

# Prevalence of Diabetes Mellitus among Adult Residents of Tinda Rural Community, Nigeria

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## Abstract

**Aim:** Diabetes mellitus (DM) is an emerging disease of public health concern in Nigeria. There has been growing speculation about rural dwellers not being susceptible to this ailment due to their lifestyle. However, this could be attributed to the paucity of data obtained from rural communities. This community-based survey was conducted to provide recent data about the prevalence of DM in a rural community in Northern Nigeria. **Subject and Methods:** Purposive sampling was used to recruit 78 participants from about 200 adults within the community in September 2019. Consent was obtained to retrieve their blood glucose results and socio-demographic data from an out-patient clinic. Data were entered and analyzed using SPSS version 20. **Results:** Over half (55%) of the respondents were male, while majority (88%) were involved in agrarian professions. Majority (69%) of the respondents were between 18 to 35 years, while around 10% were over 50 years. The respondents had an average blood glucose level of  $5.20 \pm 0.62$  mmol/L, with 6.50 mmol/L as the maximum reading. The prevalence of DM was 0.0%, majority (68%) had normal glucose level, while the remainder had pre-diabetes glucose levels. There were no statistically significant associations between the respondents' blood glucose level and any of their socio-demographic characteristics. However, the oldest respondents, male respondents, and traders had the highest blood glucose levels in their respective categories. **Conclusion:** The absence of a healthcare center in the community was of concern, as this would impede efforts to monitor the prevalence of non-communicable disease like DM. It is recommended that health interventions to discourage the rural dwellers from embracing adverse urban lifestyles associated with DM should be prioritized.

## Keywords

Diabetes Mellitus, Rural Community, Northern Nigeria, Blood Glucose,

## 1. Introduction

Diabetes mellitus (DM) is regarded as a chronic disease with high incidence, and it is also one of the conditions of public health importance. It was among the five significant global mortality risks [1]. According to the World Health Organization, one among ten adults had been diagnosed with DM [2]. Based on a report by the International Diabetes Federation in 2013, there were 3.9 million cases of diabetes in Nigeria, which was the highest prevalence rate in Africa [3]. It has also been shown that 80% of deaths by diabetes occur in low and middle-income countries, and by 2030, diabetes would record as the seventh leading cause of death [3].

Furthermore, studies have reported the prevalence of DM in urban centers like Lagos and Sokoto metropolis to be 7% and 4.6% respectively [4] [5]. A prevalence of 11% was also reported by another survey conducted in Lagos city [6]. A review conducted in 2017 reported the prevalence of DM in Nigeria was at 5.77% and that urban dwelling was identified to be a risk factor [7]. Thus, it has been suggested that DM could be classified as a disease for the high-income or urban dwellers [8] [9].

Majority of available studies conducted in rural areas have reported low level of prevalence of DM. A survey by Sabir *et al.* in a rural settlement in Northern Nigeria reported a prevalence of 0.8% [10]. A report by the Federal Ministry of Health and Social Services also reported prevalence rate as low as 0.65% in Mangu rural settlement, Northern Nigeria [6]. However, findings from a recent survey by Argu and Maduka in a rural community in Delta, Southern Nigeria, revealed that there was an 8.0% prevalence of DM in the community. Alcohol use, exercise, age, diastolic blood pressure and family history were identified as factors associated with the disease [9].

Tackling this emerging disease in Nigeria would require continuous monitoring and assessment. However, it has been reported that there is a paucity of research that assesses the burden of DM in Nigerian communities [8]. Hence, this study aimed to provide recent data about the prevalence of DM in a distant rural settlement in Northern Nigeria.

## 2. Materials and Methods

### 2.1. Study Area

The study was conducted in Tinda whose latitude and longitude is 10°47'14.23 and 10°53'26.38 respectively. Tinda is a rural community located in Dukku Local Government Area (LGA), Gombe State Nigeria. Majority of the locals were involved in farming, while other popular occupations were trading and animal husbandry. Gongola River flows via the west and north of the local government

area. Dukku LGA is one of the 11 LGAs of Gombe State. The landmass of the LGA is 3815 km<sup>2</sup>, with a population of 207,190, as at the last census. The dominant ethnic group present in the study area is Fulani.

