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Research Article

Prevalence of Impaired Fasting Glucose (Prediabetes) and Associated Factors Among Adults in Doka Community, Tofa Local Government Area, Kano State

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Abstract

Background: Prediabetes, particularly impaired fasting glucose (IFG), is an important intermediate state in the development of type 2 diabetes and an increasing public health concern in sub-Saharan Africa. However, community-based data from rural northern Nigeria remain limited. This study determined the prevalence of IFG and associated factors among adults in Doka Community, Tofa Local Government Area, Kano State, Nigeria. *Methods:* A community-based cross-sectional analytic study was conducted among 286 adults aged 20–79 years. Data were collected using a structured interviewer-administered questionnaire. Standardized anthropometric measurements, including body mass index (BMI) and waist-to-hip ratio (WHR), were obtained, and fasting capillary blood glucose was measured using a calibrated glucometer. IFG was defined according to the World Health Organization criterion of 6.1–6.9 mmol/L. Multivariable logistic regression was used to identify factors associated with IFG. *Results:* Of 286 respondents, 262 (91.6%) had heard of diabetes, although 103 (40.5%) could not identify any cause. IFG was detected in 23 (8.0%) respondents, while 1 (0.4%) had glucose in the diabetic range. Overweight (AOR=6.965; 95% CI: 2.332–20.801), obesity (AOR=7.438; 95% CI: 1.660–33.339), and high-risk WHR (AOR=8.813; 95% CI: 2.203–35.247) were independently associated with IFG. Although the overall association with age group was not statistically significant (p=0.059), respondents aged 40–49 years had higher odds of IFG than those aged 20–29 years (AOR=4.159; 95% CI: 1.109–15.599). Blood pressure was not independently associated with IFG. Occupation and selected diabetes-knowledge indicators showed bivariate associations, whereas family history did not; these variables were not retained in the final model because of non-significant or sparse outcome data. *Conclusion:* IFG affected 8.0% of adults despite high diabetes awareness. Excess body weight and central adiposity were the principal factors associated with IFG. Strengthen targeted community- and primary healthcare-based screening, diabetes education, weight management, healthy dietary practices, and physical activity to facilitate early identification and prevention of type 2 diabetes.

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Keywords

Impaired Fasting Glucose, Prediabetes, Diabetes Mellitus, Obesity, Waist-to-hip Ratio, Rural Nigeria, Kano State

1. Introduction

Diabetes mellitus (DM) is one of the fastest-growing global public health challenges of the 21st century. It is a group of metabolic disorders characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both [1]. Type 2 diabetes accounts for the majority of diabetes cases and is strongly influenced by modifiable factors including excess body weight, central adiposity, unhealthy dietary practices, and physical inactivity [2]. The increasing prevalence of these risk factors has contributed substantially to the global burden of diabetes and its complications.

According to the International Diabetes Federation (IDF), approximately 589 million adults aged 20-79 years were living with diabetes in 2024, representing 11.1% of the adult population in this age group. This number is projected to increase to approximately 853 million by 2050 [2]. The burden of abnormal glucose regulation is considerably greater when individuals with prediabetes are included. The African Region is projected to experience the largest proportional increase in diabetes burden globally, with the number of adults living with diabetes expected to increase by approximately 142% between 2024 and 2050. During the same period, the number of adults with impaired glucose tolerance and impaired fasting glucose is projected to increase substantially, reaching approximately 135 million and 88 million, respectively [1]. These projections highlight the importance of identifying abnormal glucose regulation before the development of overt diabetes.

Prediabetes is an intermediate state of abnormal glucose regulation in which blood glucose levels are higher than normal but below the diagnostic threshold for diabetes. According to the World Health Organization (WHO), IFG, defined as a fasting plasma glucose concentration of 6.1-6.9 mmol/L, represents intermediate hyperglycemia and an increased risk of developing type 2 diabetes [3]. Prediabetes is clinically important because individuals with impaired glucose regulation are more likely to progress to diabetes and may also face an elevated risk of cardiovascular disease and other metabolic complications. Importantly, progression to diabetes is not inevitable. Evidence from the Diabetes Prevention Program and subsequent studies has shown that lifestyle interventions involving weight reduction, healthier dietary practices, and increased physical activity can substantially reduce the risk of progression to type 2 diabetes [4]. Identification of individuals with IFG therefore provides an important opportunity for early intervention and prevention.

