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COMPARATIVE EFFECT OF 75 GRAMS GLUCOSE CHALLENGE TEST WITH FASTING AND POST PRANDIAL PLASMA GLUCOSE VALUES IN THE SCREENING OF GESTATIONAL DIABETES MELLITUS

Obstetrics and Gynaecology

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ABSTRACT

BACKGROUND: Pregnancy is a time when serial metabolic adaptations in maternal fuel metabolism and hormones occur, in order to accommodate a rapidly growing tissue transplant, the conceptus. Subtle perturbation in these changes can have implication not only for the index pregnancy but also for the future generation. Diabetes is the most common medical complication of pregnancy.

AIM OF THIS STUDY: This study compares the efficacy of 75 grams glucose challenge test with fasting and postprandial blood glucose values in the screening of gestational diabetes mellitus in the general population.

MATERIALS AND METHODS: The study was conducted in the Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar from May 2020 to April 2021.

Study Group: The study group included 300 pregnant women in GCT group and 300 pregnant women in fasting & post prandial group.

RESULTS: This is a comparative study of the efficacy of 75 grams glucose challenge test with fasting and postprandial blood glucose values in the screening of gestational diabetes mellitus in the general population. The study group consisted of 600 apparently normal pregnant women, randomly allotted to FBS / PPBS or 75 grams GCT group, 300 each. The respective tests were done on 4 visits. 1st visit – 8 to 10 wks, 2nd visit – 16 to 20 wks, 3rd visit – 24 to 28 wks and 4th visit – 32 to 36 wks. Patients who have GDM were given appropriate treatment. The prevalence of GDM was 2.4% in FBS / PPBS group and 5.4% in GCT group. GCT has identified 25% of cases prior to 24 weeks gestation, 50% of cases at between 24 to 28 weeks and 25% of cases after 32 weeks. Hence the earlier diagnosis allows better and effective management, thereby preventing adverse obstetric and perinatal outcomes.

CONCLUSION: To conclude, 75 grams glucose challenge test done as per WHO criteria serves both as one step screening and diagnostic procedure, is easy to perform and also economical and has detected more number of GDM cases. As the age increases, the risk of acquiring GDM also increases. Similarly when BMI is ≥ 26, GDM risk increases. Screening with fasting and post prandial plasma glucose has only 60% sensitivity when compared to screening with 75 grams glucose challenge test. Hence Glucose Challenge Test with 75 grams oral glucose irrespective of last meal for all pregnant women appear to be a simple, effective and easily reproducible screening method for early diagnosis of GDM.

KEYWORDS

Plasma glucose, diabetes mellitus, GDM, GCT

INTRODUCTION

Pregnancy is a time when serial metabolic adaptations in maternal fuel metabolism and hormones occur, in order to accommodate a rapidly growing tissue transplant, the conceptus. Subtle perturbation in these changes can have implication not only for the index pregnancy but also for the future generation.

Diabetes is the most common medical complication of pregnancy. Women can be separated into those who were known to have diabetes before pregnancy -PRE GESTATIONAL / OVERT DIABETES and those diagnosed during pregnancy - GESTATIONAL DIABETES MELLITES (GDM). GDM as a concept began in 1964 when O'Sullivan and Mahan performed the oral glucose tolerance test.

Ethnically Indian women have high prevalence of diabetes and the relative risk of developing GDM in Indian women is 11.3 times compared to white women, necessitating universal screening for glucose in tolerance during pregnancy in India.

Screening for GDM is an example of how timely intervention that costs very little and enables easy management of the condition can help in reducing the risk of both mother and child becoming diabetic at a later stage.

AIM OF THIS STUDY:

This study compares the efficacy of 75 grams glucose challenge test with fasting and postprandial blood glucose values in the screening of gestational diabetes mellitus in the general population.

MATERIALS AND METHODS

SETTINGS:

The study was conducted in the Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar from May 2020 to April 2021.

STUDY GROUP:

The study group included 300 pregnant women in GCT group and 300 pregnant women in fasting & post prandial group. The group allotment was random.

They have been followed up from the time of confirmation of pregnancy through delivery until one week post partum. GDM patients were followed up to 6 weeks post partum at which time OGTT was done to find out their glycemic status.

