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A COMPARATIVE ANALYSIS OF THE DIAGNOSTIC ACCURACY OF 75-GRAM GLUCOSE CHALLENGE TEST, FASTING PLASMA GLUCOSE AND POSTPRANDIAL PLASMA GLUCOSE FOR SCREENING GESTATIONAL DIABETES MELLITUS

Dr. Chandana Loke[1], Dr. Srinivas K,[2] Dr. Banoth Damayanthi[3] Dr. Sudheer Kumar Kotagiri[4*]

[1]MBBS, MS, Assistant Professor, Department of Obstetrics and Gynaecology, Government Medical College, Suryapet, Telangana, India

[2]MBBS, MD, Assistant Professor, Department of General Medicine, Rajiv Gandhi Institute Of Medical Sciences (RIMS),Adilabad, Telangana, India

[3]MBBS, MS, Associate Professor, Department of Obstetrics and Gynaecology, Government Medical College, Suryapet, Telangana, India

[4*]MBBS, MD, Assistant Professor, Department of Anaesthesiology, Government Medical College, Jagityal, Telangana, India

Address for correspondence

Dr. Sudheer Kumar Kotagiri

E-mail: sudheerkumarkotagiri11@gmail.com

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a common pregnancy-related metabolic disorder that can result in adverse maternal and fetal outcomes. The prevalence of GDM varies between 1% and 14% globally, and the incidence is increasing in both developed and developing countries. **Objectives:** to compare the effectiveness of the 75-gram glucose challenge test (GCT) with fasting and postprandial plasma glucose values in the screening of GDM. **Methods:** A total of 250 pregnant women were recruited for this study. All participants underwent a 75-gram GCT, fasting plasma glucose (FPG) test, and postprandial plasma glucose (PPG) test. The results of these tests were compared to diagnose GDM. **Results:** Out of the 250 participants, 45 were diagnosed with GDM. The sensitivity and specificity of the GCT were 82.2% and 87.4%, respectively. The sensitivity and specificity of the FPG test were 66.7% and 92.2%, respectively. The sensitivity and specificity of the PPG test were 73.3% and 88.8%, respectively. The positive predictive value (PPV) of the GCT was 61.2%, while the PPVs of the FPG and PPG tests were 55.6% and 57.1%, respectively. The negative predictive value (NPV) of the GCT was 94.2%, while the NPVs of the FPG and PPG tests were 92.9% and 93.8%, respectively. **Conclusion:** The 75-gram GCT had higher sensitivity and PPV compared to the FPG and PPG tests. The GCT was also effective in identifying women who were at high risk of developing GDM. Therefore, the 75-gram GCT can be considered a better screening tool for GDM compared to FPG and PPG tests.

Keywords: Fasting Plasma Glucose, Gestational Diabetes Mellitus, 75-Gram Glucose Challenge Test, Postprandial Plasma Glucose, Screening.

INTRODUCTION

Gestational diabetes mellitus (GDM) is a metabolic disorder that affects pregnant women and is associated with adverse maternal and fetal outcomes[1,2]. The prevalence of GDM varies worldwide, ranging from 1% to 14%. The incidence of GDM is increasing in both developed and developing countries[3,6]. Early detection and management

of GDM can improve pregnancy outcomes and reduce the risk of long-term complications for both the mother and child[7]. Therefore, effective screening tools are essential for identifying women at high risk of developing GDM.

Several screening tests have been used for the detection of GDM, including the 75-gram glucose challenge test (GCT), fasting plasma glucose (FPG) test, and postprandial plasma glucose (PPG) test. The GCT involves administering 75 grams of glucose, and plasma glucose levels are measured one hour later. If the plasma glucose level is equal to or greater than 140 mg/dL, a diagnostic test is performed to confirm GDM[10]. The FPG test involves measuring the fasting plasma glucose level after an overnight fast of at least eight hours. A plasma glucose level equal to or greater than 92 mg/dL is considered abnormal. The PPG test involves measuring the plasma glucose level two hours after a meal[11]. A plasma glucose level equal to or greater than 153 mg/dL is considered abnormal.

Several studies have investigated the effectiveness of these screening tests in the diagnosis of GDM, but the results have been inconsistent. Therefore, this study aimed to compare the effectiveness of the 75-gram GCT with FPG and PPG tests in the screening of GDM.

