

Prevalence Of Glycosuria, Its Correlates, And Newly Diagnosed Hyperglycaemia Among First-Time Attendees In A Family Medicine Clinic In Nigeria

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Abstract

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Background: Diabetes mellitus (DM) is a pressing global health issue that impacts severely on a regions, with many undiagnosed cases owing to inadequate healthcare. One of the key markers of Diabetes is glycosuria, which can serve as an early indication of diabetes or impaired glucose tolerance, especially in primary care. This study aims to investigate the prevalence of glycosuria and newly diagnosed hyperglycemia among first-time attendees of a family practice clinic in Port-Harcourt, Nigeria and identify the factors that affect their occurrence.

Methods: A cross-sectional study of new patients at the Family medicine clinic, selected using systematic sampling and underwent a point-of-care- testing (POCT) of their urine and blood glucose. Semi-structured, interviewer-administered questionnaires were used to collect data and subsequently analysed.

Results: A total of 380 respondents, with a female preponderance (71.1%) were studied. Prevalence of newly diagnosed glycosuria was 6.3%, hyperglycemia was 26.1%, and newly diagnosed DM was 28.4%. Glycosuria was seen more in males (12.7%), age group ≥ 60 years (11.8%), married people (11.0%), civil/public servants (13.0%), overweight individuals (11.0%) and Stage 3 Hypertension (16.7%). Statistically significant associations were with occupation ($p = .02$, $X^2 = 18.355$), and alcohol usage ($p = .005$). Highest hyperglycemia prevalence of 34.5% was recorded in females, artisans (36.6%), overweight individuals (35.4%), Stage 3 hypertension (43.9%), and significant levels (51.5%) in those > 60 years ($p = .004$) and history of hypertension ($p < .001$).

Conclusion: POCT of urine and blood glucose for first-time attendees in primary care is needed for early detection of glucosuria and hyperglycemia as pointers to DM, especially in the elderly and those with co-morbidities. Lifestyle changes will help curb this rising prevalence in the Niger Delta region of Nigeria.

Keywords: Glycosuria, Diabetes Mellitus, pre-diabetes, hyperglycemia, point-of-care-testing

Introduction

Diabetes mellitus is a pressing global health issue, with approximately 463 million adults affected by the disease in 2019, a figure expected to rise to 700 million by 2045 if current trends persist.¹ In 2019, 9.3% of the world's adults (ages 20–79 years) had diabetes.² This represents 463 million people and this number is more than the number predicted by the World Health Organization (WHO) in 2014.²

The impact of diabetes is especially severe in developing regions, where healthcare systems often struggle to address both diagnosed and undiagnosed cases. Sub-Saharan Africa, including Nigeria, is facing a significant rise in diabetes due to factors such as urbanization, changing dietary habits, sedentary lifestyles, and increasing obesity rates. One of the key markers of diabetes and associated metabolic disorders is glycosuria, the presence of glucose in the urine, which can serve as an early indication of diabetes or impaired glucose tolerance.

Glycosuria is a term that defines the presence of reducing sugars in the urine, such as glucose, galactose, lactose, and fructose. Glucosuria connotes the presence of glucose in the urine and is the most frequent type of glycosuria and is the focus of this review. It happens when the glomerulus filters more glucose than the proximal tubule can reabsorb. In normal individuals, glucosuria can be up to 0.25 mg/ml.³ Glucosuria can also occur in increased glucose concentration in the circulating blood. This phenomenon can also occur in normal individuals who consume excess carbohydrates,

known as 'alimentary glycosuria'.⁴ In healthy individuals, glucose is filtered by the kidneys and almost entirely reabsorbed, keeping blood glucose levels stable. However, when blood glucose exceeds approximately 180 mg/dl, glycosuria can develop. This condition may arise from uncontrolled diabetes, kidney dysfunction, or other metabolic disorders. While not a definitive diagnosis of diabetes, glycosuria is a useful indicator of hyperglycaemia, making it a critical tool for early diagnosis and preventive interventions.

