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A prospective observational study on relation between first trimester maternal bmi, hba1c levels and gestational diabetes mellitus and its effect on fetomaternal outcome

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Abstract

Aim

To determine the relation between first trimester maternal BMI, HbA1c and GDM with fetal and maternal outcome including complications

Objectives

1. To determine the relation between 1_{st} trimester maternal BMI and gestational diabetes mellitus
2. To estimate the HbA1C levels in order to rule out overt diabetes in antenatal mothers.
3. To describe the fetal and maternal outcome among GDM patients
4. To determine fetal and maternal outcome with respect to first trimester maternal BMI

Material & Methods

Study Area

The study was conducted among patients attending Department of Obstetrics and Gynecology of Mallareddy Medical College for Women

Study Design: Prospective Observational study

Study Period: September 2022 to February 2024

Study Population: Pregnant women attending Outpatient department and delivering at Mallareddy Medical College for Women hospital, Hyderabad

Method: After taking consent based on inclusion and exclusion criteria, total of about 126 singleton pregnant women presenting at our antenatal clinic were

enrolled in this prospective study.Demographic and Obstetric data of pregnant women were noted at their first antenatal visit.General and obstetric examination was done.Pregnant women were informed and counselled regarding Obstetric history taking and general examination.General examination of pregnant women in first trimester was performed,weight of the patient in kgs and height of the patient in centimetres were recorded their BMI calculated and recorded.Blood sample were collected for HbA1c level measurement.Oral glucose tolerance test (OGTT) was performed with 75 grams of glucose between 24-28 weeks of gestation after 8 hours of fasting, any medication like steroids, Beta blockers were stopped 48 hours before the test.Weight of the patient at the time of delivery was noted in GDM mothers to

assess maternal weight gain during pregnancy. Blood glucose levels in GDM mothers after delivery, complications if any during or after delivery of the baby were recorded.

Post delivery APGAR score, blood glucose levels, birth weight of the baby, maturity of the baby were recorded.

Conclusion: The first trimester BMI was 23.9± 1.6 Kgs/M_2, the mean HbA1c was 5.1± 0.6 mg/dl and 16.7% were diagnosed with gestational diabetes mellitus. Among these 21 except for 7 (MNT) the remaining of them were on medication. The mode of delivery was normal delivery in majority. The birth weight was 2.9± 0.29Kgs and the mean APGAR score at 1_{st} and 5_{th} minute was 7.1± 0.3 and 8.2± 0.4 respectively. Among the 126 babies only 8 of them required NICU admission.

Keywords: Gestational diabetes mellitus, body mass index, hba1c, oral glucose tolerance test, apgar score, gestational weight gain, hyperglycaemia

Introduction

Gestational diabetes mellitus (GDM) is the most common complication in pregnancy and is defined as" any degree of carbohydrate intolerance, which is first recognized during pregnancy. It considered to be a major public health concern [1, 2]. Globally, the prevalence of GDM is increasing and varies between 1% and 14%. The International Diabetes Federation (IDF) reports that maternal hyperglycemia affected about 21.3 million (16.2%) of births, with GDM accounting for

84.6% of cases [3]. The International Association of the Diabetes and Pregnancy Study Group's criteria, which were based on either of the following OGTT cut-off values: fasting plasma glucose (FPG) *k* 5.1 mmol/L or 92 mg/dl one-hour plasma glucose ≠ 10.0 mmol/L or 180 mg/dl, or two-hour plasma glucose ≠ 8.5 mmol/L or

153 mg/dl were used to describe GDM [4].

An elderly gravida, multi gravida with previous history of GDM body mass index (BMI) of greater than 30 kg/m2, family history of diabetes, previous macrosomic infant weighing more than 4.5 kg and ethnicity are some of the factors that raise the chance of developing GDM [5].