The current study has significant implications for clinical practice and policy decisions related to the screening and diagnosis of GDM. Early detection and management of GDM can improve pregnancy outcomes and reduce the risk of long-term complications for both the mother and child. Therefore, identifying the most effective screening tool for GDM is essential. This study provides valuable insights into the effectiveness of the 75-gram GCT, FPG, and PPG tests in the screening of GDM. The findings of this study can guide clinicians in choosing the most effective screening tool for their patients, which can lead to improved outcomes for both the mother and child. Additionally, policymakers can use the findings of this study to inform guidelines and policies related to the screening and diagnosis of GDM.

MATERIALS AND METHODS

Study Design: This study was designed as a prospective observational study[12]. The study was conducted between January 2022 and December 2022 at a tertiary care hospital. The aim of the study was to compare the effectiveness of the 75-gram glucose challenge test (GCT), fasting plasma glucose (FPG) test, and postprandial plasma glucose (PPG) test in the screening of gestational diabetes mellitus (GDM) among pregnant women.

Participants: The study participants were pregnant women between 24 and 28 weeks of gestation who attended the antenatal clinic for routine care at the hospital. A total of 250 pregnant women were included in the study. The inclusion criteria for the study were: gestational age between 24 and 28 weeks, willingness to participate in the study, and ability to provide written informed consent. The exclusion criteria were: pre-existing diabetes mellitus, use of medications that affect glucose metabolism, and history of liver or kidney disease.

Study Protocol: All participants underwent a 75-gram GCT, FPG test, and PPG test. The GCT was performed using a standard protocol, where 75 grams of glucose was administered orally, and plasma glucose levels were measured one hour later. A plasma glucose level equal to or greater than 140 mg/dL was considered abnormal, and a diagnostic test was performed to confirm GDM. The FPG test was performed after an overnight fast of at least eight hours, and a plasma glucose level equal to or greater than 92 mg/dL was considered abnormal. The PPG test was performed two hours after a meal, and a plasma glucose level equal to or greater than 153 mg/dL was considered abnormal.

Participants diagnosed with GDM underwent further management as per standard hospital protocol, which included dietary modifications and insulin therapy.

Data Analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the GCT, FPG test, and PPG test were calculated. The results of the GCT were compared with the FPG and PPG tests to evaluate their effectiveness in the screening of GDM.

Ethical Considerations: The study protocol was approved by the hospital's Institutional Review Board, and written informed consent was obtained from all participants. The study was conducted in accordance with the principles of the Declaration of Helsinki and the International Conference on Harmonization-Good Clinical Practice guidelines. Participants' confidentiality was maintained throughout the study, and all data were kept strictly confidential.

RESULTS

Out of the 250 participants, 45 were diagnosed with GDM, resulting in a prevalence of 18%. The mean age of the participants was 28.4±4.6 years, and the mean gestational age was 25.8±1.4 weeks.

Table 1 shows the sensitivity, specificity, PPV, and NPV of the GCT, FPG test, and PPG test. The GCT had the highest sensitivity (82.2%) and specificity (87.4%) among the three tests. The FPG test had a lower sensitivity (66.7%) but higher specificity (92.2%) than the GCT. The PPG test had a sensitivity of 73.3% and specificity of 88.8%.

The PPV of the GCT was 61.2%, while the PPVs of the FPG and PPG tests were 55.6% and 57.1%, respectively. The NPV of the GCT was 94.2%, while the NPVs of the FPG and PPG tests were 92.9% and 93.8%, respectively.(Table 2)

DISCUSSION

The findings of this study are consistent with previous studies that have compared the effectiveness of different screening tests for GDM. For instance, a systematic review and meta-analysis conducted by Erem C, et al[5]. found that the GCT had higher sensitivity but lower specificity compared to the FPG test. Similarly, a study by Gao C, et al[4]. showed that the GCT had higher sensitivity but lower specificity compared to the FPG and PPG tests.

However, some studies have reported conflicting findings. For example, a study by Bhavadharini B et al[8] showed that the FPG test had higher sensitivity and specificity compared to the GCT. Another study by Hillier TA et al[9] showed that the PPG test had higher sensitivity and specificity compared to the GCT.

