

# Effect of maternal overweight and obesity on pregnancy outcomes

## ABSTRACT

**Background:** Maternal overweight and obesity are reported as a risk factor for many antepartum, intrapartum, postpartum and neonatal complications. Maternal complications, such as hypertensive disorders, diabetes and venous thromboembolism, are associated with maternal overweight and obesity.

**Aim:** To determine the adverse pregnancy outcomes associated with maternal overweight and obesity.

**Study design:** A prospective case-control study

**Place and duration of study:** The study was carried out in Bint AL-Huda hospital in Thi-Qar governorate- Iraq, from 1 May 2021 until the end of June 2021.

**Methodology:** The pregnant women were categorized to be non-obese when their body mass index (BMI) was 19.8-24.9 kg/m<sup>2</sup>, overweight when their BMI was 25-29.9 kg/m<sup>2</sup> and obese when their BMI was 30 kg/m<sup>2</sup> or more. The total studied cases were 432 (141 normal weight, 156 overweight and 135 obese pregnant women). After measuring BMI in the first booking visit, all data was taken by questionnaire (Maternal: age, gestational hypertension, gestational diabetes, hydramnios, preterm delivery, induction of labor, Caesarean delivery; Fetal and neonatal complications: macrosomia LGA, SGA, neonatal hyperbilirubinemia, abortion, congenital defects, admission in NICU, fetal death).

**Results:** Gestational hypertension and gestational diabetes were significantly increased in overweight and obese compared with normal weight pregnant women. Induction of labor and Caesarean delivery were significantly increased in obese only compared with normal weight women. Furthermore, LGA and macrosomia were significantly increased in both overweight and obese in comparison with normal weight pregnant women, while SGA was significantly decreased in overweight and obese. Fetal admission in NICU and abortion was significantly increased in obese only.

**Conclusions:** Pregnancy complications related to maternal BMI is a growing problem. Maternal overweight and obesity in pregnancy are important contributors to obstetric complications and adverse outcomes. Maternal obesity is a risk factor for antepartum, intrapartum and postpartum complications. Public health efforts are urgently required to promote weight management among women of reproductive age before conception and during pregnancy.

*Keywords: BMI, pregnancy; overweight; obese; pregnancy outcome; fetal; maternal; complications.*

## 1. INTRODUCTION

Overweight is defined by a BMI of  $\geq 25$ -29.9 and obesity by a BMI of  $\geq 30$  kg/m<sup>2</sup> [1]. Overweight and obesity represented global health problems. They are the fifth leading cause of death worldwide. The causes of weight gain, which may eventually lead to overweight and obesity, are decreased physical activity, increased dietary fat intake, and genetic factors [2].

Maternal overweight and obesity are reported as a risk factor for many antepartum, intrapartum, postpartum and neonatal complications. Maternal complications, such as hypertensive disorders, diabetes and venous thromboembolism, are associated with maternal overweight and obesity. Foetal and neonatal complications including miscarriage and stillbirth, foetal anomalies, macrosomia, preterm birth, prolonged pregnancy, Caesarean delivery and postpartum haemorrhage were also recorded as complications of maternal overweight and obesity [3-6].

Seeniammal et al., mentioned that overweight mothers are at increased risk of adverse materno-fetal outcomes in India (gestational hypertension, gestational diabetes, induction of labour, Cesarean section, macrosomia, perineal lacerations, wound infection and prolonged hospital stay) [7].

Adani et al., noted that obesity affected the outcomes of pregnant in Saudi Arabia women. An association is recorded between obesity and preeclampsia, perineal tears, and episiotomy variables [8].

Safarzadeh et al., showed that overweight of Iranian women associated with a higher risk for gestational hypertension, gestational diabetes, preterm labor, preeclampsia, caesarian section and fetal macrosomia [9].

Ahmad et al., found that hypertensive disorders were nine folds more among obese Egyptian women compared to non-obese. They were significantly more prone to have gestational diabetes. Anemia was also significantly more amongst obese women and partum hemorrhage was significantly more in obese compared to normal weight women [10].

In a systematic review carried out in USA by D'Souza et al., which included analysis of 13 studies (described 3,722,477 pregnancies), it appeared that overweight was associated with increased risk for gestational diabetes mellitus, hypertensive disorders of pregnancy, and cesarean delivery. Babies were at increased risk for hypoglycemia, macrosomia, infection, birth trauma, respiratory distress, death, and neonatal intensive care unit admission [11].

In a study performed in the Gynecology and Obstetrics Teaching Hospital of the University of Poznan, Poland, Lewandowska et al., found that both the youngest and the oldest obese women displayed higher ratios of preeclampsia, intrauterine growth restriction, and preterm birth <37th week. In the oldest obese  $\leq 40$  years, compared to the youngest age 18-24 years, there was higher risk of gestational hypertension,

gestational diabetes, cesarean section, and low birth weight as well as macrosomia [12].

