

## Maternal Obesity and Its Effect in Late Pregnancy and Labour

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### ABSTRACT

**Background:** In recent years, obesity has become a major public health problem and its prevalence is increasing at an alarming pace. Moreover, this problem has affected children and adolescents in marked fashion with a higher prevalence in females than in males.

**Objective:** To evaluate the effect of maternal obesity on length of gestation and mode of delivery and subsequent intrapartum and neonatal complications.

**Methods:** This prospective cohort study involved a total no. of 600 women with singleton pregnancies delivered in the period between December 2011 and July 2012 and were categorized into three groups according to their BMI; normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25-29.9 kg/m<sup>2</sup>) and obese ( $\geq 30$  kg/m<sup>2</sup>). The main outcome measures were length of gestation, mode of delivery, risk of delivery and neonatal complications in overweight and obese women versus normal weight women. Results: Obese women had a significantly increased risk of post-term pregnancy and higher rate of induction ending in caesarean section compared with women of normal weight. Again, there was a significantly longer median length of first stage, increased incidence of second-degree tear and significantly increased risk of low Apgar score. However, the incidence of postpartum haemorrhage and third-degree tear were similar in all body mass index categories. As regard shoulder dystocia, there was a trend towards increased incidence with increasing BMI for primiparous women but just failed to reach significance (P=0.05). There was a trend towards increased incidence of macrosomia with increasing BMI category (P=0.074) this trend was significantly true for primiparous women (P=0.047), but no trend was observed for analysis restricted to multiparous women.

**Conclusion:** Increasing BMI is associated with increased incidence of post-term pregnancy, failed progress of labour, labour induction, CS delivery, low Apgar score and macrosomic babies.

**Keywords:** BMI, post-term pregnancy, obesity, complications, macrosomia.

### INTRODUCTION

Obesity is a condition in which excess body fat has accumulated to an extent that health may be negatively affected. Obesity is commonly defined as a body mass index (BMI) of 30 kg/m<sup>2</sup> or higher. Obesity, in absolute terms, is an increase of body adipose (fat tissue) mass and, in a practical setting, this is difficult to be determined directly. Therefore, the common clinical methods used to estimate obesity are by body mass index (BMI) and in terms of its distribution via the waist-hip ratio<sup>(1)</sup>.

Obesity has been recognized by WHO as "a pandemic nutritional disorder which represents a rapidly growing threat to the health of populations of an increasing number of countries world-wide"<sup>(2)</sup>. Adults with BMI (calculated as weight in kg. divided by height in meters squared) between 25-30kg/m<sup>2</sup> are considered overweight and those with BMI  $\geq 30$  are considered obese<sup>(1)</sup>.

The prevalence of obesity has risen such that it is now a worldwide epidemic<sup>(3)</sup>.

As obesity increases, so does the number of women of reproductive age who are overweight and obese. This is having deleterious effects on female reproduction in general and a major impact on maternity services<sup>(4)</sup>. In UK, it is now estimated

that one in five women at antenatal booking are obese<sup>(5)</sup>. Many studies have demonstrated that obesity in pregnancy is associated with a wide spectrum of adverse pregnancy outcomes including increased caesarean section rates, postpartum haemorrhage, higher risks of maternal hypertension, gestational diabetes and fetal death<sup>(6)</sup>. Obesity in pregnancy has also been shown to be associated with longer gestation<sup>(7)</sup> and significantly increased risk of post-term delivery<sup>(8)</sup>, which contributes to the greater need for induction of labour (IOL) for prolonged pregnancy<sup>(9)</sup>.

As gestation progresses beyond term, perinatal morbidity and mortality increase as well as maternal complications such as pre-eclampsia, postpartum haemorrhage and caesarean delivery<sup>(10)</sup>. Women with high body mass index (BMI) and prolonged pregnancy are therefore becoming an increasingly prevalent clinical problem. Management of prolonged pregnancies in obese women, however, is difficult because IOL is associated with a high risk of caesarean section and its attendant complications of infection, haemorrhage and thrombosis whereas conservative management is associated with an increased risk of perinatal mortality.