Complications like hypoglycemia, respiratory distress syndrome, polycythemia, hyperbilirubinemia, hypocalcemia, and even newborn birth trauma are more common in neonates born to mother with GDM [6, 7]. One way to stop the complications of GDM is early detection and management [8]. 1The World Health Organisation

(WHO) defines maternal obesity and overweight as having a BMI of around 30 kg/m2 and 25–29.9 kg/m2, respectively. [9] High BMI during pregnancy is a known risk factor for Insulin resistance and GDM and has been linked to unfavourable outcomes for both mothers and newborns. 10

A physiological drop in insulin sensitivity of 50-60% is typical during a normal pregnancy. [11] According to studies, the likelihood of gestational diabetes mellitus rose with maternal weight gain, particularly during the first trimester of pregnancy [12]. Obese pregnant women had a higher incidence of gestational diabetes mellitus (GDM) than overweight ones, indicating that BMI is a useful predictor [13]. According to certain research, individuals with higher BMIs develop more fat during the first two trimesters of pregnancy, which may have an impact on the mother's subsequent insulin resistance. 14 [15].

Glycated hemoglobin (HbA1c) reflects average blood glucose levels during the preceding 8–12 weeks. As the gold standard for assessing long-term glycemic control, it has been widely used in blood glucose monitoring and management of people with diabetes. The increase in HbA1c levels is closely related to the adverse pregnancy outcome [19]. Performing HbA1c in the first trimester helps us to rule out overt diabetes. It also helps us to mitigate the detrimental effects caused by overt diabetes on both mother and the foetus.

In addition, the gestational weight gain (GWG) of pregnant women with

GDM also has an important impact on the perinatal outcomes [20].

Rationale of the study

One controllable risk factor for poor pregnancy outcomes is excessive weight gain. The evaluation of weight throughout the first and second trimesters aids in the early detection, mitigation, and treatment of unfavorable perinatal consequences. Maternal BMI and perhaps GWG are associated with GDM; however, due to variability in diagnosis and treatment, as well as the possibility that GDM treatment may affect 3weight, these correlations could not be evaluated. An excessive weight and being overweight or obese prior to becoming pregnant are linked to an increased chance of having GDM, according to numerous researches. In light of this, a study was conducted to ascertain the relationship between a mother's BMI, her HbA1cmin the first trimester and occurance of GDM and the outcomes for the foetus and the mother following delivery.

GDM is associated with both short and long-term pregnancy adverse outcomes, including large for gestational age (LGA), preeclampsia, primary Cesarean section (Csection), post partum diabetes mellitus, macrosomia, shoulder dystocia, preterm birth, and risk of T2DM in offspring. HbA1c is used in diagnosing, treatment, preventing, and detecting progress of DM. In women with hyperglycemia, HbA1c level has beenassociated with increased birthweight, primary C-section, hypoglycemia, cord-serum C-peptide, preeclampsia, preterm birth, >90th percentile of body fat.

Early detection of high BMI and higher levels of HbA1c in first trimester and prompt interventions to mitigate their associated detrimental effects can result in significantly better fetomaternal outcome.

Aim and Objectives

Aim

To determine the relation between first trimester maternal BMI, HbA1c and GDM with fetal and maternal outcome including complications

Objectives

Primary objective

To determine the relation between 1_{st} trimester maternal BMI and gestational diabetes mellitus

Secondary objective

1. To estimate the HbA1C levels in order to rule out overt diabetes in antenatal mothers.
2. To describe the fetal and maternal outcome among GDM patients
3. To determine fetal and maternal outcome with respect to first trimester maternal BMI

Material & Methods

Study Area

The study was conducted among patients attending Department of Obstetrics and Gynecology of Mallareddy Medical College for

Women

Study Design

Observational study

Study Period

September 2022 to February 2024

Study Population

Pregnant women attending Outpatient department and delivering at Mallareddy Medical

College for Women hospital, Hyderabad

Inclusion criteria

1. Aged between18- 40 years
2. Pregnant women who are sure of their last menstrual period or those with dating scan in their 1st trimester 3. Primigravida up to 12 weeks of gestation
3. Multigravida up to 12 weeks of gestation
4. Multigravida with GDM in their previous pregnancy
5. Pregnant women with family history of GDM 24

Exclusion Criteria

1. . Subjects < 18 and >40 years
2. Pregnant women with overt diabetes
3. Pregnant women having their first antenatal visit from 13_{th} to 40_{th} week of gestation
4. Pregnant women on biguanides like metformin, other oral hypoglycaemic agents and insulin Sample Size

Since the proportion of GDM was 9% as reported by Teshome *et al.* [18] it will be used as basis for the present study sample size estimation.

