Prevalence of Gestational Diabetes in South East Nigeria Using the Updated Diagnostic Guidelines

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Keywords

Gestational diabetes mellitus · Nigeria · Risk factors · OGTT · Diagnosis · Prevalence

Abstract

Background: Controversy still surrounds the choice of screening methods for gestational diabetes mellitus (GDM). Updated guidelines on hyperglycemias in pregnancy, recognizes 2 categories; Diabetes in pregnancy or pre-gestational diabetes and GDM. Early screening and diagnosis of GDM prevents maternal and fetal adverse outcomes. **Study Objective:** The aim of the study was to determine the prevalence of GDM and associated risk factors in a population of pregnant women in Enugu, South East Nigeria. **Materials and Methods:** The study was cross sectional and descriptive. All pregnant women attending the antenatal clinic were eligible for the study. A risk factor assessment questionnaire was administered. The one step universal screening with 75 g oral glucose tolerance test was used. The results were tabulated and categorized according to the World Health Organization (2013) Diagnostic Criteria. Statistical analysis was by

SPSS version 21. **Result:** A total of 205 women were initially screened. Risk factors for GDM were identified in up to third of the subjects. They were aged 15–41 years (28.6 ± 4.9 years). OGTT was performed in 142 of the subjects (who came fasting). Gestational age was 8–40 weeks (28.5 ± 7.3); gravidity, 1–9 (2.4 ± 1.5); parity, 0–4 (1.3 ± 1.4); miscarriages, 0–5; and live births, 0–5. Blood glucose levels were 60–145 mg/dL (85.5 ± 12.5) fasting; 77–229 mg/dL (131.8 ± 27.2) at 1 h and 72–223 mg/dL (123.1 ± 25.0) at 2 h post glucose load. The WHO (2013) criteria for GDM were met in 51 subjects (35.9%), WHO 1999 in 29 (20.4%); IAPDSG/American Diabetes Association in 54 (38%); NICE in 44 (31%) and DIPSI in 25 (17.6%). Three subjects had diabetes in pregnancy. Previous miscarriages and macrosomic babies, family history of diabetes mellitus, previous GDM, hypertension and recurrent urinary tract infection were found to be significant risk factors for the development of GDM. **Conclusion:** The study highlights the high prevalence of GDM in our local population. At every level, screening and management of GDM should be incorporated as a routine antenatal service.

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Introduction

Increasing prevalence of diabetes worldwide is reflected in increasing prevalence of gestational diabetes mellitus (GDM). The world prevalence of GDM is 1–28% depending on the screening criteria [1]. Hyperglycemia, caused by GDM or preexisting diabetes is associated with maternal as well as fetal complications including gestational hypertension, pre-eclampsia, increased rate of caesarean section, fetal macrosomia, sudden intra uterine death, birth trauma and increased perinatal mortality [2]. The risk is strong and continuous and has major implications for public health. Therefore, the identification and early diagnosis of GDM are important for both maternal and fetal health. Over the years, various authorities have tried to produce a consensus set of guidelines for screening of GDM with limited success [3]. Following the HAPO Study [4], the International Association of Diabetes and Pregnancy Study Groups (IADPSG) [5] published in 2010 a consensus panel recommendation on the classification and diagnosis of hyperglycemia in pregnancy. The panel distinguished between Diabetes in pregnancy or pre-gestational diabetes or overt diabetes (diabetes diagnosed during the early pregnancy or before conception by non-pregnant criteria) and GDM, which is hyperglycemia recognized in the second half of pregnancy and not meeting the criteria for diabetes in pregnancy. These new diagnostic criteria were endorsed by the American Diabetes Association (ADA) [6], the Endocrine Society [7], the WHO [8] and FIGO [9]. Furthermore, the WHO 2013 guideline on GDM, clarified ambiguities in the IADPSG criteria related to ranges of plasma glucose values for distinguishing diabetes in pregnancy and GDM. Other notable guidelines in use for the diagnosis of GDM include the ACOG [3], NICE [10], and Diabetes in Pregnancy Study Group India (DIPSI) [11]. Their schedules and glu-

