) and group B 123 women with BMI (>30 kg/m2).The basic characteristics of the two study groups and the neonatal outcome in relation to obesity was compared between those groups.* ***Results****: The median age was 25 years, with 98.1% of the women had gestational age of between 37 – 41 weeks, 6.3% of the obese women had preeclamptic toxemia , 7.1% had gestational diabetes, and 9.4% had both preeclamptic toxemia and gestational diabetes mellitus while only 4.2% of the normal weight women had pre-eclamptic toxemia. Obese women had higher rates of thrombo-prophylaxis (8.7%) vs. 1.4%, in normal weight women (p-value = 0.005). Five neonatal deaths occurred among obese women, 66.1% of the obese women gave birth to a big baby compared with 34.3% among women of normal weight (p-value < 0.001). Cesarean section rate was significantly higher in obese group (33.1%) vs. 13.3% in non-obese..* ***Conclusions:*** *Maternal obesity associated with increased risks of feto-maternal complications ; preeclampsia, gestational diabetes, macrosomic babies and high rate cesarean delivery*

Keywords: *Maternal obesity, epidemiology, pathogenesis, , feto-maternal complications,*

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1. INTRODUCTION

Obesity is one of the significant health problem worldwide, particularly in pregnant women. It characterized by excessive levels of adipose tissue in the body. Prevalence of obesity is rising globally and no country away of this rising, however, prevalence of obesity varies in accordance with the variation of different populations, in last three decades , obesity trend almost doubled in general population so among pregnant women(1,2). Obese woman has an excess in her adipose tissue which leads to increase in leptin levels and decreases adiponectin levels, leading to insulin resistance (IR) (3–5). Obesity is also often associated with hyperandrogenemia. These and various other hormonal changes cause many disorders in pregnant and non-pregnant women such anovulation and comorbidities during pregnancy (1,3,6). Unfortunately, maternal mortalities during pregnancy or at postpartum period are high in obese women (7–9). It is still unclear whether obesity itself increases risk of adverse pregnancy outcomes or contributes to other pathological conditions that increase these risks(1,4,5,7). Adverse pregnancy outcomes are often associated with carbohydrate metabolism disorders that occur in a significant proportion of obese women. From other point of view, in women with obesity and normal glucose tolerance, the likelihood of a complicated pregnancy remains high(10–12). It is believed that the pathogenesis involves various mechanisms of dysregulation of metabolic, vascular and pro-inflammatory effects of adipose tissue in relation to other organs and systems. Previous studies and literatures documented that obesity in pregnancy is an important risk factor for abortion, gestational hypertension and diabetes mellitus, preeclampsia and venous thrombo-embolism(8,13,14). It had been widely postulated that obesity associated with poor outcomes of pregnancy such as post-term pregnancy, more likely to need induction of labor or cesarean deliveries, more prone to infection, longer hospital stay after labor and difficulty in breast fed their neonates (2,11,12,14–18)

Furthermore, clear evidence confirmed that the frequency of some complications of pregnancy increases with the progression of obesity. Maternal obesity leads to some increase in the absolute risk of congenital fetal abnormalities, and this risk increases in proportion to the degree of obesity(19). The pathogenesis of these disorders is not fully understood, but it is assumed to be associated with metabolic and hormonal disorders - primarily with hyperinsulinemia. Stillbirth also more frequently reported in obese pregnant women than non-obese. Newborns of obese mothers are more frequently need to be admitted to neonatal intensive

care unit (10,20–22). On the other hand, cohort studies documented that babies of obese mothers have higher probability to grow as an obese child. In most cases, overweight women also gain weight during pregnancy. However, they can avoid the possible complications associated with this problem through safe control of their weight by eating healthy foods and practicing regular suitable physical activity which improve the overall wellbeing of both pregnant women and their fetuses and babies(23–25).

2. PATIENTS and METHODS

A prospective case control study involving pregnant women with different BMI who attended Maternity Teaching hospital in Erbil province between August 2018-August 2019. The study was approved by ethical committee of Hawler Medical University/college of medicine under reporting code number 4, paper-coding 10 on March, 27, 2018. The study included 270 women and according to their BMI they were categorized to have normal BMI (18.5-24.9 kg/m^2) , namely, (group A) in which 143 women were assigned. The remaining 127 women with high BMI of more than or equal to 25 kg/m^2 and were assigned to Group B.

The weight of all the participants was measured twice; using standard scale , the first record was at preconception time or antenatal record at 1^{st} visit of the 1^{st} trimester and second record at the end of pregnancy, for both recordings the participants weighted with light clothes, and the height measured without shoes using a standard measuring scale fixed on the wall and the woman standing straight with occiput, shoulders, buttock and heel all touching the wall, then BMI was calculated using the standard metric BMI formula (26) :

$$\text{BMI} = \frac{(\text{weight in kilograms})}{\text{height in meters}^2}$$

All measurement were performed in an isolated room to protect privacy of the participants.

