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Original article

Interpretation of Modified Glucose Tolerance Test among Pregnant Malaysian Women

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Abstract

Aim: Is to find the mean and two standard deviation of the serum blood sugar among pregnant women while running the modified oral glucose tolerance test (MOGTT) as screening for gestational diabetes mellitus (GDM) & to compare the readings with other protocols adopted in diagnosing GDM. ***Method:*** A cross sectional study among pregnant women running routine MOGTT at 24-28 weeks' gestation. A total of 149 women participated in 4 months period. The test included 5 ml of venous blood sample taken after fasting for 8 hours and a second blood sample 2 hours after having 200 ml of 75 g glucose solution within 10 minutes. ***Results:*** The mean for the fasting blood sugar is 4.32 mmol/L±0.52 making value of 2SD of 5.36 mmol/l. The mean of the 2 hours glucose level was 6.11mmol/l±1.38 making the 2SD value of 8.87 mmol/l. ***Conclusion:*** Our results for the 1st reading in MOGTT is near to the value of the local protocol in diagnosing GDM. The 2 hours postprandial reading in the local protocol is fairly low when compared with our findings & with guidelines of nearby communities.

Keywords: ***MOGTT, GDM, screening protocol, pregnancy, Malaysia.***

Introduction

Gestational diabetes Mellitus (GDM) is a common complication of pregnancy. It is generally known as glucose intolerance that is first detected during pregnancy resulting in hyperglycaemia [1], which causes complications in 10% of pregnancies [2,3]. Among hyperglycaemic cases in pregnancies; the majority is GDM but some have overt diabetes Mellitus (DM) or pre-existing type 1 or type 2 DM. [4].

Gestational diabetes are associated with a wide spectrum of complications that affects the mother and the foetus. Associated complications include macrosomia, polyhydramnios, intrauterine death, increase obstetrical interventions as induction of labour, increase in instrumental deliveries, shoulder dystocia, caesarean section, and much more [5].

Diagnosing GDM is still a subject of controversy; there are no universal trusted reference values for the diagnosis. The cut off values depend basically on the O`Sallivan and Mahan study. O`sullivan took the 2-standard deviation (SD) above the mean for 752 pregnant women in their late 2nd and early 3rd trimesters (fasting: 5.00 mmol/L, 2h: 8.1 mmol/L). The value was validated by 20 years follow up and he concluded that 20% of women will develop diabetes within the first 8 years and 50% within 20 years [6]. The blood samples that had been used were venous whole blood, this was the case until 1982 were Carpenter made a new study using the plasma to analyse blood glucose by the enzymatic method, this method is still in use today [7]. The results of the study were higher than O`sullivan's readings (fasting: 5.27 mmol/L, 2h: 8.61mmol/L). The International Association of Diabetes in Pregnancy Study Group recommended a new strategy for identifying gestational diabetes in 2010 [8]. This depends on Hyperglycaemia and Adverse Pregnancy Outcome study which is validated by the perinatal outcome, it recommended 5.1 mmol/L for fasting and 8.5 for 2h after 75g oral glucose [8]. The American Congress of Obstetrician and Gynaecologist reported its own guidelines in GDM [9] and the Canadian diabetes association had done its own work too [10]. This variation might reflect a wide range of guidelines adopted by different entities. Taking in consideration previous variation among different recommendations throughout the world, the WHO (2013) recommendation for diagnosing gestational diabetes includes a wide range in the reference values for diagnosis, a fasting plasma glucose of 5.1-6.9mmol/L, one hour after 75g glucose ≥ 10mmol/L and two hours of 8.5-11 mmol/L [11]. The recent Malaysian guidelines adopted the fasting blood sugar value from the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study [12] but maintaining the 2 hours 75 mg value from previous guideline. The guidelines came up with a fasting blood glucose of 5.1mmol/L and two hours postprandial (2HPP) of 75g glucose of more than 7.8 mmol/L as criteria of diagnosing GDM [13].

An important factor to be taken into account is the racial difference [14,15,16] in which the values that could be meaningful in one community might not fit other communities. Racial differences were noticed with lipid profile in some studies in Malaysia, the

same difference might exist for blood sugar [17]. It is mandatory for each community to get an idea about the best values to be adopted in their population.

In general, medical institutes began to adopt the 2-SD of the blood sugar readings in a survey study to nominate the blood sugar level as abnormal along with following up their cases for future possibility of developing overt diabetes. The studies in recent advances are evaluating the pregnancy outcome to amend the old cut-off points. A multicentre study may mask the bias of racial differences. It is more convenient to run a national study that is more compatible to each community sharing race, nutritional habits, and attitudes. Such studies can increase the sensitivity of the screening test for GDM and avoid over diagnosis with unnecessary follow-ups, or under diagnosing with increasing complications.

