

## Risk Factors for Gestational Diabetes Mellitus. A Case Control Study from Gwalior District

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### ABSTRACT

**BACKGROUND:** The primary causes of gestational diabetes mellitus (GDM) are important because they are effective for the diagnosis and prevention of this condition.

**AIM:** The aim of this study was to identify the prevalence and risk factors of gestational diabetes mellitus.

**MATERIALS AND METHODS:** This case – control study was conducted with 200 women with GDM at a district hospital maternity wing Morar, Gwalior district (Madhya Pradesh).

Subjects were selected after OGTT and confirmed by gynaecologist as GDM. GDM was identified by single step test recommended by WHO for diagnosis of GDM using a 75gm OGTT irrespective of the last meal with a threshold value of 2 hour PG>140 mg/dL. Risk factors were collected by interviewing the subjects using a pretested questionnaire.

**STATISTICAL ANALYSIS :** Data collected from the study was tabulated in Microsoft Excel 2010 and were keyed into the SPSS and analyzed by appropriate statistical methods.

**RESULTS :** The results indicate that the pre-pregnancy weight and BMI was found slightly high in GDM subjects. Study participants had family History of Diabetes and History of hypertension, and none participants had Diabetes in Previous Pregnancy, Polycystic Ovarian Syndrome, and History of Macrosomic baby.

**CONCLUSION:** We observed significant associations between pre-pregnancy weight and obesity with GDM risk, Family history of diabetes was found in seven percent of Group A and eight percent of control group participants. Four percent of Group B and six percent of control group participants had family history of hypertension. Group B participants were more involved in physical activity in comparison to control group. Significant difference was observed between group B and control group. Lifestyle was sedentary among these

women; hence, the emphasis is on physical activity levels, because it is known to be beneficial and safe during pregnancy. Thus the finding of this study can help devise strategies for the prevention of GDM.

**KEYWORDS:** gestational diabetes mellitus, physical activity, body mass index, risk factors

### I. INTRODUCTION

Gestational diabetes mellitus (GDM), defined as carbohydrate intolerance of variable degree with onset or recognition during pregnancy, has been recently identified as a potential risk factor for Type II Diabetes Mellitus (T2DM).<sup>1</sup> As per International Diabetes Federation (IDF) 2017, one in seven births is affected by GDM. 16.2% (21.3 million) of live births is to women with hyperglycemia in pregnancy (HIP).<sup>2</sup>

**India, being home to 69.2 million diabetic subjects, has also become the “diabetes capital of the world” harboring around four million women with GDM alone.<sup>3</sup>**

Various risk factors have been identified as predictors of GDM. In general, they predict the occurrence of Type 2 diabetes mellitus as well. They are higher maternal age, family history of T2DM and obesity. In addition, some maternal and neonatal outcomes in previous pregnancies have also been found associated with greater chance of developing GDM in the present pregnancy. They include history of abortions, GDM, pregnancy induced hypertension (PIH), polyhydramnios, pre-term labor, caesarian deliveries, unexplained still births, macrosomia, congenital malformations, neonatal complications like respiratory distress syndrome (RDS) and hypoglycemia.<sup>4</sup>

Since GDM represents a major threat to public health, international health organizations have emphasized the necessity of devising national plans to improve the quality of care. However, the

continuous monitoring of the indicators of quality of care remains a challenge in many countries.<sup>5</sup> A meta-analysis of randomized controlled trials on prenatal physical activity showed that physical activity during pregnancy provided a 28% lower risk of GDM compared with those in a control group (relative risk [RR] 0.72, 95% confidence interval [CI] 0.58-0.91).<sup>6</sup>

Therefore, early identification of variable risk factors control the gestational diabetes mellitus. It has been observed that lifestyle modifications or medical interventions help to control the bad effect of gestational diabetes mellitus.

Therefore, the aim of this study was to identify the risk factors for GDM

## II. LITERATURE REVIEW

Gestational diabetes mellitus (GDM) is defined as any degree of dysglycaemia that occurs for the first time or is first detected during pregnancy [7,8]. It has become a global public health burden [9]. GDM is one of the leading causes of mortality and morbidity for both the mother and the infant worldwide [10–19]. Mothers with GDM are at risk of developing gestational hypertension, preeclampsia and caesarean section [20, 21–23]. Apart from this, women with a history of GDM are also at significantly higher risk of developing subsequent type 2 diabetes mellitus (T2DM) and cardiovascular diseases [24,25]. Babies born from GDM women are at risk of being macrosomic, may suffer from more congenital abnormalities and have a greater propensity of developing neonatal hypoglycaemia, and T2DM later in life [26–30].

Moreover, the prevalence of GDM is expected to increase over years [31–33], especially in Asia. This is possibly due to increase in maternal age and obesity in Asia [34, 35].

