



Maternal Obesity and Pregnancy Outcome: in Perspective of New Asian Indian Guidelines

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Abstract

Background Prevalence of obesity among women of reproductive age is increasing worldwide. As the prevalence increases among the women of reproductive age group, so it does among pregnant females. This study was conducted with the aim to assess obesity-related adverse maternal, neonatal and perinatal outcomes using new Asian Indian guidelines.

Methodology Pregnant women up to 16-week gestation on first visit were enrolled. There were two exposure groups: one with BMI < 25 kg/m² and second with BMI ≥ 25 kg/m² matched for maternal age and parity, 100 in each group. The study focused on development of various adverse maternal and foetal/perinatal complications. Comparative analysis of data was done to estimate the odds of each outcome taking non-obese group as reference.

Results There was a significant increase in risk among obese mothers compared to non-obese mothers for maternal complications like hypertensive disorders of pregnancy {OR 3.83}, preeclampsia {OR 9.2}, gestational diabetes mellitus {OR 4.85} and insulin requirement {OR 12.46}, induction of labour {OR 2.71}, caesarean section post induction {OR 8.50}, prolonged labour {OR 4.69}, caesarean sections {OR 5.18} and postpartum haemorrhage {OR 2.21}. Also, there was a significant increase in risk among obese mothers compared to non-obese mothers for foetal and perinatal complications like miscarriages {OR 4.85}, preterm newborns {OR 4.63}, medically indicated preterm {OR 6.59}, shoulder dystocia {OR could not be calculated}, large for gestational age {OR 5.91}, hyperbilirubinaemia {OR 4.26} and neonatal intensive care unit admissions {OR 3.26}.

Conclusion It was concluded that obesity defined by Asian Indian guidelines (BMI ≥ 25 kg/m²) is associated with adverse pregnancy outcomes at odds comparable to western studies with obesity taken as BMI ≥ 30 kg/m².

Keywords Maternal obesity · Asian guidelines · Pregnancy outcome · Perinatal outcome

Introduction

Obesity is a growing health problem worldwide. World Health Organisation (WHO) defines obesity as abnormal or excessive fat accumulation that may impair health with body mass index (BMI) of 30 kg/m² or more as obese among adults [1]. In 2013, the American Medical Association classified obesity as disease. Prevalence of obesity among women of reproductive age is increasing worldwide, with current estimates of 20–36% [2]. As the prevalence increases among the women of reproductive age group, so it does among pregnant females.

Several studies in India have reiterated the fact that obesity puts mother and foetus at the risk of several complications such as gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), preterm labour, dysfunctional labour, caesarean sections, postpartum infections and deep

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vein thrombosis [3–5]. Also, neonates of obese women were large for gestational age, macrosomic and had high incidences of birth injuries, shoulder dystocia, prematurity, late foetal deaths and congenital malformations [3–5]. Among women in Tamilnadu, obesity increased from 20.9% in 2005–06 to 30.9% in 2015–16 [6]. In Salem district where this study has been conducted, 29.4% of women were obese or overweight as per NFHS 4 [7].

Body shape is often described as “pear” with excess fat deposited in the buttocks and hips called as pelvic obesity or “apple” with excess fat deposited in the abdomen called as central or abdominal obesity. Though pelvic obesity is more common among female, those with abdominal fat are at increased health risks. However, it is difficult to categorise type of obesity during pregnancy unless patient presents early.

Since a pregnancy-specific definition of obesity has not been standardised, pregnant women are often considered obese/non-obese based on their prepregnancy BMI or BMI calculated at first antenatal visit (ideally by 10-week gestation). Most of the data available from the medical research related to obesity and pregnancy outcome are based on prepregnancy BMI which remains the tool of choice for determining obesity during pregnancy all over the world.

Deurenberg-Yap et al. [8] found that absolute risks for cardiovascular complications among south Asians were high, ranging from 41 to 81% at lower categories of BMI (22–24 kg/m²) well below the cut-off values of BMI recommended by WHO. South Asians settled overseas also were at increased risk of insulin resistance and cardiovascular complications than white Caucasians matched for BMI. Also, Asian Indians have more predisposition for truncal obesity as opposed to generalised obesity. Japan has defined obesity as BMI > 25 kg/m², while China uses a BMI > 28 kg/m². Hence, experts met in New Delhi in 2008 to develop Asian Indian specific guidelines and defined Obesity in Indians as BMI ≥ 25 kg/m² (Table 1) [9].

