ORIGINAL ARTICLE

Accuracy of Fasting Blood Sugar Versus Glucose Challenge Test as Screening Test for Gestational Diabetic Mellitus

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ABSTRACT

Objective: To determine the accuracy of fasting blood sugar (FBS**)** and glucose challenge test (GCT), for the diagnosis of gestational diabetes mellitus in pregnant women presenting at tertiary care hospital.
Setting: Department of Gynaecology and Obstetrics at Isra university hospital Hyderabad.
Duration: Six month from February 2017 to July 2017
Design: cross sectional study.
Subject and Methods: A total of 158 pregnant women with suspected gestational diabetes, aged between 18 to 45 years, gestational age of 24-28 weeks as per ultrasound and of either parity were included in this study. After taking history and examination all pregnant women with suspected GDM underwent both tests the blood sugar (FBS**)** and the glucose challenge test (GCT). FBS was performed after 1 hour of 50 mg glucose load in same woman. All information was recorded in predesign proforma.
Results: Overall 158 pregnant females with suspected gestational diabetes were studied their mean age was 34.98±6.64 years, mean FBS was 92.91+10.23 mg/dl and mean GCT was 126.63+18.17 mg/dl. Family history of diabetic mellitus was observed in 56.96%. Gestational diabetes mellitus in 29.11% was detected by FSB >92 mg/dl while 21.52% were detected by GCT >130 mg/dl. Kappa (k=0.734 p=0.0005) statistics showed that there were strong association between FBS and GCT in detection of GDM.
Conclusion: In our study, accuracy of fasting blood sugar (FBS**)** and glucose challenge test (GCT), for the diagnosis of gestational diabetes mellitus in pregnant women was high. However FBS and GCT measurement are adequate methods to screen for GDM.
Key Words: Gestational diabetes mellitus, Fasting blood sugar, Glucose challenge test

INTRODUCTION

Gestational diabetes mellitus (GDM) is a glucose intolerance state with the beginning or initial recognition taking place during pregnancy.[1,2] It exhibits the most frequent pregnancy-associated metabolic complications as feto-maternal mortality and morbidity.[1] For GDM, early diagnosis reduces feto-maternal morbidity and helps to delay or prevent the onset of diabetes type 2.[3] Criteria and position statements are different in terms of recommendations regarding diagnosis of GDM.[4] There are regional differences in methodologies and cut-off for diagnosing GDM according to their community-based requirements.[5] One local study showed WHO criteria as a better guide for GDM diagnosis.[6] Recently, there was another study by Chandna *et al.* suggesting a different cut-off for the glucose challenge test in pregnant subjects.[7] As per different studies, GDM prevalence, ranges from 1 to 14%,[8] and 90% of all diabetes related pregnancies have been estimated to occur because of GDM. A latest study from Pakistan reported a low (< 1%) incidence of GDM.[9] Akhter et al,[10] reported 3.3% incidence among Pakistani females. GDM results in significant and potentially frequent fetomaternal complications such as fetal macrosomia, polyhydramnios, preeclampsia, operative delivery, birth trauma, metabolic complications among neonates and perinatal mortality. The most common risk factor of GDM is family history.[11] Diabetes and obesity development during childhood in descendants and later maternal diabetes development are also associated with GDM. Thus, early diagnosis and precise screening of this medical condition is highly significant for prompt intervention that ensure a suitable pregnancy outcome.[12] Moreover, there is some new evidence in literature, which has not shown 50-g GCT as a better investigative modality and has recommended alternative screening modalities including the plasma glucose fasting application as screening test for the diagnosis of GDM.[13,14] Therefore present study aimed at determining the accuracy of fasting blood sugar (FBS) V/S glucose challenge test (GCT), after 1 hour of oral glucose dose at 50-g to early diagnose the gestational diabetic mellitus, this study will help to decrease the risk of GDM in subsequent pregnancies. If technique will shows as a good accuracy was recommended for adaptation in future for diagnosis of gestational diabetes.

MATERIAL AND METHODS

Setting: This study was conducted at department of Gynaecology and Obstetrics at Isra university hospital Hyderabad.
Study Design: Cross sectional study.
Duration of Study: Six month from February 2017 to July 2017
Sample Size: By using WHO sample size calculator taking accuracy of FBS at 11.6%, margin of error at 5% and confidence of interval at 95%, sample size was 158.

