DIAGNOSTIC ACCURACY OF 50GM GLUCOSE CHALLENGE TEST FOR DETECTING GESTATIONAL DIABETES BY TAKING 75GM ORAL GLUCOSE TOLERANCE TEST AS GOLD STANDARD AMONG HIGH-RISK PREGNANT WOMEN

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Abstract

OBJECTIVE: *To determine the diagnostic accuracy of the 50gm glucose challenge test for detecting gestational diabetes by taking a 75gm oral glucose tolerance test as the gold standard among high-risk pregnant women.*

METHODOLOGY: *A descriptive cross-sectional design study was undertaken at Sobhraj Maternity Hospital, Karachi, on a group of 195 high-risk pregnant women, aged 20 – 35 years with gestational age during 20 to 32 weeks. The diagnostic accuracy of the 50-gram glucose challenge test (GCT) was evaluated against 75-gram oral glucose tolerance test (OGTT). Participants first underwent 50-gram GCT, followed by a venous blood sample collection. Within one week, with at least a three-day gap, the 75-gram OGTT was performed similarly. A blood glucose level above 140 mg/dl on the OGTT confirmed gestational diabetes mellitus (GDM). The data was analyzed by SPSS version 26.*

RESULTS: *The average age of participants was noted as 27.69 ± 4.11 years, the diagnostic accuracy of the 50gm glucose challenge test for detecting the gestational diabetes was 91.28%, with a sensitivity of 86.84%, sensitivity of 92.36%, positive predictive value of 73.33%, and negative predictive value of 91.28%.*

CONCLUSION: *The current study findings show the significant diagnostic accuracy with 50 g GCT for GDM with fair sensitivity, but high specificity. The high negative predictive value supports the usage of this tool as a cost effective screen, although its moderate positive predictive value mandates confirmatory testing with the 75-gram oral glucose tolerance test (OGTT). Future research should refine screening protocols to improve early detection and management of GDM, ultimately enhancing maternal and fetal outcomes.*

INTRODUCTION

Pregnancy is a physiological stress state [1]. It is an elaborate endocrine metabolic feedback loop that can be thought of as the cellular insulin insensitivity adaptations in most tissues (and increased β-cell function) in the face of modestly, although often significantly elevated concentrations of blood glucose,

especially post-prandially [2]. Several hormones such as oestrogen, progesterone, human placental lactogen, cortisone, and growth hormone have anti-insulin effects, they are not a disease process modification [2] but an important and unavoidable physiological adjustment in order to satisfy nutritional requirement of fetus, to arrange maternal organs for parturition, and breastfeeding [3].

Gestational diabetes mellitus (GDM) is the most common carbohydrate metabolism disturbance during pregnancy, with a prevalence of 0.6 to 15% [4]. Gestational diabetes can negatively impact both maternal and fetal health when occur during pregnancy as the diagnosis is typically made after 20 weeks of gestation and resolve immediately or within 6 weeks postpartum [5]. Gestational diabetes mellitus (GDM) is associated with a 41% risk of subsequent pregnancies having GDM, & 16.2% rate of overt type 2 DM later in lifespan among women with GDM [6,7].

According to a research performed by Akhtar et al [8] established an overall sensitivity of 85.54% specificity of 93.03% positive predictive value of 75.53% and 96.27% negative predictive value for defining gestational diabetes. In contrast, the 50-g glucose challenge test (GCT) 7.2-mmol/L threshold sensitivity and specificity for detecting hyperglycemia in pregnancy were 47.8% and 84.2%, respectively, another study has reported. However, the sensitivity of 50-g GCT for hyperglycemia decreased to 32.6% at a threshold of 8.0 mmol, with specificity simply improved from 95.3% [9]. In a study performed in CMH Lahore, sensitivity, specificity, PPV and NPV of 50gm glucose challenge test for prediction of gestational diabetes was found as 76.92%, 89.6%, 52.6% and 96.2% respectively [10]. The sensitivity, specificity, positive predictive value, & negative predictive value of 50 g OGTT for gestational diabetes mellitus, on the other hand, were 100%, 80.7%, 27.5%, and 100%, respectively [2].

Currently, the OGTT, which is the most widely used method to detect GDM, has some limitations, such as being time-consuming, requiring an overnight fast, and needing the extraction of several blood samples [11,12]. On the other hand, the 50-gram GCT takes slightly less time and is easier to obtain but has been underutilized owing to sparse and inconsistent data on its diagnostic accuracy [13].