cose thresholds are set forth in Table 1 [3, 12]. Oral Glucose Tolerance Test (OGTT) remains the cornerstone of diagnosis of GDM. Two approaches to screening are currently in use [3]. In high risk or selective screening (ACOG and NICE [2015], the screening is usually done at 24–28 weeks of gestation except in women with high risk factors who are screened at first visit (ACOG). In universal screening (ADA, IADPSG, WHO and DIPSI), screening is done at first ANC visit (by fasting plasma glucose or random plasma glucose or HbA1c) and then at 24–32 weeks and at 30–32 weeks (DIPSI).

Materials and Methods

The study was carried out at a state-owned secondary medical facility that offered antenatal services to women. The study was part of the activities in commemoration of the 2017 World Diabetes Day, which featured “Women and Diabetes.” Prior to the investigation, the women were fully sensitized, mobilized, and informed consent obtained. They were well informed ahead of time to come fasting. The study was done first thing in the morning. All attendees were eligible for the study. A risk factor assessment questionnaire was administered. Fasting and random blood glucose measurements were made using standard pre-calibrated glucometers. The one-step universal screening with 75 g oral glucose challenge test was used and offered only to those who came fasting. Seventy-five grams of anhydrous glucose dissolved in 250 mL of water was administered. Blood glucose measurements were made at 1 and 2 h subsequently. The results were tabulated and categorized according to the World Health Organization (2013) Diagnostic Criteria and Classification of hyperglycemia first detected in Pregnancy. The results were also compared with other diagnostic guidelines (Table 1). Data were analyzed using SPSS version 21 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were used to describe the population. Categorical data were presented as frequencies and percentages. The relationship between variables was explored using 2×2 contingency tables to determine chi squares and associated p values. A p value <0.05 , was deemed statistically significant.

Table 1. Diagnostic criteria for GDM according to different guidelines

Organization	Year	Screening mode	Approach	Glucose load, g	Diagnostic criteria				Remarks
					FBG	1 h	2 h	3 h	
ACOG	2015	Selective	2 step	100	≥ 95 (5.3*)	≥ 180 (10.0)	≥ 155 (8.6*)	≥ 140 (7.8*)	≥ 2 values abnormal
WHO	1990	Universal	1 step	75	≥ 126 (7.0*)	Not required	≥ 140 (7.8*)	Not required	≥ 1 value abnormal
WHO	2013	Universal	1 step	75	92–125 5.1–6.9*	≥ 180 (10.0)	153–199 8.5–11.0*	Not required	≥ 1 value abnormal
IADPSG and ADA	2010	Universal	1 step	75	≥ 92 (5.1*)	≥ 180 (10.0)	≥ 153 (8.5*)	Not required	≥ 1 value abnormal
NICE	2015	Selective	1 step	75	≥ 100	Not required	≥ 140 (7.8*)	Not required	≥ 1 value abnormal
DIPSI	2006	Universal	1 step	75	Not required	Not required	≥ 140 (7.8*)	Not required	≥ 1 value abnormal

GDM, gestational diabetes mellitus; ADA, American Diabetes Association. * mmol/l.

