ORIGINAL ARTICLE

Gestational Diabetes Mellitus among women attending antenatal clinic in a Tertiary Hospital in Northern Nigeria

Abubakar Danladi,[1] Yetunde B. Aremu-Kasumu,[2]Kabiru B. Sada,[3]Olaniyi T. Fasanu,[1]Sikiru A. Yusuf[3]

[1]*Department of Obstetrics and Gynecology, Federal Medical Centre, Gusau, Zamfara State, Nigeria.*
[2]*Department of Obstetrics and Gynecology, Miqua General Hospital, Miqua, Aljouf region, Kingdom of Saudi Arabia.*
[3]*Department of Internal Medicine, Federal Medical Centre, Gusau, Zamfara State, Nigeria.*

ABSTRACT

Introduction: Women with gestational diabetes mellitus (GDM) are at an increased risk of adverse perinatal and maternal morbidities and mortalities. Hence, early detection and management of this condition is vital to ensure a good outcome for both mother and baby.

Aim: The aim of the study is to determine the prevalence and associated risk factors for GDM among antenatal attendees in Federal Medical Centre Gusau (FMCG), Zamfara state, Nigeria.

Methods: A descriptive cross-sectional study was carried out. Screening was done between 24 and 28-weeks gestational age with a 75g oral glucose tolerance test (OGTT). Plasma glucose measurements was performed using the glucose oxidase method. GDM was diagnosed according to the 2013 WHO diagnostic criteria. Data were collected using a proforma and analyzed using the Statistical Package for Social Sciences (SPSS) Version 26. Descriptive data were presented in frequency tables. Statistical testing using Chi-square, and multivariate analysis (Odd ratio and CI) were carried out with a level of significance set as $P < 0.05$.

Results: One hundred and thirty-six women between the gestational ages of 24-28 weeks were recruited. The mean age of the participants was 25.9±5.4 years. The prevalence of GDM was found to be 16.9%. Fasting blood glucose alone correctly diagnosed 87% of the patients. Previous history of macrosomic babies (≥4kg) and history of GDM in previous pregnancies were significantly associated with GDM.

Conclusion: The prevalence of GDM is high among antenatal attendees in Federal Medical center, Gusau.

Corresponding author
Dr Olaniyi T. Fasanu, MBChB, MWACS,
Senior Registrar, Department of Obstetric and Gynaecology,
Federal Medical Centre,
Sokoto bye-pass, Gusau, Zamfara State, Nigeria.
Tel: +234 703 535 3990
Email: nfashtolu@yahoo.com

Keywords: *Gestational Diabetes Mellitus, Antenatal clinic, Nigeria.*

This article is available online at: http://www.mjz.co.zm, http://ajol.info/index.php/mjz, doi: https://doi.org/10.55320/mjz.49.4.389
The Medical Journal of Zambia, ISSN 0047-651X, is published by the Zambia Medical Association

INTRODUCTION

Gestational diabetes mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy.[1] This definition acknowledges the possibility that patients may have previously undiagnosed diabetes mellitus or may have developed diabetes coincidentally with pregnancy.[2] Most women with GDM revert to normal glucose metabolism after delivery of their babies, they are however at an increased risk of developing GDM later in the future as are their children[3].

GDM affects 3% - 10% of pregnancies, depending on the population studied, maternal age and the criteria used for diagnosis[1, 2, 4]. Its incidence is increasing in parallel with the increase in type 2 diabetes mellitus[5]. In a meta-analysis, the pooled prevalence of GDM in Africa is 13.6% and its determinants were previous history of GDM, pre-gestational maternal obesity, and previous deliveries of macrosomic babies.[6]Of the total number of women with diabetes mellitus, women with GDM makes up 61.6%.[5]

GDM generally is most commonly diagnosed by screening during pregnancy[2, 5]. Pregnant women who present in the first trimester with risk factors should be screened at the first contact with the health care provider, these risk factors include obesity, previous history of GDM, previous macrosomic babies, family history of type 2 diabetes mellitus, and previous history of unexplained perinatal mortality.[7,8,9]