The criteria used to diagnose GDM influences its prevalence, based on systematic review, the prevalence of GDM is 10.6% [18]. Similar prevalence of GDM is observed in South East Asian (1 in 10 women) [19]. Prevalence in United State is 7.6%, Europe is 5.4% [20,21]. Until today, there is no universal criteria to diagnose gestational diabetes due to many confounders like environmental, racial, genetic differences, and nutritional habit. Diagnostic criteria need to be tailored for each community, as it is the case with modified foetal growth charts [22].

Over diagnosis of GDM leads to an increased burden to the health care system in term of workload and rate of induction of labour (IOL), CS and health costs, along with increasing anxiety, cost of follow up, and cost of home monitoring on patients.

Screening programs should be sensitive, specific, cost effective, easy, safe, and with a clear policy for diagnosis and treatment [23]. Although there are many screening programs for diabetes adopted by medical institutions, the 2 readings (fasting/2 hours postprandial) glucose tolerance is still the most widely used [24,25].

Objective

The objective of the study is to find the mean and the two standard deviations in Malaysian population while running the screening for gestational diabetes by using the modified oral glucose tolerance test (MOGTT).

Materials and Methods

A cross sectional study was done at primary care centre clinic, at which women were counselled about acceptance for participation in the study. All women with risk factor/s for developing GDM ran a routine modified glucose tolerance (MOGTT) at 24-28 weeks gestation. Women with no risk factors were counselled also to run the test for the sample to represent the real community not only the risk group and for the benefit of randomisation. All women attending the clinic in 4 months period were counselled to participate in the study with a total of 149 women. Patients with diabetes mellitus were not included in the study population as it is unethical to run the test on them. This exclusion might affect our readings. However, the prevalence of overt diabetes at the reproductive age is 2.4% [26].

After getting consents, their demographic data were obtained and screening for gestational diabetes was done by using MOGTT. The test included 5 ml of venous blood sample taken after fasting for 8 hours and a second blood sample 2 hours after having 200 ml of 75 g glucose solution within 10 minutes. Patients were instructed not to eat, drink, or perform heavy exercise between the two samples. The data was analysed by using the SPSS v.23 by obtaining the normal distribution curve for both readings to get the mean blood sugar for the fasting period (FBS) and the 2 hours postprandial (2hpp). The two standard deviation was obtained using the same system. Descriptive values obtained for the demographic data presented by the mean and standard deviation as well. The 2 tailed Pearson correlations were applied to obtain the significance between different variables.

Results

Table 1 shows the mean and standard deviation of the different variables in our studied population. The average weight gain was 9.99Kg±SD=4.28.

Table 1: Demographic measures for the studied sample

Variables	Mean	SD
Age (Years)	27.59	4.13
BMI at booking (Kg/m2)	24.55	5.41
BMI at term (Kg/m2)	28.5	5.11
Hb (g/dl)	11.63	1.05
FBS (mmol/l)	4.32	0.52
2hPP (mmol/l)	6.11	1.38
Baby weight (Kg)	3.09	0.48

Both FBS 1 and 2hpp showed a normal distribution curve (Figure no. 1, no. 2). The mean for the fasting blood sugar is 4.32 mmol/L±0.52 making value of 2SD of 5.36 mmol/L. The mean of the 2 hours glucose level was 6.11mmol/l±1.38 making the 2SD value of 8.87mmol/L.

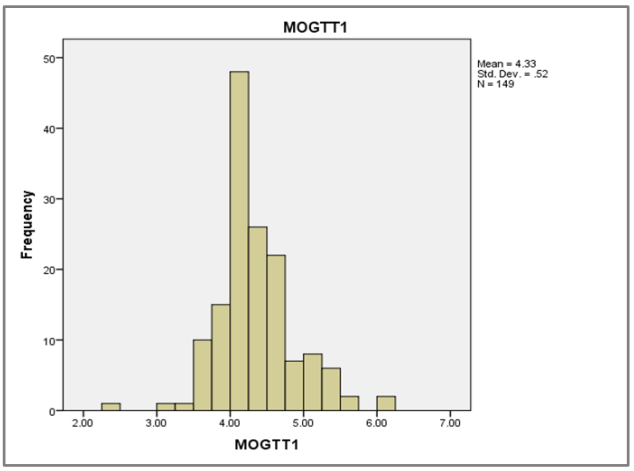

Figure 1: Normal distribution curve of the fasting blood sugar.

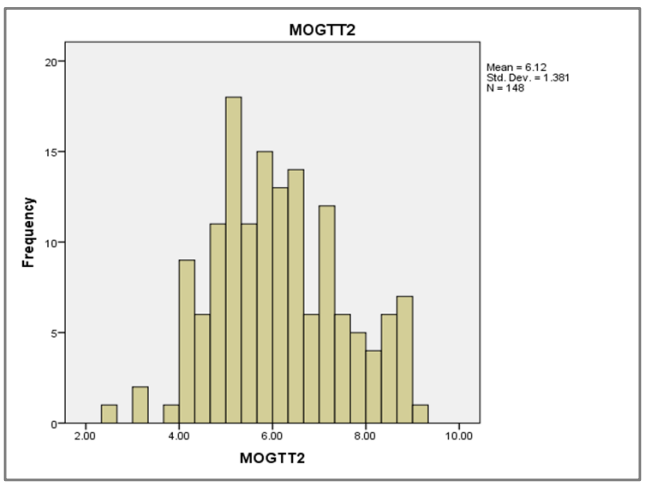

Figure 2: Normal distribution curve of the two hours postprandial blood sugar readings.

