Original Article

Impact of Maternal Obesity on Obstetric Outcome: A Prospective Study in a District Hospital of West Bengal

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Abstract

Introduction: The prevalence of obesity among women is an increasing problem, especially in urban population due to sedentary lifestyles and altered dietary habits. Maternal obesity has consequences on pregnancy and perinatal outcome. The present study was conducted to determine the impact of maternal obesity on maternal and perinatal outcome. **Materials and Methods:** A prospective hospital-based study was conducted on 176 pregnant women with body mass index (BMI) <25 kg/m^2 and 166 pregnant women with BMI ≥25 kg/m^2. Data on maternal outcomes and perinatal outcomes were collected by following up on antenatal women till the end of the pregnancy and results were analyzed among the two groups using SPSS version 27. **Results:** Around 31.3% of pregnant women with BMI ≥25 kg/m^2 had developed gestational hypertension, 22.9% had gestational diabetes mellitus (GDM), 7.8% had preeclampsia/eclampsia, 9.6% had prolonged labor, and more than half (53%) of them had emergency lower segment cesarean section (LSCS). Less than 1/3rd of pregnant women with BMI ≥25 kg/m^2 had induction of labor and perineal injuries. Association of gestational hypertension, GDM, preeclampsia/eclampsia, prolonged labor, and mode of delivery (emergency LSCS) was found to be significant with maternal obesity. About 16.9% and 7.2% of pregnant women with BMI ≥25 kg/m^2 had preterm and postterm delivery, respectively. Only 0.6% of pregnant women with BMI ≥25 kg/m^2 had weight of newborn >4 kg. **Conclusions:** Maternal obesity leads to adverse maternal and perinatal outcomes and is an important contributor to the burden of obstetric care. Thus, effective intervention is required in preconception period to reduce the obstetric complications.

Keywords: Maternal obesity, maternal outcome, perinatal outcome

Introduction

The World Health Organization (WHO) has described obesity as one of the neglected public health threat which is on the rise in both developed and lesser developed countries.[1] As per the WHO report, in 2016, approximately 1.9 billion adults (18 years and older) worldwide were overweight and at least 600 million adults were obese.[2] The National Family Health Survey (NFHS-5) in India has also indicated that obesity is on the rise in majority of the states and union territories. The prevalence of overweight/obesity in India among females is currently 24%, up from 20.6% (NFHS-4).[3]

Obesity has been measured by calculating the body mass index (BMI), which is weight in kilograms divided by height in meters squared. Several studies have shown that as compared to the Caucasian population, South Asian population have excess body fat, increased abdominal adiposity, excess metabolic perturbation, increased subcutaneous and intra-abdominal fat, fat deposition in liver, muscles, and cardiovascular risk factors at much lower BMI values. Thus, the WHO recommended values for the South Asian population for normal BMI is 18.5-22.9 kg/m^2, for overweight is 23-24.9 kg/m^2 and for obesity (in Indians) is ≥ 25 kg/m^2.[4]

Obesity is increasing, both in the general population and in women of reproductive age group. Obese women compared with women of normal BMI have a greater risk of medical conditions during pregnancy.[5] Obesity has been associated

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with an increased risk of maternal complications such as spontaneous abortion, gestational diabetes mellitus (GDM), pregnancy-induced hypertension, prolonged pregnancies, prolonged labor, increased rate of operative and cesarean deliveries, increased incidence of postnatal infections, postpartum hemorrhage, poor wound healing, and longer hospital stay. It is also associated with a higher risk of neonatal complications such as intrauterine fetal death (IUFD), congenital anomaly, fetal macrosomia, neonatal intensive care admissions, and perinatal mortality rates.[6]

The prevalence of obesity among women in the reproductive age group is on rise, especially in urban population due to sedentary lifestyles and altered dietary habits. Although some studies have been conducted on the impact of maternal obesity on pregnancy outcome in various parts of the country, the scenario of West Bengal is not much known. This study will focus on the modifiable risk factor (obesity) which is associated with various adverse obstetric outcomes as discussed above and can help the clinicians to intervene early during the preconception period. The current study was undertaken to compare the incidence of adverse maternal and perinatal outcomes in normal and obese pregnant women and to determine the association of adverse maternal and perinatal outcomes with maternal obesity.

Materials and Methods

Study design, study area, and study participants.