The burden of dysglycaemia is particularly concerning in sub-Saharan Africa, where rapid demographic, socioeconomic, and lifestyle changes are occurring alongside limited resources for prevention and chronic disease management. Although the African Region currently has the lowest estimated prevalence of diabetes among the IDF regions, it has the highest projected proportional increase in the number of people living with diabetes and the highest proportion of undiagnosed diabetes [2, 5]. Nigeria bears a substantial share of this burden. Current IDF estimates indicate that approximately 3.6 million Nigerian adults are living with diabetes, while systematic reviews have demonstrated substantial variation in the prevalence of diabetes and prediabetes across different regions and population groups in the country.

The epidemiological transition in Nigeria is accompanied by increasing exposure to risk factors for dysglycaemia, including obesity, physical inactivity, unhealthy dietary patterns, and central adiposity [2, 5]. Excess adiposity, particularly visceral fat accumulation, contributes to insulin resistance through altered adipokine secretion, increased circulating free fatty acids, chronic low-grade inflammation, and impaired insulin signaling [6]. Studies from Nigeria and other African countries have demonstrated significant associations between obesity, central adiposity, and abnormal glucose regulation [7-10]. Of particular importance, central adiposity may confer substantial metabolic risk even among individuals not classified as obese by BMI, suggesting that anthropometric measures beyond BMI may improve identification of individuals at increased metabolic risk.

Despite the increasing burden of dysglycaemia, population-based information on impaired fasting glucose remains limited in many rural communities in Nigeria. Rural populations are changing dietary patterns, physical activity, occupational structure, and access to healthcare, while often remaining underserved by non-communicable disease screening programs. Consequently, individuals with impaired glucose regulation may remain unidentified until they develop overt diabetes or its complications. Community-based assessment of IFG is therefore important for quantifying the burden of intermediate hyperglycemia and identifying modifiable risk factors that early intervention can target.

In Kano State, particularly in rural communities, contemporary evidence on impaired fasting glucose and its associated factors remains limited. Identifying the prevalence of IFG and its relationship with modifiable characteristics such as obesity and central adiposity could provide an important basis for strengthening primary healthcare-based diabetes prevention. Such evidence is particularly relevant in communities where

access to routine laboratory screening may be limited and where community-based interventions may provide an opportunity for early identification and risk reduction.

Therefore, this study aimed to determine the prevalence of impaired fasting glucose (prediabetes) and identify factors associated with prediabetes among adults in Doka Community, Tofa Local Government Area, Kano State, Nigeria. It also assessed respondents' awareness and knowledge of diabetes mellitus. The findings are expected to provide evidence to support community-based diabetes prevention, targeted screening, and the integration of cardiometabolic risk assessment into primary healthcare services in rural northwestern Nigeria.

2. Methods

2.1. Study Design

The study was an analytic cross-sectional design to determine the prevalence and risk factors of prediabetes mellitus in Doka community of Tofa Local Government, Kano.

2.2. Study Population

The study population comprised adult men and women aged 20-79 years who were permanent residents of Doka Community, Tofa Local Government Area, Kano State.

2.3. Sample Size Estimation

The formula below was used to calculate the sample size [11]:

$$n = z^2 p\ q\ /\ d^2$$

n = Minimum sample size;

Z = Normal standard deviate = 1.96;

p = Prevalence of prediabetes in northwestern Nigeria = 26.4% [12];

d = Degree of precision = 0.05.

therefore n = 1.96 × 1.96 × 0.264 × 0.736 = 0.747/0.0025 = 298.

Allowing for 10% non-response,

$n_f = 298 + (0.10 \times 298) \approx 328$.

2.4. Sampling Technique

A household listing exercise was conducted to establish the sampling frame, yielding 748 households. Systematic random sampling was used to select households. The sampling interval (k) was calculated by dividing the total number of households by the intended sample size (748/328), giving approximately 2.28. An operational sampling interval of 2 was therefore used. A random starting household was selected from the first two households using simple random sampling, after which every second household was approached for recruitment until completion of data collection. A total of 286 eligible respondents ultimately participated in the study.

