Original Article

Combining the IADPSG criteria with the WHO diagnostic criteria for gestational diabetes mellitus optimizes predictability of adverse pregnancy outcome

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is associated with adverse pregnancy outcomes, yet there are no universally accepted diagnostic criteria for GDM. The International Association of Diabetes in Pregnancy Study Group (IADPSG) and World Health Organization's (WHO) diagnostic criteria are commonly used criteria, although clinical outcome data of diagnostic performance of these diagnostic criteria are limited. This study examines the IADPSG and WHO criteria for predicting adverse pregnancy outcomes.

Materials and Methods: This longitudinal study involved 130 pregnant women who underwent Oral Glucose Tolerance Testing (OGTT) during 24–32 weeks of gestation. Fasting, 1-hour and 2-hour glucose were measured. Participants were classified as GDM and non-GDM women based on the IADPSG and WHO diagnostic criteria. Five pregnancy outcomes were observed, namely, pre-eclampsia, shoulder dystocia or birth injury, birth weight ≥4.0 kg, clinical neonatal hypoglycaemia and birth asphyxia.

Results: Twenty-eight participants (21.5%) had GDM by the IADPSG criteria (GDM_{IADPSG}) and 21 (16.2%) women had GDM by the WHO criteria (GDM_{WHO}). Only 15 women (11.5%) met the criteria for GDM by both criteria. The association of GDM with macrosomia was stronger in GDM_{WHO} women [Odds ratio (OR) =13.1, 95% confidence interval (CI) = 3.4–50.6] compared to the GDM_{IADPSG} women (OR = 5.3, 95% CI 1.5–18.9). Macrosomia or at least one adverse outcome were more likely in GDM patients who met the diagnostic criteria by both the IADPSG and WHO criteria (P = 0.001).

Conclusion: A diagnosis of GDM that meets both the WHO and IADPSG criteria provides stronger prediction for adverse pregnancy outcome than a diagnosis that meets only WHO or IADPSG criteria.

Key words: Gestational diabetes mellitus; macrosomia; oral glucose tolerance test; pregnancy outcome.

Introduction

Gestational diabetes mellitus (GDM) occurs in 2–14% of pregnancies and may lead to adverse outcomes for both the mother and her fetus.[1,2] Correct and prompt diagnosis of this condition is crucial for the institution of a proper management plan that can improve the outcome for both the expectant mother and her unborn child.

The diagnosis of GDM has remained controversial. Conventional diagnostic approach involves the use Oral Glucose Tolerance Test (OGTT). The diagnosis is made when a number of glucose values at different time points are

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Access this article online	
Website: www.tjogonline.com	Quick Response Code
DOI: 10.4103/0189-5117.192221	

How to cite this article: Imoh LC, Ogunkeye OO, Isichei CO, Gadzama AA, Ekwempu CC. Combining the IADPSG criteria with the WHO diagnostic criteria for gestational diabetes mellitus optimizes predictability of adverse pregnancy outcome. Trop J Obstet Gynaecol 2016;33:185-9.

met or exceeded. Because of a lack of consensus, several diagnostic criteria have been set and discarded. Diagnostic criteria differ in the amount of glucose load, number of time points required, the cut-off values for the time points and the number of abnormal values required to make a diagnosis.[3,4] Clinicians are often guided by national guidelines as obtained from the recommendations of local diabetic or obstetrics associations. The world health organization (WHO) diagnostic criteria is also commonly used.[5]

WHO in 1999 recommended that the diagnosis of GDM should be made with fasting glucose level of ≥7.0 mmol/L and/or 2-hour glucose of ≥7.8 mmol/L, following a 75-g glucose load OGTT.[5] Studies have shown that mild degrees of hyperglycaemia can result in maternal and neonatal complications.[6-9] This has raised concern regarding the glucose values used as cutoff in older diagnostic criteria such as that of the WHO. In some reports, it has been suggested that the current OGTT cutoff values may be too high.[10,11] Over the last three decades, many studies have been conducted for establishing how best to categorize patients with hyperglycaemia in pregnancy.[2,10] The Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) study and the Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) are notable among such studies.[12-15] The findings from these studies have led to the development of a revised approach to the diagnosis and management of hyperglycemic disorders in pregnancy. These approaches were summarized in a consensus statement of the International Association of Diabetes in Pregnancy Study Groups (IADPSG) in 2008.[13] A fasting glucose of ≥5.1mmol/L, ≥10.0 mmol/L at 1 hour or ≥8.5 mmol/L after 2 hours post 75-g glucose load would be considered as GDM.[13]