## 2.2. Sampling Design and Method

The community-based study was cross-sectional in nature. The village consisted of around 200 adults, out of which 78 were purposively selected to participate in the survey. The sample size was estimated by using the sample size formula for cross-sectional surveys:

$$n = Z_{\alpha}^2 (p - q) / d^2$$

where  $Z_{\alpha}$  = A standard score at 95% confidence interval = 1.96.

$P$  = prevalence of diabetes from a past survey in Northern Nigeria [15] = 0.046.

$q = 1 - p = 0.954$ .

$d$  = degree of precision = 0.05.

$n$  = sample size.

$$n = \frac{1.96^2 \times 0.046 \times 0.954}{0.05^2}$$

$n = 67.4$  adults.

Therefore, due to the small sample size a 15% non-response rate was included to increase the total sample size to 78 respondents.

The respondents were selected during a rural medical outreach organized by Living Stone Explorers; only respondents who met the inclusion criteria and consented to releasing their data were enrolled into the study.

## 2.3. Inclusion/Exclusion Criteria

- Residents under 18 years were excluded from the survey.
- Residents without autonomy or right to self-determination were excluded from the survey.
- Only residents that had dwelled in Tinda community since their childhood were included.

## 2.4. Data Collection

A health check-up service was provided by medical doctors, nurses, and medical laboratory scientists for three days in the village. The medical professional setup in a temporary out-patient clinic, where data was obtained from all the respondents. Basic socio-demographic data was obtained from each study participant and recorded appropriately. Fasting blood glucose level was measured using the WHO recommendations. Peripheral blood samples by finger puncture were collected early in the morning before participants took their breakfast. The Accu-Chek blood glucose meter was used with Accu-Chek test strips and micro-chips, with a lancet. Wet swabs were used to clean the thumb of the participants

to disinfect and allowed them to dry. The glucometer was set, and a tests trip placed in the glucometer of the finger tip of thumbs of the participants, was pierced, and a little drop of blood was dropped on a piece that takes blood in by capillary action. The glucometer took a few moments to read, after which the results were displayed.

## 2.5. Data Management and Analysis

The data obtained from the study were entered and analyzed using the Statistical Package for Social Sciences (SPSS), version 20. Descriptive statistics were used to obtain frequency distribution tables, while independent t-test, and Analysis of Variance (one way-ANOVA) were used to derive associations between the participants' socio-demographic characteristics and the blood glucose level. The associations were derived at 95% confidence interval. The association between the respondent's glucose level and diastolic blood pressure was also derived by obtaining related community data from Olawade *et al.* [11].

The blood glucose level of the participants that were recorded and classified into three [12]:

Normal: less than 100 mg/dl ( $\leq 5.6$  mmol/L).

Pre-diabetes: 100 mg/dl - 125 mg/dl (5.6 to 6.9 mmol/L).

Diabetes: >125 mg/dl (>6.9 mmol/L).

## 3. Results

### 3.1. Socio-Demographic Characteristics

Of the 78 respondents selected to participate in this survey, less than half (45%) of the respondents were female. Majority (69%) of the respondents were between 18 to 35 years of age, while around 10% were over 50 years old. The oldest respondent was 90 years, while the youngest was 18 years. A dominant proportion (90%) of the respondents was married. The weight of the respondents also ranged between 42 kg and 84 kg. Majority (88%) of the respondents were involved in agricultural related professions such as crop farming, animal husbandry and trading. The remainder was either unemployed or engaged in activities like tailoring and shoemaking.