2.5. Data Collection

Data were collected using a structured, interviewer-administered questionnaire adapted from the Nigeria Demographic and Health Survey (NDHS) 2018 [13] and previously validated questionnaires from published studies on diabetes mellitus and its associated risk factors. The questionnaire was modified to reflect the objectives of the study and the socio-cultural context of the study area. It was translated into Hausa and back-translated into English to ensure semantic equivalence. The questionnaire comprised sections on socio-demographic characteristics; awareness and knowledge of diabetes mellitus; lifestyle and behavioural risk factors; family history of diabetes; previous diagnosis of diabetes; and medication history. The questionnaire was pretested among adults in a neighbouring community with similar socio-demographic characteristics to the study population. Necessary modifications were made following the pretest to improve clarity, comprehension, and appropriateness of the questions. Data were collected by trained research assistants under the supervision of the principal investigator.

2.5.1. Anthropometric Measurements

Anthropometric measurements were obtained using standardized procedures.

Body weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale, with participants wearing light clothing and no footwear. Height was measured to the nearest 0.1 cm using a portable stadiometer, with participants standing erect without shoes.

BMI was calculated as weight in kilograms divided by the square of height in meters:

$$BMI = Weight(kg) / Height(m)^2$$

BMI was categorized according to the World Health Organization classification.

Waist and hip circumferences were measured using a non-elastic measuring tape according to standardized procedures. Waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, and hip circumference at the widest point of the buttocks.

WHR was calculated as:

$$WHR = Waist\ circumference / Hip\ circumference$$

Central obesity was defined as a WHR >0.90 in men and >0.85 in women, according to WHO criteria.

2.5.2. Fasting Blood Glucose Measurement and Definition of IFG

Fasting blood glucose was measured among all participants using a calibrated Accu-Chek Active glucometer following an overnight fast.

Participants were instructed to abstain from food and caloric beverages before blood glucose measurement, while water was permitted. Fasting was defined as no caloric intake for at least 8 hours before blood glucose measurement.

A capillary blood sample was obtained by finger prick and analyzed immediately using the glucometer according to the manufacturer's instructions.

Impaired fasting glucose (IFG), classified as prediabetes in this study, was defined according to the World Health Organization (WHO) criterion as a fasting blood glucose concentration of 6.1-6.9 mmol/L. A fasting blood glucose concentration of <6.1 mmol/L was classified as normal, while a fasting blood glucose concentration of ≥7.0 mmol/L was classified as diabetic range.

Participants who reported a previous diagnosis of diabetes mellitus were also identified separately.

2.5.3. Blood Pressure Measurement

Blood pressure was classified according to the 2025 American College of Cardiology/American Heart Association (ACC/AHA) guideline. Normal blood pressure was defined as systolic blood pressure (SBP) <120 mmHg and diastolic blood pressure (DBP) <80 mmHg; elevated blood pressure as SBP 120-129 mmHg with DBP <80 mmHg; Stage 1 hypertension as SBP 130-139 mmHg or DBP 80-89 mmHg; and Stage 2 hypertension as SBP ≥140 mmHg or DBP ≥90 mmHg. When SBP and DBP fell into different categories, the higher category was used [14].

2.6. Data Analysis

Data were analyzed using IBM SPSS Statistics version 25 [15]. Categorical variables were summarized using frequencies and percentages, while continuous variables were summarized using appropriate measures of central tendency and dispersion. The prevalence of impaired fasting glucose (IFG) was calculated as the proportion of respondents with fasting blood glucose values of 6.1–6.9 mmol/L. The single participant with a fasting blood glucose value in the diabetic range (≥7.0 mmol/L) was excluded from analyses in which IFG was the binary outcome.

Bivariate analyses assessed associations between IFG and sociodemographic, anthropometric, blood pressure, family history, occupational, and diabetes-knowledge variables. Pearson's chi-square test or Fisher's exact test, where appropriate, were used for categorical variables. Variables with a p-value <0.20 at bivariate analysis, together with variables considered clinically relevant, were considered for multivariable logistic regression. Because only 23 participants had IFG, the final multivariable model was kept parsimonious to minimize unstable estimates associated with sparse outcome data. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported, and statistical significance was set at $p<0.05$.