SAMPLE SELECTION

Inclusion Criteria:

1. Age between 18 to 45 years
2. All pregnant women with suspected gestational diabetes e.g family history of diabetes, previous bad obstrictical history, or polyhydroamnias on ultrasound scan. In whom 2 or 3 symptoms were present, were included.
3. Gestational age between 24 to 28 weeks assessed by ultrasound
4. Both primipara and multipara women

Exclusion Criteria:-

1. All pregnant women who have preexisting diabetes, hypertension asthma or with other chronic element, conformed by medical history and previous lab investigations.
2. Patients with other Endocrinological disorders such as Cushing syndrome, PCOs, conformed by medical history and previous lab investigations
3. Women who do not want to take part in study

Data collection procedure: Informed and written consent was taken, details of women was recorded on pre designed proforma in outpatient department in Isra university hospital. The permission for this work has been taken from ethical committee of CPSP After taking history and examination of all pregnant women with suspected GDM underwent both tests the blood sugar (FBS**)** and the glucose challenge test (GCT). FBS was performed after 1 hour of 50 mg glucose load in same woman. To decrease the chance of bias proper history regarding Age, parity, past history of diabetes mellitus or GDM or family history of diabetes and history of PCOs or Cushing syndrome was taken. Fasting blood sugar (FBS) value greater than 92mg/dl was considered positive for diagnosis of (GDM). Glucose Challenge test (GCT) defined as, the measurement of blood Glucose value by peripheral blood smear, one hour after ingestion of 50gm glucose and value > 130mg/dl was considered positive for diagnosis of (GDM). Attention was also given to clinical Examination and laboratory tests levels of FBS and GCT between 24th to 28thweeks pregnancy. All the data was recorded using the study proforma.

Data Analysis Procedure: Data analysis was conducted by SPSS 17 version. The mean and standard deviation with standard errors of mean±SD was evaluated for quantitative variables such as age, blood sugar fasting value and blood sugar by GCT value, gestational age, height and weight and BMI. Frequency and percentage was calculated for parity, resident, family history, BSF > 92 mg/dl blood sugar by GCT >130mg/dl and accuracy. Kappa test was applied and a P value less than or equal to 0.05 was taken as significant.

RESULTS

Overall 158 pregnant females with suspected gestational diabetes were studied. The mean age of the patients was 34.98±6.64 years, mean FBS was 92.91+10.23 mg/dl and mean GCT was 126.63+18.17 mg/dl. Table.1

Out of 158 cases, 56.33% were from urban and 43.67% from rural. There were 29.11% primiparous women and 70.89% were multiparous. Family history of diabetic mellitus was observed in 56.96% (90/158) cases. Table.2

Gestational diabetes mellitus in 29.11% (46/156) was detected by FSB >92 mg/dl while 21.52% (34/156) were detected by GCT >130 mg/dl. Kappa (k=0.734 p=0.0005) statistics showed that there were strong agreement between FBS and GCT in detection of GDM as shown in table 3.

Accuracy of FBS and GCT, for GDM diagnosis in pregnant females was 89.67% as shown in figure 3. Stratification analysis was performed and observed that accuracy and kappa value was high for 21 to 30 years and above 40 years of age groups, while it was low for 31 to 40 years of age. Similarly high accuracy was also observed with respect to gestational age, BMI, parity, residence and history of diabetic mellitus. Table 3.

Table 1. Descriptive Statistics of Characteristics of Patients n=158

Variables	Mean		95% Confidence Interval for Mean		Median	Inter quartile Range
		Std. Deviation	Upper Bound	Lower Bound		
Age (Years)	34.98	6.64	36.03	33.94	35	11
Gestational Age(Wks)	26.75	1.29	26.95	26.54	27	2
BMI (kg/m^2)	26.89	3.91	27.51	26.28	26.89	4.84
FBS (mg/dl)	92.91	10.23	94.527	91.309	92.5	13.0
GCT (mg/dl)	126.63	18.17	129.49	123.78	124	10

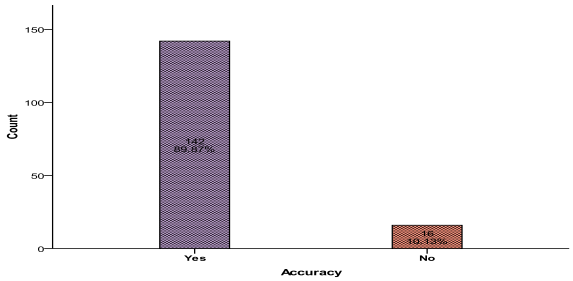
Table 2. Patients distribution according to residence, parity and Family history of DM n=158

