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Original Research Article

Association between maternal obesity and gestational diabetes mellitus and their related outcomes

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) has a direct correlation with maternal body mass index (BMI). Pre-pregnancy BMI is ideal for studying the outcomes of obesity in pregnancy. Unlike the west, in countries like India, pregnant women approach health facilities during first trimester making it appropriate to consider first trimester BMI, as a parameter to study outcome variables. In this study we correlate BMI and GDM in pregnancy as GDM has significant impact on mother and baby. Aim of study was to study maternal and neonatal outcomes in obese women who have conceived among two groups, GDM and non-GDM.
Methods: Observational study conducted at tertiary care teaching hospital over a one-year period (2021-2022). All pregnant women in first trimester with Body Mass Index (BMI) ≥30, calculated in first visit, was included in this study for follow-up. According to the results of GDM screening at 24-28 weeks of gestation by DIPSI method, pregnancies were divided into the GDM and non-GDM group. They were observed for risk of GDM. The obstetric and neonatal outcomes were noted and compared between the two groups. Data was analysed using SPSS software.
Results: Mean BMI (32.79±1.47) among GDM group is greater than Non GDM (31.15±1.22), with p-value 0.00005 is significant. In obstetric outcomes, GDM is associated with increased incidence of preterm deliveries (p-value=0.004), gestational hypertension (p-value=0.002). In case of perinatal outcomes, increase incidence of hyperbilirubinemia (p-value=0.002), hypoglycemia (p-value=0.048) and sepsis (p value=0.046) in neonates born to GDM is seen.
Conclusions: BMI calculation in early pregnancy is good indicator to monitor for complications in pregnancy including GDM. Therefore, identification of patients with high BMI and GDM requires regular follow up during pregnancy so that early intervention minimises complications.

Keywords: Gestational diabetes, Insulin resistance, Maternal outcome, Neonatal outcome, Pregnancy, Obesity

INTRODUCTION

Gestational diabetes mellitus (GDM) is a common metabolic condition seen during pregnancy which is defined as glucose intolerance first identified during pregnancy. It increases the risk of adverse pregnancy outcomes, such as preterm birth, caesarean delivery, macrosomia, postpartum type 2 diabetes mellitus, and metabolic diseases in offspring.[1] The prevalence of GDM is increasing rapidly worldwide along with the lifestyle changes, growing incidence of obesity, and older age of pregnant women.[2,3] It currently affects 3-25% of pregnancies worldwide, constituting a significant global healthcare burden.[4] Various past studies have helped to identify a multitude of potential risk factors for GDM during pregnancy. These include advancing maternal age, increasing pre-pregnancy body mass index (BMI), increasing parity, having a previous macrosomia baby,

family history of diabetes, polycystic ovarian syndrome (PCOS), and habitual smoking.[5-7] More attention should be paid to the prevention and control of GDM such as lifestyle changes, physical exercise which have a significant effect on glucose and insulin levels and can contribute to better pregnancy outcomes.[8,9]

During gestation, women experience a series of physical and metabolic modifications and adaptations, which aim to protect the fetus's development and are closely related to both pre-pregnancy nutritional status and weight gain. The negative effects of both insufficient and excessive weight gain on maternal-fetal outcomes regional BMI categories are acknowledged to be more applicable than WHO BMI categories in the Asia population.[10]

Weight is a modifiable risk factor for adverse pregnancy outcomes. Weight assessment in the first and second trimesters contributes to early identification, prevention, and intervention for adverse perinatal outcomes. GDM is related to maternal BMI and possibly to GWG, associations could not be assessed because of heterogeneity of diagnosis and treatment as well as the potential effect of GDM treatment on weight. Many studies support that overweight and obesity before pregnancy and an excessive weight are associated with a greater risk of developing GDM. Recently, Chinese researchers report that women with excessive weight gain had a significantly 32.8% increased risk of developing GDM compared with non-excessive weight gain.[11] But some studies from the United States found that women with and without GDM had similar mean weight gain before GDM screening. So, we focus on the BMI and development of GDM during pregnancy and its maternal and fetal outcome. This just reflects the new insight and practical value of this study.

METHODS

This is a prospective observational study conducted at a tertiary care hospital at Srinivas Institute of Medical College and Research Mukka Mangalore, Karnataka for a period of 2021 to 2022. All women enrolled for antenatal care were included with inclusion and exclusion criteria. Basic characteristics of pregnant women were collected at the first antenatal visit. It included maternal age, ethnicity, education, gravidity, parity, history of diabetes, hypertension, PCOS, obstetrical history (e.g., history of macrosomia, infant death), family history of diabetes or hypertension, and lifestyle habits (e.g., habitual smoking). All of them were followed up to measure their weight from early pregnancy to GDM screening. In this study, all pregnant women were tested for blood glucose at 24 to 28 weeks by DIPSI (Diabetes in pregnancy study group of India). All pregnant women with their first trimester Body Mass Index (BMI) ≥30, calculated at their first visit, were included in present study and further followed up. According to the results of GDM screening, pregnancies were divided into the GDM group and the non-GDM group. They were observed for development of GDM. The obstetric and neonatal outcomes were noted and compared between the two groups GDM and non-GDM. Data entry done based on the development of any obstetric or neonatal complications.