2.7. Ethical Consideration

Ethical approval was obtained from the Research and Ethics Committee of the Kano State Ministry of Health. Permission was also obtained from the District Head of Tofa LGA and the LGA Chairman. Written informed consent was obtained from all participants before data collection. Participants were assured of confidentiality, anonymity, and their right to withdraw from the study at any time without penalty.

3. Results

Table 1. *Sociodemographic Characteristics Of Respondents (N = 286).*

Variable	Frequency (n)	Percentage (%)
Age		
20-29	108	37.8
30-39	74	25.9
40-49	42	14.7
50-59	25	8.7
≥ 60	37	12.9
Mean age: 37.2±14.5		
Sex		
Male	138	48.3

Variable	Frequency (n)	Percentage (%)
Female	148	51.7
Tribe		
Hausa	245	85.7
Fulani	30	10.5
Others	11	3.8
Marital status		
Married	248	86.7
Single	38	13.3
Educational level		
No formal education	97	33.9
Primary	46	16.1
Secondary	122	42.7
Tertiary	21	7.3
Occupation		
Petty trader	82	28.7
Farmer	78	27.3
Housewife	42	14.7
Artisan	70	24.5
Civil servant	14	4.9
Monthly income		
<70,000	227	79.4
70000-100000	37	12.9
>100,000	22	7.7
BMI		
Normal	224	78.3
Overweight	40	14.0
Obese	22	7.7
Waist-hip ratio (WHR)		
Normal	135	47.2
High risk	151	52.8

Table 2. *Awareness of diabetes among respondents (n = 286).*

Variable	Frequency (n)	Percentage (%)
Have you heard of diabetes		
Yes	262	91.6
No	24	8.4
Causes of diabetes		

Variable	Frequency (n)	Percentage (%)
Excessive intake of sugar	25	9.5
Obesity	71	27.1
Heredity	27	10.3
Lack of physical exercise	9	3.4
Drinking too much soda	14	5.3
Don't know	103	40.5
Symptoms of diabetes		
Frequent urination	23	8.8
Extreme thirst	9	3.4
Excessive hunger	16	6.1
Ulcers that don't heal	16	6.1
Weight loss	10	3.8
Dizziness	88	33.6
Blurred vision	9	3.3
Numbness of limbs	12	4.6
Don't know	5	1.9

* Percentages for causes and symptoms are based on respondents who had heard of diabetes (n = 262).

Table 3. *Diabetes history, family history, fasting blood glucose, and blood pressure status of respondents (N = 286).*

Variable	Frequency (n)	Percentage (%)
Have you ever been diagnosed with diabetes		
Yes	7	2.7
No	255	97.3
Place of diagnosis		
General hospital	5	71.4
PHC	2	28.6
Were you ever on medication		
Yes	5	71.4
No	2	28.6
Are you currently on medication		
no	7	100.0
Were you pregnant at time of diagnosis (n = 4)		
Yes	3	75.0
No	1	25.0
Do you have a family history of diabetes		
Yes	27	10.3
No	235	89.7

Variable	Frequency (n)	Percentage (%)
Blood Sugar		
Normal (<6.1mmol/L)	262	91.6
IFG (6.1-6.9mmol/L)	23	8.0
Diabetic range (≥ 7)	1	0.4
Hypertension category		
Normal	81	28.3
Elevated	36	12.6
Stage 1	96	33.6
Stage 2	73	25.5

*IFG = impaired fasting glucose.

Table 4. *Multivariable logistic regression analysis of factors associated with impaired fasting glucose among respondents (n = 285).*

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Age group (years)			0.059†
20–29	1.00	Reference	
30–39	0.673	0.135–3.346	0.628
40–49	4.159	1.109–15.599	0.035
50–59	1.418	0.256–7.863	0.689
≥60	0.554	0.085–3.607	0.537
BMI			0.001†
Normal	1.00	Reference	
Overweight	6.965	2.332–20.801	0.001
Obese	7.438	1.660–33.339	0.009
Waist-to-hip ratio			
Normal	1.00	Reference	
High risk	8.813	2.203–35.247	0.002
Blood pressure category			0.194†
Normal	1.00	Reference	
Elevated	7.913	0.788–79.461	0.079
*High	6.604	0.760–57.355	0.087

*Stage 1 and stage 2 hypertension were combined as a single high blood pressure category; AOR = adjusted odds ratio; CI = confidence interval; BMI = body mass index. Reference categories: age 20–29 years, normal BMI, normal waist-to-hip ratio, and normal blood pressure. †Overall Wald test for categorical variable. We excluded participants with fasting blood glucose in the diabetic range from the IFG regression analysis.