This study will enable to highlight a problem that is a modifiable risk factor for several complications in pregnancy and also a long-term risk factor for cardiovascular diseases and diabetes mellitus and to educate treating clinicians about the importance of preconceptional counselling regarding obesity and related issues.

Table 1 Indian Asian classification of adult BMI [9]

Classification	BMI (kg/m ²)
Normal	18.0–22.9
Overweight	23.0–24.9
Obesity	> 25

Aims and Objectives

The study was conducted to evaluate the impact of maternal obesity on overall outcome of pregnancy and labour, aimed towards sensitisation of obstetricians about the modifiable risk factor that can grossly impact the life of mother and baby.

Methodology

This cohort study was conducted at the Department of Obstetrics and Gynaecology, Sri Gokulam Hospital, Salem, Tamilnadu. To calculate sample size, HDP was considered as the main variable and relative risk taken as 1.92 at BMI ≥ 25 kg/m² [10]. The sample size estimated with 80% power at 5% level of significance was 83 in each group. The study was conducted between May 2016 and April 2017, included pregnant women coming for 1st ANC visit at or before 16 weeks of period of gestation and consenting to be part of study. There were two exposure groups: one with BMI < 25 kg/m² and second with BMI ≥ 25 kg/m² matched for maternal age group and parity; 100 subjects in each group (Fig. 1). HDP, GDM and caesarean section were the primary maternal outcomes to be studied, while instrumental deliveries, multiple gestation, preterm labour, antepartum haemorrhage (APH), maternal injuries, etc. were secondary outcomes. Primary foetal/perinatal outcomes include miscarriages, birth asphyxia, neonatal intensive care unit (NICU) admissions, while congenital anomalies, shoulder dystocia, hyperbilirubinaemia etc. in newborn were also assessed. Maternal demographics were compared statistically to know whether the groups were comparable. Incidences of various maternal, foetal and neonatal outcomes were calculated, statistical tests of significance were applied and odds ratios calculated where the difference of incidence was found to be significant. All statistical analyses were

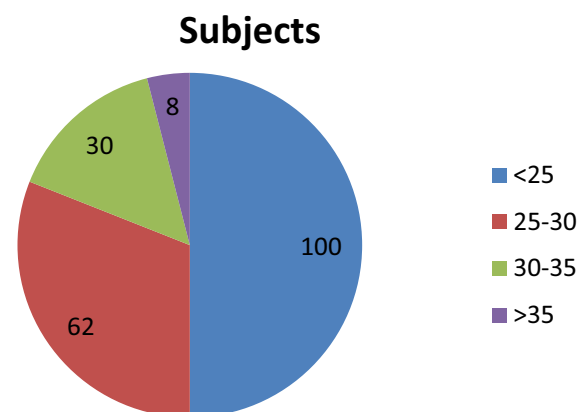


Fig. 1 Distribution of study subjects according to body mass index

done at 95% confidence interval considering p value < 0.05 significant.

Results

A total of 100 subjects in each group (obese and non-obese) were included in the study. There was no difference in age distribution of both the groups, average maternal age in obese group was 26.55 years (SD 3.71) and in non-obese group 26.44 years (SD 3.77) with p value > 0.05 . Most of the subjects were well educated with 89% of obese and non-obese subjects having education till graduation/diploma or higher. 41% of obese subjects and 43% of non-obese subjects came from rural area, but the difference was not significant. 88% of obese subjects and 84% of non-obese subjects belonged to socio-economic class II or I with no significant difference. As both the group subjects were matched for parity, there were 60% primipara and 40% multipara in each group. The average BMI in obese group was calculated as 29.16 kg/m² (SD 3.74), while for non-obese group, it was 22.05 kg/m² (SD 2.04).