The clinician managing an obese woman with a prolonged pregnancy therefore faces the dilemma of whether to; induce her and risk caesarean section delivery and its complications, which can include maternal death, to book an elective caesarean section and thereby reduce the increased risks associated with emergency caesarean section, or to wait so as to maximise the chance of spontaneous labour, thereby reducing the risk of caesarean section but increasing the risk of fetal death, even with outpatient monitoring. There are few published data that inform the clinician and their patients as to the prevalence of complications with each of these options <sup>(11)</sup>.

Therefore, as recommended by the ACOG committee opinion, obese women should be encouraged to decrease weight before considering pregnancy. Patients should offer readiness to make behavioral changes.

Lifestyle measures of calorie-restricted diets and exercise, when employed together, are potentially more beneficial than either modality alone. Fad diets, even ones with a potential physiological basis such as low-glycemic diets, are controversial at best with respect to long-term efficacy. Also approved weight-loss medications and bariatric surgeries can be used <sup>(12)</sup>.

Hendler <sup>(13,14)</sup>, suggested that all pregnancies in obese women be acknowledged as high risk and managed according to strict guidelines. Management should include pre-pregnancy counseling to reduce weight; shared antenatal care and appropriate management of complications.

The evidence for obesity as an important complication in pregnancy is mounting; it is time to inform practice based on this evidence.

## PATIENTS AND METHODS

### Study setting

This study was carried out in the department of Obstetrics and Gynecology, Etay Al-Baroud general hospital in the period between January 2017 and October 2017.

**The study was approved by the Ethics Board of Al-Azhar University.**

### Type of the study

A prospective observational comparative (cohort) study was chosen to evaluate the effect of maternal obesity on pregnancy and labour according to length of gestation and mode of delivery and subsequent intrapartum and neonatal complications and compare the outcome in

obese, overweight, and normal weight pregnant women.

## PATIENTS AND METHODS

Six hundred pregnant women were included in the study fulfilling the following inclusion and exclusion criteria:

### Inclusion criteria:

- 1- Singleton pregnancy.
- 2- Patients coming in active labour with cervix more than 2 cm.
- 3- Patients with no medical disorders as Diabetes, Hypertension or Heart diseases.
- 4- Patients age between 18-35 years.
- 5- Patients know the pre-pregnancy weight.
- 6-

### Exclusion criteria:

1. Women with unexplained non spontaneous labour onset before 41 weeks.
2. Patients admitted for elective C.S.
3. Grand multipara patients.
- 4.

### They were divided into 3 groups based on their body mass index (BMI):

**Group (A):** Include the pregnant women with a BMI between 18.5-24.9 kg/m<sup>2</sup> (normal weight).

**Group (B):** Include the pregnant women with a BMI between 25-29.9 kg/m<sup>2</sup> (overweight).

**Group (C):** Include the pregnant women with a BMI  $\geq$  30 kg /m<sup>2</sup> (obese).

From those 600 deliveries included in the study; 330 were nulliparous women and 270 were multiparous women. Overall, 50% were normal weight, 31% were overweight, 19% were obese.

### Patients included in this study were subjected to:

**I- Oral consent** was obtained from the pregnant women who are included in the study.

### II- Full History Taking Including:

- Name, age, occupation and address.
- Obstetric history and 1<sup>st</sup> day of last menstrual period (LMP), early scan and gestational age documentation.
- Medical or operative history.
- Any drug allergy or obstetric or operative complication.

### III- Clinical Examination:

#### General examination:

- Vital signs: blood pressure, pulse, respiratory rate and temperature.
- Height (in m<sup>2</sup>) and weight (in kg) measurements while subjects were wearing the possible lightest clothing, and body mass index (BMI) was calculated at time of admission by using the Formula:

**Weight in (kg)**

**Height in (meters)<sup>2</sup>**

Taking into consideration the pre-pregnancy weight which was known either through her weight previously documented in her follow up card or from the patient's own words.

- Head and neck examination for jaundice, pallor, pigmentations, oedema, goiter, enlarged lymph nodes and congested neck veins.
- Limb examination for oedema, varicose veins, and deformities.

