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Comparison of 75g OGTT and Four Sugar Profiles in Diagnosis of Gestational Diabetes Mellitus

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ABSTRACT

Objective: Gestational diabetes mellitus (GDM) is a growing issue in Pakistan because of its associations with the adverse maternal and fetal outcomes. This study aimed to evaluate the diagnostic accuracy of the Four Sugar Profile Test compared with the Oral Glucose Tolerance Test (OGTT) which is the current gold standard in detecting GDM. **Methods:** A descriptive cross-sectional study was conducted by enrolling 260 pregnant women who were between 24-28 weeks gestation at Shifa International Hospital, Islamabad from 1st July 2024 to 31st December 2024. Both the Four Sugar Profile Test (which measures fasting and postprandial glucose levels after meals) and the OGTT were administered to all participants. Sensitivity, specificity, and predictive values were calculated to compare the diagnostic performance of the two tests. **Results:** The prevalence of GDM was 87.6% using the Four Sugar Profile Test and 91.5% with the OGTT which was taken as gold standard. The Four Sugar Profile Test had a sensitivity of 91.18%, specificity of 50%, a positive predictive value (PPV) of 95.18%, and a negative predictive value (NPV) of 34.38%. The overall diagnostic accuracy was 87.69%. **Conclusion:** The Four Sugar Profile Test demonstrated a good sensitivity to the OGTT; suggesting it may serve as an alternative diagnostic tool for GDM, especially in settings where the OGTT cannot be done. However, we need further studies to validate the findings and assess long-term maternal and neonatal outcomes for the Pakistan population.

INTRODUCTION

Gestational diabetes mellitus (GDM) is a common complication of impaired glucose tolerance, developing in the last two trimesters of pregnancy.[1]The steady rise in GDM is attributed to the rise in obesity overall. GDM results in adverse fetal outcomes. The main risk factors for the development of GDM is maternal obesity, maternal age, race and family history. GDM manifests itself in several ways.[2]

In the mother, it results in polyhydramnios, increased risk of placental complications and emergency caesarian sections. In the fetus, it results in fetal macrosomia, intra-uterine growth restriction and death. Exposure to maternal hyperglycemia results in neonatal hypoglycemia, polycythemia hyperbilirubinemia and enhanced NICU stay.[3]

Many screening tests have been proposed to diagnose GDM. No consensus exists currently with every consultant having a test of choice. The gold standard test for GDM diagnoses is the Oral Glucose Tolerance Test (OGTT). [4,5] The downside to the test is the unpleasant side effects as many women are unable to tolerate the high glucose load associated with the test leading to low compliance and gaps in the diagnosis of GDM.[6] An alternative for such women is the four-sugar test. Four sugar tests include fasting blood sugar and one-hour post-prandial random blood sugar at breakfast, lunch, and dinner measured by capillary finger prick method. Both tests aim to detect abnormalities in glucose metabolism, but the sensitivity and specificity may vary. The OGTT is generally considered more sensitive but may be more burdensome for the patient[6-8].

A study in Pakistan done in 2019 showed the prevalence of gestational diabetes in the second trimester to be 39.9% when diagnosed using the OGTT test[7]. A pilot study done by us showed that the prevalence of gestational diabetes using the four sugar profiles was 88%.

Evaluating the cost-effectiveness of both diagnostic

methods is crucial, especially considering the potential differences in the number of blood samples, time requirements, and associated costs. Identifying a test that is both accurate and cost-effective can have implications for healthcare systems and resource allocation. The rationale of the study is that assessing whether the Four Sugar Profiles offer comparable diagnostic accuracy to the OGTT could be important for identifying a more convenient and less burdensome test for pregnant women. If the Four Sugar Profiles prove to be equally effective in detecting GDM, it could lead to increased patient compliance and acceptance of the screening process.

METHODOLOGY

This study was done at the Department of Gynaecology and Obstetrics, Shifa International Hospital, Islamabad using a descriptive cross-sectional study design from 1st July 2024 to 31st December 2024. The study was done after approval from the CPSP. Pregnant women with singleton vertex pregnancies between 24-28 weeks gestation were included in the study. Women with multiple gestations, non-vertex presentations, or pre-existing non-gestational diabetes mellitus were excluded. 260 women who met the inclusion criteria were requested to enroll into the study from the obstetrics ward, either through outpatient visits or emergency admissions.