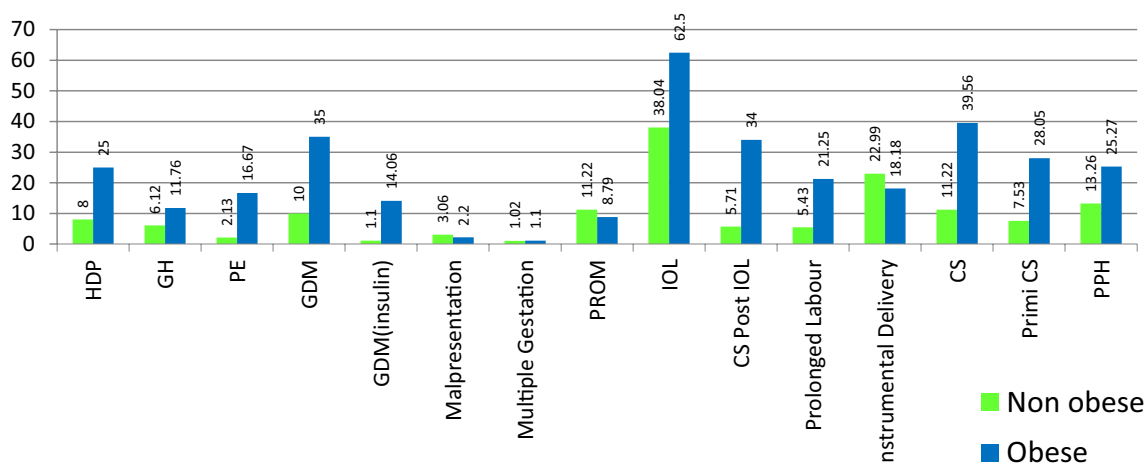
There was a significant increase in risk among obese mothers (BMI > 25 kg/m²) compared to non-obese mothers (BMI < 25 kg/m²) for maternal complications like hypertensive disorders of pregnancy {OR 3.83, (95% CI 1.63,8.99)}, preeclampsia {OR 9.2, (95% CI 2.04,41.5)}, gestational diabetes mellitus {OR 4.85, (95% CI 2.24,10.48)}, gestational diabetes mellitus requiring insulin {OR 12.46, (95% CI 1.54,100.8)}, need of induction of labour {OR 2.71, (95% CI 1.46,5.04)}, caesarean section post induction {OR 8.50, (95% CI 1.89,39.75)}, prolonged labour {OR 4.69, (95% CI 1.65,13.4)}, need of

caesarean sections {OR 5.18, (95% CI 2.43,11.01)} and postpartum haemorrhage {OR 2.21, (95% CI 1.04,4.69)} (Fig. 2; Table 2). The risks for maternal complications like antepartum haemorrhage, malpresentations, increased antenatal admissions, premature rupture of membranes, instrumental deliveries, vaginal birth after caesarean trial failures, maternal injuries, anaesthetic complications, need of blood transfusions and lactational failure did not increase significantly with obesity.

Also, there was a significant increase in risk among obese mothers compared to non-obese mothers for foetal and perinatal complications like miscarriages {OR 4.85, (95% CI 1.02,23.03)}, preterm newborns {OR 4.63, (95% CI 1.47,14.51)}, medically indicated preterm {OR 6.59, (95% CI 1.42,30.57)}, shoulder dystocia {OR could not be calculated, p -value < 0.05 }, large for gestational age {OR 5.91, (95% CI 1.26,27.76)}, hyperbilirubinaemia {OR 4.26, (95% CI 1.50,12.08)} and neonatal intensive care unit admissions {OR 3.26, (95% CI 1.21,8.75)} (Fig. 3; Table 3). The risks for complications like congenital malformations, meconium-stained amniotic fluid, birth asphyxia and perinatal mortality did not increase significantly with obesity.

Discussion

In the present era, lifestyle-related factors like sedentary lifestyle, maternal smoking/alcoholism and late age pregnancies are on rise, adversely affecting the pregnancy outcome. Obesity, the common one among them complicates the process of child bearing and child birth with its long-term implications. With proper antenatal and intranatal care, good outcome can be achieved in obese patients. This study