A total of 286 respondents participated in the study, giving a response rate of 87%. More than half (63.6%) were below 40 years of age, comprising 37.8% aged 20-29 years and 25.9% aged 30-39 years. Respondents aged 40-49 years constituted 14.7%, those aged 50-59 years 8.7%, while 12.9% were aged 60 years and above. Females constituted 51.7% of the respondents, while males accounted for 48.3%. The majority

were Hausa (85.7%), followed by Fulani (10.5%), while 3.8% belonged to other ethnic groups. Most respondents were married (86.7%). Regarding educational attainment, 42.7% had secondary education, 33.9% had no formal education, 16.1% had primary education, and 7.3% had tertiary education. Petty trading (28.7%) and farming (27.3%) were the most common occupations, followed by artisan work (24.5%), housewifery (14.7%), and civil service (4.9%). Most respondents (79.4%) reported a monthly income below ₦70,000. Regarding anthropometric characteristics, 78.3% had normal BMI, 14.0% were overweight, and 7.7% were obese. More than half (52.8%) had a high-risk waist-to-hip ratio (Table 1).

Overall, 91.6% (262/286) of respondents reported having heard of diabetes, while 8.4% had never heard of the disease. Among those aware of diabetes, the most identified cause was obesity (27.1%), followed by heredity (10.3%), excessive sugar intake (9.5%), excessive soda consumption (5.3%), and lack of physical exercise (3.4%). However, a substantial proportion (40.5%) did not know any cause of diabetes (Table 2).

Regarding symptoms, dizziness (33.6%) was the most frequently recognized symptom. Other symptoms identified included frequent urination (8.8%), excessive hunger (6.1%), non-healing ulcers (6.1%), numbness of the limbs (4.6%), weight loss (3.8%), extreme thirst (3.4%), and blurred vision (3.3%). Only 1.9% of respondents reported not knowing any symptoms of diabetes (Table 2).

Table 3 presents the respondents' history of diabetes, family history, fasting blood glucose status, and blood pressure categories. Among the 262 respondents who had heard of diabetes, 7 (2.7%) reported a previous diagnosis, while 255 (97.3%) had never been diagnosed. Of those previously diagnosed, 5 (71.4%) were diagnosed at a general hospital and had previously received antidiabetic medication; however, none were currently receiving medication. A family history of diabetes was reported by 27 (10.3%) respondents. Blood glucose screening identified 23 (8.0%) respondents with impaired fasting glucose (IFG), 1 (0.4%) with a fasting glucose value in the diabetic range, and 262 (91.6%) with normal glucose levels. Regarding blood pressure, 81 (28.3%) respondents had normal blood pressure, 36 (12.6%) had elevated blood pressure, 96 (33.6%) had Stage 1 hypertension, and 73 (25.5%) had Stage 2 hypertension (Table 3).

Additional bivariate analyses showed that occupation met the prespecified screening criterion for multivariable analysis ($p = 0.143$), whereas family history of diabetes was not significantly associated with IFG ($p = 0.325$). However, we did not retain occupation in the final multivariable model because outcome data were sparse, including the absence of IFG cases among civil servants, which resulted in unstable parameter estimates.

Among the diabetes-knowledge indicators examined, identifying obesity as a cause of diabetes ($p = 0.001$), reporting "don't know" regarding the causes of diabetes ($p = 0.005$), and identifying dizziness as a symptom of diabetes ($p = 0.015$) were significantly associated with IFG in the bivariate analysis.

In the multivariable logistic regression analysis, BMI and waist-to-hip ratio remained independently associated with IFG. Compared with respondents with normal BMI, overweight respondents had nearly seven-fold higher odds of IFG (AOR = 6.965; 95% CI: 2.332–20.801; $p = 0.001$), while obese respondents had approximately 7.4-fold higher odds (AOR = 7.438; 95% CI: 1.660–33.339; $p = 0.009$). Respondents with a high-risk waist-to-hip ratio had approximately 8.8-fold higher odds of IFG compared with those with a normal waist-to-hip ratio (AOR = 8.813; 95% CI: 2.203–35.247; $p = 0.002$).