This hospital-based prospective study was conducted at the Department of Obstetrics and Gynaecology of North 24 Parganas District Hospital, West Bengal. The study was conducted between May 2019 and April 2020, which included pregnant women coming for their first antenatal visit at or before 16 weeks of gestation fulfilling inclusion/exclusion criteria and consenting to be a part of the study.

Inclusion criterion

- Singleton pregnant women
- Gave consent/assent to participate in the study.

Exclusion criterion

- Women with multiple pregnancies
- Preexisting hypertension, diabetes, and any other medical disorders (renal disease/thyroid disease/heart disease/epilepsy/bronchial asthma, etc.)
- Women with a history of prior cesarean section.

Sampling

To calculate the sample size, hypertensive disorders in pregnancy were considered the main outcome variable. The incidence of hypertensive disorders in pregnancy with normal BMI (<25 kg/m^2) (p0) was 8.8% and the incidence of hypertensive disorders in pregnancy with BMI ≥ 25 kg/m^2 (p1) was 18.5%.[7]

Considering each group, $n = (2 \times ((p0 + p1)/2) \times ((q0 + q1)/2) \times (Z\alpha_{/2} + Z_{1\text{-}\beta})$ ^2)/(p0 − p) ^2

α = level of significance (0.05), β = 0.20 (power = 0.80), and 10% loss to follow-up.

Applying the above formula, the estimated sample size for each group was 176 ≈ 180 and the total sample size was 360. Based on the BMI in their first antenatal visit, pregnant women were categorized into two groups (BMI <25 kg/m^2 and BMI ≥25 kg/m^2), and 180 pregnant women were included in each group.

Purposive sampling was done to enroll the pregnant women in each group and they were followed subsequently during their antenatal visits, delivery/termination of pregnancy, and till discharge from the hospital. Four pregnant women were loss to follow-up in the BMI <25 kg/m^2 group and 10 were loss to follow-up in the BMI ≥25 kg/m^2 group [Figure 1].

Data collection

A predesigned, pretested schedule was used to obtain detailed information regarding age, socioeconomic status, parity, previous obstetrics outcome, number of antenatal visits, and details of referral history (if any). Patients were examined thoroughly for general conditions and vital parameters. Moreover, obstetrics and vaginal examination findings were noted.

Follow-up of pregnant women was done antenatally, in labor and in postpartum till they were discharged from the hospital. Delivery was conducted either through vaginal route or lower segment cesarean section (LSCS).

Detailed outcomes of both the study groups were recorded in the predesigned schedule.

Predictor variable

BMI: It is defined as body mass (weight in kg) divided by the square of height (in m).

Outcome variable

- Maternal outcomes: gestational hypertension, GDM, preeclampsia/eclampsia, prolonged labor, mode of delivery (normal vaginal delivery, instrumental vaginal delivery, and cesarean section delivery), need for induction of labor (IOL), and perineal injuries
- Perinatal outcomes: fetal growth restriction (FGR), preterm, term, postterm birth, birth weight, APGAR score, and IUFD.

Statistical analysis

Data were compiled in Microsoft Excel 2019 and were analyzed using SPSS (version 27, IBM, Chicago, Illinois, USA). Continuous data were summarized as mean and categorical data were summarized based on frequency and proportions. For categorical variables, the χ^2 test was used as a test of significance. Univariate and multivariate analysis was done to ascertain the role of BMI on various adverse obstetric and perinatal outcomes. All statistical analyses were done at a 95% confidence interval and $P < 0.05$ was considered statistically significant.