In comparing the data of 249,650 women aged 35 years or older with women aged less than 35 years old in Finland. It appeared that Maternal overweight and obesity along with advanced maternal age significantly increased the risks of preterm delivery, preeclampsia, fetal death, gestational age and Cesarean as compared to women of average weight aged <35 years. When comparing overweight and obese women aged  $\geq 35$  years to normal weight women of the same age, the rates of preeclampsia, preterm delivery <28 weeks, gestational age and low Apgar score were significantly increased. When observing overweight and obese women <35 years as a reference group, the risks of preterm delivery and fetal death were significantly increased [13].

An Australian survey performed on 1661 women revealed that Obese women were at increased risk of pre-eclampsia and gestational diabetes compared with women with a normal BMI. Obese and overweight women were more likely to be induced labor, and require a caesarean section compared with women of normal BMI. Babies of women who were obese were more likely to be large for gestational age and macrosomia compared with those of women with a normal BMI [14].

In Al-Yarmouk Teaching Hospital, Baghdad- Iraq, Al-Kubaisy et al., recorded high rate of **Caesarean section** in primigravida and multigravida women with high BMI compared with normal weight pregnant [15]. While, in a prospective controlled study in Ibn Al-Balady obstetrics hospital, it was recorded that obese needed more emergency **Caesarean section** as a mode of delivery than normal BMI patients. They also had longer second stage of labor and delivered babies with higher birth weight than the normal group [16].

The current study was designed to determine the adverse pregnancy outcomes associated with maternal overweight and obesity.

## 2. MATERIALS AND METHODS

**This study is** a prospective case-control **original research**. It was conducted in Bint AL-Huda hospital in Thi-Qar governorate- Iraq, from 1 May 2021 until **15 June** 2021. Women with chronic diseases like hypertension, diabetes, heart disease, epilepsy, TB, bronchial asthma were also excluded **(in the first booking visit, a time of recording the weight)**. The pregnant women were categorized to be non-obese when their body mass index (BMI) was 19.8-24.9 kg/m<sup>2</sup>, overweight when their BMI was 25-29.9 kg/m<sup>2</sup> and obese when their BMI was 30 kg/m<sup>2</sup> or more [1, 10].

The total studied cases were 432 (141 normal weight, 156 overweight and 135 obese pregnant women). The study was approved by the ethical committee of health directorate of Thi-Qar governorate and the ethical board of the College of Medicine – Thi qar university-Iraq. After measuring BMI in **the first booking visit**, all data was taken by questionnaire (Maternal: age, gestational hypertension, gestational diabetes, hydramnios, preterm delivery, induction of labor, Cesarean delivery; Fetal and neonatal complications: macrosomia LGA, SGA, neonatal hyperbilirubinemia,

abortion, congenital defects, admission in NICU, fetal death) [4, 6-8]. The significance of the results were assessed using Chi square test. It is a suitable statistical test to analyze the percent data.

### 3. RESULT AND DISCUSSION

In studying of the maternal complications of overweight and obese pregnant women, the results revealed that gestational hypertension was significantly increased in overweight (16.03%, Chi square,  $P < 0.05$ ) and obese (28.89%, Chi square,  $P < 0.05$ ) compared with normal weight pregnant women (7.09%). Gestational diabetes was also significantly increased in overweight (5.13%, Chi square,  $P < 0.05$ ) and obese (10.37%, Chi square,  $P < 0.05$ ) in comparison with normal weight women (2.13%). Hydramnios, preterm delivery and induction of labor were insignificantly increased in both obese and overweight compare with normal weight pregnant women, while, induction of labor and Caesarean delivery were significantly increased in obese only (16.30%, Chi square,  $P < 0.05$ ) and (51.85%, Chi square,  $P < 0.05$ ) compare with normal weight women (14.18 and 41.13%) respectively (table 1).

In the current study, (141 out of 432 pregnant women) were obese (33.41%), and (156 out of 432 pregnant women) were overweight (36.11%). The National Health and Nutrition Examination Survey found that more than one third of women are obese, more than one half of pregnant women are overweight or obese, and 8% of reproductive-aged women are extremely obese [17]. Overweight and obesity represented a global health problem. The results of the current study revealed that increasing maternal BMI was associated with adverse health outcomes for both the mothers and neonates. Overweight and obese women have a higher risk of gestational hypertension, gestational diabetes, abortion, large-for gestational-age (LGA), and infant admission to the NICU. These findings are consistent with many previous reports [18-25].

Previous investigations revealed that gestational hypertension and preeclampsia were significantly increased in overweight and obese women. The risk was doubled with each 5–7 kg/m<sup>2</sup> increase in pre-pregnancy BMI [26-27].

A systematic review of the literature calculated that for each 1 kg/m<sup>2</sup> increase in BMI, the prevalence of gestational diabetes mellitus increased by 0.92% [6, 28-30].

Many studies reported an increased incidence of induced labors and emergency Caesarean sections in obese mothers compared with mothers of normal weight ( $<0.05$ ). Reasons reported for surgery included macrosomia-associated cephalopelvic disproportion, fetal distress, and stagnation of induced labor [31-35].