Demographic information, including maternal age, gestational age, and body mass index (BMI), were noted for each participant. Participant were counseled about GDM and the potential risks plus all the available diagnostic tests. Each participant underwent the Four Sugar Profile Test and the OGTT both. For the Four Sugar Profile Test, participants used a glucometer for measuring th e fasting and one-hour postprandial glucose levels after breakfast, lunch and dinner for 3 consecutive days. A fasting blood glucose level > 95 mg/dL and/or a postprandial glucose level > 140 mg/dL were considered to be positive for GDM.

For the Oral Glucose Tolerance Test (OGTT), the participants fasted overnight and were asked to consume a 75g glucose load. Venous blood samples were collected at fasting, one hour and two hours after the glucose intake. A fasting blood glucose level > 92 mg/dL, a one-hour glucose level > 180 mg/dL, or a two-hour glucose level > 152 mg/dL was considered indicative of GDM.

Statistical Methods

The sample size was estimated using the WHO Sample Size calculator, assuming a 39.9% prevalence of gestational diabetes mellitus (GDM) diagnosed via the Oral Glucose Tolerance Test (OGTT). With a 6% absolute precision and a 95% confidence level, a total sample size of 260 participants was calculated. A non-probability consecutive sampling method was employed to recruit participants.

All collected data were entered and analyzed using SPSS version 25. Quantitative variables such as age, gestational age, and BMI were expressed as means and standard deviations. Qualitative variables, including the presence of risk factors were presented as frequencies and percentages. The results of the Four Sugar Profile Test and OGTT were compared using the Chi-square test. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 260 pregnant women were included in the study, with a mean age of 30.7 years, ranging from 18 to 45 years. The mean gestational age at the time of testing was 26.1weeks, with a range from 24 to 28 weeks. The median BMI was 30.5 kg/m². In terms of risk factors, 10% of participants had a previous history of gestational diabetes mellitus (GDM), while 5% had a family history of type 2 diabetes mellitus (T2DM). Additionally, 5.38% of women presented with polyhydroamnios, and 11.9% had an increased amniotic fluid index (AFI).

Table 1

Participant Demographics and Risk Factors

Characteristic	Value
Total Participants	260
Mean Age (years)	30.7
Age Range (years)	18 to 45
Mean Gestational Age (weeks)	26.1
Gestational Age Range (weeks)	24 to 28
Median BMI (kg/m²)	30.5
Previous Gestational Diabetes (GDM)	10%
Family History of Type 2 Diabetes (T2DM)	5%
Polyhydramnios	5.38%
Increased Amniotic Fluid Index (AFI)	11.9%

Figure 1

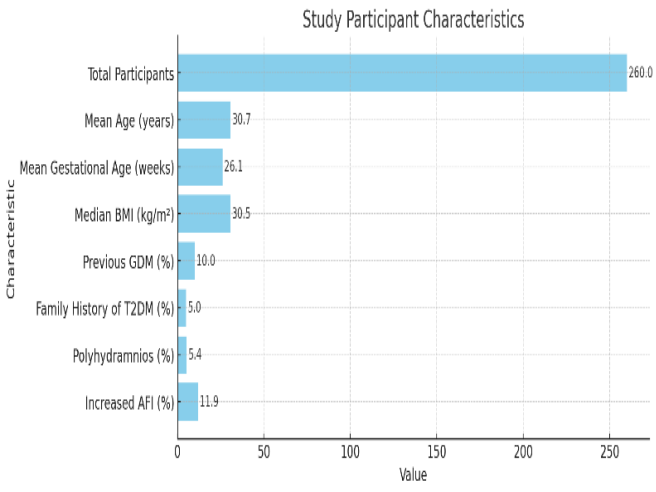
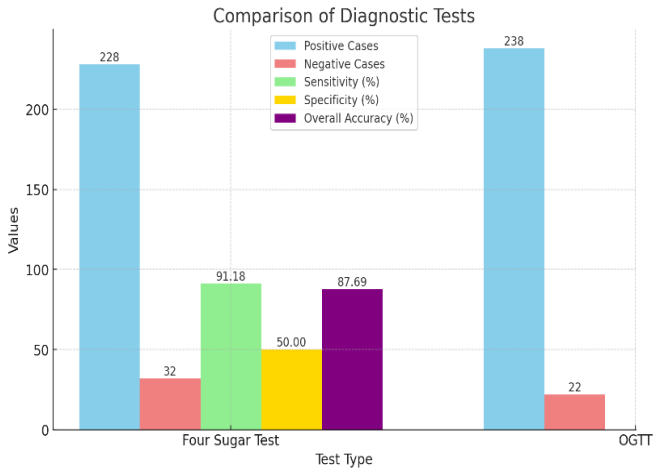