Inclusion criteria

Inclusion criteria was the all pregnant women with singleton pregnancy in reproductive age group.

Exclusion criteria

Exclusion criteria were women with pre-existing diseases like diabetes, hypertension, chronic illness, steroid treatment excluded from this study.

Statistical analysis

Data was analysed using MS Excel and SPSS software.

RESULTS

In this study there were 78 pregnant women (GDM group, n = 35 vs. non-GDM group, n = 43) eligible for inclusion in the final analysis, with a mean (SD) age of 29.6 and BMI in each group was 32.7 and 31.1 which was statistically significant. Women in the GDM group were older, had higher stature, body weight, BMI, with higher risk of gestational hypertension (P<0.002) (Table 1).

Table 1: Demographic data and obstetric outcome.

	Diabetic (n= 35)	Non-diabetic (n=43)	P value
Mean age (years)	29.63±3.53	29.86±4.39	0.4
Mean BMI	32.79±1.47	31.15±1.22	0.00005
Preterm delivery/PPROM	6 (17.14%)	0	0.004
Gestational hypertension	6 (17.14%)	1 (2.3%)	0.002
Gestational age at delivery (mean)	37.43±2.23	38.63±0.98	0.0006
Baby weight	2885.23±675.47	3285.58±535.34	

Regarding maternal outcome noted are development of gestational hypertension noted in 6 patients in diabetic group compared to one in non-diabetic group. Gestational age at the time of delivery was 37 weeks in both groups, occurrence of postpartum haemorrhage it was noted in 1

patient in GDM group patient, whereas 3 had in non-diabetic group.

Weight in each trimester was checked in both groups. There was significant change in obese GDM group compared to non GDM groups. The reduction in weight in obsess GDM group could be due to multiple factors like diet, exercise, daily physical activity was noted compared on GDM obsess group (Table 2). And normal-weight women who gain too much weight seemed to have the lowest prevalence of GDM.

Table 2: Weight changes in each trimester.

Trimester	Diabetic (n=35)	Non diabetic (n=43)	P value
1st trimester	32.7	31.1	0.03078
2nd trimester	33.8	34.9	0.05486
3rd trimester	33.0	35.0	0.09102

Most of the women in non GDM had vaginal birth (48.8%) compared to GDM which were 8 cases one patient in GDM group had undergone vacuum delivery due to prolonged 2nd stage of labour. The caesarean section rate was equal in both the group which was statistically not significant with a p value of 0.068. Regarding indications for caesarean section, majority of the women had previous CS, failed induction and CPD whereas fetal growth restriction was the least indication among the women both groups (Table 3 and 4).

Neonatal outcome was more predominant in GDM group compared to non GDM group. Out of all effects about 17 (48.5%) babies had hyperbilirubinemia in GMD group as compared to non GDM patients which were about 7 cases (16.2%). Macrosomia and hypoglycaemia were equally distributed in both groups and sepsis was seen in 3 babies in GDM group (Table 5).

Table 3: Mode of delivery in both groups.

	GDM (n=35) (%)	Non GDM (n=43) (%)	P value
Vaginal delivery	8 (22.8)	21 (48.8)	0.018
Preterm vaginal delivery	1 (2.8)	0	0.262
Vacuum vaginal delivery	1 (2.8)	0	0.262
LSCS	25 (71.4)	22 (51.1)	0.068

Table 4: Indications for caesarean section.

	GDM (n=35) (%)	Non GDM (n=43) (%)	P value
Vaginal delivery	8 (22.8)	21 (48.8)	0.018
Preterm vaginal delivery	1 (2.8)	0	0.262
Vacuum vaginal delivery	1 (2.8)	0	0.262

Table 5: Neonatal outcome in both groups.

	Diabetic (n=35) (%)	Non-diabetic (n=43) (%)	P value
Macrosomia	5 (14.2)	5 (11.6)	0.726
Hypoglycaemia	5 (14.2)	1 (2.3)	0.048
Hyperbilirubinemia	17 (48.5)	7 (16.2)	0.002
Sepsis	3 (8.5)	0	0.046
Low APGAR scores	2	1	

DISCUSSION

Diabetes in pregnancy causes a significant change both for mother and for the baby. As recent papers have shown an increasing trend in GDM cases and its effect on maternal and fetal morbidity and mortality. Approximately 1 in 6 live births is affected by diabetes in pregnancy, 84% of which are diagnosed as gestational diabetes mellitus (GDM).[12,13] This study mainly focused on high BMI and its adverse effect on glucose metabolism, and study maternal and fetal effects. AS in recent years the prevalence of GDM has increased in south east Asia especially in Indian population, this study mainly focuses on the outcome of pregnant women among Indian women.