The overall association between age group and IFG approached but did not reach statistical significance (overall $p = 0.059$). However, respondents aged 40–49 years had significantly higher odds of IFG compared with those aged 20–29 years (AOR = 4.159; 95% CI: 1.109–15.599; $p = 0.035$). The other age categories were not significantly associated with IFG. Blood pressure category was also not independently associated with IFG (overall $p = 0.194$). (Table 4) In a sensitivity analysis in which age was dichotomized as <40 and ≥40 years, respondents aged ≥40 years had higher adjusted odds of IFG, although the association was not statistically significant (AOR = 2.326; 95% CI: 0.856–6.316; $p = 0.098$).

4. Discussion

This study assessed the awareness of diabetes mellitus, the prevalence of impaired fasting glucose (IFG), and factors associated with IFG among adults in Doka Community, Tofa Local Government Area, Kano State, Nigeria. The study found that awareness of diabetes was high, with 91.6% of respondents having heard of the disease; however, detailed knowledge of its causes and symptoms was limited. Screening identified IFG in 8.0% of respondents, while 0.4% had fasting blood glucose in the diabetic range. In the multivariable analysis, overweight, obesity, and high-risk waist-to-hip ratio were independently associated with IFG. Although the overall association with age group did not reach statistical significance, respondents aged 40-49 years had significantly higher odds of IFG compared with those aged 20-29 years, while blood pressure category was not independently associated with IFG.

The high level of diabetes awareness observed in this study is encouraging and suggests that diabetes has become a recognized health problem even within this rural community. More than nine out of ten respondents reported having heard of diabetes. This finding is higher than that reported in some earlier Nigerian community-based studies, including the study by Sabir et al. among an urban Fulani population in northern Nigeria [16]. Studies from other settings have similarly demonstrated considerable awareness of diabetes, although important gaps in disease-specific knowledge persist [17-19]. However, awareness in the present study was not accompanied by adequate knowledge. More than 40% of respondents

who had heard of diabetes could not identify a cause, while recognition of several important symptoms was relatively poor. This distinction between awareness and adequate knowledge is important because simply having heard of diabetes does not necessarily translate into the ability to recognize personal risk, adopt preventive behaviors, or seek appropriate screening.

The findings concerning knowledge are particularly relevant to diabetes prevention. Obesity was the most commonly identified cause, while heredity, excessive sugar intake, excessive soft drink consumption, and lack of physical exercise were recognized less often. Although some of these responses reflect established risk factors, the relatively low recognition of physical inactivity and dietary factors suggests important gaps in understanding modifiable risks. Similarly, dizziness was the most frequently identified symptom, despite more characteristic symptoms of hyperglycemia including frequent urination, excessive thirst, weight loss, and visual disturbance. These findings suggest that community health education should move beyond general awareness campaigns and focus on practical diabetes literacy, including recognition of risk factors, symptoms, and the importance of screening among apparently healthy individuals [16-19].

The prevalence of IFG in this study was 8.0%. This represents a substantial proportion of adults who already have abnormal glucose regulation despite the relatively low proportion reporting a previous diagnosis of diabetes. The finding is broadly consistent with evidence that dysglycaemia and prediabetes are increasingly prevalent in African populations. A systematic review and meta-analysis of Nigerian studies demonstrated a substantial burden of prediabetes nationally, although estimates varied considerably between populations and geographical settings [20]. Similarly, studies from rural and urban Nigerian populations have demonstrated the presence of prediabetes and undiagnosed diabetes in apparently healthy adults [21]. The prevalence reported in the present study should, however, be interpreted in relation to the diagnostic criterion used. In this study, IFG was defined according to the WHO criterion of fasting blood glucose of 6.1-6.9 mmol/L. Differences in diagnostic thresholds between studies can produce substantial variation in reported prevalence and should therefore be considered when making comparisons [3, 20].