In 2010, American Diabetes Association (ADA) adopted the diagnostic criteria suggested by the IADPSG.[2,16,17] This represents a downward revision from the pre-2010 diagnostic criteria and is still used as one of the recommended diagnostic criteria for GDM in the ADA's more recent position statement.[18]

There are no consensus diagnostic criteria for the diagnosis of GDM in Nigeria. Different guidelines continue to be used for diagnosing and managing GDM and hyperglycaemic disorders in pregnancy with varying results.[19,20] The IADPSG guidelines have not been well-tested in different populations particularly in comparison with the existing paradigm. This study examines the WHO and the IADPSG criteria in the light of pregnancy and perinatal outcomes.

Materials and Methods

This was a prospective study at our teaching hospital involving 130 pregnant women who were referred to the metabolic unit of the chemical pathology department to be tested for GDM between July 2012 and March 2013. A 75-g OGTT was performed on each woman during 24–32 weeks of gestation. Blood specimens were collected to measure fasting serum glucose, 1-hour and 2-hour serum glucose. Serum glucose was analysed on the Roche/Hitachi 902 automatic analyzer. The women were classified as gestational diabetics and non-gestational diabetic according to the WHO and IADPSG diagnostic criteria. Five pregnancy outcome parameters were observed during the ongoing pregnancy and at delivery. These included pre-eclampsia, shoulder dystocia or birth injury, birth weight ≥4.0 kg, clinical neonatal hypoglycaemia and birth asphyxia. Women with multiple gestation, very low birth weight (<2.5 kg), deliveries at <29 weeks or >41 weeks, medical conditions such as thyroid disorders, human immunodeficiency virus, and sickle cell anaemia were excluded from the study.

The data were compiled on excel® spread sheet and analysed using the Statistical Package for Social Sciences (SPSS Incorporated, Chicago, USA, Version 15.0) software. The association between GDM and pregnancy outcomes was tested by univariate analysis, and then multiple logistic regression analysis where confounding variables including GDM, hypertensive disorder, maternal age, maternal obesity, family history of diabetes mellitus, sex of the baby, estimated gestational age (EGA) at OGTT, age at delivery, previous macrosomia and parity were controlled. A *P* value of <0.05 was considered to be statistically significant.

The study was conducted after due approval from the ethics committee of our hospital (Ethical Approval reference: DCS/ADM/127/XIX/5105), and written consent was obtained from the participants.

Results

One hundred and thirty pregnant women were selected for this study. After an OGTT, 28 (21.5%) and 102 (78.5%) of the women were classified as gestational diabetic (GD_{IADPSG}) and non-gestational diabetic (NGD_{IADPSG}) respectively using the IADPSG criteria, whereas 21 (16.2%) and 109 (83.8%) were classified as gestational diabetic (GD_{WHO}) and non-gestational diabetic (NGD_{WHO}) respectively by the WHO diagnostic criteria. A total of 34 (26.2%) participants had GDM with any of the two criteria whereas only 15 (11.5%) met the criteria for GDM in both the IADPSG and WHO criteria [Figure 1]. In addition, 10% of the participants had GDM by IADPSG (GD_{IADPSG}) but not by WHO criteria (GD_{WHO}), whereas 4.6% had GDM by WHO (GD_{WHO}) but not by IADPSG criteria (GD_{IADPSG}).

