Original Article

Prevalence and Correlates of Postpartum Glucose Screening among Women with Hyperglycemia in Pregnancy in a Nigerian Tertiary Hospital

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Abstract

Background: Postpartum follow-up of women with gestational diabetes mellitus (GDM) is key for early identification of impairment of glucose tolerance and preventing progression to diabetes mellitus (DM). Postpartum screening rates among Nigerian women are largely unknown. **Aim:** We examined the prevalence of postpartum glucose testing and its associated factors. **Patients, Materials and Methods:** This was a retrospective study conducted between November 2017 and October 2019, involving women who had been diagnosed with GDM at the Chemical Pathology Department of Jos University Teaching Hospital. Ninety-seven women responded to follow-up phone calls to determine their postpartum care. Sociodemographic data and obstetric history were obtained from hospital records. **Results:** The mean (standard deviation) age of the participants was 34.1 (4.9) years. Only 31 (31.9%) women had glucose testing within six weeks postpartum, most of them (27.8%) by fasting blood glucose or random blood glucose. Forty eight percent tested after six weeks postpartum, while 19 (19.6%) did not have any form of glucose testing after delivery. Postpartum glucose testing was significantly associated with a history of DM or previous GDM and receiving counselling about postpartum testing and higher diagnostic glucose values, $P < 0.05$. Age, educational status, gravidity, and filling of requisition form before delivery were not associated with postpartum glucose testing, $P > 0.05$. **Conclusion:** Early postpartum screening rate is generally poor but more common among women with high diagnostic glucose levels who received appropriate counselling after diagnosis of GDM. Adequate sensitisation of healthcare workers about postpartum care and proper counselling of women with GDM will improve screening rate.

Keywords: Diabetes mellitus, diabetes screening, gestational diabetes mellitus, hyperglycemia in pregnancy, postpartum glucose screening

Background

The incidence of gestational diabetes mellitus (GDM) and Type 2 diabetes mellitus (T2DM) or overt diabetes mellitus (ODM) in pregnancy is rising globally. These forms of hyperglycemia in pregnancy (HIP) are increasingly becoming public health concerns not only because of their propensity to cause adverse pregnancy outcomes for both the mother and her infant but also the untoward long-term sequelae in them.

The adverse effects of HIP on the fetus and newborn include macrosomia or large for gestational age, neonatal hypoglycemia, perinatal mortality, congenital malformation, hyperbilirubinemia, polycythemia, hypocalcemia, and respiratory distress syndrome of the newborn.[1-3] Macrosomia increases the risk of shoulder dystocia and birth injuries.[4] Documented obstetric consequences of HIP on pregnant women include increased risk of urinary tract infections, polyhydramnios, premature rupture of membranes, preterm deliveries, hypertension, preeclampsia, and other placental anomalies.[3] Maternal health is also put at risk from instrumental deliveries and cesarean sections consequent upon increased fetal size.[4]

Health care for women diagnosed with GDM often focuses on obtaining the best outcomes for the mother and her infant in

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the index pregnancy with less considerations for the long-term effects of this condition on the health of women.[5] In part, this may reflect the focus of obstetricians on the outcome of the index pregnancy. GDM foreshadows future T2DM and cardiovascular disease in women. After delivery, women diagnosed with GDM have an increased chance of progressing to T1DM and T2DM.[6,7] Postpartum follow-up of these women is therefore key for early identification of the impairment of glucose tolerance and intervention aimed at delaying or preventing the progression to diabetes mellitus (DM).[8] It has been advocated that the follow-up testing of women diagnosed with GDM should be done within 6–12 weeks postdelivery.[9,10] There are debates as to the most effective or suitable type of glucose testing during the postpartum period. Fasting plasma glucose (FPG), random glucose, oral glucose tolerance test (OGTT), and HbA_{1c} have been suggested and used to screen women for glucose abnormalities postpartum.[10] The turn up for postpartum screening after GDM is largely suboptimal in some low-middle-income countries (LMICS) and across Europe, North America, and Australia, although interventions to improve the picture are encouraging.[11,12] However, not much is known about the outlook in Sub-Saharan Africa and there is a paucity of data on postpartum screening for DM among women who had HIP. In this study, we followed up women diagnosed with HIP to examine the postnatal care, prevalence of postpartum glucose testing, and the factors associated with testing.