Results

A total of 205 women were initially screened. Multiple risk factors for GDM were identified and presented in Table 2. They were aged 15–41 years (28.6 ± 4.9 years). Their gestational age was 8–40 weeks (28.5 ± 7.3). A total of 142 subjects underwent the OGTT. Their basic data is presented in Table 3 and Figures 1–3. Only 3 of the women were <20 weeks gestation at the time of testing (2%); 13 were 20–23 weeks (9%), while the rest were >24 weeks (89%). Applying the blood glucose cut off points recommended by the various guidelines (Table 1), GDM was diagnosed in 20.4%, (WHO 1999), 35.9% (WHO 2013, 38% [IADSG/ADA], 31% [NICE] and 17.6% for DIPSI Table 4; Fig. 4). However, DIPSI had a sub-category of glucose intolerance in pregnancy (gestational glucose intolerance), which is peculiar to it and so cannot strictly be compared with their diagnostic criteria. Prevalence of GDM by gestational age is shown in Table 5. Three cases met the criteria for diabetes in pregnancy by WHO 2013 criteria (2.1%). FBG was the major contributor to GDM diagnosis by the WHO 2013/IADPSG/ADA criteria (85%), 48% for NICE and only 7% for the WHO 1999. The major contributors for the WHO 1999 and NICE were the 2 h post glucose values (Table 4). The 1 h post glucose values were abnormal only in 7 cases and it was the only abnormal value in a single case. Two abnormal blood glucose values were also found mainly in the WHO 2013/IADPSG/ADA group (31%) as well as 3 cases of 3 abnormal values. Several of the traditional risk factors analyzed proved to be significant risk factors for the

Fig. 1. Age distribution of participants.

development of GDM (family history of diabetes mellitus, previous GDM, having a baby weighing ≥ 4 kg and recurrent UTI Table 3; Fig. 2, 3).

Discussion/Conclusion

Though the burden of diabetes is high in low- and middle-income countries, limited published data exist on the prevalence of GDM in such countries. In a review

Table 2. Identified risk factors for GDM

Variable (<i>n</i> = 205)	Value, <i>n</i> (%)
>35 years	22 (10.7)
Miscarriages	34 (16.6)
INND	8 (3.9)
Overweight/obese	20 (9.7)
Family history DM	27 (13.2)
Previous GDM	4 (2.0)
Baby ≥ 4 kg	19 (9.3)
Malformed baby	2 (1.0)
Steroid use	0 (0.0)
PCOS	0 (0.0)
HPN	8 (3.9)
Recurrent UTI	62 (30.5)
African origin	205 (100.0)

GDM, gestational diabetes mellitus; DM, diabetes mellitus.

Table 3. Basic data on 140 OGTT subjects and risk of GDM

Variable	Value	<i>p</i> value
Age, years	15–41, 28.3 ± 5.1	0.963
Gravidity	1–9, 2.4 ± 1.5	0.756
Parity	0–5, 1.3 ± 1.4	0.464
Miscarriages	0–5	*
Live births	0–5	
Gestational age	8–40, 28.5 ± 7.3	0.311
Weight	50–106, $75.3.0 \pm 12.6$	
Height	147–181, 161.6 ± 6.9	
Obese/overweight	8	0.754
Family hx diabetes	23	0.032*
Miscarriages	22	0.195
Previous GDM	3	0.008*
>35 years	9	0.763
Baby >4 kg	11	0.002*
Hypertension	5	0.041*
Recurrent UTI	46	0.026*
FBG	60–145, 87.5 ± 12.5	
1 HR post-glucose	77–229, 131.8 ± 27.2	
2 HR post-glucose	74–223, 123.1 ± 25.0	

GDM, gestational diabetes mellitus. * *p* < 0.05

Fig. 2. Risk factors for GDM identifies in participants ($n = 142$). DM, diabetes mellitus; GDM, gestational diabetes mellitus.