Table 1 shows the clinical and biochemical characteristics of the study population. The mean age and EGA were 31.1 years

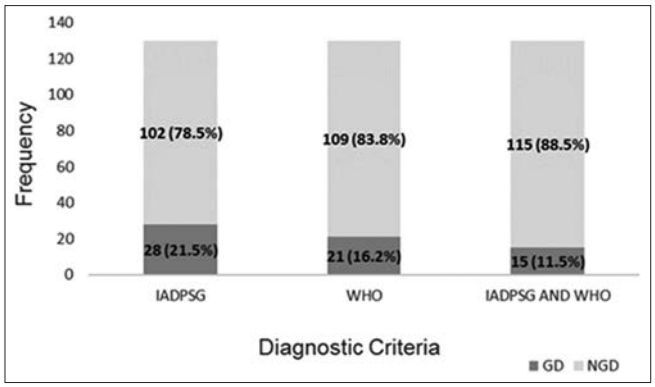

Figure 1: Distribution of GDM (GD) and non-GDM (NGD) in study population

and 28.1 weeks, respectively. The mean fasting glucose was 4.4 mmol/L whereas the mean 1-hour glucose and 2-hour glucose values were 7.4 and 6.7 mmol/L respectively.

Table 2 shows the univariate and multiple regression analysis to examine the association between pregnancy outcome and GDM (diagnosed by the IADPSG and WHO criteria) after adjusting or controlling for risk factors such as family history of DM, previous macrosomia, previous still birth, previous intrauterine fetal death (IUFD), maternal obesity, preterm delivery and previous caesarean section. GDM_{WHO} was significantly associated with macrosomia ($P = 0.01$) unlike GDM_{IADPSG} ($P = 0.05$). GDM_{WHO} but not GDM_{IADPSG} was independently associated with total outcome score ≥ 1, ($P = 0.01$) and ($P = 0.47$), respectively. The association with "at least one adverse outcome" was greater with GDM_{WHO} than with GDM_{IADPSG} [Adjusted odds ratio (OR) = 4.6 and 2.9, respectively].

The association between pregnancy outcome and a diagnosis of GDM that meets both the IADPSG and WHO criteria as against IADPSG criteria alone or WHO criteria alone is presented in Table 3. After controlling for the confounding variables, women with GDM who met the diagnostic criteria in both the IADPSG and WHO criteria ($GDM_{COMBINED}$) were more likely to have macrosomia and "at least one adverse pregnancy outcome" ($P < 0.05$). On the other hand, those who met one criterion but not the other criterion were not independently associated with adverse pregnancy outcomes ($P > 0.05$).

Discussion

This study sought to evaluate the diagnosis of GDM by the WHO and the IADPSG diagnostic criteria based on their ability to predict adverse pregnancy outcome in Nigerian women. The results show that more women were classified as GDM using the IADPSG criteria compared to using the WHO criteria. This was expected considering that the IADPSG

Table 1: Clinical and biochemical characteristics of study populations

Characteristics	Mean±SD
Age (years)	31.1±5.0
Estimated Gestational Age (weeks)	28.1±1.9
FG[a] (mmol/L)	4.4±1.3
1-hour Glucose (mmol/L)	7.4±2.6
2-hour Glucose (mmol/L)	6.7±2.5

[a]FG - Fasting serum glucose

Table 2: Association between pregnancy outcome and GDM (diagnosed by IADPSG and WHO criteria)

Variables/Groups	GDM criteria	Unadjusted Odds Ratio (95%CI)	**Adjusted Odds Ratio (95%CI)
Macrosomia	IADPSG	5.3 (1.5-18.9)*	2.9 (0.9-19.2)
	WHO	13.1 (3.4-50.6)*	9.6 (2.2-41.2)*
At least one adverse outcome	IADPSG	3.5 (1.4-8.8)*	2.9 (1.0-8.8)
	WHO	4.9 (1.8-13.3)*	46 (1.5-14.4)*

*Significant; **Adjusted for confounding variables such as: family history of DM, previous macrosomia, previous still birth, previous IUFD, maternal obesity, preterm delivery and previous caesarean section

Table 3: Multivariate analysis of association between pregnancy outcome and GDM (diagnosed by IADPSG alone, WHO alone and $GDM_{COMBINED}$)

Variables/Groups	GDM criteria	*P* value**
Macrosomia	IADPSG Alone	0.99
	WHO Alone	0.89
	$GDM_{COMBINED}$	0.001
At least one adverse outcome	IADPSG Alone	0.76
	WHO Alone	0.57
	$GDM_{COMBINED}$	0.008