Identifying IFG in 8.0% of participants has important public health implications. IFG represents an intermediate state of abnormal glucose regulation and is associated with an increased risk of progression to type 2 diabetes [22, 23]. Recent evidence also indicates that prediabetes may be associated with adverse clinical outcomes even among individuals who do not subsequently progress to overt diabetes [24]. Importantly, progression to diabetes is not inevitable. Evidence from the Diabetes Prevention Program demonstrated that intensive lifestyle intervention can substantially reduce the incidence of type 2 diabetes among individuals at high risk [4]. More recent evidence also supports the effectiveness of lifestyle interventions in reducing cardiometabolic risk among individuals with prediabetes [25]. Consequently, identifying individuals with IFG at the community level provides an important opportunity for early intervention before the development of established diabetes and its complications.

Only one respondent (0.4%) had a fasting glucose value in the diabetic range, while 2.7% of respondents who had heard of diabetes reported a previous diagnosis. These relatively low figures should not be interpreted as evidence that diabetes represents a negligible problem in the community. The relatively young age structure of the study population may partly explain the low proportion with overt hyperglycemia, as the risk of dysglycaemia generally increases with advancing age. In addition, underdiagnosis remains a major challenge in sub-Saharan Africa. The IDF estimates that a substantial proportion of adults living with diabetes in the African region remain undiagnosed [2]. Evidence from community-based studies in Nigeria and Ethiopia similarly demonstrates the presence of undiagnosed diabetes and prediabetes among adults [10, 21]. Therefore, the relatively low prevalence of previously diagnosed diabetes in the present study may partly reflect limited case detection rather than an absence of metabolic risk.

A particularly important finding was the independent association between excess body weight and IFG, with both overweight and obesity remaining associated with IFG after adjustment for other factors. These findings are consistent with evidence from West African populations demonstrating strong associations between obesity indices and IFG or type 2 diabetes [26]. Studies from Ghana and Ethiopia have likewise demonstrated the usefulness of anthropometric measures in identifying individuals at increased metabolic risk [6-9, 27, 28]. The association is biologically plausible because excess adiposity promotes insulin resistance through altered adipokine secretion, inflammation, increased free fatty acid availability, and other metabolic mechanisms [29, 30].

The association between obesity and IFG is noteworthy given that only a relatively small proportion of respondents were classified as obese. This reinforces the importance of identifying individuals with excess body weight during routine primary healthcare encounters and providing early lifestyle interventions before dysglycaemia progresses to overt diabetes. The relationship between obesity and dysglycaemia is especially important in sub-Saharan Africa, where rapid nutritional and lifestyle transitions are contributing to an increasing burden of metabolic disease [26, 30, 31].

A high-risk waist-to-hip ratio was also independently associated with IFG, complementing the findings for BMI and highlighting the importance of central adiposity in impaired glucose regulation. This finding complements the BMI results and highlights the importance of central adiposity in the development of metabolic abnormalities. Evidence from West African populations has shown that anthropometric measures of central obesity are associated with diabetes and IFG, while studies in Ghana and Ethiopia have similarly demonstrated the

usefulness of central obesity measures in identifying cardiometabolic risk [6-9, 26, 27]. Visceral adipose tissue is metabolically active and releases free fatty acids and inflammatory mediators that can interfere with insulin signaling and promote metabolic dysfunction [29, 32]. These findings therefore support incorporating simple anthropometric measures, including waist and hip circumference, into community-based screening and primary healthcare services.

The relationship between age and IFG was less consistent. Although the overall association across age groups did not reach statistical significance, respondents aged 40-49 years showed a significant association with IFG compared with the youngest age group. However, this pattern was not consistent across older age categories, and the sensitivity analysis using a dichotomous age classification also showed no statistically significant association. Although advancing age is an established risk factor for dysglycaemia, through changes in insulin sensitivity, pancreatic β-cell function, body composition, and physical activity, the absence of a clear age-related gradient in this study warrants cautious interpretation. The relatively small number of IFG cases may have limited the precision of the age-specific estimates.

Blood pressure category was not independently associated with IFG after adjustment, although the observed associations suggested higher odds among respondents with elevated or high blood pressure. The estimates were imprecise, as reflected by the wide confidence intervals, and should therefore be interpreted cautiously. Hypertension and dysglycaemia frequently coexist because they share several risk factors and pathophysiological pathways, including obesity, insulin resistance, inflammation, endothelial dysfunction, and unhealthy dietary patterns [23, 31]. The lack of statistical significance in the present study should therefore not be interpreted as evidence of no relationship, particularly given the relatively small number of IFG cases.