Parameters	Frequency(%)
Residence	
Rural	69(43.67%)
Urban	89(56.33%)
Total	158(100.0%)
Parity	
Primiparous	46(29.11%)
Multiparous	112(70.89%)
Total	158(100.0%)
Family history of DM	
Primiparous	90(58.96%)
Multiparous	68(43.04%)
Total	158(100.0%)

Table 3. Comparison of Test in Detecting Of Gestational Diabetic Mellitus

GDM BY FBS	GDM BY GST		Total
	Positive GST>130 mg/dl	Negative GST≤130 mg/dl	
Positive (FBS>92mg/dl)	32(20.3%)	14(8.9%)	46(29.1%)
Negative (FBS ≤ 92mg/dl)	2(1.3%)	110(69.6%)	112(70.9%)
Total	34(21.5%)	124(78.5%)	158
All percentages were computed by 158. Kappa = 0.734 p=0.0005			

Figure. 1. Accuracy Of Fasting Blood Sugar (Fbs) And Glucose Challenge Test (Gct), For The Diagnosis Of Gestational Diabetes Mellitus In Pregnant Women n=158



Accuracy = 142 /158 = 89.87%

Table 3. Comparison of gestational diabetic mellitus by FBS and GST with respect to BMI

BMI	GDM BY FBS	GDM BY GST		Total	Accuracy	Kappa	P-Value
		Positive	Negative				
Normal	Positive Negatives Total	4(6.7%) 2(3.4%) 6(10.2%)	5(8.5%) 48(81.4%) 53(89.8%)	9(15.3%) 50(84.7%) 59	88.1%	0.46	0.0005
Overweight	Positive Negatives Total	23(32.4%) 0(0%) 23(32.4%)	6(8.5%) 42(59.2%) 48(67.6%)	29(40.8%) 42(59.2%) 71	91.5%	0.82	0.0005
Obese	Positive Negatives Total	5(17.9%) 0(0%) 5(17.9%)	3(10.7%) 20(71.4%) 23(82.1%)	8(28.6%) 20(71.4%) 28	89.3%	0.70	0.0005

DISCUSSION

Gestational diabetes mellitus (GDM) is a glucose intolerance of any extent with initial recognition in the course of pregnancy and is correlated with raised risk of numerous adverse maternal and perinatal outcomes. [122,123] Adverse perinatal outcomes involve macrosomia causing raised shoulder dystocia risk, neonatal hypoglycemia, and necessitating neonatal intensive care [124]. GDM associated maternal complications lead to raised risk of pre-eclampsia and C-section delivery.

Moreover, females with GDM are at 60% risk of type 2 diabetes mellitus (T2DM) development within five to fifteen years after delivery, and the children prenatally uncovered to diabetes mellitus have been suggested to have a raised risk of T2DM development in their later life. [124, 125] A number of studies reported significant lessening of these unfavorable outcomes, by proper and timely interventions undertaken for prompt diagnosing and maintaining satisfactory hyperglycemia control during pregnancy. [122, 124] The milestone study of Hyperglycemia and Adverse Pregnancy Outcome (HAPO) and in addition several other research articles including the Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) had revealed maternal hyperglycemia to be less severe as compared to that of overt diabetes, which was associated with clinically significant perinatal problems or disorders and that their impacts can be lowered through treatment. [126, 127] Hence, the methods applied in GDM diagnosis must have greater sensitivity for the detection of even GDM's milder cases.

In current study the patients' mean age was 35±7 years. Herath et al [16] documented relatively old pregnant females with 31±7 years of mean age. Several studies have reported fasting GCT with 140 mg/dl of cutoff value in GDM diagnosis [122, 128, 129]. Professional bodies such as Sri Lankan Obs & Gynea College and Diabetes in Pregnancy Study Group of India (SCOG and DIPSI respectively) have suggested non-fasting GCT for GDM diagnosis.[130, 131]. However, there was no comparison made between GCT and standard GTT in these studies and the justification of cutoff values were based on equal incidence of macrosomia among GDM and non-GDM groups; equal incidence was taken into consideration because of GDM's appropriate identification and management. However, incidence of macrosomia as a surrogate indicator for GDM diagnosis is inaccurate because several factors such as treatment with successful outcome can perplex the macrosomia prevalence. Several other studies reported that GCT has poor sensitivity for GDM diagnosis. [132,133]. A recent Indian ethnicity based study reported that non-fasting GCT has a sensitivity lower than IADPSG criteria (22.6 % sensitivity, 97.8 % specificity) [134].Other South Asia ethnicity-based studies, in addition to Caucasians, have reported that 50 and 75-grams GCT have poor sensitivity [132, 135].