Table 2
Diagnostic Test Results

Test	Positive Cases	Negative Cases	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Overall Accuracy (%)
Four Sugar Test	228 (87.6%)	32 (12.3%)	91.18	50	95.18	34.38	87.69 (CI: 83.14-91.15)
Oral Glucose Tolerance Test (OGTT)	238 (91.5%)	22 (8.4%)	-	-	-	-	-

Figure 2



The diagnostic accuracy of the tests was assessed, with 228 cases (87.6%) yielding positive results on the Four Sugar Test, while 32 cases (12.3%) tested negative. Similarly, the Oral Glucose Tolerance Test (OGTT) indicated that 238 cases (91.5%) were positive for GDM, whereas 22 cases (8.4%) were negative. There were 217 true positive cases, 11 true negative cases, 11 false positive cases and 21 false negative cases.

The sensitivity of the Four Sugar Test was 91.18%. The specificity of the test was 50%, the positive predictive value (PPV) was 95.18%. The negative predictive value (NPV) was 34.38%. The overall diagnostic accuracy of the Four Sugar Test was 87.69% with a confidence interval of 83.14% to 91.15%.

DISCUSSION

This study aimed to compare the diagnostic accuracy of the Four Sugar Profile Test with the Oral Glucose Tolerance Test (OGTT) to detects the gestational diabetes mellitus (GDM) among pregnant woman. The findings revealed high prevalence of GDM in our cohort with 87.6% of participants testing positive using the Four Sugar Test and 91.5% testing positive using the OGTT which showed a remarkable result. These results are according to the reported global rise of GDM prevalence especially in regions (such as Pakistan) with a high burden of diabetes risk factors, such as family history and elevated BMI [9,10].

The demographic characteristics of the study population like mean age of 30.7 years and a median BMI of 30.5 kg/m² indicates that this group was at elevated risk for developing GDM which is consistent with the known risk factors for example advanced maternal age and obesity [11,12]. The presence of risk factors i.e history of GDM (10%), family history of type 2 diabetes mellitus (5%), polyhydroamnios (5.38%) and an increased amniotic fluid index (11.9%) further emphasize the high-risk profile of the participants.

In terms of diagnostic performance, both the Four Sugar Test and the OGTT detected a significant number of GDM cases with a small number of discrepancies between the two tests. While the OGTT is widely considered the gold standard for diagnosing GDM the Four Sugar Test demonstrated comparable sensitivity as 87.6% of participants tested positive for GDM using this method. This suggests that the Four Sugar Test could be a useful alternative especially in resource-limited settings where access to laboratory-based OGTT may be challenging like in remote areas. Some studies have shown that it may be used as an early screening test [13-15].

The study has several strengths such as the relatively large sample size and its focus on a homogenous group of pregnant women between 24-28 weeks of gestation which is the optimal window for GDM screening as per guidelines. Nonetheless some limitations must be considered. Firstly, the study employed a non-probability consecutive sampling method, which may introduce selection bias. Secondly the reliance on a glucometer for the Four Sugar Test could be practical but may be less accurate than laboratory-based measurements. This can affect the sensitivity and specificity of the test. Finally, the study did not assess the long-term maternal or neonatal outcomes associated with the different diagnostic methods which could provide additional insights into the clinical relevance of discrepancies between the tests.

CONCLUSION

Our study highlights the utility of the Four Sugar Test as an important diagnostic tool for GDM and it also offering a viable alternative to the OGTT in certain clinical settings. Due to its simplicity and ability to monitor glucose over multiple meals has many advantages particularly in outpatient or low-resource environments such as Pakistan. However further research with larger sample sizes and the inclusion of maternal and neonatal outcomes is needs to confirm these findings and for the better understanding of the clinical implications of using the Four Sugar Test for GDM screening.

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