We aimed to assess if 50 gram glucose challenge test could be an effective screening test for the identification of GDM using the OGTT as the gold standard. It could also lower the risk of suffering from complications for both the mother and the baby when the diagnosis is done earlier with a motility test like GCT (and found to be accurate). This also has implications for obstetricians and gynaecologists so our findings will assist them in better screening decisions for GDM. Timely diagnosis and early initiation of management can help reduce the risks and complications of GDM and improve maternal and fetal outcomes. In addition, there remain some scope for improvement of information and conclusion in

METHODOLOGY

This descriptive cross-sectional study was performed at the Department of Gynecology & Obstetrics, Sobhraj Maternity Hospital Karachi, over six months. A total of 195 high-risk pregnant women were included using a non-probability consecutive sampling technique. The study cohort comprised of women, aged 20 – 35 years with a gestational age between 20 to 32 weeks, identified as high-risk due to a history of macrosomia (birth weight >4 kg), obesity having a BMI of 30 kg/m² or higher, earlier gestational diabetes, or a family history of type II diabetes mellitus. Women with known diabetes, cardiac disease, respiratory disease, epilepsy, renal disease, metabolic syndrome, polycystic ovary syndrome (PCOS), multiple gestations, placenta previa, congenital fetal anomalies, or other obstetric complications were excluded.

After obtaining informed written consent, participants were enrolled, and their demographic and clinical details were recorded. The diagnostic accuracy of 50-gram glucose challenge test (GCT) was assessed against 75-gram oral glucose tolerance test (OGTT), which served as gold standard. Each participant first underwent the 50-gram GCT, in which 50 grams of glucose dissolved in 200 ml of water was consumed within five minutes. Two hours post-ingestion, a venous blood sample was collected to measure blood glucose levels, with a reading above 140 mg/dl considered a positive result. Within one week, with a minimum interval of three days, the same participant underwent the 75-gram OGTT, consuming 75 grams of glucose dissolved in 200 ml of

water within five minutes, followed by a venous blood sample collection two hours later. A blood glucose level above 140mg/dl on the OGTT confirmed gestational diabetes mellitus (GDM).

The accuracy of the 50-gram GCT was evaluated using a 2×2 contingency table by categorizing results as true positive, true negative, false positive, and false negative. True positives were cases where both the 50-gram GCT and the 75-gram OGTT exceeded 140 mg/dl, while true negatives were those with glucose levels below 140 mg/dl on both tests. False positives were identified when the 50-gram GCT exceeded 140 mg/dl, but the 75-gram OGTT did not, and false negatives were cases where the 50-gram GCT was ≤140 mg/dl while the 75-gram OGTT was >140 mg/dl.

Data was interpreted using SPSS Version 26.0. Continuous variables were presented as mean ± standard deviation (SD) while categorical variables were reported as frequencies & percentages. The dichotomous table was constructed for assessing sensitivity, specificity, and diagnostic accuracy of 50gm glucose challenge test by taking a 75gm oral glucose toleratrce test as the gold standard.

RESULTS

A total of 195 participants were studied and had a mean age of 27.69 ± 4.11 years. Ninety-seven participants (49.7%) were aged 20–27 years, and 98 participants (50.3%) were aged over 27 years. The mean Body Mass Index (BMI) was 25.82 ± 3.63 kg/m^2, the number (n) of participants with BMI of 20-26 kg/m² was 125 (64.1%), and BMI > 26 kg/m² was 70 (35.9%). Concerning gestational diabetes, out of 195 participants, 45 (23.1%) tested positive on the 50g Glucose Challenge Test and 150 (76.9%) tested negative. Also, 38 participants (19.5%) were gestational diabetes positive on the 75g oral glucose tolerance test versus 157 participants (80.5%) negative as demonstrated in TABLE I.

The GCT and OGCT diagnostic accuracy for the detection of gestational diabetes was assessed in 195 participants. Out of the 45 women who were positive on the GCT, 33 were also positive on the OGCT and 12 were negative on the OGCT. In TABLE II it is shown, among those with negative GCT, 5 were positive on OGCT, and 145 the result on both tests was negative.

A total of 195 women the validity of the 50g Glucose Challenge Test (GCT) as screening test for Gestational Diabetes which showed sensitivity 86.84%, indicating high capabilities of the test to identify positive cases of gestational diabetes. Similarly, the specificity was 92.36%, indicating robust performance in differentiating subjects without the condition. The test exhibited positive predictive value 73.33% and negative predictive value 96.67%. Summary diagnostic accuracy of 50g GCT is detailed in TABLE III, giving a global accuracy of 91.28 %.

DISCUSSION

The goal of this study was to assess accuracy of the 50-gram glucose challenge test (GCT) for diagnosis of gestational diabetes mellitus (GDM) relative to the gold standard—75-gram standard oral glucose tolerance test (OGTT). 50-gram GCT yielded sensitivity, specificity, PPV, & NPV values to predict GDM (type and/or severity) at 47/55/46/86 respectively, and was also a good predictor for identification of high risk pregnancies. As GDM is on the rise and involves serious maternal and fetal complications, it is of great importance to diagnose this condition as early and accurately as possible, to intervene in a timely manner.