Several associations have proposed diagnostic criteria for GDM, these include the World Health Organization (WHO), American Diabetes Association (ADA), International Association of Diabetes in Pregnancy Study Group (IADPSG). Currently, the American College of Obstetrics and Gynaecology (ACOG) e.t.c. It is recommended that GDM should be screened for between 24 and 28 weeks of gestation[10]. The WHO 2013 diagnostic criteria for GDM which is widely accepted uses the 75g Oral Glucose tolerance test (OGTT). This involves taking the fasting blood glucose (FBG) before the administration of 75g of glucose and taking the 1-hour and 2 hours post glucose load values. GDM would be diagnosed if the FPG is 92 – 125 mg/dl, and/or 1-hour post-glucose load is greater than or equal to 180 mg/dl, and/or the 2-hour post glucose load is 153 – 199 mg/dl after the administration of the 75-g OGTT test.[11]

GDM is associated with adverse pregnancy outcomes, such as fetal macrosomia, neonatal hyperinsulinism, neonatal hypoglycaemia, respiratory distress syndrome (RDS), shoulder dystocia, preterm birth, stillbirth, increased risks of operative delivery, brachial plexus injury and pre-eclampsia.[5, 12,13,14.] These complications that can be minimized by prompt diagnosis and early intervention, thereby making screening essential in pregnancy.

GDM is a treatable condition and most patients are treated only with dietary and lifestyle modification, but some may need medications including insulin, which effectively decreases the accompanying complications.[5]

METHODS

Evaluation, inclusion criteria, and data collection

A cross-sectional study was carried out among pregnant women attending the antenatal clinic at Federal Medical Centre, Gusau. The inclusion criteria included women who have been confirmed by ultrasound to be at a gestational age between 24 and 28 weeks and who are not type 1 or type 2 diabetics. The sample size was calculated using a prevalence of 7.7% by Adoke *et al*[15] and was found to be 121 including a 10% attrition rate. The women were recruited as they presented to the antenatal clinic using a non-probability sampling technique till the sample size is achieved.

The participants were counseled about the study consent was obtained. Data was collected using a proforma which elicited information on social demographic characteristics, the presence of risk factors associated with GDM. Blood pressure, weight and heightwere measuredbefore blood sample collection. Blood samples were collected for fasting blood glucose after an overnight fast, then a standardized 75g anhydrous glucose in 250–300ml of water was given to the women to be taken orally over 5 – 15 minutes. First and sesecond-hourenous blood samples were collected and plasma glucose levelsweres measured using the glucose oxidase method in the side laboratory of the FMC, Gusau.

GDM was diagnosed using the WHO 2013 diagnostic criteria i.e. FBS ≥92mg/dl, 1-hour post prandial (1HPP) ≥180mg/dl, 2HPP of ≥155mg/dl, 3hour blood sugar <140mg/dl. At least 1 abnormal reading is diagnostic.

Statistical Analysis and Ethical Approval

The data was imputed into an SPSS software version 26. Association between two variables was determined using chi-square, and T-test. Those with association were subjected to logistic regression to determine the independent predictors. A p-value less than 0.05 was considered to be statistically significant at a 95% confidence interval. Ethical approval was obtained from the ethical committee of the Federal Medical Centre, Gusau, and informed consent was obtained from participants.

RESULT

Sociodemographic Characteristics

One hundred and thirty-six women between the gestational ages of 24 and 28 weeks were recruited for the study. The mean age of the participants was 25.9±5.4 years. Table 1 showed the summary of the socio-demographic characteristics of the study participants. About half of the women 67 (49.3%) were less than 25 years and 16 (11.8%) were ≥35 years.

Table 1: Summary of demographic characteristics of study participants

Demographic variables	Number (n=133)	Percentages (%)
Age (years)		
<25	67	49.3
25-34	53	38.9
≥35	16	11.8
Occupation		
Unemployed	63	46.3
Students	7	5.1
Business/Artisans	52	38.2
Civil servants	14	10.3
Tribe		
Hausa	117	86.0
Yoruba	2	1.5
Igbo	4	2.9
Others	13	9.6
Religion		
Muslim	128	94.1
Christian	8	5.9
Education		
No formal education	52	38.2
Primary/Secondary	56	41.2
Tertiary	28	20.6
Marital status		
Married	136	100
Parity		
Primigravida	48	35.3
P1/P2	60	44.1
P3/P4	16	11.8
≥P5	12	8.8
Booking weight		

Sixty-three (46.3%) of the participants were unemployed, 7 (5.1%) were students and 66 (48.5%) were either civil servants or self-employed individuals. The majority of the participants, 117

(86%) were Hausa by tribe. Fifty-two (38.2%) of the respondents have no formal education, 56(41.2%) had primary or secondary education and 28 (20.6%) had tertiary education. They were all married and twelve (8.8%) had a booking weight of ≥90kg.