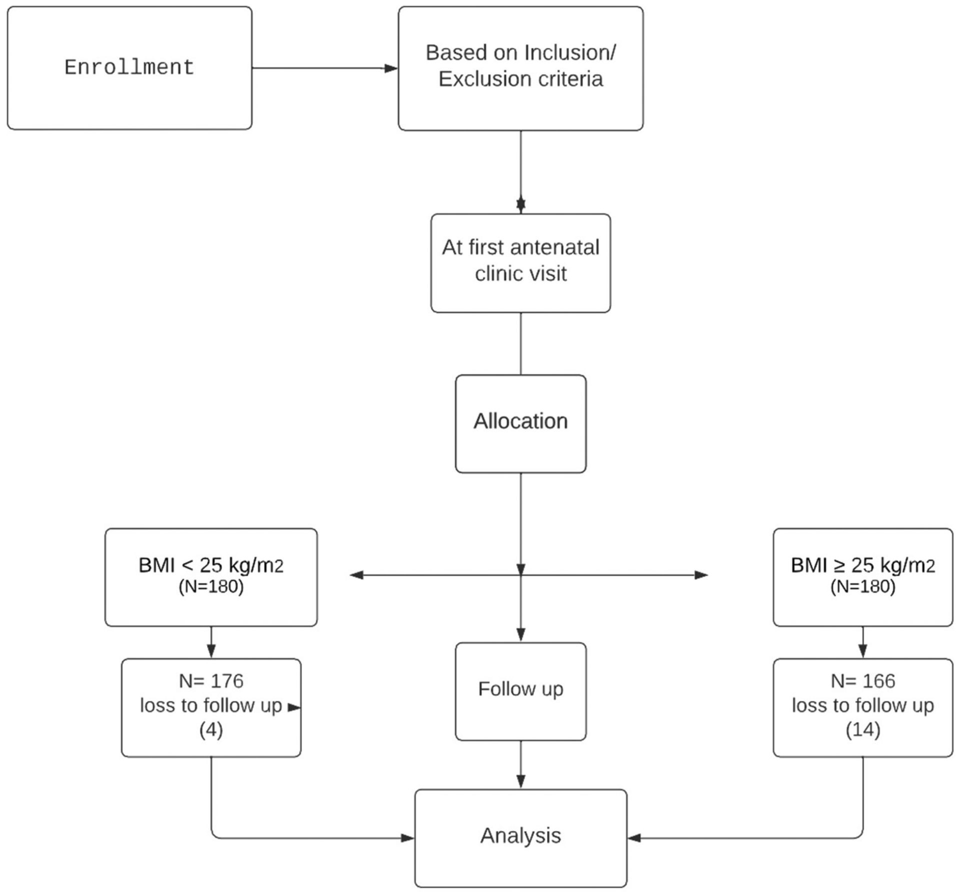

Figure 1: Flow chart depicting enrollment of pregnant women and their follow-up in the study

Ethical considerations

Ethical approval was obtained from the IEC, RG Kar Medical College (approval number, memo no: RKC/576 dated August 06, 2019). Written informed consent was obtained from each participant and they were assured about the confidentiality of information. The research followed the guidelines laid down in the Declaration of Helsinki, updated in 2013.

Results

Majority of pregnant women of BMI <25 kg/m^2 (67%) and of BMI ≥25 kg/m^2 (74.7%) belonged to the age group of 20–29 years. The mean maternal age with BMI <25 kg/m^2 was 22 (standard deviation [SD] 4.14) years and BMI ≥25 kg/m^2 was 25 (SD 4.57) years (not shown in table). Most of them belonged to lower middle-class socioeconomic status in both the groups. Around 50.6% of pregnant women of BMI <25 kg/m^2 and 52.4% of BMI ≥25 kg/m^2 were multigravida [Table 1].

Majority (44.4%) of pregnant women belonged to the BMI range of 18.5–24.9 kg/m^2. Around 21.2% of pregnant women belonged to the BMI range 30–39.9 kg/m^2 and 7.1% were underweight (BMI range <18.5 kg/m^2). Less than 1% was ≥40 kg/m^2 [Figure 2].

On univariate analysis, the occurrence of gestational hypertension, GDM, preeclampsia/eclampsia, prolonged labor, and emergency LSCS was significantly higher ($P < 0.005$) in pregnant women with BMI ≥25 kg/m^2 compared with BMI <25 kg/m^2 [Table 2].

The incidence of FGR, preterm birth (<37 weeks), IUFD, congenital anomaly, and APGAR at 5 min (≤7) was comparable in both groups (pregnant women with BMI ≥25 kg/m^2 and BMI <25 kg/m^2). Only 0.6% of pregnant women with BMI ≥25 kg/m^2 had weight of newborn > 4 kg, whereas none of the pregnant women with BMI <25 kg/m^2 [Table 3].

On multivariate analysis, the occurrence of gestational hypertension, GDM, and LSCS as mode of delivery was higher with BMI ≥25 kg/m^2 [Table 4].