In India, one of the most populous country globally, rates of GDM are estimated to be 10-14.3% which is much higher than the west. As of 2010, there were an estimated 22 million women with diabetes between the ages of 20 and 39 & an additional 54 million women in this age group with impaired glucose tolerance (IGT) or pre-diabetes with the potential to develop GDM if they become pregnant. The incidence of GDM is expected to increase to 20% i.e. one in every 5 pregnant women is likely to have GDM. (37)

Evidences from India show that women in the country are at much higher risk of developing glucose intolerance during pregnancy as compared to white women. In pan India study conducted by FOGSI and DIPSI shows about one-third of the

pregnant women are diagnosed with GDM during the first trimester and over quarter of them have a history of fetal loss in the previous pregnancies. Similar findings were also found in GDM demonstration project in Hoshangabad where pregnant women Maternal Risk Fetal Risk , Abortion , Polyhydramnios , Pre-eclampsia , Prolonged labour , Obstructed labour , Cesarean section , Uterine atony , Postpartum hemorrhage , Infection , Spontaneous abortion , Intra-uterine death , Stillbirth ,Congenital malformation , Shoulder dystocia , Birth injuries , Neonatal hypoglycemia , Infant respiratory distress syndrome Diagnosis and management of Gestational Diabetes Mellitus Technical and Operational Guidelines 3 diagnosed for GDM during first, second and third trimester were 33%, 40% and 28% respectively. Advancing age and BMI were found to be important risk factor for developing GDM, but their positive predictive value differed substantially from rural to urban settings. Indian study endorse the "Single Step Procedure" for screening and diagnosis of GDM by 2 hr 75 gms post blood sugar  $\geq$  140 mg/dL being a simple and economical procedure. (38)

Repeatedly stated risk indicators for GDM are as follows, increase maternal age, parity, increasing weight, positive family history of diabetes, previous history of GDM, less physical activity, previous history of macrosomic delivery of the baby. A population based study conducted in Sweden found increasing maternal age, and high BMI were risk factor for increase OGTT values (39). A study conducted in U.S. Showed a risk of developing GDM is 2, 4, 8 times higher among overweight, obese and severely obese women compared with normal weight pregnant women (40). Universal screening on GDM of Italian women GDM was found to be higher with increasing age, prepregnancy overweight, positive history of diabetes short stature (41). A population based cross sectional study conducted in Australia found increasing maternal age and ethnic factors ( non-Caucasian ethnicity) result in increasing GDM rates (42). A study conducted in India had the prevalence proportion GDM increased with gravida (43).

## III. MATERIALS & METHODS

### 1. SELECTION OF THE SUBJECTS

The study was a hospital based conducted over a period of 1 year from august 2021 TO may 2022. 200 pregnant women who had been diagnosed with GDM and receiving prenatal care at the department of obstetrics and gynecology department

were selected from the district hospital maternity wing Morar, Gwalior district (Madhya Pradesh). Informed consent was taken from all the patients. Study participants were divided in to two groups according to convenience ,group A and group B. Detailed history was taken including age, gestational age, Socio economic status like types of family, earning family members, types of work, financial status, pre pregnancy weight ,BMI, history of polycystic ovary syndrome, family history of diabetes, past history of diabetes, history of macrosomic baby were also collected from the selected subjects.

**INCLUSION AND EXCLUSION CRITERIA**

**INCUSION CRITERIA**

- All pregnant women with gestational diabetes mellitus visiting OBG department, who are willing to participate in the study were included in the present study.

**EXCLUSION CRITERIA**

- All pregnant women without gestational diabetes, a patient with pre-existing diabetes mellitus, and patients who are not willing to participate in the study were excluded from the study.

**SAMPLING TECHNIQUE**

- 1) A case-control descriptive and analytical study was conducted between august 2021 to may 2022 in district hospital maternity wing Morar, Gwalior district (Madhya Pradesh). A total of 200 pregnant women were included for the study based on the willingness to participate. The study consists of all pregnant women aged 20-35 years.

- 2) A one step screening and diagnostic procedure with 75 gm of oral glucose is advocated during the first antenatal care visit, irrespective of the last meal. **(DIPSI TEST-**National guidelines for diagnosis and management of gestational diabetes mellitus. New Delhi. Maternal health division ,ministry of health and family welfare. New Delhi ; Government of India ;2015)
- 3) First antenatal test positive subjects that is above 140mg/dl declared as Gestational diabetes mellitus .And these subjects were included in the study.
- 4) Subjects were divided in to two groups GROUP A and GROUP B according to convenience . In group A 100 subjects and in group B 100 subjects were included. A pretested questionnaire was used to interview the subjects to elicit information for data collection . Maternal details were collected and documented from the direct interview includes maternal name ,age, sex, education, income, physical activity, family health history, past medical history, anthropometric data like height, weight, bmi, of the respondents were recorded . For measuring body weight, weighing machine were used and BMI were calculated according to height and weight. Standard measuring instruments was used to assess anthropometric parameters.

**IV. STATISTICAL ANALYSIS:**

Statistical analysis was done using SPSS software. Data collected from the study was tabulated in Microsoft Excel 2010 and were keyed into the SPSS and analyzed by appropriate statistical methods.