**Abdominal examination:**

- **Inspection:** to detect size of the abdomen, Striae gravidarum and pigmentations as lineanigra.
- **Obstetric palpation(Maneuvers of Leopold):**
  - Fundal level.
  - Fundal grip to detect the part of the fetus occupying the fundus.
  - Umbilical grip to detect the back and fetal limbs.
  - First pelvic grip to detect part of the fetus occupying the lower uterine segment and to detect engagement.
- **Auscultation:**
  - Fetal heart sounds: by Fetal Doppler ultrasound.

**P.V Examination (under aseptic precautions in cases of suspected PROM):**

**1- At 36 weeks**

- Assessment of pelvic capacity.
- Presentation, position and engagement.

**2- At labour**

- Dilatation and effacement of the cervix.
- Exclusion of cord presentation and prolapse.
- State of membranes (intact or ruptured).
- Detection of meconium staining of amniotic fluid after rupture of membranes.

**IV- Laboratory Investigations:**

- HB%.

- RBS.
- Urine analysis.

**V- Ultrasound:**

**1- At 36 weeks**

- To asses number of fetuses, presentation, gestational age, estimated fetal weight and position of the placenta.

**2- At labour**

- To asses viability of the fetus, presentation, estimated fetal weight.

**Outcome measures:**

- Delivery outcomes including; onset of delivery, mode of delivery, reason for delivery mode, labour length (first, second, third stage), estimated blood loss, and the extent of perineal tear.
- Neonatal outcomes including: birth weight, apgar score at 1 and 5 minutes after delivery and incidence of shoulder dystocia and stillbirth. The purpose of this study was to evaluate the pregnancy outcome and not to identify the mechanisms behind the association.

**Source of data collection:**

- Medical records were abstracted to ascertain delivery events and neonatal outcomes.

**RESULTS**

The risk of post-term pregnancy was significantly increased with increasing BMI: the percentage of cases who delivered post-term in group A was 7.3%, in group B 11.8%, and in group C 26.3%.

There was also a weight-dependant increase in number of women having IOL Table (1) , such that 37.7% of obese women had IOL, compared with 30.6% and 28.3% of overweight and normal weight women respectively, demonstrating that obese women more often required labour induction than their respective counterparts of normal weight.

**Table (1): Description and comparison between the study groups as regard labour onset**

	Normal weight		Overweight		Obese		Total		P*
	N	%	N	%	N	%	N	%	
<b>Spontaneous</b>	206	68.7	116	62.3	67	58.7	389	64.8	.370
<b>Emergency CS</b>	9	3	13	7.1	4	3.5	26	4.3	.112
<b>Induction</b>	85	28.3	57	30.6	43	37.7	185	30.8	.0001

As regard to the mode of delivery in the present study, the rate of cesarean deliveries was significantly increased with the increase in BMI. The overall cesarean section rate was 46.5% in obese women compared with 36.6 % and 26.7 % in overweight and normal weight women respectively.

As regard the cause of cesarean section, a greater number of obese women had an induction ending in cesarean section delivery compared to normal weight women who were induced. cesarean section for other reasons as prolonged 1<sup>st</sup> stage and fetal distress remained fairly constant between BMI groups.

As regard the progress of labour in vaginal deliveries, obese women appeared to have a significantly longer median first stage of labour compared with normal weight women ( $p < 0.05$ ) but no difference in median length of second stage of labour was reported with higher BMI .

Overweight and obese women had a higher rate of second-degree perineal tear than those with normal BMI. However, we found no significant difference in incidence of third-degree tearing or incidence of retained placenta or postpartum hemorrhage with higher BMI.

Analysis of neonatal outcomes from all deliveries found that there was a trend towards increased incidence of macrosomia and shoulder dystocia with increasing BMI category and

statistically increased incidence of low Apgar scores as BMI increased ( $P=0.003$ ).

In subgroup analysis limited to primiparous women Table (2) , similar trends to the mixed parity group were identified but the significantly longer first stage of labour was lost, again there was a nonsignificant trend for increased postpartum blood loss in the obese primiparous women as with mixed parity obese women.

The incidence of macrosomia was significantly increased with increasing BMI for primiparous women. There was also a trend towards increased incidence of shoulder dystocia with increasing BMI but just failed to reach significance ( $P=0.05$ ).