In this study, the diagnosis accuracy (50-gram GCT: 91.28%, sensitivity: 86.84%, specificity: 92.36%, PPV: 73.33%, NPV: 91.28%). The NPV of the test also indicated it is a potentially useful screening test, especially for ruling out GDM. This lower PPV means however that there is a considerable false positive rate leading to some unnecessary confirmatory testing. These results are comparable to previous research. One study reported sensitivity 100%, specificity 80.7%, PPV 27.5%, & NPV 100%, highlighting its strength to rule out GDM but also demonstrating a lower ability to confirm true positives [2]. Akhtar et al. reported sensitivity 85.54%, specificity 93.03%, PPV 75.53%, & NPV 96.27%, closely aligning with this study's findings [8]. In contrast, another study found significantly lower sensitivity and specificity values of 47.8% and 84.2%, respectively, indicating variability in diagnostic performance across populations [9]. Additionally, the sensitivity of the 50-gram GCT for hyperglycemia was reported to drop to 32.6%, while specificity improved to 95.3%, emphasizing its

stronger role as a screening rather than a diagnostic tool [9]. Olagbuji et al. noted sensitivity 76.92%, specificity 89.6%, PPV 52.6%, & NPV 96.2%, further reinforcing the need for confirmatory testing in high-risk populations.

The results support the literature, advocating 50-gram glucose challenge test (GCT) being acceptable screening tool. According to Jani, although a sensitive GDM screening is required to prevent complications, the 50-gram GCT has remained the gold standard test mainly due to its convenience; nonetheless, its accuracy is highly debatable [14]. Abu-Heija et al. [15] and Safdar et al. After which, [16] reported that the test is not specific enough, resulting in significant false-positive rates, and thus, an increased amount of unnecessary OGTT testing. Kumar et al. Concerns about overdiagnosis and unnecessary interventions were also flagged in a study.[17] In contrast, Yadav et al. [18] and De Silva et al. With its better diagnostic performance, the 75-gram OGTT was preferred universal screening method in high-risk populations over the 100-gram equivalent [19]. Furthermore Chandramathy et al. Finally, work by [20] highlighted the importance of uniformity in screening procedures and tested a simplified screening process, advocating for a single 75-gram OGTT to improve the efficiency and reduce unnecessary testing with follow-up OGTTs to confirm a diagnosis of GDM. The findings provide further backing to the case for universal screening to assist in the early identification of these patients who respond poorly to treatment and so may benefit from intensive management.

Despite its strengths, this study had some limitations. The use of non-probability consecutive sampling may have initiated selection bias potentially affecting results generalizability. The reliance on a single cutoff value of 140 mg/dl for both tests may not account for inter-individual variations in glucose metabolism. Additionally, this was a single-center study, limiting its applicability to broader populations. Factors such as dietary habits, genetic predisposition, and physical activity were not accounted for, which may have influenced test performance. Furthermore, the time interval between the 50-gram GCT and the 75-gram OGTT (ranging from three to seven days) could have introduced variations in blood glucose levels, affecting the accuracy of comparisons.

Considering these findings, a two-step screening approach remains a practical strategy, particularly for high-risk pregnancies. Given the moderate specificity of the 50-gram GCT, clinicians should interpret positive results cautiously and ensure timely confirmatory testing with the 75-gram OGTT. Future research should explore the integration of alternative biomarkers, such as HbA1c and fasting insulin levels, to improve GDM screening accuracy. Larger multi-center studies with diverse populations are needed to refine diagnostic criteria and develop standardized screening protocols. Implementing such strategies could enhance early detection and management of GDM, ultimately improving maternal and neonatal outcomes.

CONCLUSION
The findings of the current study show the significant diagnostic accuracy with the 50 g GCT for GDM with fair sensitivity but high specificity. The findings of the current study show the significant diagnostic accuracy with 50 g GCT for GDM with fair sensitivity, but high specificity. The high negative predictive value supports the utilization of this tool as a cost-effective screen, although its moderate positive predictive value mandates confirmatory testing with the 75 gram oral glucose tolerance test. Future research should refine screening protocols to improve early detection and management of GDM, ultimately enhancing maternal and fetal outcomes.

Table I: Characteristics of Study Participants (n=195)	
Variable	**n (%)**
Age (Mean ± SD) = 27.69 ± 4.11	
20-27 years	97 (49.7)
>27 years	98 (50.3)
Body Mass Index (Mean ± SD) = 25.82 ± 3.63	
20-26 kg/m^2	125 (64.1)
>26 kg/m^2	70 (35.9)

Gestational Diabetes on 50gm Glucose Challenge Test	
Positive	45 (23.1)
Negative	150 (76.9)
Gestational Diabetes on 75gm Oral Glucose Tolerance Test	
Positive	38 (19.5)
Negative	157 (80.5)

Table II: Diagnostic Accuracy of GCT and OGCT in Detecting Gestational Diabetes (n=195)

GCT	OGCT	
	Positive	Negative
Positive	33	12
Negative	5	145

Table III: Validity of 50g GCT as a Screening Test for Gestational Diabetes (n=195)

Diagnostic Variables	50gm GCT
Sensitivity	86.84%
Specificity	92.36%
Positive Predictive Value	73.33%
Negative Predictive Value	96.67%
Diagnostic Accuracy	91.28%

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