Patients, Materials and Methods

Ethical considerations

Ethical approval was obtained from the Health Research and Ethics Committee of the Jos University Teaching Hospital with approval number-JUTH/DCS/ADM/127/XXIX/1692 in keeping with the ethical principles for medical research involving human subjects, in accordance with the Declaration of Helsinki. Informed consent was obtained from the respondents and confidentiality was ensured using name's initial. Data storage was in a pass-worded document.

This was a retrospective study conducted between November 2017 and October 2019 involving women who were diagnosed with GDM at the metabolic Clinic of the Chemical Pathology Department of Jos University Teaching Hospital. The classification of hyperglycemic status in pregnancy was done using the Modified WHO 2013 diagnostic criteria after a 75-g OGTT. Sociodemographic data, past medical history, obstetric history, and laboratory parameters were obtained from patients' records. A follow-up interview by telephone was conducted for women within one–five years of being diagnosed for GDM (i.e., women diagnosed between April 2013 and April 2017). The interview sought to obtain information regarding management of HIP, postnatal care including postnatal glucose testing and testing methods.

A total of 236 women who had GDM in the period under review were eligible for the study. Phone calls were made to the phone numbers provided for contact obtained from the patients' records. A suitable time for an interview was arranged for those who were not ready to be interviewed when initially contacted. A total of three calls were made to numbers that were unreachable or unresponsive before they were excluded from the study. Only women who gave consent to participate in the survey and provided responses to the questions in the interview were included in the study. Women who had poor recollection of vital information for the study were excluded from the analysis.

Data analysis

The data were cleaned and entered into Microsoft Excel® version 2.0 and exported to Statistical Product and Service Solutions (SPSS) version 23.0 (IBM Corp. 2015, Armonk, NY, USA) software for statistical analysis. Descriptive statistics were presented as counts, percentages summarised on frequency tables. Inferential statistics to test factors associated with postpartum testing were assessed using Chi-square tests or Yates's correction test for continuity where appropriate. All tests were 2-tailed, a 95% confidence interval was used, and $P < 0.05$ was considered statistically significant.

Results

In Table 1, a total of 121 women were accessible during the survey, but only 97 women gave consent and provided valid responses to the follow-up phone interview to determine their postpregnancy status and were included for analysis. The mean (standard deviation [SD]) age of the participants was 34.1 (4.9) years. Sixty-three (64.9%) and 34 (35.1%) of them had GDM and ODM, respectively. Most of the women had tertiary education (80; 82.5%), were <35 years of age (50; 51.5%) and 33 (34.0%) were grand-multiparous. The mean (SD) gestational age at testing was 27.4 (7.2) weeks.

Only 31 (31.9%) women had glucose testing within six weeks postpartum, most of them (27.8%) by fasting blood glucose (FBG) or random blood glucose (RBG). Almost half (48.5%) of the participants had glucose testing at some point after six weeks postpartum by FBG or RBG, while 19 (19.6%) did not have any form of glucose testing after delivery. The most common (59%) testing method was point of care testing (POCT) device (glucose meters), while 24.2% had testing conducted in the laboratory. The majority (75.6%) of the women self-reported glucose results to be within normal limits, while 18% were told their glucose results were "abnormally high." Only 45.4% of the women confirmed that they received counselling to come for glucose testing after delivery and only 17.5% of them were given test requisition form for postpartum glucose test.

In Table 2, postpartum glucose testing was significantly associated with a positive history of DM or previous GDM and receiving counselling about postpartum testing, $P < 0.05$. Furthermore, women who screened for hyperglycemia after delivery had significantly higher glucose levels than those who did not. Age, educational status, gravidity, and filling of requisition form predelivery were not associated with postpartum glucose testing, $P > 0.05$.