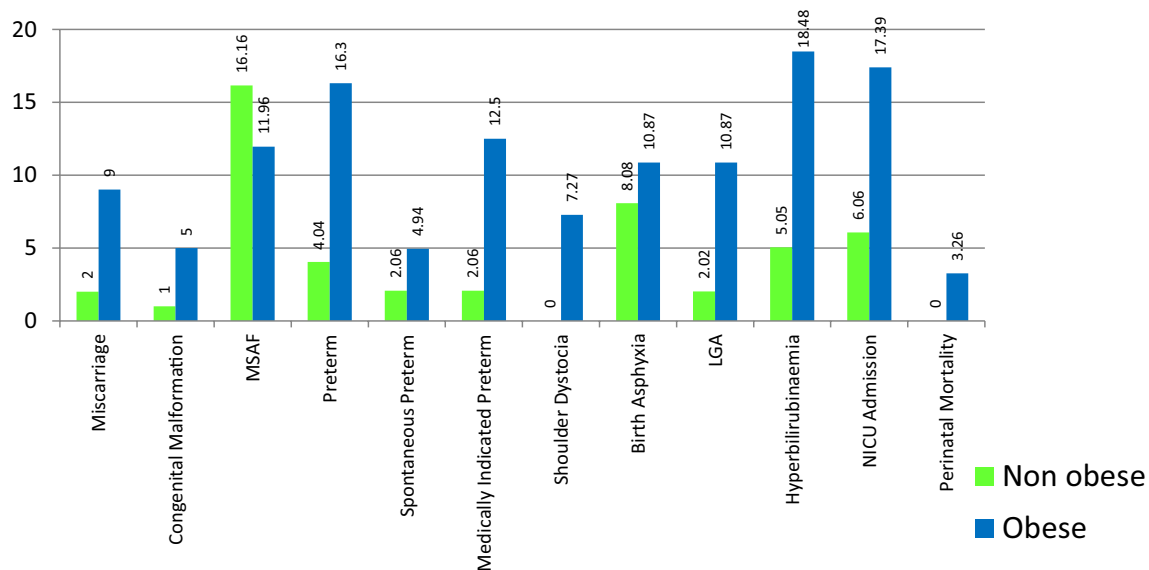


X-axis: Maternal outcome parameters, Y-axis: Percentage of subjects

Fig. 2 Maternal obesity and maternal outcome

Table 2 Obesity and maternal outcome

Outcome	Non-obese	Obese	P-value	Odds ratio
Hypertensive disorder Complicating pregnancy	8 (8%)	25 (25%)	0.00	3.83 (1.63–8.99)
Gestational hypertension ^a	6 (6.12%)	10 (11.76%)	0.18	
Preeclampsia ^b	2 (2.13%)	15 (16.67%)	0.00	9.2 (2.04–41.5)
Gestational diabetes mellitus (GDM)	10 (10%)	35 (35%)	0.00	4.85 (2.24–10.48)
GDM on insulin ^c	1 (1.10%)	9 (14.06%)	0.00	12.46 (1.54–100.8)
Malpresentation ^d	3 (3.06%)	2 (2.20%)	0.71	
Multiple gestation ^d	1 (1.02%)	1 (1.10%)	0.99	
Premature rupture of membranes ^d	11 (11.22%)	8 (8.79%)	0.58	
Induction of labour (IOL) ^e	35 (38.04%)	50 (62.5%)	0.00	2.71 (1.46–5.04)
Caesarean section post-IOL	2 (5.71%)	17 (34%)	0.00	8.5 (1.89–39.75)
Prolonged labour ^e	5 (5.43%)	17 (21.25%)	0.00	4.69 (1.65–13.4)
Instrumental delivery ^f	20 (22.99%)	10 (18.18%)	0.49	
Caesarean section ^d	11 (11.22%)	36 (39.56%)	0.00	5.18 (2.43–11.01)
Primi caesarean section	7 (7.53%)	23 (28.05%)	0.00	4.79 (1.93–11.88)
Postpartum haemorrhage ^d	13 (13.26%)	23 (25.27%)	0.03	2.21 (1.04–4.69)

^aPreeclampsia excluded^bGestational hypertension excluded^cGDM on diet excluded^dMiscarriages excluded^eMiscarriages and elective caesarean sections excluded^fMiscarriage and caesarean sections excluded

X-axis: Fetal/perinatal outcome parameters, Y-axis: Percentage of subjects

Fig. 3 Maternal obesity and foetal/perinatal outcome

adds to the evidence that obesity during pregnancy, inspite of adequate antenatal and prenatal care, leads to increased interventions, medical as well as obstetric, and do pose a risk to the mother and the foetus.