The prevalence of diabetes in Nigeria has been steadily rising, with estimates ranging between 1.9% and 9.8% across various studies.^{5,6,7}

The overall pooled prevalence of DM in a meta-analysis in Nigeria was 5.77% (95% CI 4.3–7.1).⁵ The pooled prevalence of DM in the six geopolitical zones of Nigeria were 3.0% in the north-west, 5.9% in the north-east, 3.8% in the north-central zone, 5.5% in the south-west, 4.6% in the south-east, and 9.8% in the south-south zone. The associated risk factors noted for the pooled prevalence of DM included a family history of DM 4.6%; urban dwelling (6.0%); cigarette smoking (4.4%); older age (6.6%); physical inactivity (4.8%) and obesity (5.3%).⁵ High prevalence of diabetes and pre-diabetes were also noted among residents of western Nigeria.⁶ DM was reported to be more common in the females, and in those below the age of 61 years.⁶ Amaewhule et al, reported a high DM prevalence of 16.8%, in their study in Port Harcourt (South-south Nigeria).⁸ Co-morbidities like hypertension among diabetics have formed a joint high prevalence of 55.9%, as reported by Bello-Ovosi et al., in a study in an urban community in North-

West Nigeria.⁹

Although clinical trials results provide a successful method for prevention of type 2 diabetes, the success of this idea depends on acceptance of intervention programs among populations.¹⁰ However, these figures may not fully reflect the true extent of the disease, as many individuals remain undiagnosed due to limited access to healthcare, lack of awareness, and cultural factors that discourage seeking medical attention. The Niger Delta region, known for its rich natural resources but also environmental degradation, faces unique health challenges that may worsen the diabetes burden.¹⁰ This region is characterized by poverty, pollution from oil extraction activities, and a high prevalence of both communicable and non-communicable diseases, such as hypertension and obesity, which are closely linked to diabetes.¹⁰

Family practice clinics serve as primary healthcare access points in Nigeria, particularly in underserved regions like the Niger Delta, where specialized care is often scarce. These clinics provide a crucial opportunity for early detection and management of chronic diseases, including diabetes, through routine screenings and preventive care. First-time visitors to these clinics, many of whom may not have had consistent healthcare access previously, represent an important group for early detection of glycosuria and other risk factors for diabetes and metabolic disorders. Screening for glycosuria in this population can not only facilitate early diagnosis but also enable healthcare providers to implement timely interventions to prevent the progression of diabetes and its associated complications.

The increasing prevalence of diabetes in Nigeria, particularly in the Niger Delta region, highlights the urgent need for early detection and intervention to lessen the disease's impact on individuals and the healthcare system. Despite the importance of early detection, there is limited data on the prevalence of glycosuria and its associated risk factors in the Niger Delta, particularly among first-time attendees of family practice clinics. Understanding the prevalence of glycosuria and its correlates, such as age, gender, body mass index (BMI), hypertension, and lifestyle factors, is essential for improving clinical practices, shaping public health policies, and addressing the growing diabetes burden in the region.

However, many individuals with diabetes or pre-diabetes remain undiagnosed, particularly in resource-limited settings where access to healthcare services is inadequate, and public awareness of diabetes is low. Family practice clinics play a crucial role in identifying those at risk of diabetes through routine screenings and preventive care. The prevalence of glycosuria is a key marker of diabetes risk, among first-time clinic attendees in the Niger Delta region. Glycosuria, though not a definitive diagnosis of diabetes, serves as a critical sign of hyperglycaemia and possible renal dysfunction. Its presence in first-time clinic attendees may signal undiagnosed diabetes, impaired glucose tolerance, or other underlying metabolic disorders that require prompt medical intervention. Additionally, glycosuria is often linked to modifiable risk factors such as obesity, hypertension, and unhealthy lifestyle choices,⁵ which are prevalent in the Niger Delta due to ongoing socio-economic and environmental challenges.

The lack of comprehensive data on glycosuria and its associated factors in the Niger Delta hinders the development of effective

screening and prevention strategies. Therefore, there is a pressing need for studies that assess the prevalence of glycosuria among first-time clinic attendees and explore the demographic and clinical factors linked to its occurrence. Such data will offer valuable insights into the early detection of diabetes and other metabolic disorders in this population and support the design of targeted interventions aimed at reducing the burden of these diseases. A study by Verma et al., revealed that the frequency of diabetic complications will rise if there is a lack of cost-effective and sustainable interventions.¹¹ Researchers have also advocated for the prevention of diabetes and its complications such as diabetic retinopathy and cardiovascular disease as a crucial part of all future health-related public policies among all nations.¹¹

This study aims to investigate the prevalence of glycosuria and newly diagnosed hyperglycemia among first-time attendees of a family practice clinic in the Niger Delta region of Nigeria and identify the factors that relate with their occurrence.