Using the 2013 WHO diagnostic criteria for GDM, The prevalence rate of gestational diabetes mellitus (GDM) at the Federal Medical Centre Gusau was 16.9%, 2for 3 of the 136 participants. [Table 2]. Fasting blood glucose (FBG) alone correctly diagnosed 20 of the 23 participants, one-hour post-prandial (1HPP) blood glucose alone correctly diagnosed 8 out of 23, and two-hour postprandial blood (2HPP) glucose alone correctly diagnosed 10 out of 23 giving a sensitivity of 87%, 34.8%, and 43.5% respectively.

Table 2: Summary of participants' prevalence of GDM

GDM status	Frequency (n)	Percentage (%)
No GDM	113	83.1
Has GDM	23	16.9
Total	136	100

Table 3 shows the mean glucose value for FBG, 1HPP, and 2HPP. The mean FBG, 1HPP, and 2HPP for all participants were 4.4±1.6mmol/L, 6.5±2.5mmol/L, and 6.0±2.3mmol/L.

Table 3: FBG, 1HPP, and 2HPP mean blood glucose values among participants

Level of preparedness	Mean FBG ± SD (mmol/L)	Mean 1HPP ± SD (mmol/L)	Mean 2HPP ± SD (mmol/L)
All participants	4.4 ± 1.6	6.5 ± 2.5	6.0 ± 2.3
Participants without GDM	4.0 ± 0.5	5.9 ± 1.4	5.4 ±1.3
Participants with GDM	6.4 ± 2.9	9.7 ± 3.7	8.5 ±4.2

Table 4 shows the distribution of participants by potential risk factors and the chi-square test results in comparison to the prevalence of GDM among pregnant women attending antenatal clinics in FMC, Gusau. GDM was significantly related to participants' previous history of GDM and previous history of macrosomic babies (≥4kg), these were subjected to multiple logistic regression and still found to be statistically significant. Factors such as age, booking weight, family history of diabetes mellitus, history of miscarriages, and history of perinatal mortality were analyzed but did not show a significant relationship with GDM.

Table 4: Distribution of participants by risk factors and Chi-square test result.

Variable	No GDM *n* (%)	Has GDM *n* (%)	Total *n* (%)	p-value
Age				
<25	59 (88.1)	8 (11.9)	67(100)	0.48
25-34	43(81.1)	10(18.9)	53(100)	
≥35	12(75.0)	4(25.0)	16(100)	
Booking weight				
<50kg	7(77.8)	2(22.2)	9(100)	0.91
50-89kg	96(83.5)	19(16.5)	115(100)	
≥90kg	10(83.5)	2(16.7)	12(100)	
Family history of diabetes				
No	93(83.8)	18(16.2)	111(100)	0.65
yes	20(80.0)	5(20.0)	25(100)	
Previous history of macrosomic baby				
No	113(83.7)	22(16.3)	135(100)	0.03

Variable	No GDM *n* (%)	Has GDM *n* (%)	Total *n* (%)	p-value
Previous history of GDM				
No	0(0.0)	1(100)	1(100)	
yes	106(84.8)	19(15.2)	125(100)	0.07
History of miscarriage	7(63.6)	4(36.4)	11(100)	
No	110(85.3)	19(14.7)	129(100)	<0.01
yes	3(42.9)	4(57.1)	7(100)	
History of macrosomic babies				
No	102(85.8)	18(14.2)	120(100)	0.10
Yes	11(68.8)	5(31.3)	16(100)	
History of perinatal				

DISCUSSION

This study shows that the prevalence of GDM among antenatal attendees in Federal Medical Centre Gusau is 16.9%, the same figure of 16.9% was found by Guariguata[16], and a similar finding was noted by Egbe *et al* with a prevalence of 20.5%.[17] This is higher than a study done in Southern Nigeria which quoted 7.7%[18], lower figures were found by John et al with a prevalence of 0.8% (8.4 per 1,000 women).[19] A study done in Tanzania however found a higher prevalence of GDM, quoting a figure of 27.5%.[20] This difference may have resulted from the difference in the criteria used in the diagnosis of GDM. For example, the study by John *et al*[19] used the 1999 WHO diagnostic criteria (Fasting blood glucose {FBG} of ≥7.0mmol/L and two-hour postprandial {2HPP} of ≥7.8mmol/L) while we used the 2013 WHO diagnostic criteria (FBG of ≥ 5.1mmol/L, 1HPP of ≥10.0mmol/L and 2HPP of ≥ 8.5mmol/L). The Tanzanian study[20] tested women in all trimesters while we tested only women between 24-28 weeks, this could have been responsible for the increase in the prevalence of GDM because blood glucose has been found to significantly increase late in pregnancy.[21]