After extensive search we found that there are limited studies who have examined the association between BMI and GDM in Asian populations. Most of the studies were conducted in Asian immigrants. A London-based study among 53,264 mothers found that risk of GDM in South Asian and East Asian women with BMI values of 21 kg/m^2 was equivalent to the risk of GDM in white women with

BMI values of 30 kg/m^2.[14] Another study conducted in a cohort of women in California found that GDM prevalence was considerably higher among Asian women than among non-Hispanic white women (10.2% vs 4.5%).[15] Our study provides support for the suggestion that the effect of BMI on GDM risk differs in South Asian compared with general population women.

There are numerous factors which are influencing in pregnancy, and its effect on BMI. It's important to know why Asian women are more obese than white women. One explanation is that the differences in the distribution of body fat across ethnicities south Asian women have greater levels of visceral abdominal fat, an important determinant of insulin resistance compared to white women and also more prone for metabolic syndromes.[16] Pre-pregnancy BMI also has a greater influence on insulin resistance in pregnancy in Asian women than in white women.[17] Together, these observations suggest that BMI may not be a sufficient marker of metabolic risk in Asian populations and that markers of visceral fat and insulin resistance may be more important for predicting susceptibility to GDM and diabetes. In our study pre-pregnancy weight was not known by many women as they first visited the hospital after confirmation of their pregnancy. So, we calculated all women BMI in the early pregnancy status. Higher the BMI in early pregnancy they had risk for development of GDM and pre-eclampsia during pregnancy. Among the maternal effect of high BMI, gestational hypertension and pre-eclampsia were most commonly seen with GDM women.

Hypertension: A history of GDM was related to increased risk of hypertension (HTN) after the index pregnancy in some but not all studies. A Dutch cohort suggested the risk of developing HTN was mainly significant among women with a history of hypertensive disorders during pregnancy (HDP) rather than GDM probably due insulin resistance inflammation and oxidation mechanism.[18] We also noted pre-eclampsia in GDM group compared to non-insulin group.

Women with GDM had high risk for development of labour abnormalities and difficult labour process and more prone to operative deliveries including caesarean section. We noticed operative delivery in GDM patient due to prolonged second stage of labour as compared to non GDM patients.

Forbes et al studied neonatal conditions like hypoglycaemia, low apgar score, hyperbilirubinemia/ jaundice, polycythaemia and respiratory distress syndrome. All studies consistently reported that neonates born to women with GDM were more susceptible to hypoglycaemia, hyperbilirubinemia, respiratory distress syndrome and low Apgar score (<7 at 5 minutes), compared with those born to women without GDM. During our study we noticed a major metabolic changes among babies born with GDM and obsess mother. Hyperbilirubinemia and NICU admission were common compared other complications. Surprisingly macrosomia is noticed in both groups. There was no adverse neonatal outcome identified in both groups. Women with GDM group were more concerned about baby growth and wellbeing and followed all the advice given to them including diabetic diet and regular exercises along with medical therapy.[19]

BMI in relation with GDM is an important modifiable risk factor that may be targeted to reduce GDM risk. There are many randomised control trials of lifestyle interventions to reduce GDM incidence have reported mixed findings, and have primarily been conducted among high-risk women who previously had a GDM pregnancy or who had high BMI (>29 kg/m^2).[20] Given the comparatively high risk of GDM in South Asian and especially Indian population is required to identify whether GDM risk can be reduced through lifestyle interventions in these populations. One lifestyle intervention study conducted among Chinese women with a mean BMI of 23.6 kg/m^2 found no difference in risk of GDM between intervention and control groups.[21] This finding may suggest that achieving GDM risk reduction in low-BMI populations may be difficult to achieve. However, there is limited changes noted in weight gain between the groups, probably ineffective life style modifications. Further extensive meta-analysis is required to study the high prevalence of GDM in South Asian women and identifying interventions that reduce GDM risk in these ethnicities and also to reduce maternal and foetal morbidity during pregnancy.

This study has some limitation. In this study, the data was small and outcome parameters are quite contrasting compare to other studies as many of patients after diagnosed with GDM and obesity went on strict diet and exercise control than people with non GDM as they were worried about the baby's outcome. This is a most striking point compared to other studies. Further research is required in case of Indian multicentered studies to know the outcome of GDM and obesity in pregnant women.

CONCLUSION

Weight gain during pregnancy is a physiological phenomenon which helps for both mother and the developing fetus. If this exceeds than normal it leads to obesity which has number of negative impact on pregnancy and on the fetus. These women are more prone to develop complications during pregnancy such as GDM. BMI calculation in early pregnancy is a good indicator to monitor for further complications during pregnancy including GDM, which is as a risk factor for GDM. Therefore, identification of patients at risk with regular follow up during pregnancy to decrease BMI along with early detection of complications and timely intervention which will yield in better outcomes for both mother and child.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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