By shedding light on the prevalence and correlates of glycosuria in this resource-limited population, this research seeks to contribute to broader efforts to address the diabetes epidemic in Nigeria. The findings will be particularly valuable for the Niger Delta region, where healthcare challenges are compounded by environmental degradation, urbanization and socio-economic inequalities, and where more effective interventions are urgently needed.

Methods

This study was a descriptive hospital-based cross-sectional study, conducted at the Family Medicine clinic, Rivers State University Teaching hospital, Port Harcourt, South-south Nigeria.

The Study population comprised all adult patients assessing care for the first time at the Family Medicine clinic, RSUTH, Port Harcourt. Inclusion Criteria were the consenting adults (18 years and above) who were assessing care for the first time while old patients (not coming for the first time), those below 18 years and those who were too ill to participate were excluded from the study.

Sample Size Determination

The sample size was calculated using the Leslie-Kish formula. With the standard normal deviate of 1.96 which corresponds to the 95% confidence level, the prevalence (p) which was 46.15%, chosen from a prevalence study¹² on hyperglycemia among workers in south-west Nigeria, a sample size of 376 was therefore derived. This was approximated to 380 participants. Thus, a sample size of 380 was used for the study.

Sampling technique/data collection

A total of 380 adult participants were selected systematically and underwent a point-of-care- testing of their urine and blood glucose levels. Semi-structured, interviewer-administered questionnaires were used to collect data within a period of two months, and subsequently analysed.

The first respondent each day was selected by simple random sampling using a list of the first two new patients as sampling frame and a proportionate sample size taken for each clinic day. The Family medicine clinic of RSUTH received an average of 50 new patients each day. This gave a total of 250 patients/week (five working days in a week) and 2,000 in eight weeks. A sampling interval of approximately 5 ($2000/380=5.2$) was used. With a daily first-time attendees' population of about 50, and interval of 5, ten

patients were recruited on each working day, until the sample size of 380 was reached.

The study participants underwent a point-of-care- testing of their urine and blood glucose levels using Dipstix and Kiptrack glucometer, respectively. Their blood pressure levels, weights and heights and BMI were checked. Urine glucose was interpreted as normal, 1+ (mild), 2+ (moderate), ≥3+ (severe) using the appropriate colour change on urinalysis strip but was graded as either normal urine glucose or glycosuria for purpose of data analysis. Blood glucose was classified as normal (Fasting blood glucose-FBG of <5.5mmol/L or Random blood glucose- RBG of <7.7mmol/L), Pre-diabetes (FBG of 5.5-6.9mmol/L, or RBG of 7.7-10.9mmol/L), and Diabetes (FBG of >7mmol/L or RBG of >11mmol/L). It was thereafter graded as normal blood glucose and hyperglycemia (pre-diabetes + diabetes) for analysis purpose.

Ethical approval was obtained from the RSUTH ethical committee (RSUTH/REC/2024/615) and confidentiality maintained.

Statistical Analysis: The data collated in excel sheet was analysed using the Statistical Package for Social Sciences [SPSS] version 25. Categorical variables were expressed as frequencies and proportions. Appropriate charts and tables were used to illustrate results. Descriptive statistics were calculated using chi square and Fischer's exact test, where necessary to check for confounders, and significant levels were set at a p value of < 0.05.

Results

Distribution of urine glucose levels

The prevalence of glycosuria in this study was 9.5% (n=36), while those with normal urine glucose was 90.5% (n=344).

Socio-Demographic Characteristics of Participants

Table 1 shows a total of 380 respondents, with preponderance of 71.1%, within the female gender, the younger ages (20-40 years), 56.8%, the unmarried (23.4%) and those who were artisans or involved in business (51.1%).