Discussion

In the present study, around 31.3% of pregnant women with BMI ≥25 kg/m^2 had developed gestational hypertension, 7.8% had developed preeclampsia/eclampsia, and 22.9% had developed GDM, and the association of gestational hypertension, preeclampsia/eclampsia, and GDM is significantly associated with maternal obesity (BMI ≥25 kg/m^2). The odds ratio of the development of gestational hypertension, preeclampsia/eclampsia,

Table 1: Distribution of pregnant women according to clinical profile (*n*=342)

Parameter	Normal weight: BMI <25 kg/m², *n* (%)	Obesity: BMI ≥25 kg/m², *n* (%)	Total, *n* (%)
Age (years)	*n*=176	*n*=166	*n*=342
<20	45 (25.6)	14 (8.4)	59 (17.2)
20–29	118 (67.0)	124 (74.7)	242 (70.8)
≥30	13 (7.4)	28 (16.9)	41 (12.0)
Socioeconomic status (modified BG Prasad Scale, January 2020)	*n*=176	*n*=166	*n*=342
Upper class	5 (2.8)	2 (1.2)	7 (2.0)
Upper middle class	7 (4.0)	8 (4.8)	15 (4.4)
Middle class	19 (10.8)	20 (12.0)	39 (11.4)
Lower middle class	117 (66.5)	100 (60.3)	217 (63.5)
Lower class	28 (15.9)	36 (21.7)	64 (18.7)
Gravida	*n*=176	*n*=166	*n*=342
Primigravida	87 (49.4)	79 (47.6)	166 (48.5)
Multigravida	89 (50.6)	87 (52.4)	176 (51.5)

BMI: Body mass index

Table 2: Distribution of pregnant women according to maternal outcomes

Outcome	Normal weight: BMI <25 kg/m², *n* (%) (*n*=176)	Obesity: BMI ≥25 kg/m², *n* (%) (*n*=166)	Total, *n* (%) (*n*=342)	*P*
Gestational hypertension	11 (6.3)	52 (31.3)	63 (18.4)	0.000*
GDM	8 (4.5)	38 (22.9)	46 (13.5)	0.003*
Preeclampsia/eclampsia	2 (1.1)	13 (7.8)	15 (4.4)	0.006*
Prolonged labor	4 (2.3)	16 (9.6)	20 (5.8)	0.008*
Mode of delivery	*n*=176	*n*=166	*n*=342	
VD†	156 (88.6)	78 (47.0)	234 (68.4)	0.000*
Emergency LSCS	20 (11.4)	88 (53.0)	108 (31.6)	
Instrumental VD (forceps)	*n*=156	*n*=78	*n*=234	
Yes	1 (0.6)	4 (5.1)	5 (2.1)	0.452
No	155 (99.4)	74 (94.9)	229 (97.9)	
IOL	*n*=176	*n*=166	*n*=342	
Yes	18 (10.2)	20 (12.0)	38 (11.1)	0.534
No	158 (89.8)	146 (88.0)	304 (88.9)	
Maternal injuries (perineal)	*n*=156	*n*=78	*n*=234	
Yes	17 (10.9)	19 (24.4)	36 (15.4)	0.653
No	139 (89.1)	59 (75.6)	198 (84.6)	

**P*<0.05 is significant, †Vaginal delivery includes both normal VD and instrumental VD. BMI: Body mass index, IOL: Induction of labor, VD: Vaginal delivery, GDM: Gestational diabetes mellitus, LSCS: Lower segment cesarean section

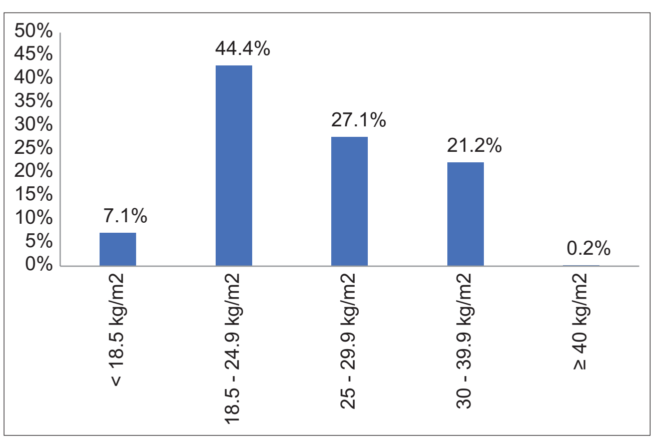

Figure 2: Bar diagram showing distribution of pregnant women according to body mass index (*n* = 342)

and GDM is 6.84, 7.39, and 6.23, respectively, in the present study. Some previous work conducted by Dasgupta *et al*., Kamalarani and Ramyajothi Ramalakshmi, Vanlalfeli and Zosangpuii, and Vijay *et al*. also demonstrated similar outcomes.[7-10]