$N = 1.96*1.96*pq/L_2$ (absolute precision)

P: Proportion

Q: 1- proportion L: Allowable error p= 9% = 0.09 q= 0.91 (1-p)

L=5% = 0.05

N= 1.96*1.96* 0.09*0.91/0.05*0.05

= 0.3146/ 0.0025

= 126

The minimum sample size required for the study is 126 subjects with the above formula.

Study Methods

Scientific committee and institutional ethics committee approval was obtained After taking consent based on inclusion and exclusion criteria, total of about 126 singleton pregnant women presenting at our antenatal clinic were enrolled in this prospective study Demographic and Obstetric data of pregnant women were noted at their first antenatal visit.

General and obstetric examination was done.

Pregnant women were informed and counselled regarding Obstetric history taking and general examination.

General examination of pregnant women in first trimester was performed, weight of the patient in kgs and height of the patient in centimetres were recorded their BMI calculated and recorded.

Fig 1: Measurement of height and weight of pregnant woman in first trimester

Blood sample were collected for HbA1c level measurement. Oral glucose tolerance test (OGTT) was performed with 75 grams of glucose between 24-28 weeks of gestation after 8 hours of fasting, any medication like steroids, Beta blockers were stopped 48 hours before the test. Diagnostic criteria of GDM according to IADPSG is

Fasting blood glucose level 92mg/dl

1. hour blood glucose 180mg/dl
2. hour blood glucose 153mg/dl

Weight of the patient at the time of delivery was noted in GDM mothers to assess maternal weight gain during pregnancy.

Blood glucose levels in GDM mothers after delivery, complications if any during or after delivery of the baby were recorded.

Post delivery APGAR score, blood glucose levels, birth weight of the baby, maturity of the baby were recorded.

Fig 2: Measurement of blood glucose level inGDM mother

Fig 3: Baby of GDM mother with macrosomia weighing 4.1 kg

Results

Table 1: BMI distribution

BMI	Frequency	Percent
<18.5 (underweight)	-	-
18.5- 24.9 (Normal)	84	66.7%
25- 29.9 (overweight)	35	27.7%
>30 (obese)	7	5.6%
Total	126	100%
Mean BMI: **23.9± 1.6 Kgs/M^2**		

The mean BMI was 23.9± 1.6 Kgs/M2 with majority (66.7%) of the women having normal BMI, 27.7% were overweight and 5.6% were obese as seen in table 1.

Table 2: HbA1C Distribution

HbA1c	Frequency	Percent
<6.5 mg/dl	116	92%
>6.5 mg/dl	10	8%
Total	126	100%
Mean HbA1c: **5.1± 0.6**		

The mean HbA1c in the study was 5.1± 0.6 mg/dl with 92% having normal levels i.e <6.5 mg/dl and the remaining 8% had levels >6.5 mg/dl as shown in table 2.

Table 3: Outcome of GDM

GDM	Frequency	Percent
Yes	21	16.7%
No	105	83.3%
Total	126	100%
Treatment (n= 21)		
Medical nutritional treatment	7	33.3%
Oral hypoglycemic agents	9	42.8%
OHA+ Insulin	5	23.9%
Total	21	100%

Based on the HbA1c reading 21(16.7%) were diagnosed with gestational diabetes and among these 21 patients 7(33.3%) were on medical nutritional treatment, 9(42.8%) were on oral hypoglycemic agents (OHA) and 5(23.9%) were taking OHA and insulin together as shown in table 3.