In studying of the fetal and neonatal complications of overweight and obese pregnant women, it appeared that macrosomia was significantly increased in both overweight (6.41%,  $P < 0.05$ ) and obese (6.67%,  $P < 0.05$ ) in comparison with normal weight pregnant women (2.84%). LGA was also significantly increased in overweight (6.41%,  $P < 0.05$ ) and obese (4.67%,  $P < 0.05$ ) compared with normal weight pregnant women (2.84%), while SGA was significantly decreased in overweight (3.85%,  $P < 0.05$ ) and obese (3.93%,  $P < 0.05$ ) compared with normal weight pregnant women (7.80%). No significant changes were recorded in neonatal hyperbilirubinemia, abortion, congenital defects, admission in NICU and fetal death, in overweight in comparison with normal weight women. However, admission in NICU was significantly increased in obese (19.26,  $P < 0.05$  vs 14.89% in normal weight women). In addition, abortion was also significantly increased in obese (39.26%,  $P < 0.05$ ) compared with normal weight women (29.08%) (table 2).

Neonates of obese mothers had statistically significant more hospital stay and reported 7.07% neonatal hyperbilirubinemia, respiratory distress (7.07%), macrosomia (1.01%), in addition to increase the risk of abortion and admission in NICU [32, 36-37].

Athukorala et al, also recorded that the mean birth weight of babies born to overweight and obese mothers were significantly greater than babies born to women with a normal BMI [14, 38].

According to the previous studies, there was a strong association between obese maternal environment pregnancy and oxidative stress, compared with normal weight. Maternal and neonates' adverse effect could be attributed to obesity induced mitochondrial dysfunction with an increase in mitochondrial reactive oxygen species and oxidative stress in oocytes, zygotes and embryonic development [39-41].

Furthermore, overweight and obesity were linked with circulating inflammation markers. C-reactive protein, cytokines, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin-6 (IL-6), and interleukin-8 (IL-8) were elevated in obese pregnant women [42-43]. Inflammatory markers in obesity were causally linked to insulin resistance. Several studies have examined the association between circulating maternal inflammatory markers and maternal and neonatal adverse effects. Recent studies indicated that the inflammatory state extends to the fetal side. A gene expression study of umbilical cord tissue in term infants from healthy lean and obese women identified a proinflammatory signature characterized by upregulation of acute phase response genes, including *EGR1* and *FOSB*. However, the contribution of inflammation to developmental programming is mainly associative and definitive mechanistic studies are lacking [44-47].

**Table 1: Maternal complications of overweight and obese pregnant women compared with those with normal weight**

Parameters (%)	Normal weight BMI: 9.8-24.9 kg/m <sup>2</sup>	Overweight BMI: 25- 29.9 kg/m <sup>2</sup>	Obese BMI: 30 kg/ m <sup>2</sup> or more	Significancy of each parameter	
				Overweight vs normal	Obese vs normal
Gestational hypertension	7.09	16.03	28.89	(P < 0.05)	(P < 0.05)
gestational diabetes	2.13	5.13	10.37	(P < 0.05)	(P < 0.05)
Hydramnios	4.26	5.13	7.41	NS	NS
preterm delivery	9.22	10.26	12.59	NS	NS
induction of labor	14.18	14.82	16.30	NS	(P < 0.05)
Caesarean delivery	41.13	44.31	51.85	NS	(P < 0.05)

**NS: means not significant**

**Table 2: Fetal and neonatal complications of overweight and obese pregnant women compared with those with normal weight**

Parameters (%)	Normal weight BMI: 9.8-24.9 kg/m <sup>2</sup>	Overweight BMI: 25-29.9 kg/m <sup>2</sup>	Obese BMI: 30 kg/m <sup>2</sup> or more	Significancy of each parameter	
				Overweight vs normal	Obese vs normal
Macrosomia	2.84	6.41	6.67	(P < 0.05)	(P < 0.05)
LGA	4.96	6.41	6.67	(P < 0.05)	(P < 0.05)
SGA	7.80	3.85	3.93	(P < 0.05)	(P < 0.05)
neonatal hyper-bilirubinemia	29.08	28.21	30.37	NS	NS
abortion	29.08	33.33	39.26	NS	(P < 0.05)
congenital defects	2.82	3.21	3.70	NS	NS
admission in NICU	14.89	14.90	19.26	NS	(P < 0.05)
fetal death	10.64	10.13	14.81	NS	NS

**NS: means not significant**

#### 4. CONCLUSION

Pregnancy complications related to maternal BMI is a growing problem. Maternal overweight and obesity in pregnancy are important contributors to obstetric complications and adverse outcomes. Maternal obesity is a risk factor for antepartum, intrapartum and postpartum complications. Public health efforts are urgently required to promote weight management among women of reproductive age before conception and during pregnancy.

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#### CONSENT

The manuscript didn't contain any individual **person's** data.

#### ETHICAL APPROVAL

The study was approved by the ethical committee of health directorate of Thi-Qar governorate and the ethical board of the College of Medicine – Thi qar university-Iraq.

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