Table 1: Socio-demographic Characteristics of Respondents

Socio-demographic characteristics	Frequency (n)	Percentage (%)
Age Group		
<20 Years	7	1.8
20-40 Years	216	56.8
40-60 Years	89	23.4
>60 Years	68	17.9
Gender		
Female	270	71.1
Male	110	28.9
Marital Status		
Married	273	71.8
Unmarried	107	28.2
Occupation		
Unemployed/Student	87	22.9
Artisan/Business	194	51.1
Civil/Public Servant	54	14.2
Professional	45	11.8

DISTRIBUTION OF GLYCAEMIC LEVELS IN RESPONDENTS

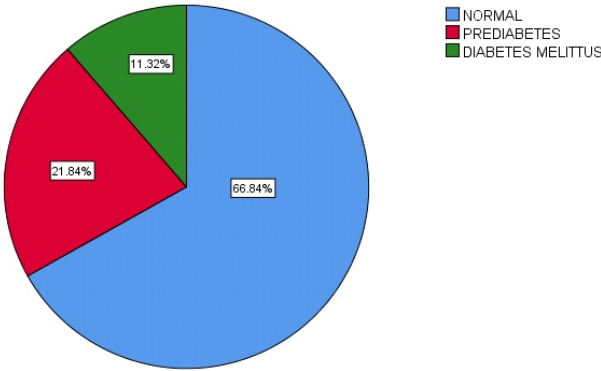


Figure 1: Distribution of glycemic levels in Respondents

Figure 1 show prevalence of normal blood glucose as 66.8% and hyperglycemia as 33.2% (being 21.8% for pre-diabetes and 11.3% for Diabetes Mellitus).

Proportion of Newly diagnosed Glucosuria and DM

Table 2 shows the number of cases of Glucosuria with no previous history of DM as 6.3% .

Table 2: Urine glucose status and history of Diabetes Mellitus

History of DM	Urine Glucose			df	χ ²	p-value
	Negative N (%)	Positive N (%)	Total (100%)			
Yes	17 (54.8)	14(45.2)	31	1	50.126	.000
No	327 (93.7)	22 (6.3)	349			

Table 3: Urine Glucose Levels And Socio-Demographic Characteristics Of Participants

Socio-demographic Factors	Negative Glucosuria n (%)	Positive Glucosuria n (%)	df	χ^2	p-value
Gender					
Female	248 (91.9)	22 (8.1)	2	1.911	0.167
Male	96 (87.3)	14 (12.7)			
Age range (years)					
<20	7 (100)	0 (0)	3	1.799	0.615
20-40	198 (91.7)	18 (8.3)			
41-60	79 (88.8)	10 (11.2)			
>60	60 (88.2)	8 (11.8)			
Marital status					
Married	243(89.0)	30 (11.0)	1	2.596	0.107
Unmarried	101(94.4)	6 (5.6)			
Occupation					
Unemployed/student	84 (96.6)	3 (3.4)	3	18.355	0.020
Artisan/Business	169 (87.1)	25(12.9)			
Civil/Public Servant	47 (87.0)	7 (13.0)			
Professional	44 (97.8)	1(2.2)			

According to Table 3 above, more males had glucosuria (12.7%) compared to the females (8.1%). For the age groups, no glucosuria was recorded for those < 20 years old in this study, while the elderlies (>60 years) showed the highest preponderance of glucosuria (11.8%). Highest levels of glucosuria were also observed in the married people (11.0%) than the unmarried (5.6%). Occupation was found to be statistically associated with urine glucose levels (p = .02, γ² =18.355), with highest glucosuria observed more among Civil/Public Servants (13%) and Artisan/Business people (12.9%), and lowest levels (3.4%) in the unemployed/students.

Table 4: Relationship between Clinical Factors and Urine Glucose Levels in Participants

Clinical Factors	GLUCOSURIA			df	χ^2	P-value
	Negative n (%)	Positive n (%)	Total (100%)			
Blood Pressure (mmHg)						
<130/85	176 (93.6)	12 (6.4)	188	3	6.951	.073
130/85 -139/89	47 (87.0)	7 (13.0)	54			
140/90- 159/99	66 (91.7)	6 (8.3)	72			
≥160/100	55 (83.3)	11 (16.7)	66			
BMI (kg/m²)						
Underweight (<25)	30 (100)	0 (0)	30	3	3.637	.303
Normal weight (25- 29.9)	121(89.6)	14 (10.4)	135			
Overweight (30-34.9)	113 (89.0)	14(11.0)	127			
Obese (≥35)	82 (93.2)	6 (6.8)	88			
Alcohol Consumption						
Yes	2(50)	2(50)	4	3	7.742	.005
No	342 (91.0)	34 (9)	376			
Tobacco Use						
No	361(95)	19 (5)	380			

Clinical Factors and Urine Glucose Levels of Participants

Table 4 shows that most of the respondents (n=180) had normal blood pressure reading of < 135/85 mmHg, had normal weight (n=135), were non- alcohol consumers (n=376), while none of the respondents used tobacco.