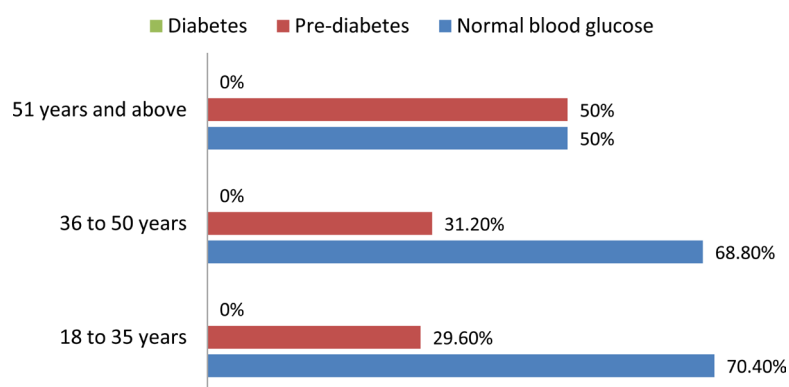
### 3.2. Respondents' Blood Glucose Level

The mean blood glucose level of the respondents was  $5.20 \pm 0.62$  mmol/L. The maximum reading recorded was 6.50 mmol/L, while the lowest value recorded was 4.10 mmol/L. Based on the American Diabetes Association classification (2017), 68% of the respondents had normal blood glucose level, while 32% had blood glucose levels classified as pre-diabetes. None of the respondents had blood glucose level in the diabetes category. Therefore, the prevalence of diabetes was 0.0%.

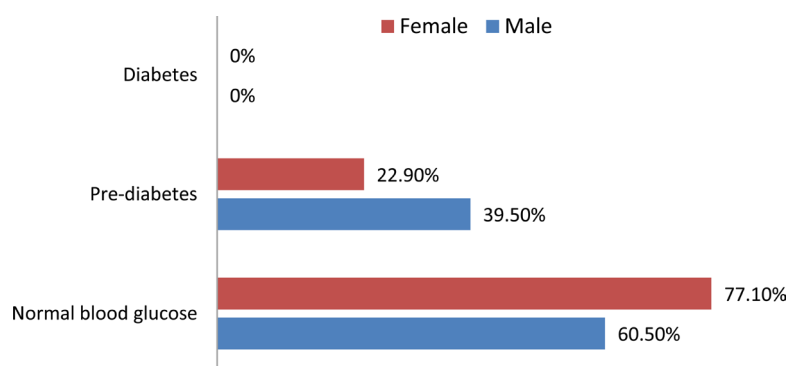
Categorizing the glucose levels of the respondents based on their age, half of the respondents over 50 years had their blood glucose level classified as pre-dia-

betes, 31% of respondents between 36 to 50 years were classified as pre-diabetes, while about 30% of the respondents between 18 to 35 years also fell within this category. **Figure 1** provides more details about this.

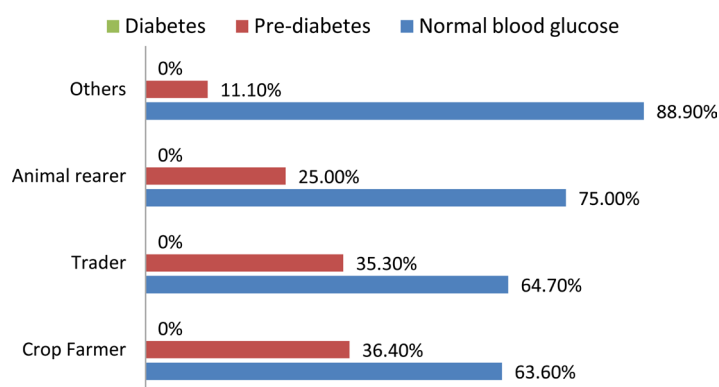
Categorizing their glucose level based on sex, a higher proportion (39.5%) of male respondents had their blood glucose level in the pre-diabetes category compared to 22.9% of the female respondents. **Figure 2** provides more information about this. Moreover, over one-third of both farmers (36%) and traders (35%) had their blood glucose levels classified as pre-diabetes, lower proportion of respondents' other job specifications had their blood glucose levels in the pre-diabetes category. **Figure 3** provides more details about this.