In Table 3, none of the factors assessed were significantly associated with early postpartum glucose testing (defined in this study as testing at less than or equal six weeks). History of DM or previous GDM, receiving counselling about postpartum testing, higher glucose levels, Age, educational stratus, gravidity, filling of requisition form predelivery were not associated with postpartum glucose testing, $P > 0.05$.

Discussion

This study sought to examine postpartum testing for DM and its determinants among women diagnosed with GDM. The prevalence of postpartum screening for DM at six weeks postdelivery, among the women in this study, was 31.9%. The low rate of testing is comparable with short-term follow-up rate of 23%–58% reported in Europe and North American countries,[13,14] but higher than reports in previous studies in the UK, Canada, and Europe, where the six-week postpartum glycemic assessment rates were <20%.[13,15,16] Overall, up to 80% of the women have had any type of screening for DM following delivery after a diagnosis of GDM. This is similar to previous findings in the USA and Australia, where long-term screening rate of up to 67%–73% was obtained.[16,17] Although this study did not capture exactly when and how they were tested, the fact that they were tested offers opportunity for detecting glucose abnormalities. It also mirrors the wide accessibility of glucose testing, which could form the bedrock of grassroots screening programmes for this category of women.

Our data suggest that the majority of those who screened within six weeks postpartum were tested with POCT and not in the hospital laboratory. Opportunities for screening for diabetes in LMICS are not limited to testing in structured settings like hospitals and primary health centres. Free health outreaches to communities, religious centres, and markets are a few of the opportunities in which screening for diabetes is often carried out in these settings. These avenues, however, may not be effective if testing is not coupled to the right counselling and treatment as is often the case in some of these outreaches and therefore would not preclude the necessity for a deliberate postpartum diabetes screening programme.

For the successful institution of an effective postpartum diabetes screening for women who have had GDM, it is fundamental to understand the factors that influence its uptake. It has been suggested that successful screening programmes depend on multiple factors including patient-related, physician, and healthcare system factors.[18] Patient-related factors may include diminished motivation to health-seeking behaviour after delivery commonly observed in women being more likely to undergo testing to screen for GDM to prioritise health of the baby during pregnancy than testing after pregnancy for their own health benefit.

There is a paucity of data regarding determinants for postpartum screening among LIMICs.[19] Several factors though have been associated with a willingness to screen for diabetes after delivery in Western countries. These include sociodemographic, obstetric, and healthcare-related factors.[14,17,20] In this study, sociodemographic factor such as age and level of education were not related to postpartum diabetes screening although previous studies suggest inconsistent associations.[14,17,20,21] Morrison *et al*. found that women with tertiary education were more likely to screen for diabetes.[17] Clinical and obstetric history such as gravidity, prior macrosomia, maternal obesity, previous miscarriage or intrauterine fetal death, and family history of DM were not significantly predicators for postpartum testing. This is in keeping with the finding of previous studies, although Morrison *et al*. found a significant association with a family history of DM.[17,19]

Table 1: General characteristics and testing pattern

	Frequency (%)
Age group	
<35	50 (51.5)
≥35	47 (48.5)
Gravidity	
1	6 (6.2)
2–4	53 (54.6)
>5	33 (34.0)
No record	5 (5.2)
Education	
Primary	3 (3.1)
Secondary	12 (12.4)
Tertiary	80 (82.5)
No record	2 (2.1)
Hyperglycemic status	
GDM	63 (64.9)
Overt DM	34 (35.1)
Postpartum testing	
At six weeks	31 (31.9)
Six-weeks OGTT	4 (4.1)
Six-weeks FBG/RBG	27 (27.8)
>six weeks	47 (48.5)
None	19 (19.6)
Method of testing	
Laboratory	19 (24.4)
POCT	59 (75.6)
None	19
Reported result of testing	
High	14 (18.0)
Normal	59 (75.6)
Not sure	5 (6.4)
Counselled to test	
Yes	44 (45.4)
No	32 (33.0)
Not sure	21 (21.6)
Given preordered requisition form	
Yes	17 (17.5)
No	19 (19.6)
Not sure	61 (62.9)