The findings have important implications for diabetes prevention in rural Nigeria. The combination of high awareness, inadequate detailed knowledge, an appreciable prevalence of IFG, and strong associations with excess body weight and central adiposity suggests that prevention should begin before the development of overt diabetes. Community-based interventions should incorporate practical diabetes education, promotion of healthy diets and physical activity, weight management, and targeted glucose screening. Individuals who are overweight or obese or who have central adiposity should receive particular attention during community and primary healthcare screening.

Primary healthcare facilities provide an appropriate platform for implementing such interventions because they are accessible to rural populations and can integrate diabetes prevention with existing non-communicable disease services. Opportunistic screening of individuals who are overweight or obese or who have high-risk WHR may be particularly useful where resources are limited. Other established diabetes risk factors should also be considered when determining screening eligibility. The growing burden of diabetes and prediabetes in sub-Saharan Africa makes such preventive strategies increasingly important [2, 20, 31].

Strengths and Limitations

This study contributes valuable evidence from a rural Nigerian setting where population-based data on impaired fasting glucose remain limited. Standardized anthropometric measurements, together with objective blood glucose testing, strengthened the reliability of the findings and enabled assessment of key cardiometabolic factors. However, the cross-sectional design precludes causal inference. Although the calculated minimum sample size was 298, the final achieved sample was 286, and only 23 respondents had IFG. The small number of outcome events limited statistical power and model complexity, contributed to wide confidence intervals for some estimates, and restricted the reliable inclusion of variables with sparse outcome data in the multivariable analysis. In addition, dietary patterns and physical activity were not adequately assessed for inclusion in the multivariable analysis; therefore, residual confounding by these important lifestyle factors cannot be ruled out. In addition, IFG and diabetic-range hyperglycemia were determined using a single point-of-care capillary blood glucose measurement. Capillary glucose testing is practical for community-based screening but may differ from laboratory-measured venous plasma glucose because of physiological differences between capillary and venous blood and variability related to point-of-care devices and measurement conditions. Venous plasma glucose measured using standardized laboratory methods is generally preferred for diagnostic classification, while glycated hemoglobin (HbA1c) reflects average glycemia over the preceding two to three months and does not require fasting. However, HbA1c may be influenced by conditions affecting red blood cell turnover and hemoglobin characteristics. The absence of confirmatory venous plasma glucose, oral glucose tolerance testing, or HbA1c may therefore have resulted in some misclassification of glycaemic status. Despite these limitations, the study provides important baseline evidence to inform diabetes prevention strategies and highlights the need for larger longitudinal studies in rural northern Nigeria.

5. Conclusion

This study demonstrates that impaired fasting glucose is present among adults in Doka Community despite a relatively low prevalence of previously diagnosed diabetes. Although awareness of diabetes was high, important gaps remained in knowledge of its causes and symptoms. Overweight, obesity, and high-risk waist-to-hip ratio were independently associated with IFG, highlighting excess and central adiposity as important targets for preventive interventions. Strengthening diabetes education, promoting healthy lifestyles, and integrating targeted glucose and anthropometric screening into primary healthcare services could facilitate early identification of individuals at increased risk of type 2 diabetes.

6. Recommendations

Primary healthcare services should strengthen targeted screening for impaired fasting glucose and diabetes, particularly among adults who are overweight, obese, or have central adiposity. Community-based health education should move beyond general diabetes awareness to emphasize modifiable risk factors, healthy dietary practices, regular physical activity, weight control, recognition of diabetes symptoms, and the importance of screening. Lifestyle interventions focused on healthy weight and reduced central adiposity should be incorporated into community- and primary healthcare-based diabetes prevention programs. Larger prospective studies are recommended to determine the progression of IFG to type 2 diabetes and to clarify the contribution of sociodemographic, behavioral, and cardiometabolic factors in rural northern Nigeria.

Abbreviations

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
HbA1c	Glycated Haemoglobin
IFG	Impaired Fasting Glucose
LGA	Local Government Area
PHC	Primary Health Care
SPSS	Statistical Package for the Social Sciences
WHR	Waist-to-Hip Ratio
WHO	World Health Organization

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Conflicts of Interest

The authors declare no competing interests.

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