Fasting blood glucose in this study correctly diagnosed 87% of the patients and a similar finding was also noted by a Tanzanian study where FBG alone detected 96.2% of those with GDM.[20]

We found that GDM was significantly associated with a previous history of GDM. This is probably because the factors responsible for the development of GDM in pregnancy may be present in subsequent pregnancies. In an Ethiopian study by Feleke et al[22], they found that the previous history of GDM is one of the most predictive risk factors for the development of GDM. It is supported by a study done in the south-Eastern part of Nigeria.[23]

This study found that the previous history of fetal macrosomic babies was significantly associated with GDM. There is a higher amount of glucose passed to the fetus through the placenta due to the hyperglycaemia present in women with gestational diabetes mellitus, this excess glucose in the fetus is stored as body fat causing large for date fetus and fetal macrosomia[24]. Association between fetal macrosomia and GDM was also noted in a study in Southern Nigeria by Akinyemi et al, where the previous history of fetal macrosomia was found in 60% of women with GDM.[25] Several Nigerian and African studies have also noted similar findings.[17, 26, 27]

Though some studies have found an association between age, family history of diabetes mellitus, booking weight, and history of abortion to be associated with GDM,[19, 20, 28] we did not find such an association.

STUDY LIMITATION

This is a single-facility study hence the findings cannot be generalized, it however provides useful insights to guide intervention.

CONCLUSION AND GLOBAL HEALTH IMPLICATION

The prevalence of GDM is high affecting 1 in 6 pregnant women in northern Nigeria. The predictors of GDM include previous history of GDM and previous history of fetal macrosomia.

Based on these findings, women with these risk factors should be promptly screened for GDM to have optimal pregnancy outcomes and prevent the long-term complications of GDM.

Conflicts of Interest: The authors report no conflict of interest.

Financial Disclosure: None.

Funding/Support: None

Ethics Approval: Institutional ethical **committee**

REFERENCES

1. Chukwunyere CF, Awonuga DO, Igwe U. Gestational Diabetes in a Tertiary Health Care Centre at Abeokuta, Southwestern Nigeria: A Five Year Retrospective Review. *International Journal of Tropical Disease and Health*. 2015; 7(1):23-31.
2. Al-Kuwari MG, Al-Kubaisi BS. Prevalence and predictors of gestational diabetes in Qatar. *Diabetologia Croatica*. 2011; 40(3)
3. Macaulay S, Dunger DB, Norris SA. Gestational diabetes mellitus in Africa: a systematic review. *PloS one*. 2014 Jun 3;9(6):e97871.
4. American Diabetes Association. Gestational Diabetes Mellitus. *Diabetes Care*. 2006; 29(1): 543-8
5. Wilson EU, Aniekan MA, Aniefiok JU, Ntience MU. The prevalence of gestational diabetes among antenatal attendees in a tertiary hospital in South-south Nigeria. *International Journal of Medical Health and Research*. 2015; 1(6) : 72-79
6. Muche AA, Olayemi OO, Gete YK. Prevalence and determinants of gestational diabetes mellitus in Africa based on the updated international diagnostic criteria: A systematic review and meta-analysis. *Arch Public Health.* 2019;77:36.
7. Garrison A. Screening, diagnosis, and management of gestational diabetes mellitus. *Am Fam Physician.* 2015;91:460–7.
8. Pippitt K, Li M, Gurgle HE. Diabetes mellitus: Screening and diagnosis. *Am Fam Physician.* 2016;93:103–9.
9. Kim K-B, Shin Y-A. Males with obesity and overweight. *J ObesMetabSyndr*. 2020;29:18–25.
10. Moyer VA. U.S. Preventive Services Task Force. Screening for gestational diabetes mellitus: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med.* 2014;160:414–20
11. World Health Organization. Diagnostic Criteria and classification of hyperglycaemia first detected in pregnancy. 2013
12. Jiraporn L, Prasert S, Pattarawalai T. Pregnancy outcomes in women with gestational diabetes mellitus according to the Carpenter – Coustan criteria in Thailand. *Journal of Obstetric and Gynaecology Research*. 2015
13. Erem C, Kuzu UB, Deger O, Can G. Prevalence of gestational diabetes mellitus and associated risk factors in Turkish women: the Trabzon GDM Study. *Archives of Medical Science*. 2015; 11(4): 724-735.
14. Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, Roura LC, McIntyre HD, Morris JL, Divakar H. The International

Federation of Gynecology and Obstetrics (FIGO) Initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. *International Journal of Gynecology and Obstetrics*.2015; 131(53): 5172-5211.