by Kanguru et al. [13], the prevalence of GDM varied depending on the diagnostic criteria; ADA (15.5%), DIPSI (13.4%), IADPSG (20.4%) and WHO 2013 (24.3%). The highest prevalence rates were recorded for Vietnam, India, and Cuba. Studies on GDM on the African continent are even fewer. Most of the studies used the 75 g OGTT and the WHO 1985 and 1999 diagnostic criteria [14]. The reported prevalence for GDM were usually low (<7%) [15]. In a South African study that adopted universal screening and 75 g OGTT, the reported prevalence was 25.8% for the IADPSG criteria and 17.0% for NICE. The study noted that the prevalence would have been 15.2% with the IADPSG criteria and 3.6% with the NICE criteria had selective screening been used showing that selective screening tends to underestimate the true prevalence of GDM [16]. The situation in Nigeria is plagued with the same lack of definite consensus on criteria for the diagnosis of GDM. The 2013 Clinical Guideline for Diabetes Management in Nigeria recommends both the 75 and 100 g OGTT [17]. The few studies conducted used the WHO 1999 criteria. Screening was selective and data was retrospective yielding a prevalence of 3.3–13.9% [18–21]. In a report by Kuti et al. [21], 13.9% of cases of GDM were diagnosed in the first trimester and 55.7% in the third highlighting the fact that universal screening will capture more of those at risk early enough for the desired intervention. A recent report by Imoh et al. [22], which was a retrospective

Fig. 3. Miscarriages and the risk of GDM ($n = 142$). GDM, gestational diabetes mellitus.

analysis of selective screening for GDM using the updated criteria showed that 15.9, 20.2, and 15.7% of the women had GDM according to WHO (1999), IADPSG and WHO (2013) diagnostic criteria, respectively, while 4.8% had DM in pregnancy by WHO 2013 criteria confirming that GDM prevalence will increase using the updated criteria. Similarly, a study by Nakabuy et al. [23] reported a GDM prevalence of 31.9%; of which 23.8%

Fig. 4. GDM prevalence by various criteria ($n = 142$).

Table 4. Prevalence of GDM by various diagnostic criteria ($n = 140$)

Variable	WHO 1999		WHO 2013		ADA		NICE		DIPSI	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
GDM	29	20.4	51	35.9	54	38	44	31	25	17.6
DM	–	–	3	2.1	–	–	–	–	–	–
GGI	–	–	–	–	–	–	–	–	46	32.4
Abnormal blood glucose values										
FBG	2	7	46	85	46	85	21	48	–	–
1 HR	–	–	7	13	7	13	–	–	–	–
2 HR	29	100	17	31	17	31	29	66	24	100
2 values abn	1	4	13	24	13	24	5	11	–	–
3 values abn			3		5.5		3	5.5		

GDM, gestational diabetes mellitus; DM, diabetes mellitus; ADA, American diabetes association.

of women had no known risk factor. This underscores the fact that selective risk-based screening underestimates the prevalence of GDM. In all these reports and more [24], the same risk factors in varying degrees of significance were identified; increasing maternal age, maternal obesity, family history of diabetes mellitus, previous miscarriages, stillbirths or GDM, and fetal macrosomia as was seen in this report. The current study recorded a high prevalence of GDM. It was a universal screening irrespective of the risk status of the subjects. The updated diagnostic criteria were adopted with resulting predictable increase in the prevalence of GDM as high as 35.9% [25]. Previous reports have noted that a substantial number of cases will be missed using a risk-based screening approach, therefore, reporting lower prevalence rates [16, 18, 23]. In this study, OGTT screening was done at every gestational age, unlike guidelines that recommend screening at 24–28 or 24–32 weeks gestation. It is likely that this was contributory to the high

Table 5. GDM by gestational age according to WHO 2013 criteria

Gestational age, weeks	<i>n</i>	GDM	%
<24	16	5	31
24–32	57	22	38.6
>32	69	24	35
Total	142	51	35.9

GDM, gestational diabetes mellitus.

prevalence figures obtained. Late antenatal booking is well known in this culture. This practice means that a substantial number of women may not present themselves for screening at the required gestational age window, which is said to be most beneficial to improve outcome. However, it is an interesting finding that before the 24 weeks of gestation, a comparable percentage of the women had developed GDM as seen in Table 5. This

was highlighted in the report by Kuti et al. [21], where >10% of GDM were diagnosed in the first trimester reflecting those patients with pregestational diabetes. Early diagnosis of GDM is beneficial to mother and child because it affords time for the necessary intervention to be implemented. Late diagnosis offers limited benefit, but provides information about risk status for future pregnancies and DM later in life. Lack of uniformity of the various international guidelines on the diagnosis of GDM is breeding considerable confusion in the field. Thus, the GDM prevalence across the globe varies from 9.2 to 45.3% depending on which criteria was used [26].