Data were collected and reported on a structured Pro forma contained demographic data, complications during pregnancy and labor , gestational age at labor, neonatal outcomes including birth-weight, gender, Apgar score at one and five minutes, admission to NICU, and any other complication

Inclusion criteria

1. Women with aged ranging between 20-36 years old
2. Prime gravid or multigravida
3. Singleton pregnancy
4. Gestational age from 28-42 weeks

Exclusion criteria

1. Women with prior C/S
2. History of sever hyperemesis gravidarum
3. Heart disease
4. Thyroid disease
5. Blood disease
6. Autoimmune disease
7. Other medical disease prior to pregnancy

Data management and analysis:

All statistical procedures and tests were applied using the statistical package for social sciences (SPSS 22). Statistical tests were applied according to the type of variable Student's t test used to compare means of continuous variables between the studied groups while chi square used to compare frequencies and proportions between both groups. All statistical tests applied at level of significance of two tailed, 0.05.

3. RESULTS

A total of 270 women were enrolled in this study with a mean age of 25.7± 4.24 (range: 20-36), They were composed of two groups of women 143 were non-obese (normal BMI; 18.5-24.9 Kg/m^2) and 127 were obese (BMI ≥ 30 Kg/m^2).. The mean age in non-obese group was significantly lower than that in obese group, 24.34 ± 3.53 vs. 27.20 ± 4.47 years, respectively, (P. value < 0.001). Almost one third (29.9%) of the obese women aged ≥ 30 years compared with only 6.3% of the normal weight women (p < 0.001) as presented in (**Table 1**). Gestational age of almost all women (98.1%) was ranged 37-41 weeks (p = 0.478). Regarding the parity, (44.8%) of women in Group I were primiparous compared with (22.8%) of women of Group II (p <

0.001). No significant differences were detected between the two groups regarding the history of abortion (p = 0.058), history of attending the antenatal care clinics (p = 0.106), and history of smoking (p = 0.191). Significant (p < 0.001) differences were detected between the two groups regarding the medical history, where it is evident that 6.3% of the obese women had pre-eclamptic toxemia (PET), 7.1% had gestational diabetes (GDM), and 9.4% had both PET and GDM while only 4.2% of the normal weight women had PET. Regarding the thrombo-embolism, as outlined in table (1) 8.7% of the obese women had thrombo-embolic event, which was significantly (p = 0.005) higher than the rate (1.4%) of the normal weight women (**Table 1**). Majority (97.8%) of the women gave birth to alive baby. statistically No significant association was found between mother's weight and neonatal outcome (p = 0.062), but it is worth to mention that 5 neonatal deaths occurred among obese women. More than half (58.6%) of the neonates were males, but there was no significant association between sex of the baby and the weight of the mother (p = 0.429). The table shows that 10.6% of neonates of the normal weight mothers had been admitted to the NICU compared with 8.7% of the neonates of obese mothers (p = 0.598). Only two neonates had congenital anomalies, and those were in the obese group (1.6%) while none of the normal weight group had such an anomaly (p = 0.220). No significant association was observed between the APGAR score in the first minute and the APGAR score in the fifth minute with the weight of the mother (p = 0.401, and p = 0.070 respectively). It is evident in the table that 66.1% of the obese women gave birth to a big baby compared with 34.3% among women of normal weight (p < 0.001), (**Table 2)**

Association among mode of delivery and post-partum hemorrhage with maternal obesity are illustrated in (**Table 3)**. The rate of cesarean section was significantly (p <0.001) higher in the obese group (33.1%) compared with 13.3% in the normal weight group. The results shows a higher rate of postpartum hemorrhage among obese women (24.4%) than normal weighted women (11.9%).

Table 1. Basic characteristics of the study group

Variables		Group I (Normal) (N = 143)		Group II Obese (N = 127)		P. value
		No.	%	No.	%	
Age (year)*	20-24	74	51.7	32	25.2%	<0.001
	25-29	60	42.0	57	44.9%	
	≥30	9	6.3	38	29.9%	
Gestational age* (week)	<37	3	2.1	1	0.8%	0.478
	27-41	140	97.9	125	98.4%	
	>41	0	0.0	1	0.8%	
Parity	Primipara	64	44.8	29	22.8%	<0.001
	Multipara	74	51.7	86	67.7%	
	Grand multipara	5	3.5	12	9.4%	
Abortion		11	7.7%	19	15.0	0.058
Antenatal care		76	53.1%	55	43.3	0.106
Medical history	PET	6	4.2	8	6.3%	<0.001
	GDM	0	0.0	9	7.1%	
	PET+GDM	0	0.0	12	9.4%	
Thrombo-embolism		2	1.4%	11	8.7	0.005
Smoking		1	0.7%	4	3.1	0.191

*Mean Maternal age ± SD: Group I; 24.34 ± 3.53m Group I ; 27.20 ± 4.47
*Mean Gestational age ± SD: ;Group I38.57 ± 2.94 ;Group II 38.77 ± 2.97