In present study gestational diabetes mellitus was 29.11% (46/156) detected by FSB >92 mg/dl while 21.52% (34/156) were detected by GCT >130 mg/dl. Kappa (k=0.734 p=0.0005) statistics showed that there were strong association between FBS and GCT in detection of GDB. Accuracy of FBS and GCT, for the diagnosis of GDM in pregnant females was 89.67%. Mohan V et al [134] reported 40% sensitivity of GCT, which is far lower than acceptable range to be used as a tool for screening. GCT missed nearly 60% cases, and also gave a false positive diagnose in around 33% of cases as GDM. All of these detected GDM cases (33%) would unnecessarily be submitted to further examination and intervention such as modification in diet. By looking at the incidence of GDM, the extent of suggesting and implementing false test could be explained. An earlier research carried out at a tertiary care center revealed an astonishingly higher incidence of

GDM (22%) in pregnant Sri Lankan females [134]. The major explanation of GCT preferred over GTT can be ease of usability of the non-fasting GCT. Non-fasting GCT supporters claim that GTT is very difficult to implement in antenatal clinical context and will also lead to substantial low turnover, because pregnant females need to fast overnight. Earlier research showed strong compliance of pregnant females to GTT when encouraged [134]. In the HAPO report, FBS alone at around 92 mg / dl identified 8.3% of GDM cases in HAPO population. In comparison to the threshold of 1 hour at 180 mg / dl, further 5.7% individuals who didn't have a raised fasting value were detected and a further 2.1% of individuals were detected by the threshold of 2 hour at 153 mg / dl [136]. SCOG suggestions regarding GDM diagnosis and screening are comparable to DIPSI, which include 75 gm GCT with 140mg/ dL of cutoff value regardless of the state of fasting [131]. Although there are potential benefits like convenience and simplicity to implement, because it does not need fasting of pregnant females, this approach has still not been approved for local communities as benchmark.

CONCLUSION

In our study accuracy of fasting blood sugar (FBS**)** and glucose challenge test (GCT), for the diagnosis of gestational diabetes mellitus in pregnant women was high so we concluded that FBS and GCT measurement is an adequate method to screen for GDM. It should be recommended for adaptation in future for diagnosis of gestational diabetes.