Consensus on a common diagnostic criterion for GDM is needed. The study highlights the high prevalence of GDM in our local population with the potential for serious adverse maternal and fetal outcomes. Universal screening appears to be the best approach to detect most of the affected population right from the first antenatal booking. The WHO 2013 criteria offers the advantage that in resource constrained settings, more than 80% of the affected population can be captured with FBG alone. Unfortunately, in most institutions, the problem of GDM is unrecognized and scant provision made to address it. It is recommended that at every level of antenatal care, sensitization and screening for the detection and management of GDM be incorporated as a routine antenatal service for the best health outcome of mother and child.

References

- 1 Jiwani A, Marseille E, Lohse N, Damm P, Hod M, Kahn JG. Gestational diabetes mellitus: results from a survey of country prevalence and practices. *J Matern Fetal Neonatal Med*. 2012 Jun;25(6):600–10.
- 2 Committee on Practice Bulletins—Obstetrics. Practice Bulletin No. 180: Gestational Diabetes Mellitus. *Obstet Gynecol*. 2017;130(1):e17–37.
- 3 Saxena P, Miglani S, Nigam A. Screening and Diagnosis of Gestational Diabetes Mellitus: from Controversy to Consensus. *Curr Res Diabetes Obes J*. 2017;2(5):1–4.
- 4 Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, et al.; HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med*. 2008 May;358(19):1991–2002.
- 5 Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, Damm P, et al; International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care*. 2010;33(3):676–82.
- 6 American Diabetes Association. 2. Classification and Diagnosis of Diabetes. *Diabetes Care*. 2016;39 Suppl 1:S13–22.
- 7 Blumer I, Hadar E, Hadden DR, Jovanović L, Mestman JH, Murad MH, et al. Diabetes and pregnancy: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab*. 2013 Nov;98(11):4227–49.
- 8 World Health Organization. Diagnostic Criteria and Classification of Hyperglycaemia First Detected in Pregnancy. *Diabetes Res Clin Pract*. 2014;37(1):S14–80. Available from: http://apps.who.int/iris/bitstream/10665/85975/1/WHO_NMH_MND_13.2_eng.pdf.
- 9 Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. The International Federation of Gynecology and Obstetrics (FIGO) Initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. *Int J Gynaecol Obstet*. 2015 Oct;131 Suppl 3:S173–211.
- 10 NICE. Diabetes in pregnancy: management from preconception to the postnatal period. Nice. 2015:2–65. Available from: <http://www.ncbi.nlm.nih.gov.ez.srv.meduniwien.ac.at/pubmed/25950069>.
- 11 Seshiah V, Balaji V, Balaji MS, Sekar A, Sanjeevi CB, Green A. One step procedure for screening and diagnosis of gestational diabetes mellitus. *J Obstet Gynecol India* 2005; 55(6):525–9.
- 12 Rani PR, Begum J. Screening and diagnosis of gestational diabetes mellitus, where do we stand. *J Clin Diagn Res*. 2016 Apr;10(4):QE01–04.
- 13 Kanguru L, Bezawada N, Hussein J, Bell J. The burden of diabetes mellitus during pregnancy in low- and middle-income countries: a systematic review [Internet]. *Glob Health Action*. 2014 Jul;7(1):23987. Available from: <https://www.tandfonline.com/doi/full/10.3402/gha.v7.23987>.
- 14 Macaulay S, Dunger DB, Norris SA. Gestational Diabetes Mellitus in Africa: A Systematic Review. *PLoS One*. 2014 Jun 3;9(6):e97871.