Positive glucosuria was observed mostly among those with elevated blood pressures, being 16.7% in Stage 3 hypertension (≥160/100 mmHg), 11% in overweight people and only 5% of those that used tobacco. It was noted that 50% of alcohol consumers had positive glucosuria, which was statistically significant (P=.005, $\chi^2=7.742$, Fischer's Exact Test=0.046).

Glycemic Levels Of Participants

Glycemic levels and socio-demographic characteristics of participants

Table 6 shows that more females had hyperglycemia (34.5%) than males. Most of the youngest age group (<20 years) had normal glucose levels (85.7%), while the elderly people(>60 years) recorded the highest proportion of hyperglycemia (51.5%), with a statistical significance of p <0.01. Higher glycemic levels were also reported in married group (53.5%) and atisans /business men (36.6%).

Relationship between Clinical Factors and Glycemic Levels of Participants

Table 5 below shows the relationship between clinical factors and glycemic levels of Participants that most of the participants recorded normal blood pressure of <130/85mmHg. However the highest level of hyperglycemia were recorded among respondents with stage 3 hypertension, with BP ≥160/100mmHg (43.9%), those that are overweight (35.4%), alcohol consumers (75%), those who had a past history of hypertension (53.3%) and past history of DM (87.1%). Statistical significant associations were with past history of hypertension (p< .001, Fischer's exact test=.001) and past history of DM (p< .001, Fischer's exact test=.000). The new cases of hyperglycemia were 28.4%.

TABLE 5: Clinical Factors and Glycemic Levels of Participants

Clinical factors	Glycaemic Levels		Total	df	χ^2	p- value	Fisher's exact
	Normal n (%)	Hyperglycaemia n (%)					
Blood Pressure (mmHg)							
<130/85	132(70.2)	56 (29.8)	188	3	4.495	.213	
130/85 -139/89	37 (68.5)	17 (31.5)	54				
140/90- 159/99	48 (66.7)	24 (33.3)	72				
≥160/100	37 (56.1)	29 (43.9)	66				
BMI (kg/m²)							
Underweight (<25)	22 (73.3)	8 (26.7)	30	3	.940	.816	
Normal weight (25- 29.9)	90 (66.7)	45 (33.3)	135				
Overweight (30-34.9)	82 (64.6)	45 (35.4)	127				
Obese (≥35)	60 (68.2)	28 (31.8)	88				

Alcohol Consumption							
Yes	1 (25.0)	3 (75.0)	4	1	3.193	.074	
No	253 (67.3)	123 (32.7)	376				
Tobacco Use							
No	254 (66.8)	126 (33.2)	380				
History of Hypertension							
Yes	28 (46.7)	32 (53.3)	60	1	13.086	0.000	.001
No	266 (70.6)	74 (29.4)	320				
History of DM							
Yes	4 (12.9)	27 (87.1)	31	1	42.208	0.000	.000

Relationship between Urine Glucose and Blood Glucose Levels of Participants

According to table 6, the participants with hyperglycaemia had the highest proportion of positive glucosuria (25.4%), which are the true positives, while 74.6% had negative glucosuria. Only 1.6% of those with normal glycemia had positive glucosuria. These were the false positives. The proportion of participants who had both normal glycemic levels and negative urine glucose accounted for 98.4% (true negatives). There was a statistically high association between urine glucose and blood glucose in this study. (p=< .001, $\chi^2 = 55.729$, Fischer's exact test=.000)

Table 6: Urine Glucose and Blood Glucose Levels of Participants

Glycaemic levels	Urine Glucose		df	χ^2	p- value	Fisher's Exact
	Positive n (%)	Negative n (%)				
Hyperglycaemia	32 (25.4)	94 (74.6)	1	55.729	.000	.000
Normal	4 (1.6)	250 (98.4)				
	36 (9.5)	344 (90.5)				