REFERENCES

1. Metzger BE, Buchanan TA, Coustan DR, de Leiva A, Dunger DB, Hadden DR, et al. Summary and recommendations of the fifth international workshop-conference on gestational diabetes mellitus. Diabetes Care 2007;30:S 251.
2. Jovanovic L, Pettitt DJ. Gestational diabetes mellitus. JAMA 2001;286: 2516-18.
3. Mogibian M, Rahimi-Saghand S, Rashidi M, Soheilykhah S, Piroz M. Incidence of gestational diabetes mellitus in pregnant women. Sedigheh Soheilykhah1M.D. Iranian JRM 2010;8;1:24-28.
4. Mello G, Elena P, Ognibene A, Cioni R, Tondi F, Pezzati P, *et al.* Lack of concordance between the 75-g and 100-g glucose load tests for the diagnosis of gestational diabetes mellitus. Clin Chem 2006;52:1679-84.
5. Silva JK, Kaholokula JK, Ratner R, Mau M. Ethnic differences in perinatal outcome of gestational diabetes mellitus. Diabetes Care 2006;29:2058-63.
6. Asma S, Arain TM, Sumbul A, Mahmud R. Criteria for detecting gestational diabetes mellitus: national diabetes data group versus World Health Organization. J Coll Physicians Surg Pak 1999;9:211-4.
7. Chandna A, Zuberi LM, Munim S. Threshold values for the glucose challenge test in pregnancy. Int J Gynaecol Obstet 2006;94:119-20.
8. American Diabetes Association. Gestational Diabetes Mellitus. Diabetes Care 2004;27:88-90.
9. 9: Jawa A, Raza F, Qamar K, Jawad A, Akram J. gestational diabetes mellitus is rare in primigravida Pakistani women. Indian J Endocrinol Metab 2011;15:191-3.
10. Ahkter J, Qureshi R, RahimF, Moosvi S, Rehman A, JabbarA et al, Diabetes in pregnancy in Pakistani women: prevalence and complications in an indigenous south Asian community. Diabet Med 1996;13:189-91.
11. Jalil f. Gestational diabetic mellitis selective versis univaersl screening. Pakistan J surg 2009;25;4;290-94
12. Ferrara A, Hedderson MM, Quesenberry CP, Selby JV. Prevalence of gestational diabetes mellitus detected by the National Diabetes Data Group or the Carpenter and Coustan plasma glucose thresholds. Diabetes Care 2002;25: 1625.
13. Montagnana M, Lippi G, Targher G, Fava C, Guidi GC. Glucose challenge test does not predict gestational diabetes mellitus. Intern Med 2008;47:1171-4.
14. Lanni S, Barrett D. The predictive value of the 1-hr 50-g glucose screen for diagnosing gestational diabetes mellitus in a high-risk population. J Matern Fetal Neonatal Med 2004;15:375-9.
15. Metzger BE, Coustan DR. Summary and recommendations of the Fourth International Workshop-Conference on Gestational Diabetes Mellitus. The Organizing Committee. *Diabetes care.* 1998;2:B161-167.
16. Holt RI: The Hyperglycemia and Adverse Pregnancy Outcomes trial: answers but still more questions about the management of gestational diabetes. *Diabetic medicine: J British Diabetic Association.* 2008;25(9):1013-14.
17. Group HSCR: Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study: associations with neonatal anthropometrics. Diabetes. 2009;58(2):453-59.
18. Maresh M: Screening for gestational diabetes mellitus. Seminars in fetal & neonatal medicine. 2005;10(4):317-23.
19. Group HSCR, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, Hadden DR, McCance DR, Hod M et al: Hyperglycemia and adverse pregnancy outcomes. The New England J medicine. 2008;358(19):1991-2002.
20. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS, Australian Carbohydrate Intolerance Study in Pregnant Women Trial G: Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. The New England J medicine. 2005;352(24): 2477-86.
21. Virally M, Laloi-Michelin M: Methods for the screening and diagnosis of gestational diabetes mellitus between 24 and 28 weeks of pregnancy. Diabetes & metabolism.2010;36(6 Pt 2):549-65.
22. Sharma K, Wahi P, Gupta A, Jandial K, Bhagat R, Gupta R, Gupta S, Singh J: Single glucose challenge test procedure for diagnosis of gestational diabetes mellitus: a Jammu cohort study. J Association of Physicians of India. 2013;61(8):558-59.
23. Seshiah V, Sahay BK, Das AK, Shah S, Banerjee S, Rao PV, Ammini A, Balaji V, Gupta S, Divakar H et al: Gestational diabetes mellitus--Indian guidelines. J Indian Medical Association. 2009;107(11):799-802.
24. Goonewardene M, Dias T. Antenatal care: paradigm changes over the years. The Ceylon Medical J. 2013;58(2): 47-50.
25. vanLeeuwen M, Louwerse MD, Opmeer BC, Limpens J, Serlie MJ, Reitsma JB, Mol BW: Glucose challenge test for detecting gestational diabetes mellitus: a systematic review. BJOG. 2012;119(4):393-401.
26. Crete JE, Anasti JN: Diagnosis of gestational diabetes mellitus: can we avoid the glucose challenge test? J American Association of Nurse Practitioners. 2013;25(6):329-33.
27. Mohan V, Mahalakshmi MM, Bhavadharini B, Maheswari K, Kalaiyarasi G, Anjana RM, et al. Comparison of screening for gestational diabetes mellitus by oral glucose tolerance tests done in the non-fasting (random) and fasting states. Actadiabetologica. 2014.
28. Montagnana M, Lippi G, Targher G, Fava C, Guidi GC. Glucose challenge test does not predict gestational diabetes mellitus. Internal Medicine. 2008;47(13): 1171-74.
29. Hansarikit J, Manotaya S: Sensitivity and specificity of modified 100-g oral glucose tolerance tests for diagnosis of gestational diabetes mellitus. Journal of the Medical Association of Thailand = Chotmaihetthangphaet. 2011;94(5):540-544.