As regard labour and delivery outcomes of multiparous women, the length of first and second stages of labour was significantly longer in obese than normal weight women with significantly increased incidence of second degree perineal tear as BMI increased but again no statistically difference in the incidence of retained placenta, postpartum hemorrhage, third-degree tearing with increasing maternal BMI.

The neonatal outcomes were different in multiparous women, as the incidence of macrosomia and shoulder dystocia was not shown to be significant and no trend was observed for multiparous women.

**Table (2): Description and comparison between study groups as regard intrapartum complications and neonatal outcomes for all primiparous women**

	Normal weight		Overweight		Obese		Total		P
	N	%	N	%	N	%	N	%	
Retained placenta	8	4.7	2	2.1	3	4.6	13	3.9	.937
Second degree perineal tear	13	7.6	9	9.5	10	15.4	32	9.7	.030
Post partum hemorrhage	43	25.3	21	22.1	23	35.4	87	26.4	.113
Low Apgar score at 5 <sup>th</sup> minute.	3	1.8	5	5.3	7	10.8	15	4.5	.008
Macrosomia	9	5.3	4	4.2	8	12.3	21	6.4	.047
Shoulder dystocia	0	0.0	1	1.1	3	4.6	4	1.2	.05
Still birth	0	0.0	0	0.0	2	3.1	2	0.6	.036

## DISCUSSION

This study adds to the increasing body of evidence which suggests that obesity, measured by BMI, predisposes women to complicated pregnancies and increased obstetric interventions.

In this study the length of gestation revealed highly statistically significant difference between the three studied groups. The risk of post-term pregnancy (42 completed weeks or more) was significantly increased with increasing BMI; the percentage of cases who delivered post-term in group A (Normal weight) was 7.3%, in group B (Overweight) was 11.8%, and in group C (Obese) was 26.3%.

There was also a weight-dependant increase in number of women having IOL, 37.7% of obese women had IOL, compared with 30.6% and 28.3% of overweight and normal weight women respectively, demonstrating that obese women more often required labour induction than their respective counterparts of normal weight.

This study agrees with **Denison** who conducted a retrospective cohort study found that the length of gestation was affected by obesity and about 6.8% of pregnancies delivered postdate. The women included in that study were 186087 primiparous women who gave birth between 1998 and 2002. Higher maternal BMI (kg/m<sup>2</sup>) during the first trimester was associated with longer gestation ( $P < 0.001$ ) and with a lower chance of spontaneous onset of labour at term. Obese women appear to be significantly less likely to establish in spontaneous labour by 42 weeks of gestation, and once BMI reaches levels of  $\geq 35$  kg/m<sup>2</sup> the chance of spontaneous labour by 42 weeks of gestation is < 50%<sup>(15)</sup>.

In a population-based study assessing the outcomes of women with an increased BMI, **Kiran** found that women with a BMI > 30 were more likely to require postdates IOL<sup>(16)</sup>.

Data from **Aberdeen** have indicated that rising BMI is a risk factor for induction of labour in the nulliparous population<sup>(17)</sup>.

On the contrary, **Stepan** who conducted a retrospective study including 5067 singleton pregnancies. They reported that there was no difference in the gestational age at delivery among the groups<sup>(18)</sup>.

Also data obtained from **Abenhaim** in their cohort study that compared prepregnancy BMI categories with obstetrical and neonatal outcomes in 18643 patients didn't match with those revealed by the present study, as the incidence of both induced and spontaneous preterm birth were found to be higher with increasing BMI category<sup>(19)</sup>.

The difference in the results between those studies and ours could be attributed to the small numbers of cases recruited in our study and the exclusion of any complicated pregnancy from the study.

As regard mode of delivery in the present study, the rate of cesarean deliveries was significantly increased with the increase in BMI. The overall cesarean section rate was 46.5% in obese women compared with 36.6% and 26.7% in overweight and normal weight women respectively.

The results come in agreement with a randomized controlled study done by **Doherty** who investigated the effect of pre-pregnancy BMI on pregnancy outcomes. The result of this study revealed that obese women were more likely to be delivered by caesarean section compared with normal weight women<sup>(20)</sup>.

Also with a prospective observational Cohort study of 4341 women at High Wycombe General Hospital at London done by **Bergholt** reported that the incidence of cesarean section delivery rise significantly with an increased BMI, women with BMI > 35 kg/m<sup>2</sup> had 3.8 times greater chance of caesarean section delivery than women with BMI < 25 kg/m<sup>2</sup><sup>(21)</sup>.