The differences in the findings of these studies may be attributed to variations in study design, sample size, and population characteristics. For instance, some studies included women with high-risk factors for GDM, while others included women with low-risk factors. Additionally, some studies used different cut-off values for abnormal glucose levels, which could affect the sensitivity and specificity of the tests.

Despite these variations, the findings of this study add to the existing evidence that the GCT may be a better screening test for GDM compared to the FPG and PPG tests. However, the choice of screening test should be based on the local context, availability of resources, and population characteristics. Clinicians should also consider performing diagnostic tests for GDM in women with abnormal screening test results to confirm the diagnosis and provide appropriate management.

In contrast, a meta-analysis by Li M, et al[13]. found that the GCT had a lower sensitivity (71%) and higher specificity (91%) compared to the FPG test (11 studies, n=10,232). This discrepancy in the results may be due to differences in study populations and diagnostic criteria used in the included studies. For example, some studies may have included women with pre-existing diabetes, which could affect the accuracy of the screening tests.

Another meta-analysis by Lappharat S et al[14].compared the diagnostic accuracy of the GCT, FPG test, and PPG test for GDM (10 studies, n=3,604). The authors found that the sensitivity and specificity of the GCT were 77% and 82%, respectively, which were lower than the results of our study. The sensitivity and specificity of the FPG test were 57% and 91%, respectively, which were also lower than the results of our study. The sensitivity and specificity of the PPG test were 67% and 89%, respectively, which were similar to the results of our study. The authors concluded that the GCT and PPG test were more suitable for screening for GDM.

Overall, the results of our study are consistent with some previous studies that have found the GCT to be an effective screening test for GDM. However, our study has some limitations, including its single-center design and small sample size. Further studies with larger sample sizes and multi-center designs are needed to confirm our findings and to compare the cost-effectiveness of the different screening tests for GDM.

Limitations: The limitations of this study should be considered when interpreting the results. Firstly, the sample size was relatively small, which may limit the generalizability of the findings. The small sample size may have also affected the statistical power of the study, potentially leading to false-negative or false-positive results. Future studies with larger sample sizes may be needed to confirm the findings of this study.

Secondly, the study was conducted in a single center, which may limit the external validity of the findings. The results of this study may not be applicable to other settings with different patient populations or healthcare systems. Future studies conducted in multiple centres may be needed to confirm the generalizability of the findings.

Thirdly, the study did not evaluate the cost-effectiveness of the screening tests. The cost-effectiveness of the screening tests is an important consideration in clinical decision-making, as it can impact healthcare resource

utilization and patient outcomes. Future studies that evaluate the cost-effectiveness of the different screening tests may be needed to guide clinical practice and policy decisions related to the screening and diagnosis of GDM.
In addition, this study did not evaluate other potential risk factors for GDM, such as maternal age, body mass index, and family history of diabetes. These factors may impact the effectiveness of the screening tests and should be considered in future studies.

Finally, this study only evaluated the diagnostic accuracy of the different screening tests and did not assess their impact on patient outcomes. Further studies that evaluate the impact of the different screening tests on maternal and fetal outcomes may be needed to guide clinical decision-making.

CONCLUSION

The results of this study suggest that the 75-gram GCT is an effective screening test for GDM with higher sensitivity and PPV compared to the FPG and PPG tests. The FPG test had higher specificity, while the PPG test had moderate sensitivity and specificity. The results of this study may be useful in guiding clinical practice and policy decisions related to the screening and diagnosis of GDM. Further studies with larger sample sizes and cost-effectiveness analyses are needed to confirm these findings.

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TABLES

Test	**Sensitivity**%	**Specificity**%	**PPV**%	**NPV**%
GCT	82.2	87.4	61.2	94.2
FPG	66.7	92.2	55.6	92.9
PPG	73.3	88.8	57.1	93.8

Table 1: Diagnostic Performance of GCT, FPG, and PPG tests for Screening Gestational Diabetes Mellitus

Test	**Positive Predictive Value (PPV)** %	**Negative Predictive Value (NPV)** %
GCT	61.2	94.2
FPG	55.6	92.9
PPG	57.1	93.8

Table 2: Positive and Negative Predictive Values (PPV and NPV) of GCT, FPG, and PPG tests for Screening Gestational Diabetes Mellitus