POCT: Point of care testing, OGTT: Oral glucose tolerance test, DM: Diabetes mellitus, GDM: Gestational DM, FBG: Fasting blood glucose, RBG: Random blood glucose

Table 2: Factors associated with postpartum glucose testing

	Tested, *n* (%)	Not tested, *n* (%)	*P*
Age group			
<35	41 (82.0)	9 (18.0)	0.684
≥35	37 (78.7)	10 (21.3)	
Education			
Primary	3 (100)	0	0.584
Secondary	2 (75.0)	3 (25.0)	
Tertiary	66 (82.5)	14 (17.5)	
Gravidity			
1	5 (83.3)	1 (16.7)	0.377
2–4	45 (84.9)	8 (15.1)	
≥5	24 (72.7)	9 (27.3)	
Hypertension			
Yes	16 (84.2)	3 (15.8)	0.342
No	28 (70.0)	12 (30.0)	
Previous GDM/DM			
Yes	16 (100)	0	0.027*
No	23 (67.6)	11 (32.4)	
Family history of hypertension			
Yes	11 (68.8)	5 (31.3)	0.559
No	20 (79.6)	6 (21.3)	
Family history of DM			
Yes	39 (83.0)	8 (17.0)	0.276
No	15 (71.4)	6 (28.6)	
Previous miscarriage			
Yes	33 (78.6)	9 (21.4)	0.873
No	20 (76.9)	6 (23.1)	
Previous macrosomia			
Yes	29 (82.9)	6 (17.1)	0.444
No	21 (75.0)	7 (25.0)	
Previous stillbirth			
Yes	10 (76.9)	3 (23.1)	0.609
No	25 (69.4)	11 (30.6)	
Weight >100 kg			
Yes	18 (75.0)	6 (25.0)	0.441
No	60 (82.2)	13 (17.8)	
Counselled to test			
Yes	40 (90.9)	4 (9.1)	0.001*
No	19 (59.4)	13 (4.6)	
Given preordered requisition form			
Yes	15 (88.2)	2 (11.8)	0.662
No	15 (78.9)	4 (21.1)	
FBG (mmol/L), mean (SD)	6.2 (2.0)	5.5 (0.6)	0.013*
1-h glucose (mmol/L), mean (SD)	10.9 (3.3)	8.8 (2.1)	0.013*
2-h glucose (mmol/L), mean (SD)	10.0 (3.3)	7.7 (1.5)	<0.001*

*P <.05 are statistically significant, DM: Diabetes mellitus, GDM: Gestational DM, SD: Standard deviation, FBG: Fasting blood glucose

However, we found that a history of previous GDM was significantly associated with postpartum screening for diabetes. This may be consistent with these women having had more experience due to previous testing as well as a heightened perception of risk for future complications. This is in contrast to the report of Hunt *et al*., who suggested that women who failed to return for postpartum glucose testing were more likely to report prior GDM.[16,20]

Investigating the influence of occurrence in the current GDM on the likelihood of postpartum testing for diabetes, we found that women with higher diagnostic glucose levels were more likely to screen for diabetes postpartum. A converse scenario was observed by Hunt and Conway, who found that women who had higher diagnostic glucose levels and require insulin during pregnancy were less likely to return for postpartum glucose testing.[20] The increased perception of risk for future complications may also explain our finding. Maternal obesity was not associated with returning for postpartum screening in our study. Other studies found increased prepregnancy weight, gain in maternal weight, and high body mass index as predictors for postpartum screening, while others did not.[17,19,20]