**Figure 1.** Blood glucose levels of the respondents based on their age categories.



**Figure 2.** Blood glucose levels of respondents based on their sex.



**Figure 3.** Blood glucose level of respondents based on their occupation.

### 3.3. Association between Respondents' Blood Glucose Levels and Socio-Demographic Characteristics

There was no statistically significant association between the blood glucose levels of the respondents and their sex ( $p = 0.183$ ). However, the male respondents had a higher average blood glucose level ( $5.28 \pm 0.61$  mmol/L) compared to the female respondents ( $5.09 \pm 0.63$  mmol/L). There was also no statistically significant association between the respondents' blood glucose level and their marital status ( $p = 0.995$ ). The married and single respondents had very similar average blood glucose levels ( $5.20 \pm 0.62$  mmol/L and  $5.20 \pm 0.67$  mmol/L respectively).

**Table 1** provides details about these associations.

Furthermore, there was no statistically significant association between the respondents' blood glucose levels and their age categories ( $p = 0.308$ ). Respondents above 50 years had the highest average blood glucose ( $5.44 \pm 0.73$  mmol/L), followed by respondents between 36 to 50 years with an average of  $5.31 \pm 0.58$  mmol/L, while respondents between 18 to 35 years had the lowest average blood glucose ( $5.13 \pm 0.62$  mmol/L). There was also no statistically significant relationship between the respondents' blood glucose level and their occupation ( $p = 0.181$ ). Traders had the highest average blood glucose level ( $5.32 \pm 0.64$  mmol/L), followed by crop farmers ( $5.24 \pm 0.61$  mmol/L), animal rearers ( $5.14 \pm 0.68$  mmol/L) and then the respondents minority occupations such as tailoring and shoemaking had the least blood glucose level ( $4.79 \pm 0.53$  mmol/L). Details of the associations are present in **Table 2**.

**Table 1.** Association between respondents' blood glucose level and their sex/marital status.

Variables	F	T	df	P-value	t-test for Equality of Means			
					Mean Difference	Std. Error Difference	95% Confidence Interval	
							Lower	Upper
Sex	0.021	1.345	76	0.183	0.189	0.141	-0.0910	0.470
Marital status	0.209	-0.006	76	0.995	-0.00143	0.234	-0.467	0.464

**Table 2.** Association between respondents' blood glucose level and their age/occupation.

Variables	Sum of Squares	df	Mean square	P-value	F
<b>Age categories</b>					
Between Groups	0.92	2	0.461	0.308	1.197
Within Groups	28.85	75	0.385		
Total	29.77	77			
<b>Occupation</b>					
Between Groups	1.89	3	0.629	0.181	1.670
Within Groups	27.88	74	0.377		
Total	29.77	77			

### 3.4. Association between Respondents' Blood Glucose Levels and Their Blood Pressure

There were no statistically significant association between the respondents' glucose levels and their diastolic ( $p = 0.328$ ) and systolic blood pressure ( $p = 0.207$ ). Respondents with normal blood glucose had a mean diastolic and systolic blood pressure of  $85.0 \pm 20.7$  mmHg and  $128.1 \pm 9.7$  mmHg respectively, while those with blood glucose levels in the pre-diabetes range had mean diastolic and systolic blood pressure of  $80.3 \pm 17.0$  mmHg and  $124.6 \pm 14.5$  mmHg respectively. Details of this association are provided in **Table 3**.

## 4. Discussion

The 0.0% prevalence of diabetes found in this study community is quite close to the prevalence of 0.8% obtained in a survey by Sabir *et al.* in a rural community in Northern Nigeria [10]. However, higher levels of prevalence have been reported in other Northern rural surveys. A survey among rural villages in Maiduguri reported a prevalence of 2.6% [13], while another survey conducted among rural communities in Kwara State revealed there was a prevalence of 2.9% [14]. In addition, studies conducted in rural communities in Southern Nigeria revealed relatively higher level of prevalence compared to the Northern communities. A survey conducted in a rural community in the Southern Nigeria reported a prevalence of 4.6% [15], while another survey in Delta state reported a prevalence of 8.0% [9].