INCLUSION CRITERIA:

- Women with singleton gestation
- Women with no past history of GDM / DM
- Not on any long term treatment for other medical illness
- No previous history of treatment for GDM/DM including on meal plan

EXCLUSION CRITERIA:

- Women with diabetes mellitus
- Women with multiple gestation
- Women with other risk factors like anemia, heart disease, epilepsy, thyroid disorders, bad obstetric history, jaundice and auto immune disorders.
- Women with past history of GDM
- Those on long term medical treatment for any illness

SCREENING METHODOLOGY:

- GCT group:

75grams glucose was administered to women allotted to the GCT group, irrespective of the last meal. Plasma glucose is estimated after two hours from a venous blood sample using glucose oxidase – peroxidase (GOD-POD) method. The test was considered to be positive when the plasma glucose values were ≥ 140mg% after 2 hours

of glucose administration (WHO criteria).

- **FASTING / POSTPRANDIAL group:**

In women allotted to the fasting and post prandial group, fasting blood glucose and post prandial plasma glucose values were taken. The fasting value of ≥ 95 mg% after an overnight fasting and a post postprandial value of ≥ 140 mg% at the end of 2 hours after meal were considered to be abnormal.

GCT and fasting & post prandial plasma glucose testing was done in the pregnant women allotted to the respective groups during 4 visits.

- 1st visit – 8 to 10 wks
- 2nd visit – 16 to 20 wks
- 3rd visit – 24 to 28 wks
- 4th visit – 32 to 36 wks

When they test positive, they were considered to have GDM and were treated. Either put on meal plan or given insulin as per their glucose values.

RESULTS

Table 1 : Age Distribution

Age group (yrs)	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
16-20	1	58	0	58	63	1	64
21-25	2	137	1	138	125	3	128
26-30	3	52	6	58	58	7	65
31-35	4	39	0	39	32	4	36
36-40	5	1	0	1	0	1	1
Total		287	7	294	278	16	294

This study commenced with 300 women in each group out of which 6 in each group could not be followed up. This has reduced the total number of test subjects to 294 women in each group.

The mean age of the pregnant women screened was and 24.2 ± 4.5 yrs in FBS/ PPBS group (group 1) and 24.3 ± 4.5 yrs in GCT group (group 2). The distribution of women in the age group 21 to 25 yrs was relatively higher in both the groups (46.6% in group 1 & 42.5% in group 2). The prevalence of GDM across the age group of women in group 1 was ranging from 14.3 to 85.7% and that in group 2 was from 6.3 to 43.8%. Highest prevalence was observed in the age group of 26 to 30 yrs in both the groups. In both groups, age was a significant parameter ($p<0.001$).

Table 2 : BMI Distribution

BMI range (kg/m^2)	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
<18	1	12	0	12	7	0	7
18-25	2	255	1	256	263	7	270
>25	3	20	6	26	8	9	17
Total		287	7	294	278	16	294

There was a consistent increase in the prevalence of GDM as BMI increased in both the groups and the trend was statistically significant ($p < 0.001$). Among the 49 GDM women, the highest prevalence was observed in women with BMI ≥ 26 kg/m^2 and it was 87.5% in group 1 and 56.3% in group 2.

Table 3 : Parity

Parity	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
Primi	1	218	4	222	196	8	204
2^{nd} gravida	2	51	3	54	60	6	66
3^{rd} gravida	3	14	0	14	20	1	21
4^{th} gravida	4	4	0	4	2	1	3
Total		287	7	294	278	16	294

Since the distribution of primi was more, the prevalence of GDM was also more in them.

Table 4 : Gestational Age at Delivery

Gestational Age	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
Term	1	263	7	270	262	15	277
Preterm	2	14	0	14	9	1	10
Post dated	3	10	0	10	7	0	7
Total		287	7	294	278	16	294

Most of the women with GDM delivered at term in both the groups. There was one preterm in GDM women of GCT group. This is due to premature rupture of membranes leading to preterm labour.

Table 5 : Type of Delivery

Type of delivery	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
Labour natural	1	186	3	189	193	7	200
Assisted vaginal	2	13	0	13	16	0	16
Caesarean section	3	88	4	92	69	9	78
Total		287	7	294	278	16	294

The total caesarean delivery rate was 31.29% in group 1 and 26.53% in group 2. This might be due to the higher number of previous caesarean rates. There were 61 women with previous caesarean in group 1 and 65 women in group 2.