Women with GDM need to receive the right counselling after a diagnosis of HIP. This counselling should not be lopsided to emphasis on immediate care measures to improve pregnancy outcome with little focus on long-term outcome. In this study, women who received counselling were also likely to have had a follow-up testing for DM. This instructively demonstrates the importance of appropriate counselling after a diagnosis of GDM is made. Unfortunately, one in three of the women did not receive the necessary counselling for postpartum testing following their diagnosis of GDM. There may be several reasons for this including inadequate capacity to provide required counsel among health workers, overburdened health workforce with time pressure, differing perceptions of the value of postpartum screening among healthcare providers, and confusion regarding who provides the counselling. It has been reported in other studies that poor communication and collaboration among healthcare providers for women with GDM may have impact on postpartum screening.[18,19] Most patients do not receive the right information on why follow-up is essential, what investigations have to be done, at what time, and who to see for a follow-up.[22]

The confusion over who will provide counselling may be manifest because this posttesting activity and fall within the gray zone of clinic-laboratory interface. In our experience, the obstetricians who generate the request for screening for GDM are often expected to provide adequate information after diagnosis has been made; however, due to the inadequate number of health workforce to carter for a myriad of health challenges in African healthcare setting, this activity is often secondary. In these instance, post testing counselling can be provided for, by qualified labortory professionals. Furthermore, appropriate guidelines or protocols universally agreed by the stakeholders in the patient care may help address this challenge.[13] Health workers should be trained to provide balanced counselling that will address both concerns. Among the issues that should be addressed include when to be tested, how to be tested, and what to expect. Women with GDM are receptive to diabetes education and may serve as role models to other women for diabetes prevention interventions.[23]

Table 3: Factors associated with early and late postpartum glucose testing

	≤ six weeks (%)	> six weeks (%)	*P*
Age group			
<35	20 (48.8)	21 (51.2)	0.086
≥35	11 (29.7)	26 (70.3)	
Education			
Primary	1 (33.3)	2 (66.7)	0.164
Secondary	1 (11.1)	8 (88.9)	
Tertiary	29 (43.9)	37 (56.1)	
Gravidity			
1	1 (20.0)	4 (80.0)	0.068
2–4	23 (51.1)	22 (48.9)	
≥5	6 (25.0)	18 (75.0)	
Hypertension			
Yes	6 (31.6)	13 (68.4)	0.747
No	11 (27.5)	29 (72.5)	
Previous GDM/DM			
Yes	7 (43.8)	9 (56.3)	0.222
No	9 (26.5)	25 (73.5)	
Family history of hypertension			
Yes	6 (54.5)	5 (45.5)	0.100
No	5 (25.0)	15 (75.0)	
Family history of DM			
Yes	15 (38.5)	24 (61.5)	0.416
No	4 (26.7)	11 (73.3)	
Previous miscarriage			
Yes	14 (42.4)	19 (57.6)	0.592
No	7 (35.0)	13 (65.0)	
Previous macrosomia			
Yes	13 (44.8)	16 (55.2)	0.413
No	7 (33.3)	14 (66.7)	
Previous stillbirth			
Yes	4 (40.0)	6 (60.0)	0.652
No	8 (32.0)	17 (68.0)	
Weight >100 kg			
Yes	6 (33.3)	12 (66.7)	0.562
No	25 (41.7)	35 (58.3)	
Testing done in the laboratory			
Yes	9 (47.4)	10 (52.6)	0.435
No	22 (37.3)	37 (62.7)	
Testing done by POCT device			
Yes	24 (40.7)	35 (59.3)	0.766
No	7 (36.8)	12 (63.2)	
Counselled to test			
Yes	19 (47.5)	21 (52.5)	0.122
No	5 (26.3)	14 (73.7)	
Given preordered requisition form			
Yes	8 (53.3)	7 (46.7)	0.136
No	4 (26.7)	11 (73.3)	
FBG (mmol/L), mean (SD)	6.7 (2.6)	5.8 (1.2)	0.072
1-h glucose (mmol/L), mean (SD)	11.3 (4.6)	10.6 (2.0)	0.352
2-h glucose (mmol/L), mean (SD)	10.5 (4.3)	9.6 (2.5)	0.241