The average blood glucose level of  $5.20 \pm 0.62$  mmol/L obtained in this survey is higher than the average blood glucose reported from rural surveys in Enugu ( $4.64 \pm 1.7$  mmol/L), Kwara ( $5.0 \pm 2.2$  mmol/L) and Sokoto ( $5.0 \pm 0.60$  mmol/L) States [10] [14]. The higher average blood glucose among male respondents in this survey was also like results obtained in other rural surveys [10] [13]. Furthermore, surveys conducted in urban regions have reported prevalence rates as high as 10.5%, 11% and 24% [16] [17] [18].

The higher prevalence rates in urban areas have been associated with the

**Table 3.** Association between respondents' blood glucose level and their blood pressure (B.P).

Variables	Sum of Squares	df	Mean square	P-value	F
<b>Diastolic B.P</b>					
Between Groups	372.06	1	372.06	0.328	0.968
Within Groups	29,199.44	76	384.20		
Total	297,571.50	77			
<b>Systolic B.P</b>					
Between Groups	211.93	1	211.925	0.207	1.620
Within Groups	9942.08	76	130.817		
Total	10,154.00	77			

predominance of sedentary lifestyle, and other factors like high-calorie diets, smoking and drinking [10]. The predominance of physically active occupations like crop farming and animal husbandry among the rural dwellers in this Tinda community could be a contributory factor to the zero prevalence of DM. Moreover, due to the remoteness of the village, common alcoholic beverages were not available for the residents. Also, palm wine trees commonly known to produce alcohol locally were not available in the study area due to the climatic conditions. This implies that the villagers did not have routine access to alcohol, which could also be a contributory factor to the zero-diabetes prevalence. It has been reported that rural areas that are beginning to report relatively higher prevalence of DM are most definitely embracing some of the associated urban lifestyles [9].

In addition, past studies have reported statistically significant association between DM and hypertension, thereby making DM a risk factor of hypertension [19] [20]. However, in this study there was no statistically significant association derived between glucose level and blood pressure. This is probably because none of the respondents had blood glucose levels in the diabetes range. This hypothesis was further strengthened as none of the blood glucose groups had high blood pressure. In conclusion, lack of basic health facilities in rural areas have been reported to hamper global targets to reduce the prevalence of non-communicable diseases [21]. With the paucity of health facilities in the study area, it becomes almost impossible for the locals to monitor their health, thereby making it difficult to track the trends of non-communicable diseases in such areas.

## 5. Conclusion

The lack of basic health services in this rural community implies that it would be difficult to continuously monitor the prevalence of non-communicable diseases like DM. Preventive health interventions via health promotion and education need to be facilitated in such rural communities so as to discourage rural dwellers from embracing some of the adverse lifestyle factors that could predispose them to DM.

## 6. Limitation of the Study

Blood glucose levels were evaluated just based on a single contact via random blood sugar. This was because the medical outreach was just for a couple of days. Moreover, due to the lack of health care facilities in the distant village, majority of the dwellers had not participated in routine health checkups, thereby lacking medical records. This made it difficult to account for factors like family history and other possibly undetected co-morbidities. Furthermore, because the village was small and sparsely populated, the sample size was also small. Lastly, due to the remoteness of the study location, it was difficult to link up with an Institutional Review Board.

## Compliance with Ethical Standards

The researchers were bound to the three ethical principles—beneficence, respect for human dignity, and justice through the survey. With the rural community lacking a health center, majority of the villagers had never undergone a health check. This survey was an opportunity to tell the world their story, with the hope that the data provided would influence policy makers. Verbal consent was obtained from the study participants before they were enrolled into the survey. Only autonomous adults (at least 18 years) were allowed to participate in the survey. No personal or identifiable information was collected from the participants; each respondent was assigned a study code. No undue compensation was given to the participants. All the villagers had equal access to medical care notwithstanding on whether they enrolled in the study or not. Due to the unavailability of a tertiary hospital around the village and the far distance between the village and the city, the research team was unable to obtain an IRB ethical approval.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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