Table 6 : Birth Weight

Range of weight (kg)	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
<2.5	1	23	0	23	26	1	27
2.5-4	2	259	7	266	250	15	265
>4	3	5	0	5	2	0	2
Total		287	7	294	278	16	294

The mean birth weight of babies in FBS / PPBS group was 3.01 kg and that of babies in GCT group was 2.93 kg. There were 5 cases of macrosomic babies in the non GDM women of group 1. Hence for the last 100 women of group 1, GCT was done at 28 wks. The sensitivity of FBS / PPBS testing was found to be only 60%.

Since most of our women come from economically weaker sections of the society, the birth weight also is somewhat lower than the average birth weight.

Hence there is more number of babies with birth weight <2.5 Kg.

Table 7 : Management

Management	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
No treatment	0	287	0	287	278	0	278
Meal plan	1	0	5	5	0	10	10
Insulin	2	0	2	2	0	6	6
Total		287	7	294	278	16	294

Out of the 7 GDM patients in group 1, 5 were on meal plan and 2 were put on insulin. Out of the 16 GDM patients in group 2, 10 were on meal plan and 6 were put on insulin.

Table 8 : Neonatal Admission

Admission status	Legend	FBS/PPBS group			GCT group		
		No GDM	GDM	Total	No GDM	GDM	Total
No admitted	0	246	4	250	255	14	269
Admitted	1	41	3	44	23	2	25
Total		287	7	294	278	16	294

The reasons for admission were preterm, low birth weight, sepsis, transient tachypnea of new born, hyperbillirubinemia, respiratory distress syndrome, meconium aspiration, birth asphyxia and hypoglycemia. There were 8 cases of hypoglycemia in group 1 and 2 cases in group 2. Plasma glucose levels were tested in all the babies of GDM mothers and if found to be normal, the babies were handed over to the mother with instructions to start early breast feed.

FINDINGS ON FOLLOW UP:

There were 2 patients with LSCS wound infection and 1 patient with episiotomy wound gaping in group 1 women who did not have GDM.

In both the groups, GDM patients had normal plasma glucose levels on follow up. Only one woman in Group 2 continued to have increased levels of blood glucose even after 6 weeks and she is being managed appropriately.

DISCUSSION

Gestational diabetes mellitus (GDM) is the most common medical complication of pregnancy. GDM occurs in women who have insulin resistance and a relative impairment of insulin secretion. These women have a significant risk of developing diabetes later in life. Identifying this group of women is important in not only preventing perinatal morbidity but also improving long-term outcomes for the mothers and their children.

Proponents of universal screening for GDM emphasize that pregnancy provides a unique opportunity to diagnose a disease that has significant short- and long-term implications for both mothers and children.

In the study group that includes 600 pregnant women, 300 women randomly allocated to undergo either a glucose challenge test or a fasting and post prandial plasma glucose estimation at different periods of gestation, mean age was 24.3 ± 4.5 yrs, mean BMI was 21.95 ± 2.5 kg/m^2, 70.4% were primigravida and 29.6% were multigravida. The results of the present study are compared with the results of various other published studies.

Comparison of the prevalence of GDM:

The prevalence of GDM ranges between 1–14% of patients, depending on the population described and the criteria used for diagnosis. The prevalence of GDM was 2.4% in the fasting post prandial group. It has identified 7 cases of GDM among the 300 pregnant women allotted to the fasting & post prandial group (group 1).

The prevalence of GDM was 5.4% in the GCT group. It has identified 16 cases of GDM among the 300 pregnant women allotted to the GCT group (group 2).

Age distribution:

In the present study, the mean age of patients without GDM was 24.15 ±4.5 yrs and that of those with GDM was 26.76 ±4.4 yrs.

BMI distribution:

Shin Y. Kim et al[1], reported the proportions of gestational diabetes cases attributable to overweight, obesity, and extreme obesity were 15.4%, 9.7%, and 21.1%, for a total of 46.2%. "In other words, if all women with a BMI of 25 or greater had a GDM risk equal to that of women in the normal BMI category, nearly half of GDM cases could be prevented. Lifestyle interventions to reduce BMI have the potential to lower GDM risk," she commented. According to Ogonowski and Miazgowski et al[2], the cut off point for BMI as a risk indicator for GDM was 22.85kg/m^2 (odds ratio = 1.91; 95% confidence interval 1.5-2.1; sensitivity 47.8%, specificity 65.9%). Significant relationships between pregravid BMI and GDM were found and BMI was the strongest predictor for GDM treated with insulin. In our study, the mean BMI of patients with GDM was 26.02 kg/m^2 and for those without GDM was 21.75 kg/m^2.