Obesity induces pathophysiological changes in the body causing hyperinsulinemia, dyslipidemia leading to oxidative stress, decreased prostacyclin, and more peroxide formation resulting in vasoconstriction and platelet aggregations. Thus, increasing the risk for the development of hypertensive disorder in pregnancy. Furthermore, exaggerated insulin resistance in obese pregnant women results in an increased risk of GDM.[11]

About 9.6% of pregnant women with BMI ≥25 kg/m² had developed prolonged labor in this present study, similar to a study conducted by John and Mahendran.[12]

Table 3: Distribution of pregnant women according to perinatal outcomes

Outcome	Normal weight: BMI <25 kg/m², n (%) (n=176)	Obesity: BMI ≥25 kg/m², n (%) (n=166)	Total, n (%) (n=342)	P
FGR	2 (1.1)	2 (1.2)	4 (1.2)	0.384
Gestational age (weeks)	n=176	n=166	n=342	
Preterm (<37)	37 (21.0)	28 (16.9)	65 (19.0)	0.412
Term (37–40)	135 (76.7)	126 (75.9)	261 (76.3)	
Postterm (>40)	4 (2.3)	12 (7.2)	16 (4.7)	
IUFD	n=176	n=166	n=342	
Yes	4 (2.3)	6 (3.6)	10 (3.0)	0.085
No	172 (97.7)	160 (96.4)	332 (97.0)	
Congenital anomaly	n=176	n=166	n=342	
Yes	4 (2.3)	3 (1.8)	7 (2.0)	0.385
No	172 (97.7)	163 (98.2)	335 (98.0)	
Weight of newborn (kg)	n=176	n=166	n=342	
<2.5	38 (21.6)	30 (18.1)	68 (19.9)	0.124
2.5–4	138 (78.4)	135 (81.3)	273 (79.8)	
>4	0	1 (0.6)	1 (0.3)	
Apgar score (at 5 min)	n=172	n=160	n=332	
≤7	29 (16.9)	30 (18.8)	59 (17.8)	0.653
>7	143 (83.1)	130 (81.2)	273 (82.2)	

FGR: Fetal growth restriction, BMI: Body mass index, IUFD: Intrauterine fetal death

Table 4: Logistic regression analysis showing the effect of maternal obesity on obstetric outcome

Variables	BMI <25 kg/m² (n=176)	BMI ≥25 kg/m² (n=166)	OR (CI)	AOR (CI)
Gestational hypertension				
Present	11 (6.3)	52 (31.3)	6.84 (0.07–0.29)*	7.23 (2.3–11.9)*
Absent	165 (93.7)	114 (68.7)	1 (reference)	1 (reference)
GDM				
Present	8 (4.5)	38 (22.9)	6.23 (0.09–0.30)*	5.52 (2.9–10.5)*
Absent	168 (95.5)	128 (77.1)	1 (reference)	1 (reference)
Preeclampsia/eclampsia				
Present	2 (1.1)	13 (7.8)	7.39 (0.03–0.60)*	0.90 (0.15–5.1)
Absent	174 (98.9)	153 (92.2)	1 (reference)	1 (reference)
Prolonged labor				
Present	4 (2.3)	16 (9.6)	4.58 (0.07–0.66)*	4.62 (0.70–8.35)
Absent	172 (97.7)	150 (90.4)	1 (reference)	1 (reference)
Mode of delivery				
LSCS	20 (11.4)	88 (53.0)	8.8 (5.0–15.35)*	5.86 (3.23–10.6)*
VD†	156 (88.6)	78 (47.0)	1 (reference)	1 (reference)