In our study, risk of HDP was 3.83 times higher among obese subjects, while risk of preeclampsia increased 9.2 times (Table 2). Similar results were obtained by Dasgupta et al. [4] and Menon and Isac [11]. Studies of women who underwent bariatric surgery suggest that weight loss

Table 3 Obesity and foetal/perinatal outcome

Outcome	Non-obese	Obese	P value	Odds ratio
Miscarriage	2 (2%)	9 (9%)	0.03	4.85 (1.02–23.03)
Congenital Malformation	1 (1%)	5 (5%)	0.09	
Meconium-stained Amniotic fluid ^a	16 (16.16%)	11 (11.96%)	0.40	
Preterm delivery ^a	4 (4.04%)	15 (16.30%)	0.00	4.63 (1.47–14.51)
Spontaneous Preterm delivery ^b	2 (2.06%)	4 (4.94%)	0.33	
Medically induced preterm delivery ^c	2 (2.06%)	11 (12.5%)	0.01	6.79 (1.46–31.53)
Shoulder dystocia ^d	0 (0%)	4 (7.27%)	0.01	Can not be calculated
Birth asphyxia ^a	8 (8.08%)	10 (10.87%)	0.51	
Large for gestational age ^a	2 (2.02%)	10 (10.87%)	0.01	5.91 (1.26–27.76)
Hyperbilirubinemia ^a	5 (5.05%)	17 (18.48%)	0.00	4.26 (1.50–12.08)
NICU admission ^a	6 (6.06%)	16 (17.39%)	0.01	3.26 (1.22–8.75)
Perinatal mortality ^a	0 (0%)	3 (3.26%)	0.07	

^aTotal number of births = total number of neonates

^bMedically induced preterm excluded

^cSpontaneous preterm excluded

^dOnly vaginal birth cases

significantly reduces the occurrence of preeclampsia [12]. The pathophysiologic changes associated with obesity-related cardiovascular risk, such as triglycerides and inflammation, may be responsible for the increased incidence of preeclampsia in obese gravidas [13].

Risk of GDM was 4.85 times more among obese gravidas with 12.46 times higher risk of requiring insulin (Table 2). Dasgupta et al. showed that the risk of GDM increased with increasing BMI [4]. Similar results were obtained by Menon and Isac [11]. Thus, GDM developed more frequently even at lower BMI range in our study. The increased risk of GDM is related to an exaggerated increase in insulin resistance in the obese state. Also, GDM increases the long-term risk of developing type 2 diabetes. An observational cohort study of 330 Danish women with diet-treated GDM showed that 41% of these women developed diabetes during a median of 10 years follow-up [14]. Seshiah et al. has recommended early diagnosis and tight maternal glucose control during pregnancy (fasting blood sugar 80–90 mg/dl, 2 h postprandial 110–120 mg/dl) for better maternal–foetal outcome.

In our study, there was no difference in rate of multiple pregnancy; however, Feresu et al. concluded that obese mothers were more likely to deliver twins [15]. In our study, the incidence of malpresentation at term premature rupture of membranes (PROM) was higher in non-obese group but statistically not significant. Vijay et al. found malpresentations more common in obese group but not statistically significant [16]. Avcı et al. showed that PROM is more common in obese subjects [17].

In obese gravidas, labour is more frequently planned at late preterm or at early term to improve neonatal outcome. Often, these subjects have poor cervical scores before induction and also the uterine musculature is prone to inadequate

contraction, which add to the risk of induction failure. In one study, obese women overall were twice as likely to experience a failed induction and the risk increased with increasing class of obesity [18]. We achieved similar results with odds ratio for induction of labour as 2.71 and for need of caesarean section after induction as 8.5 for obese subjects (Table 2).

Maternal obesity appears to have modest impact on labour progression that is independent of foetal size but related to maternal size. Duration of labour is usually longer for obese women. In our study, obese subjects were 4.69 times more likely to experience prolonged labour (Table 2). Zhang et al. concluded that obese mothers are more prone to dystocia [19]. Cedergren [20] found fourfold increased risk of ineffective uterine contractility in morbidly obese women, and we achieved similar values at even lower cut-off. Instrumental deliveries were more common among non-obese subjects though statistically insignificant while most of the researchers [4, 11, 16] have found increased risk of operative vaginal deliveries among obese subjects.

Obesity is a risk factor for both elective and emergency caesarean delivery, and risk increases with increasing maternal weight [21]. Obesity-related pregnancy complications, macrosomia and increased preterm account for excess risk of caesarean delivery. In our study, caesarean sections were 5.18 times more common among obese subjects (Table 2), similar to Menon and Isac [11]. Chu et al. proved that even if other comorbidities of obesity on pregnancy are controlled, obesity itself is an independent risk factor for caesarean sections [22].