**V. RESULT:**

**Table 1: Risk factors in antenatal women**

History	GROUP A		GROUP B		P value
	N	%	N	%	
History of Diabetes	0	0%	0	0%	NA
History of Hypertension	0	0%	0	0%	NA
Diabetes in Previous Pregnancy	0	0%	0	0%	NA
Polysystic Ovarian Syndrome	0	0%	0	0%	NA
History of Macrosomia Baby	0	0%	0	0%	NA
History of Preterm Delivery	0	0%	0	0%	NA
Family History of Diabetes	7	7.0%	8	8.0%	0.145
Family History of Hypertension	4	4.0%	6	6.0%	0.055

Family history of diabetes was found in seven percent of Group A and eight percent of group

B participants. Four percent of Group A and six percent of group B participants had family history of

hypertension. None of the study participants had history of diabetes, history of hypertension,

polysystic ovarian syndrome, history of macrosomic baby, and history of preterm delivery.

**Table 2 : Anthropometric measurements**

Group Statistics	GROUP A	GROUP B	T	P
	Mean ± SD	Mean ± SD		
HEIGHT (CM)	153.72±6.14	153.64±5.04	-0.101	0.920
PRE-PREGNANCY WEIGHT(KG)	46.65±7.49	53.27±6.2	6.810	<0.001
BMI	19.63±2.14	22.51±1.83	10.219	<0.001

Height of group A participants and group B participants was similar but pre-pregnancy weight was significantly higher in group B, so BMI of group B was also significantly higher in group B.

**Table 3: lifestyle intervention - Do you exercise**

Do you exercise	GROUP A		GROUP B		P Value
	N	%	N	%	
5 times per week	46	46%	18	18%	<0.001
3 times per week	23	23%	29	29%	
No	31	31%	53	53%	

Group A participants were more involved in physical activity in comparison to group B. Significant difference was observed between group A and group B.

## VI. DISCUSSION

This study was conducted to illuminate the prevalence of risk factors for GDM in a study of 200 women with GDM. In our study, family history of diabetes mellitus, low physical activity before pregnancy, and obesity were significant risk factors of GDM. In this systematic study Family history of diabetes was found in seven percent of Group A and eight percent of group B participants (TABLE 1). According to previous studies, family history of diabetes (particularly in a first-degree relative) increases the risk for GDM [44, 45]. Onset of GDM has a familial tendency and this potentially suggests that there is a genetically predisposition to develop GDM [46–48 ) And if we discuss about physical activity Group A participants were more involved in physical activity in comparison to group B. 46% of group A participants exercise 5 times per week, 23% exercise 3 times per week and 31% doesn't exercise and in group B only 18% participants exercise 5 times per week, 29% exercise 3 times per week and 53% doesn't exercise (TABLE 3) during pre pregnancy. Significant difference was observed between group A and group B. Low physical activity during pre pregnancy increased the risk of developing GDM. A study by Mishra et al highlights the significant protective effect of physical activity

against GDM by showing a 10 fold lower prevalence of GDM among people who carry out >3000 METs of activity per week [49]

In our study 0% participants had history of diabetes, polysystic ovarian syndrome, history of macrosomic baby, and history of preterm delivery.( TABLE 1).Polycystic ovarian syndrome (PCOS) is a common cause of insulin resistance [50, 51]. Women with PCOS have higher risk of developing GDM [50, 51] However, unlike other studies, our study did not find any significant association between GDM and history of diabetes, polysystic ovary syndrome, macrosomic baby and preterm delivery history in pregnant woman. More research is needed to establish the underlying mechanisms.

In our study four percent of Group A and six percent of group B participants had family history of hypertension . Notably, pre-HTN was associated with an OR of GDM of 4.0 on adjusted analysis. Pre-HTN and HTN have been reported to be associated with increased risk of GDM in previous literature, including in one study in India conducted in a population with very low GDM prevalence (52,53)

In this study, the increased pre-pregnancy BMI, and family history of diabetes were independent predictors of developing GDM. According to Statistical analysis T test result Height of group A participants and group B participants was similar but pre-pregnancy weight was significantly higher in group B, so BMI of group B was also significantly higher in group B (TABLE 2). BMI is commonly used in risk-based screening for GDM.

Prevalence of GDM is also increased with increasing pre-pregnancy BMI [54]. There are several studies confirming a strong association between obesity and the development of GDM (55–57). A study in the USA (58) found the overall population-attributable fraction was 46.2%, meaning nearly half of GDM events could have been avoided if these mothers had a normal prepregnancy BMI. Animal experiments have also shown that adipose tissue macrophages in obese mice secrete miRNA-containing exosomes, molecules that induce glucose intolerance and insulin resistance when administered to lean mice (59). The study indicates that it is crucial to attain adequate pre-pregnancy weight to experience normal pregnancy, to reduce the risk of complications like abnormal birth weight babies and also reduce the occurrence of GDM.

## VII. CONCLUSION

According to the findings of this study, inadequate amount of physical activity prior to pregnancy, abnormal weight, and family history of diabetes mellitus were important risk factors of GDM. GDM is one of the major health problems in the world that requires efficient prevention and control strategy. Therefore, having accurate and reliable information about the causes of GDM is very helpful in planning the prevention of GDM.

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