Table 2: Incidence of GDM in the studied sample according to different diagnostic guidelines

	Fasting in mmol/L	2 hpp in mmol/L	Incidence of GDM
Mean ± 2SD	≥5.36	≥8.87	6.41%
Malaysia	≥5.1	≥7.8	21.14 %
Singapore/ Australia/China	≥5.1	≥8.5	18.46%
Canadian	≥5.3	≥9	7.38%
UK	≥5.6	≥7.8	14.09%

Table 2 shows the incidence of GDM when it is calculated using different cut-off points according to guidelines.

Discussion

During our study, we explored our community blood sugar values while doing routine screening in the late second trimester. The fasting blood sugar showed a mean of 4.32 mmol/l with a SD of 0.52. The cut-off point according to the mean +2-SD = 5.36 mmol/l. We are considering our cut-off point as 5.43 mmol/l according to O`Sullivan criteria in calculated the abnormal value to diagnose GDM. Most of the previous works and guidelines recommended a fasting reading ranging 5.00 - 5.80 mmol/L apart from the world health organization (WHO) which gives a wide range for fasting value, up to 7 mmol/L [7,9,11,12,27]. Malaysian guidelines recommended fasting blood sugar of ≥ 5.1 mmol/l. This reading is lower than the mean +2 SD of the population calculated value [13]. It might over diagnose but somehow increases the sensitivity of the test in view of high prevalence of GDM in South East Asia [18].

Fasting plasma glucose level decreases by 0.5 mmol/L by the late first trimester and the early second trimester. It remains static in the second trimester and declines again in third. Diagnostic test using FBS that is done in early pregnancy would over-diagnose GDM [28]. Researchers suggested to use higher cut-off point for FBS 6.1-6.9 mmol/L in first trimester to diagnose GDM, taking into account the physiological changes in pregnancy [29]. This point of view was suggested as some women with risk factors to develop GDM could benefit from the early diagnostic test. The earlier the foetus is exposed to hyperglycaemia (during organogenesis), the more severe the consequences [30]. However, FBS ≥ 5.1 mmol/L is generally accepted as hyperglycaemia in pregnancy regardless of trimesters [12].

Postprandial levels are usually higher in pregnant women as compared to the non-pregnant [31]. The 2hpp blood sugar level showed a mean of 6.11 mmol/L with a SD of 1.38. The cut-off point for the 2hpp according to the mean +2-SD = 8.87 mmol/L. We are considering our cut-off point as 8.87 mmol/L according to O`Sullivan criteria in calculated the abnormal value to diagnose GDM. The range of two hours postprandial in most references is between 8-9 mmol/L apart from WHO & UK, which gives a value, as low as 7.8 mmol/L [11,12,18,32]. Our reading for the 2hpp reflects a harmony with other guidelines that adopt two hours postprandial glucose reading between 8-9 mmol/L.

Malaysian guidelines is following the WHO criteria of 7.8 mmol/L for the 2 hours reading in diagnosing GDM. It is considered the lowest among the guidelines if compared with other countries in the same geographical area [29,33]. To modulate this value, we need to run further studies exploring the complications associated with adopting higher reference numbers as cut-off point; This would decrease the cost and burden on patients & medical institutions in case we are over diagnosing GDM.

Table 2 shows the incidence of GDM in our studied population using the criteria of different guidelines [10,13,32,34,35,36]. A wide spectrum of incidence ranges from 6-21% can be noticed in table 2. We think; it is difficult to establish a universal cut off point for MOGTT test values. This might be explained by the existence of different confounders like genetic, racial, dietary habits…etc. Test should be tailored on each region or community that is sharing the same environment, which include the race, life style dietary habits.

In our study, the incidence of GDM is 6.04% while it is 21.14% according to the Malaysian guidelines in the studied population. We think that; this difference is due to the fact that Malaysian guideline has adopted international cut off point in diagnosing GDM rather than a community-based study. We recommend a larger community survey covering whole Malaysia for more accurate results keeping in view to keep reasonable sensitivity of our tests.

Conclusion

In our studied community; the mean + 2SD of fasting blood sugar during MOGTT is 5.36 mmol/L, which is near to the values adopted by many nearby countries. However, our 2 hpp value which is 8.87 mmol/L which is considered as high compared to other universal guidelines.

Study Limitation

The sample size are relatively small for a community survey study.

Precise

The purpose of the study is to compare the blood sugar reading of the MOGTT and its compatibility with the regional protocols.

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