$P<0.05$=Significant; IADPSG Alone, GDM satisfying IADPSG criteria (but not WHO criteria); WHO Alone, GDM satisfying WHO criteria (but not IADPSG A criteria); $GDM_{COMBINED}$, GDM satisfying both IADPSG and WHO criteria; *Significant; **Adjusted for confounding variables

criteria represent a downward revision of diagnostic cutoff values for the 0 hr time point. It was anticipated that the use of the IADPSG criteria will result in an increase in the reported prevalence of GDM from approximately 5–6% to 10–20%.[21] The IADPSG increased the rate of GDM from 3.2% to 7.3% in a universal-screened population.[22] However, in our study population (consisting of screened women on account of high risk for GDM), an increase in the rate of GDM was observed using the IADPSG criteria (21.5%) in relation to WHO criteria (16.2%). This increased in GDM rate is expected to impact the costs of managing GDM, as well as the potential for increased "medicalization" of pregnancies previously categorized as normal. However, It could be beneficial in the context of concerns related to the reported worldwide increase in the rates of obesity and diabetes, with the intent of optimizing gestational outcomes for women and their infants.[18]

Our study demonstrated a significant association between GDM and macrosomia. This is in agreement with data in

several published articles.[23,24] In the unadjusted model, women classified as GDM by the IADPSG or WHO criteria were significantly more likely to have macrosomic babies or at least one adverse outcome. While this may not be unexpected for the WHO criteria, it is noteworthy for the IADPSG criteria because this finding lends credence to recent evidences that intervention for mild hyperglycaemia in pregnancy results in modest benefits such as reducing the risk for macrosomic delivery. This finding, arguably the first in a Nigerian population, is consistent with reports in similar outcome studies,[25,26] and strengthens the argument for the universal acceptance of the IADPSG recommended glucose cutoff values.

The results from our study, however, revealed that overall, the WHO diagnostic criteria more strongly predicts adverse pregnancy outcome than the IADPSG criteria. The WHO criteria had higher odds for predicting adverse outcome compared to the IADPSG criteria. WHO criteria independently predict macrosomia and "one or more adverse pregnancy outcomes" after controlling for other risk factors, the IADPSG criteria do not.

We observed an overlap between the two diagnostic criteria under review such that most women met the conditions in both the diagnostic criteria whereas a few met the criteria for either the IADPSG criteria only or the WHO criteria only. We found that the participants who met both the diagnostic criteria for GDM were more likely to be associated with adverse pregnancy outcome compared to those who met the IADPSG criteria alone or WHO criteria alone. For instance, only a diagnosis of GDM with both criteria ($GDM_{combined}$) was an independent risk factor for macrosomia, and "one or more adverse pregnancy outcomes" after adjusting or controlling for risk factors such as family history of DM, previous macrosomia, previous still birth, previous IUFD, maternal obesity, preterm delivery and previous caesarean section.

The import of these findings is that combining the IADPSG and WHO criteria in screening for women with GDM may provide a stronger strategy for predicting adverse pregnancy outcome compared to using only either of the diagnostic criteria. In this model, pregnant women who meet the diagnostic criteria for GDM in both the criteria should be considered at higher risk for adverse pregnancy outcome and given more active management such as treatment with insulin. On the other hand, pregnant women who meet one criteria but not the other could be managed with a more conservative approach. However, we acknowledge that the number of individuals enrolled in the study was small and that larger studies may need to be performed to confirm this strategic approach.

It is pertinent to keep in mind that the IADPSG and WHO diagnostic criteria are based on different paradigms. Apparently, the goal of WHO criteria is identifying women at risk for postpartum type 2 DM;[27] the IADPSG criteria on the other hand focuses on identifying adverse outcomes in the index pregnancy.[13] Therefore, a diagnostic strategy that combines the strengths of both the criteria may provide a more pragmatic approach for risk stratification of pregnant women with GDM.

Acknowledgements

We are grateful to Dr. Alexander Abu, Dr. Noel Amadu, Dr. Solomon Asorose and the members of the staff of chemical pathology department, JUTH for their technical assistance during the research. We also appreciate Mrs. Joy AbiolaImoh for helping with statistical analysis.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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