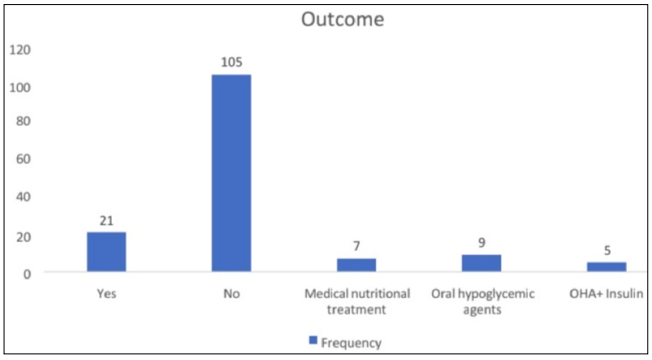

Fig 4: Column chart showing outcome and treatment

Table 4: Maternal Complications distributions

Maternal complications	Frequency	Percent
None	111	88.1%
Hypothyroidism	3	2.4%
Hypothyroid+ polyhydramnios	2	1.6%
Mild polyhydramnios	2	1.6%
Severe polyhydramnios	3	2.4%
PROM	3	2.4%
Severe pre- eclampsia	2	1.6%
Total	126	100%

In the study among the 126 women 111 did not have any complication during pregnancy and the remaining 15 had various complications as shown in table 4

Results showing maternal outcome

In the study among the 126 women 111 did not have any complication during pregnancy and the remaining 15 had various complications like hypothyroidism, polyhydramnios, PROM, severe preeclampsia 2 wound infections were noted among them.

72.2% were normal deliveries and the remaining 27.8% were caesarean sections.

Results showing foetal outcome

The mean APGAR score at the 1st minute was 7.1± 0.3 and at the 5thminute it was 8.2± 0.4. The mean birth weight was 2.9± 0.29 Kgs.Among the 126 babies born 8 of them required NICU admission, among these 8 babies the reason for admission in 3 each was respiratory distress and TTNB (transient tachypnoea of new born) and 2 were admitted due to jaundice.

Association between BMI, HbA1c, GDM and maternal outcome

In the study a significant association ($p<0.001$) was seen when HbA1c, BMI and GDM were compared with maternal outcome suggesting a 5.1 mg/dl, 23.9 Kgs/M2 were associated with normal maternal outcome. Normal HbA1c, normal BMI and GDM were significantly associated ($p<0.001$) with each other suggesting normal levels of HbA1c and normal BMI reduced the risk of gestational diabetes mellitus.

Summary & Conclusion

This observational study was conducted in the department of Obstetrics and Gynaecology of Malla Reddy Medical College for Women, Hyderabad with an aim to determine the relation between first trimester maternal BMI, HbA1c and GDM with fetal and maternal outcome after delivery, complications if any. The study was done between September 2022 to February 2024. A total of 126 subjects were included in the study After obtaining consent from all the subjects' and their attendants detailed history and clinical examination was noted using a pre-tested questionnaire. The results of the study showed the overall mean age was 24.1± 2.2 years with majority of them beings gravidas, the mean gestational age was 38.4± 1.08 weeks and 11.9% had comorbidities. The first trimester BMI was 23.9± 1.6 Kgs/M2, the mean HbA1c was 5.1± 0.6 mg/dl and 16.7% were diagnosed with gestational diabetes mellitus. Among these 21 except for 7 (MNT) the remaining of them were on medication. The mode of delivery was normal delivery in majority. The birth weight was 2.9± 0.29 Kgs and the mean APGAR score at 1st and 5th minute was 7.1± 0.3 and 8.2± 0.4 respectively. Among the 126 babies only 8 of them required NICU admission. From the study it can be concluded 5.1 mg/dl, 23.9 Kgs/M2 were associated with normal maternal outcome which was significant and also suggesting normal levels of HbA1c and normal BMI reduced the risk of gestational diabetes mellitus.

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