In our study, PPH was found to be 2.21 times more common among obese subjects (Table 2). Fyfe et al. in their study concluded that nulliparous obese women have twofold increased risk of major PPH regardless of mode of delivery [23]. Increased PPH may be due to increased surface area of

placental implantation or due to large volume of distribution and decreased bio-availability of uterotonic agents. Other outcomes like APH, anaesthetic complications and wound dehiscence were similar among two groups in our study. There was no case of venous thromboembolism though it is consistently associated with morbid obesity.

Obese subjects have unfavourable hormonal environment which renders endometrium unreceptive to the implanting embryo and increase the risk of miscarriage. In our study, obese subjects were 4.85 times more prone to miscarriage compared to non-obese subjects (Table 3) which was similar to that achieved by Seehra and Khichar [24]. Obese women are at increased risk for having foetus with congenital anomalies. Callaway et al. concluded that congenital malformations were more common in obese and morbidly obese mothers with respective odds at 1.58 and 3.41 [25]. We did not find significant difference in malformation rates among the two groups.

Tayade et al. concluded that BMI > 25 kg/m² was a good predictor for low-birth-weight babies [26]. In our study, when miscarriages were excluded, the average birth weight among obese subjects (3109.46 gm, SD 582.62gm) was significantly higher than that of non-obese subjects (3000.61 gm, SD 425.04gm). Similar results were obtained by Callaway et al. [25] and Hincz et al. [27]. Obese subjects are more prone for LGA and macrosomia and tend to have overall higher birth weights on average.

Obesity increases the risk of medically indicated preterm delivery, primarily due to obesity-related maternal disorders. In our study, obese subjects were 4.63 times more prone to have preterm birth than non-obese subjects (Table 3). Also, medically indicated preterm births were significantly higher among obese subjects, while the difference in spontaneous preterm births was not significant. Similar results were derived in a 2010 systematic review of maternal overweight and obesity and risk of preterm birth [28].

Obesity is one of the risk factors for gestational diabetes mellitus, thus indirectly increases the risk of macrosomia and thus, shoulder dystocia. Few studies also consider obesity as independent risk factor for shoulder dystocia. In our study, shoulder dystocia was significantly common among obese subjects (Table 3) similar to Vijay et al. [16] and Leung et al. [29]. Also, obese subjects were 5.91 times more prone to have LGA newborn than non-obese subjects (Table 3). Leung et al. also showed that as BMI increased, risk of LGA also increased linearly [29].

There are conflicting results from various studies related to maternal obesity and birth asphyxia. In our study, there was no significant difference in incidence of birth asphyxia between the two groups. Dasgupta et al. has shown increased risk of birth asphyxia among obese subjects [4]. Callaway et al. in their study concluded that respiratory distress was

not significantly different among the groups while the need of mechanical ventilation significantly increased with increase in maternal BMI [25].

Rougee et al. [30] concluded that maternal obesity was significantly associated with elevated neonatal unconjugated bilirubin. We observed that hyperbilirubinaemia was 4.26 times more common among newborns in obese group. Also, the newborns in obese group were 3.26 times more likely to be admitted in NICU (Table 3). Vijay et al. [16] had similar results at BMI cut-off of 30 kg/m².

Obese women have higher rates of diabetes and hypertension which increase the risk of perinatal deaths. Other potential etiologies include metabolic changes associated with obesity and nocturnal apnoea with transient oxygen desaturation. In our study, perinatal mortality occurred among 3.26% obese subjects while none among non-obese subjects (Table 3). However, this difference was not significant. Dasgupta et al. [4] also found no significant difference in incidence of perinatal mortality. Vijay et al. [16] showed significant difference with one perinatal death; however, their sample size was too small to derive any strong conclusion.

Conclusion

Rates of obesity in India have significantly increased in recent years; these rates are particularly alarming among women of childbearing age. Maternal obesity not only affects the mother but foetus is also adversely affected and perinatal outcomes are also jeopardised. Maternal obesity when defined as prepregnancy BMI \geq 25 kg/m² for the Indian population, there is increased risk of maternal and perinatal complications and comprehensive strategies need to be developed to improve maternal and perinatal outcomes in obese mothers.

Compliance with Ethical Standards

Conflict of interest Imran Kutchi, P. Chellammal and A. Akila declare that we have no conflict of interest to declare.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (Sri Gokulam Hospital Ethical Committee, Salem, Tamilnadu) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Human and Animal Rights This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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