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# Prevalence of Diabetes in Rural Communities in South South and South East Nigeria A Retrospective, Cross Sectional Community Based Survey

Cookey SN, Gomba V, Wariboko CM
*Cookey S N, Rivers State University Teaching Hospital*
*No 8-10 Harley Street, Old GRA Port Harcourt, Rivers State*
*Gomba V.E, Rivers State University Teaching Hospital*
*Department of Internal Medicine, No 8-10 Harley Street, Old GRA*
*Port Harcourt, Rivers State*
*Wariboko CM, Rivers State University Teaching Hospital*
*Department of Internal Medicine, No 8-10 Harley Street, Old GRA*
*Port Harcourt, Rivers State*

***Abstract***
***Background****: A previous meta-analysis of community-based survey of data collected from 1997 – 2017, showed an increase in prevalence of diabetes in Nigeria from 2.2% to 5.77%. The highest prevalence was seen in the South South and South East states of Nigeria. There is need for a more recent study to ascertain progression of diabetes prevalence in these geopolitical zones.*
***Method****: Data of casual fasting and random blood sugar assessed from blood collected from subjects, attending mobile clinics held in 10 (ten) different communities in south south and south east Nigerian states: Abia, Akwa Ibom, Enugu and Rivers states, was collected. Nine hundred and seventeen symptomatic subjects, who attended mobile clinic over a 2-year period from 2019 to 2021, met the inclusion criteria and were assessed for diabetes using the WHO definition of fasting blood sugar ≥ 7mmol/l, Random blood Sugar ≥ 11.1mmol/litre. In addition, any value of blood sugar for diabetics receiving glucose lowering agents, met the inclusion criteria.*
***Results****: 332 (three hundred and thirty-two) males and 585 (Five hundred and eighty-five) females, accounting for 35.1% and 64.9%, respectively made up the study population. 686 (74.8%) of the subjects were residents of communities in Rivers state, followed by 105(11.5%) Akwa Ibom state residents, with 69(7.5%) residing in Enugu state and residents of Abia state were 57(6.2%). The crude prevalence of diabetes for the south south and south east geopolitical zones was 7.96% (approx. 8%); with Enugu state 10.0%, Akwa-Ibom state 9.5% and Rivers state 8.6% and Abia state (0%). The Rivers state analysis showed an estimated 42.7% increase in diabetes when compared to previous studies.*
***Conclusion.*** *The prevalence rate of diabetes in the rural communities is increasing and surpassing previous urban values. With urbanization and loss of our rural communities with its added value of healthy diet and increased physical activity, the huge burden of diabetes may see an exponential rise.*
***Keywords:*** *Diabetes, Rural, Nigeria.*

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## I. Introduction

The global burden of diabetes has continued to increase and there is a projected rise in the figure. With westernization and increased urbanization, Nigeria is set to see an exponential rise in the diabetes figure in the rural communities. The prevalence of diabetes in Nigeria rose from 2.2% in 2002[1] to 5.77% in 2017 as shown by a meta-analysis of community-based survey.[2]. The highest prevalence was seen in the south-south and south east study. However, findings were based on meta-analysis of pooled data collected from 1992-2017. This study seeks to review prevalence of diabetes in communities of two Nigerian geopolitical zones; South - South and South -East, from a more recent data from 2019 to 2021.

In the past decade statistics have shown a 36.05% increase, from 14.7 million adults(20-79yrs) in 2011 to 20 million adults(20-79yrs) in 2021 living with Diabetes in Africa [3-4]. There is a postulated increase in the future with a projected 143% in 2034 (the highest projected increase amongst other continents) [5]. This African figure is questionable and more research is required as there is no doubt paucity of recent of data the prevalence

of diabetes in the African continent-[4]. In the International Diabetic Federation (IDF)publication of 2021 for diabetes, the data collected for the African study were mostly old from only 25 sources. Only Zambia published data from the past 5 years [4]

The prevalence of diabetes in Nigeria set at 5.77% [1] by a publication of 2018, was meant to reflect data for 1992 - 2017. However, a more recent publication by IDF for 2021, gave a diabetes prevalence of 3.6% for the Nigeria population with 53.3% undiagnosed diabetics [4]. This would postulate a decrease in the prevalence of diabetes from 2017 to 2021 or a mere reflection of the existing problem of paucity of recent data. Another explanation may be put forward by the age range as the IDF figures were for people aged 20-79yrs of age[4]. Diabetes prevalence is notably higher in urban communities when compared with rural communities and urbanization has been associated with excessive adiposity and physical inactivity, which in turn, increase the risk for diabetes [6-10]. This index study, focussed on data from rural communities.

Nigeria has two main parts North and South Nigeria; each with 3 geopolitical zones, for economic and revenue allocation purposes. Giving a total of 6 geopolitical zones. In the North there is the north west, north east, and north central and in the South is the south south, south east and south west geopolitical zones [11]. In these geo-political zones are states with varied ethnic groups and diverse cultural practices. These different lifestyles and prevalence of obesity amongst the Nigerian populace may account for the huge variation in the prevalence of diabetes [12.13].

## II. Method

Data was acquired from the records of subjects, who attended a mobile clinic after ethical clearance was sought from the organizers of the mobile clinic. Data included; location of mobile clinic, sex, age. blood sugar, blood pressures, weight and height from which BMI was calculated. Previous history of diabetes was obtained from the case notes. Diabetes was defined by Random blood Sugar ≥ 11.1mmol/litre with symptoms, fasting blood sugar ≥ 7.0mmol/litre [14,15] and normal blood sugar in patients already on hypoglycaemic agents; drugs or insulin.