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Statement of Ethics

The subjects gave their informed consent. The study protocol was approved by the institutional review board on human research.

Disclosure Statement

The authors declare that they have no conflicts of interest to disclose.

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Author Contribution

All the authors were involved in the concept and design of study, acquisition of data, analysis and interpretation of data, drafting the article, revising and in the final approval of the version to be published.

- 15 Mwanri AW, Kinabo J, Ramaiya K, Feskens EJ. Gestational diabetes mellitus in sub-Saharan Africa: systematic review and metaregression on prevalence and risk factors. *Trop Med Int Heal*. 2015 Aug;20(8):983–1002.
- 16 Adam S, Rheeder P. Screening for gestational diabetes mellitus in a South African population: Prevalence, comparison of diagnostic criteria and the role of risk factors [Internet]. *S Afr Med J*. 2017 May;107(6):523–7. Available from: <http://www.samj.org.za/index.php/samj/article/view/11907>.
- 17 Chinenye S, Ofoegbu EN, Onyemelukwe GC, Andrew E, Uloko AE, Ogbera A (eds). The Clinical Practice Guidelines for Diabetes Management in Nigeria (2nd edition). Diabetes Association of Nigeria (DAN) 2013. <http://gracelanddiabetesfoundation.org/wp-content/uploads/2018/03/Guideline-For-Diabetes-Management-In-Nigeria-2nd-Edition.pdf>
- 18 Ugege WE, Abasiattai AM, Umoiyoho AJ, Ntiense M. The prevalence of gestational diabetes among antenatal attendees in a tertiary hospital in south – south Nigeria. 2015;72–9.
- 19 Ogu R, John C, Maduka O, Chinenye S. Screening for Gestational Diabetes Mellitus: Findings from a Resource Limited Setting of Nigeria. *Br J Med Med Res*. 2017;20(11):1–8.
- 20 Umar A, Constance A, Shehu E, Ikechukwu E. Gestational Diabetes Mellitus and Outcome of Pregnancy among Women Attending Antenatal Care Clinic in North Western Nigeria The J Mid East North Africa Sci. 2018;4(6):27–32.
- 21 Kuti MA, Abbiyesuku FM, Akinlade KS, Akinsun OM, Adedapo KS, Adeleye JO, et al. Oral glucose tolerance testing outcomes among women at high risk for gestational diabetes mellitus. *J Clin Pathol*. 2011 Aug;64(8):718–21.
- 22 Imoh LC, Asorose SA, Odo AI, Aina DO, Abu AO, Ocheke AN. Modification of WHO diagnostic criteria for gestational diabetes: implications for classification of hyperglycemia in pregnancy. 2017;6(7):2716–23.
- 23 Nakabuye B, Bahendeka S, Byaruhanga R, Francis Hospital Nsambya. Prevalence of hyperglycaemia first detected during pregnancy and subsequent obstetric outcomes at St. *BMC Res Notes*. 2017 May;10(1):174.
- 24 Oga EO, Egbodo CO. Profile of Risk Factors in Relation to the Outcome of Screening for Gestational Diabetes Mellitus (GDM) among Pregnant Women in Jos University Teaching Hospital (JUTH), Jos. *Res Obstet Gynecol*. 2018;6(3):41–6. Available from: <http://article.sapub.org/10.5923.j.rog.20180603.01.html>.
- 25 Agarwal MM, Dhatt GS, Othman Y. Gestational diabetes: differences between the current international diagnostic criteria and implications of switching to IADPSG [Internet]. *J Diabetes Complications*. 2015 May-Jun;29(4):544–9. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S1056872715001026?via%3Dihub>.
- 26 Agarwal MM. Gestational diabetes mellitus: an update on the current international diagnostic criteria [Internet]. *World J Diabetes*. 2015 Jun;6(6):782–91. Available from: <http://www.wjgnet.com/1948-9358/full/v6/i6/782.htm>.