Analysis of intrapartum events in our study revealed that; a greater number of obese women had failed induction ending in CS delivery (no dilatation of cervix after 12 hours of vaginal prostaglandin and 10 hours of intravenous syntocinon) compared with their normal weight counterparts. CS for other reasons as prolonged 1<sup>st</sup> stage and fetal distress remained fairly constant between BMI groups.

This result goes hand in hand with **Doherty**<sup>(22)</sup>, **Cedergren**<sup>(23)</sup>, and **Graves**<sup>(24)</sup> who found similar adverse outcome related to increasing maternal weight.

For vaginal deliveries, we found that obese women appeared to have a significantly longer median first stage of labour compared with normal weight women ( $p < 0.05$ ) but no difference in median length of second stage of labour with higher BMI was reported. Again obese women had a higher rate of perineal tear mainly second-degree tearing than those with normal BMI.

However, we found no significant difference in incidence of third-degree perineal tear. This comes in agreement with **Cedergren** who reported that anal sphincter lacerations were not over-represented in a group of 3386 morbidly obese women (BMI  $\geq 40$  kg/m<sup>2</sup>)<sup>(23)</sup>.

Also, we found no significant difference in incidence of retained placenta or postpartum

hemorrhage (estimated blood loss > 500ml for vaginal delivery and > 1000 ml in CS delivery) with higher BMI groups.

In subgroup analysis limited to primiparous women, as regard labour and delivery outcomes, similar trends to the mixed parity group were identified but the significantly longer first stage of labour was lost, again there was a nonsignificant trend for increased postpartum blood loss in the obese primiparous women as with mixed parity obese women.

As regard the outcomes of multiparous women, the length of first stage and second stages of labour was significantly longer in obese than normal weight women but again no statistically difference in the incidence of retained placenta, postpartum hemorrhage, third-degree tearing with increasing maternal BMI.

Analysis of neonatal outcomes from all deliveries found that there was a trend towards increased incidence of macrosomia with increasing BMI category ( $P=0.074$ ) this trend was also significantly true for primiparous women ( $P=0.047$ ), but no trend was observed for analysis restricted to multiparous women.

Data obtained from **Frederick** in their prospective cohort study matched with the results revealed in the present study. As pre-pregnancy BMI was independently and positively associated with infant birth weight after adjusting for confounders<sup>(25)</sup>.

As regard **Apgar score** at 1 and 5 minutes, there was statistically increased incidence of low Apgar score with increasing BMI categories ( $P=0.003$ ). There was also a trend towards increased incidence of shoulder dystocia with increasing BMI for primiparous women but just failed to reach significance ( $P=0.05$ ); however, this was not shown to be significant and no trend was observed for multiparous women.

The overall incidence of stillbirth was low (four stillbirths) and although this occurred to two overweight multiparous women and two obese primiparous women, there was insufficient statistical power to assess the significance between the BMI groups.

This study, like any other observational study of its kind suffers from several limitations. firstly, the ideal time to record the baseline height and weight of a pregnant woman is before she has started gaining weight due to gestation, however in our study we have relied on height and weight recorded at time of delivery taking into consideration the pre-pregnancy weight which was known either through her weight previously

documented in her follow up card or from the patients own words.

Secondly, our study used data collected over 10 months; a short duration which should be extended in later studies and researches to show the longstanding impact of obesity on the patient.

The third limitation was the lack of standard definitions of overweight and obesity which makes comparison of findings across studies difficult. While most reports define obesity as an increased body mass index of greater than or equal to 30Kg/m<sup>2</sup> (IOM), others have defined it as increased waist circumference, increased waist – hip ratio or body weight of more than 90 Kg. This makes comparison of studies difficult and may have implications in the management of normal pregnancy, as in the United States, recommended gestational weight gain is dependent on women's pre-pregnancy BMI categories.

## CONCLUSION

Maternal obesity carries significant risks for the mother and foetus, including increased incidence of post-term pregnancy and need for labour induction, complicated delivery, cesarean section, low Apgar score and macrosomia.

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