Parity:

According to D. Simmons et al[3], GDM was less common among women with a parity of 1 to 2 (OR = 0.64) and 3 to 4 (OR = 0.72) than in grand multiparous women. Vibeke Anna et al found women who had reported a previous pregnancy of > 20 weeks' gestation had a small but significantly reduced risk of GDM in subsequent pregnancies. There was nearly a 10% reduction in risk in women who had a previous pregnancy compared with that in women having their first pregnancy. A similar small protective effect was also apparent among women who had two or more previous pregnancies. In our study, 57.1% of GDM was in Primigravidas in group 1 and 50% in group 2.

Time of diagnosis:

According to Seshiah et al, among the GDM women detected in his study, 35.4% were < 24 weeks of gestation and this included 12.4% of GDM women < 16 weeks of gestation and remaining 64.6 % more than 24 weeks of gestation.

In our study, the GDM prevalence at <24 wks was 25.1%, at 24 wks was 50% and that at >32 wks was 25%. Hence early screening for glucose intolerance and care is likely to result in the reduction of some of the hyperglycemia-related complications.

Gestational age at delivery:

Yariv Yogev et al[4] found no difference in the rate of spontaneous preterm delivery (sPTD) in GDM (163/1,526, 10.7%) in comparison to non-GDM patients (1193/10,560, 11.3%, P = 0.2). GDM patients with sPTD were characterized by higher glucose values in the OGTT and higher mean blood glucose (114±16 vs. 106±14, P<0.0001). In our study, nearly all patients with GDM delivered at term.

Birth weight:

According to R G Moses et al[5], for women with GDM, the mean (± 1 SD) birth weight was 3293 ± 493 g. Their values were not significantly different from the matched group, which had a birth weight of 3315 ± 460 g. In our study, the mean birth weight of IDM babies was 3.10 and those of normal women was 3.01 ± 0.5 kg in group 1 and that in group 2 was 2.99 and 2.92 ± 0.4 kg respectively.

Intrapartum and neonatal characteristics:

According to Jana Kaida Silva et al[6], statistically significant differences in type of delivery, neonatal weight / macrosomia, hypoglycemia, and hyperbilirubinemia were found among ethnic groups. Neonates born to Native -Hawaiian / Pacific - Islander and Caucasian women were more likely to have hypoglycemia whereas neonates born to Native – Hawaiian / Pacific - Islander, Filipino, and Caucasian women were more likely to have hyperbilirubinemia than neonates from other ethnic groups. Native – Hawaiian / Pacific - Islander women were also more likely to have neonates with macrosomia than women from the other ethnic groups. Chinese women were more likely to have assisted vaginal delivery (vacuum extraction or forceps) but were least likely to have had cesarean section compared with women from the other ethnic groups.

In our study, there were no assisted vaginal deliveries in both groups, whereas, 57.2% of GDM patients delivered by caesarean and 42.8% by labour natural in group 1 and 56.2% and 43.75% in group 2. 42.9% of infants of diabetic mother were admitted in group 1 and the same in group 2 was 12.5%.

CONCLUSION

To conclude, 75 grams glucose challenge test done as per WHO criteria serves both as one step screening and diagnostic procedure, is easy to perform and also economical and has detected more number of GDM cases.

Screening and subsequent treatment started in the early weeks of pregnancy has the potential to detect cases early and can prevent or minimize adverse obstetric and perinatal outcomes.

As the age increases, the risk of acquiring GDM also increases. Similarly when BMI is ≥ 26, GDM risk increases.

Screening with fasting and post prandial plasma glucose has only 60% sensitivity when compared to screening with 75 grams glucose challenge test.

Hence Glucose Challenge Test with 75 grams oral glucose irrespective of last meal for all pregnant women appear to be a simple, effective and easily reproducible screening method for early diagnosis of GDM.

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