Discussion

This study assessed the prevalence of glycosuria, its correlates, and newly diagnosed hyperglycaemia among first-time attendees in a Family Medicine clinic in Nigeria. A female preponderance (71%) was observed among the total of 380 respondents in this study, which was similar to other studies.^{8,13,14} Prevalence of glycosuria in this study was 9.5% and 33.2% for Hyperglycaemia (pre-diabetes (21.8%) and Diabetes Mellitus (11.3%). This is in consonant with the prevalence of 10% glycosuria reported by Ormonde et al in Brazil and 10.67% in a cohort study in Ghana.^{15,16} These values are higher than those reported by Alhaji et al with a prevalence of 2.7% for Hyperglycaemia and 2.1% for glycosuria in adult respondents during a routine screening in a rural part of Northern Nigeria. They are also higher than the overall prevalence of DM and pre-diabetes of 4.6% and 6.0% respectively in the study by Rasaki et al, in Bayelsa state, Nigeria.¹⁴ However, a previous study in the South-south region of Nigeria revealed a similarly close prevalence of 13.9% for DM.¹⁷ However, a higher figure (16.8%) was reported from a prevalence study on DM in Port-Harcourt, Nigeria by Amaewhule et al.⁸ This high prevalence may be due to urbanization and increasing prevalence of obesity as well as inadequate exercise practice being experienced in many parts of Africa.¹⁸

A significant association with glycosuria was found in alcohol consumers in this study, which is similar to common reports from a Ghana study,¹⁹ where glycosuria was detected in 21% of people with chronic alcoholism and another study by Eniedo et al, which reported that heavy drinkers had severe glycosuria compared to moderate drinkers.²⁰ People's response to alcohol

consumption may however, vary greatly with some individuals more susceptible to glycosuria due to genetic or other factors.

This study also found a significant association between glycosuria and occupation, with the highest prevalence in the employed population (Civil/public servants, followed by artisans/business people). Worthy of note was also a higher prevalence of hyperglycaemia in artisans (36.6%). This is in agreement with findings by Yahaya et al, where artisans had the highest hyperglycaemic population of 46.15% among other workers in South-west Nigeria.²¹ The notably higher glucosuria prevalence among artisans could have been influenced by factors such as lifestyle choices, work-related stress, dietary habits, or disparities in healthcare access within specific occupational groups.

High glycaemic levels were recorded among the female gender, obese people, people with grade 3 hypertension and significant association with age and highest prevalence seen in > 60years age group. These are in agreement with other studies, which reported a female gender tendency towards higher glycaemic levels than males.^{6, 22} This could be due to the higher percentage of body fat which can influence insulin sensitivity and glucose metabolism is found more in females.⁶

A clear trend emerges in this study, as higher BMI scores were associated with an increased risk of glycosuria. This is in agreement with reports by other researchers.^{23, 24} Obese individuals may face a higher risk of diabetes or impaired glucose metabolism. Even within the normal BMI range, some individuals exhibited glycosuria, which could signal underlying metabolic issues. While Obesity and hypertension are important risk factors for developing Hyperglycaemia and hence, insulin resistance, hypertension has been found to be more implicated in individuals with metabolic syndrome.^{22, 25}

Hyperglycaemia was mainly associated with older age in our study, similar to findings from other reserchers.²⁶ However, a contrast was reported in a Tanzanian study among secondary school students, where high glycaemic levels were observed in younger individuals, with a male preponderance, particularly in those with other risk factors for diabetes.²⁷ This study shows that urine glucose levels have a strong association with blood glucose levels. Although several studies have shown the efficacy of using urine glucose test in screening for Diabetes Mellitus,^{28, 29} the absence of glucose in urine does not, however, eliminate the possibility of a person having diabetes, as some pre-diabetic and diabetic individuals may still test negative for urine glucose. These are the false negatives. Hence, blood glucose level is a strong predictor of diabetes mellitus.

Limitations of the study

It was a hospital-based study and may need more power to ensure higher validity. The instrument used was urine dipstix, which is a sensitivity test with high tendency to have false positive results.

Conclusion

Point-of-care testing of (POCT) of urine and blood glucose in primary care is important for first-time clinic attendees to aid early detection of glucosuria and Hyperglycaemia as pointers to DM, especially in the elderly and those with co-morbidities. Lifestyle changes may help curb this rising prevalence in the Niger Delta region of Nigeria.

Recommendation

Regular urine and blood glucose checks should be prioritised in primary care to help early detection and treatment of DM. More specialized blood testing,

may be necessary to assess diabetes risk in hypertensive and overweight/obese individuals who show signs of glycosuria. Further studies will be needed to test associations between lifestyle factors and blood glucose control.

Conflict of interest

The authors declare no conflict of interest.

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