POCT: Point of care testing, DM: Diabetes mellitus, SD: Standard deviation, FBG: Fasting blood glucose

Previous studies showed that the use of reminder systems including phone reminder and preordering of follow-up test and the patients' given the requisition forms could help promote postpartum screening rate.[10,18,24,25] We found that preordering and provision of requisition form to the women before discharge did not significantly impact on postpartum screening rates in this study. Loss of the forms is a possible reason considering that the women may be distracted by other aspects of care for their baby. Other forms of intervention that could improve the screening rates include self-administered OGTT, phone calls, education programmes, or postages.[22,25]

The majority of the screening was done by FBG and RBG. Only about 13% of women who were screened at six weeks postdelivery in this study had OGTT. The National Institute for Health and Care Excellence recommends FPG testing at six weeks postpartum for screening for diabetes following a diagnosis of GDM (although OGTT has also been recommended).[13] Other tests such as RBG, OGTT, and HbA_{1c} have been recommended or used for this purpose in some guidelines or studies. There have been debates about the applicability and efficacy of these various methods of testing for hyperglycemia in the postpartum period. It has been argued that the simplicity and reproducibility of FPG makes it a more suitable test for this purpose. However, there are questions regarding the sensitivity of FPG to identify women with impaired glucose tolerance or T2DM.[26] Random glucose testing on the other hand is not well standardised or systematic and has wide variations in glucose values, though it is very convenient and can be done without prior patient preparations. The utility of HbA_{1c} as a postpartum test is being investigated although it has been suggested that HbA_{1c} assays lacks sensitivity to detect moderate hyperglycemia or glucose intolerance in women diagnosed with GDM.[10,26]

Almost one in five of those who had been screened for diabetes self-reported a "high" glucose value. This is similar to the finding in a predominantly Caucasian population, where 19.1% of those tested had evidence of abnormal glucose tolerance postpartum.[25] A survey of postpartum follow-up after GDM reported that up to 40% of Japanese women tested for glucose had abnormal glucose metabolism within the prediabetic range within two years postdelivery.[27] A substantial number of women with GDM progress to diabetes over the following decades, with a suggested cumulative occurrence of between 15% and 50%. The highest incidence of diabetes is during the first five years after delivery.[10,13,28] Although, due to the recall nature of the study, we could not obtain the actual glucose value, even a conservatively lower proportion of abnormally high glycemic status in this category of women would underscore the need to strengthen surveillance for future diabetes for this high-risk group. This is particularly instructive considering the high long-term healthcare burden of undiagnosed and untreated diabetes among these females who are mostly within relatively reproductive age bracket.

Conclusion

To our knowledge, this is the first study to provide data about postpartum diabetes screening in women with GDM in Northern Nigeria. We have shown that early postpartum screening rate is generally poor but more common among women with high diagnostic glucose levels who received appropriate counselling after diagnosis of GDM. Adequate sensitisation of healthcare workers postpartum and long-term care of women with GDM is important and proper counselling of these women should be pursued vigorously. We recommend further qualitative and quantitative studies in our local setting to explore the effect of interventions such as reminder phone calls and text messages that have been reported to improve follow-up rates in some developed and developing countries.

What is already known on this topic

- Hyperglycemia in pregnancy is an ongoing research area to improve pregnancy outcomes; however, there is a paucity of these studies in Northern Nigeria.

What this study adds

- The article will make for interesting readership because it examines information regarding management of HIP, postnatal care including postnatal glucose testing, and testing methods
- It highlights key factors and challenges that should be addressed to create and improve effective postpartum diabetes screening for women who had GDM during index pregnancy
- Data from this part of the world on this subject are uncommon. Lessons drawn from this study could be applied to improve outcomes of glucose control for mother and baby during pregnancy and prevent postpartum glucose impairment in poor resourced settings and elsewhere.

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Conflicts of interest

There are no conflicts of interest.

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