15. Adoke AU, Shehu CE, Nwobodo EI, Ekele BA, Sabir A, Umar AG. Gestational diabetes mellitus and outcome of pregnancy among women attending antenatal care clinic in North Western Nigeria. *JMENAS*. 2018 Jun;4(6):27-32.
16. Guariguata L, Linnenkamp U, Beagley J, Whiting DR, Cho NH. Global estimates of the prevalence of hyperglycaemia in pregnancy. *Diabetes Research and Clinical Practice*. 2014 Feb 1;103(2):176-85
17. Egbe TO, Tsaku ES, Tchounzou R, Ngowe MN. Prevalence and risk factors of gestational diabetes mellitus in a population of pregnant women attending three health facilities in Limbe, Cameroon: a cross-sectional study. *Pan African Medical Journal*. 2018 Nov 20;31(1).
18. Olumodeji AM, Okere RA, Adebara IO, Ajani GO, Adewara OE, Ghazali SM, Olumodeji UO. Implementing the 2013 WHO diagnostic criteria for gestational diabetes mellitus in a Rural Nigerian Population. *Pan African Medical Journal*. 2020 Jul 22;36(1).
19. John CO, Alegbeleye JO, Otoide AO. Foeto-maternal outcome of diabetes in a tertiary health facility in Nigeria. *African Journal of Diabetes Medicine* Vol. 2015 Nov 1;23(2).
20. Ekhator CN, Ebomoyi MI. Blood glucose and serum lipid profiles during pregnancy. *African Journal of Diabetes Medicine*. 2012 May 1;20(1).Gynecol. 2019 Feb 26;8:802-7.
21. Mdoe MB, Kibusi SM, Munyogwa MJ, Ernest AI. Prevalence and predictors of gestational diabetes mellitus among pregnant women attending antenatal clinic in Dodoma region, Tanzania: an analytical cross-sectional study. *BMJ Nutrition, Prevention & Health*. 2021;4(1):69.
22. Feleke BE. Determinants of gestational diabetes mellitus: a case-control study. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2018 Oct 2;31(19):2584-9.
23. Onyenekwe BM, Young EE, Nwatu CB, Okafor CI, Ugwueze CV, Chukwu SN. Prevalence of gestational diabetes in South East Nigeria using the updated diagnostic guidelines. *Dubai Diabetes and Endocrinology Journal*. 2019;25(1-2):26-32.
24. Kamana KC, Shakya S, Zhang H. Gestational diabetes mellitus and macrosomia: a literature review. *Annals of Nutrition and Metabolism*. 2015;66(Suppl. 2):14-20.
25. Akinyemi OA, Omokhodion OV, Fasokun ME, Makanjuola D, Ade-Ojo IP, Adeniyi AA. Screening for Gestational Diabetes Mellitus: Is There a Need for Early Screening for All Women in Developing Countries?. *Cureus*. 2023 Feb 27;15(2).
26. Ugege WE, Abasiattai AM, Umoiyoho AJ, Utuk NM. The prevalence of gestational diabetes among antenatal attendees in a tertiary hospital in south–south Nigeria. *International Journal of Medical and Health Research*. 2015;1(1):72-9.
27. John DH, Awoyesuku PA, MacPepple DA, Kwosah NJ. Prevalence of gestational diabetes mellitus and maternal and fetal outcomes at the Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria. *Journal of Advances in Medicine and Medical Research.* 2020 Jan 2;34(9):1-6.
28. Uloko AE, Musa BM, Ramalan MA, Gezawa ID, Puepet FH, Uloko AT, Borodo MM, Sada KB. Prevalence and risk factors for diabetes mellitus in Nigeria: a systematic review and meta-analysis. *Diabetes Therapy*. 2018 Jun;9:1307-16.