Table 2. Neonatal outcomes of the studied groups

Variables		Group I (Normal BMI) (N = 143)		Group II Obese (N = 127)		P. value
		No.	%	No.	%	
Neonatal outcome	Alive	142	99.3	122	96.1	0.030
	IUD	1	0.7	0	0.0	
	Stillbirth	0	0.0	5	3.9	
Gender	Male	80	55.9	77	60.6	0.429
	Female	62	43.4	49	38.6	
Admission to NICU		15	10.5	11	8.7	0.598
Congenital anomalies		0	0.0	2	1.6	0.220
Low APGAR at 1 min		7	4.9	1	0.8	0.070
Macrosomia,		49	34.3	84	66.1	<0.001

Table 3. Maternal outcomes of the studied groups

Variables		Group I (Normal BMI) (N = 143)		Group II Obese (N = 127)		P. value
		No.	%	No.	%	
Mode of delivery	Vaginal	124	86.7	85	66.9	0.030
	Cesarean section	19	13.3	42	33.1	
Postpartum hemorrhage		16	11.2	31	24.4	0.598

4. DISCUSSION

The current study found that obese women were more likely to have adverse maternal and neonatal pregnancy outcomes and complications compared to non-obese women. Women with extreme ages and those with medical history(Heart disease, thyroid disease, autoimmune disease and other medical diseases) were excluded to reduce the bias effect. The incidence of obesity increases with parity. In the normal weight group, 44.8% were primi and 51.7 % were multiparous. Whereas in the obese group only 22.8% women were primipara and 67.7% were multiparous. In grand multiparous women, 3.5% were normal weight and 9.4% were obese and p value is < 0.001.

In the present study neonatal macrosomia was significantly higher in obese women (66.1% vs. 34.3%, p-value <0.001), these findings agreed that reported by Lynch et al. [15] who reported that obesity increase risk of Fetal macrosomia by 2.2 folds (OR, 95%CI 2.2, 1.6–3.1, p-value <0.001), and similar to Bhavadharini et al study (OR: 1.6, 95% CI: 1.1-2.4, P = 0.01) (26). An earlier systematic review performed in 2014, found that maternal obesity was singnificantly associated with overgrowth of fetus (Birth-weight>4 kg) (16) . A major pathway to macrosomia is thought to be intermittent maternal and, in turn, fetal hyperglycemia fetal fat deposition increased and fetal size rise-up in response to fetal release of insulin, growth hormone and insulin-like growth factor (16). Abnormalities in maternal lipids levels may be an important factor as well (12). In the present study the rate of CS was significantly higher in obese women (33.1% vs. 13.3%, p-value<0.001), this was similar to other studies like Bhavadharini et al (26).in which obesity associated with cesarean section (OR: 1.9, 95% CI: 1.4-2.5; P < 0.001) (26). and Lynch et al study with CS compared to NVD (15). In contrary, Edwards et al (14). and Graham et al (27) found that when stratified by maternal weight gain, there was no significant association between obesity and cesarean section. Cesarean section is usually influenced by several factors, such as practice behavior of the obstetrician or other pregnancy complications in obese women, may necessitate the need for cesarean section. Nevertheless, results from our study show that obese women at a significantly higher risk of cesarean delivery. In the present study the rate of stillbirth was higher in obese women (5% vs. 0%) with marginal level of significance (p-value = 0.062), in Lynch et al study obesity associated with stillbirth (Odds ratio: 2.8) (15). Obesity is an important modifiable risk factor, for fetal death. A systematic review of observational studies showed that overweight mothers (odds ratio 1.2 and 25 to 30 kg / m2 BMI) or obese (odds ratio 1.6) for a BMI> 30 kg / m2) are more likely to give still birth than those with a normal BMI (21). A systematic review showed that women with a BMI of 40 had twice the risk of stillbirth compared to women with a BMI of 20 (relative risk 2.19) (21). Observational studies agree that obesity and overweight in mothers are 40% more likely to have stillbirths (20–22). However, pathophysiology is unclear, but it probably relates to maternal placental abnormalities, inflammatory reactions , imbalance of metabolism, and hormones. Obesity is associated with diseases such as diabetes, which can also cause fetal death (26).

The current study documented that obese women had higher risk of GDM which is in accordance with previous studies (1,4). A meta-analysis done by Chu et al surveying the relation between GDM and BMI, and reported similar findings with regard to the risk of GDM in obese women (5).

5. CONCLUSIONS

According to our findings and assessment, we concluded that increased maternal body weight associated adverse pregnancy outcomes for both maternal and feto-neonatal outcomes. Higher maternal BMI is associated with increased risk of preeclampsia, gestational diabetic, caesarian section deliveries, and a greater chance of having a macrosomic baby.

Ethical Clearance

Ethical clearance and approval of the study are ascertain by the authors, study protocol was approved by the Scientific Council and Ethical Committee at Kurdistan Board for Medical Specialties – Kurdistan-Iraq. All ethical issues and data collection were in accordance with the World Medical Association Declaration of Helsinki 2013 for ethical issues of researches involving humans, verbal and signed informed consent obtained from all patients. Data and privacy of patients were kept confidentially.

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