*$P<0.05$, †Vaginal delivery includes both normal VD and instrumental VD. Figures in parentheses indicate percentage. For each independent variable, the AOR was calculated after adjusting for other independent variables. OR: Odds ratio, AOR: Adjusted OR, CI: Confidence interval, BMI: Body mass index, GDM: Gestational diabetes mellitus, VD: Vaginal delivery, LSCS: Lower segment cesarean section

A significant association is seen in the present study between maternal obesity and emergency LSCS and the odds ratio of undergoing emergency LSCS in pregnant women with BMI ≥25 kg/m² is 8.8. The study conducted by Kamalarani and Ramyajothi Ramalakshmi showed that around 57.1% of obese women underwent emergency LSCS, which was similar to our study.[8] Reasons for such a higher rate could be due to nonprogress of labor, failed induction, failure of maternal efforts, maternal complications (preeclampsia/eclampsia, GDM), and macrosomia. A higher rate (31.17%) of IOL and emergency LSCS (41.56%) in obese women compared to nonobese was also seen in the study conducted by Vanlalfeli and Zosangpuii.[9] Furthermore, the need for IOL was higher (20%) in obese women as seen in the study by John and Mahendran.[11] This could be explained as postdated pregnancy and maternal complications increases the rate of IOL in obese women to achieve successful vaginal delivery.

According to the study by Vanlalfeli and Zosangpuii, about 6.49% of obese pregnant women had undergone forceps-assisted vaginal delivery similar to the present study.[9]

According to the study conducted by Kamalarani and Ramyajothi Ramalakshmi, the occurrence of postterm pregnancy was higher (8.2%) in obese pregnant women compared to nonobese (2.1%). The rate of preterm delivery was higher (18.4%) in nonobese than obese (14.3%).[8] The finding was similar to the present study.

The incidence of stillbirth in the present study was 3.6% in pregnant women with BMI ≥25 kg/m^2. As per the study done by Kamalarani and Ramyajothi Ramalakshmi, the incidence of stillbirth was 12.2% and by John and Mahendran incidence of stillbirth was 2% in obese pregnant women.[8,12] This variable rate of incidence in stillbirth in different studies may be attributed to various contributing factors such as gestational hypertension, preeclampsia, and GDM.

Finding from the studies conducted by Kamalarani and Ramyajothi Ramalakshmi and Shah *et al*. showed that the risk of congenital anomaly in fetus of obese pregnant women was higher compared to nonobese women,[8,13] although in the present study newborn with congenital anomaly was slightly higher in nonobese pregnant women. This finding may be due to the fact that ours' is a district hospital and pregnant women with anomalous fetus are usually referred to higher care centers during their antenatal visit, thus resulting in such skewed outcomes in the current study.

Several studies have reported an increased incidence of macrosomia in obese pregnant women compared to nonobese women.[9,11,12] This finding was similar to the present study. Maternal obesity is associated with an increased risk of GDM, which indirectly causing macrosomia.

Low APGAR score in the newborn of obese pregnant women as seen in the present study may due to several reasons such as maternal complications (GDM, gestational hypertension, and preeclampsia), operative interventions, prolonged labor, increased fetal weight, all leading to fetal hypoxia and resulting in NICU admissions, and longer hospital stay. Studies conducted by Vanlalfeli and Zosangpuii, John and Mahendran, and Shah *et al*. had similar findings.[9,12,13]

Limitation

The study was conducted in North 24 Parganas district hospital, more generalization of the result would have been achieved if a larger sample size and larger area were included in the study.

Being a district hospital, many complicated cases were referred to higher tertiary care centers. Thus, adverse maternal and perinatal complications were less reflected in our study.

Conclusions

It is clearly evident from the present study which was conducted in a district hospital that maternal obesity is associated with adverse maternal outcomes such as GDM, gestational hypertension, and preeclampsia. There is an increase in IOL and operative interference with maternal obesity. Macrosomia and increased postpartum complications were common with an increase in maternal weight.

Obesity is a lifestyle-related disorder; preventable steps must be taken to reduce maternal and perinatal morbidity and mortality. Often it is seen that during antenatal visits, overweight and obese pregnant women are not counseled enough regarding the complications. It may be due to lack of awareness among health-care staff. Creating awareness among both the pregnant women and health-care staff, proper preconception counseling, considering obese mothers as a high-risk category and by increasing their accessibility to health-care services, can help in minimizing the obstetric complications.

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Conflicts of interest

There are no conflicts of interest.

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