***Inclusion Criteria***: Those with complete records of blood pressures, weight and height and aged 20-79yrs were included.

***Data Analysis:*** Data obtained was collated on excel spread sheet and analysed using the Statistical Package for Social Sciences version 23(SPSS 23). Non categorical variables were expressed as means and standard deviations. Whilst categorical variables were expressed as frequencies. Comparison between groups were performed with paired sample t- test. The mean blood sugar, age, BMI and blood pressure was assessed for the general population, non- diabetic and compared with those of the diabetic population The crude prevalence rate of every state and geopolitical zones was calculated by the formula:

$$\text{Crude Prevalence Rate}^{[16]} = \left[ \frac{\text{Total Number of Cases}}{\text{Total Number of Population}} * 100 \right]$$

## III. Results:

Out of the 965 subject's data collected, data for 917 (Nine hundred and seventeen) subjects aged between 20- 79yrs[4] met the inclusion criteria. They attended the mobile clinic held in the different communities of Rivers (Ahoada, Emuohia, Egbellu Ozodo, Etche, Dighriga in Abua, Rumuekpe), Akwa Ibom State (Ikot Ayan in Ikono Local government Area), Abia State (Mbubo), and Enugu states (Obeagwu Agwu LGA) in the south south and south east geopolitical zones, from November 2020 – November 2021. 686 (74/8%) of the subjects were residents of Rivers State accounting for majority of the study population, followed by 105(11.5%) Akwa Ibom residents, with 69(7.5%) residing at Enugu state and residents of Abia State were 57(6.2%).

332(three hundred and thirty-two) males and 585 (Five hundred and eighty-five) females, accounting for 35.1% and 64.9%, respectively of the study population. The mean age of the study population was 44.99 ±15.27years, with a mean BMI of 27.12 ± 5.56kg/m$^2$, mean systolic blood pressure of was 131.67 ± 25.56mmHg and mean diastolic blood pressure of 80.20 ± 13.61mmHg.

Diabetes Mellitus was found in 73 subjects accounting for 7.96% (approx. 8%) of the population studied. The diabetic population was made of 50 females with crude prevalence of 8.6% for females' diabetics and 23 with a crude prevalence of 7.14% for the male diabetics. The mean age of the diabetic group was 48.17 ± 13.42yrs, mean BMI; 30.38 ± 7.76 kg/m$^2$, mean SBP; 148.59 ± 27.54mmHg and mean DBP; 85.02 ± 15.36mmHg. All parameters were significantly higher in the diabetic group than in non - diabetic group. 41 (56.16%) had hypertension.

The male diabetics were significantly older than the female diabetics, though statistics did not show any significant difference in the BMI, SBP, DBP of the study population, nevertheless the BMI was higher in the female diabetic subjects and the blood pressures were higher in the male diabetic subjects.

With regards to the Geopolitical zones the crude prevalence of diabetes per state population studied. was Enugu state 10.0%, Akwa-Ibom state 9.5% and River's state 8.6%. There was no case of diabetes picked amongst the residents from Mbubo in Abia state community that attended the mobile clinic. Crude age prevalence was highest among those aged 50-59yrs.

## IV. Discussion

Diabetes is a chronic, progressive, debilitating, metabolic disorder resulting from impaired glucose, fat and protein metabolism due to a relative or absolute lack of insulin. Identified by increased blood glucose with fasting ≥ 7.0mm0l/l, random blood sugar ≥ 11.1mmol/l, glycated haemoglobin ≥ 6.5%. It is a very costly disease, froth with acute life-threatening and chronic crippling complications. It poses a huge economic burden to families, states and the world at large. The concern and significance of the disease burden was recently heightened by the coronavirus pandemic as Diabetes, either type 1 and type 2 diabetes were significant risk factor for developing severe life-threatening Coronavirus infection and death from the disease.[17-20] Diabetes is classified as type1 diabetes with an absolute lack of insulin, type 2 diabetes with a relative lack, and gestational diabetes which refers to impaired glucose range and diabetic range blood sugar occurring in pregnancy and secondary diabetes. [21]

Type 1 diabetes usually presents at a younger age group, though some presents later in life and some type 2 diabetes would later progress to an absolute lack requiring insulin therapy for blood glucose control. Though. genetic factors have not been shown to play a major role in the etiology of type 1 diabetes there are well known shows geographic and seasonal variations [22] implicating environmental factors in the aetiology. Autoimmunity to islet cells, viral infections and dietary factors: the consumption of breast milk over cow milk has been implicated in some studies [22-23]. Also, the role of vitamin D has been evaluated by other studies [24 - 26].

Type 2 Diabetes accounts for 90- 95% of cases of diabetes [27]. Though there is a strong genetic predisposition but there is also, a significant genetic and environmental interplay in the development of type 2 diabetes. Environmental factors like obesity and physical activity are important risks factors in the development of type 2 diabetes, The strong gene-environment interaction in the development of diabetes is demonstrated in the thrifty gene theory; genetic predisposition to obesity, can mask the development of obesity in food scarcity, but with food in abundance and development of western food habits increases the risk of diabetes [28]. Also exercise against sedentary life style not only mitigates the development of obesity but also reduces insulin requirements.

537 million adults (20yrs to 79yrs) are said to be living with diabetes globally. The highest prevalence is seen in the western pacific region where 206 million people are living with the diseases and the region least affected is Africa with 24 million adults (20yrs to 79yrs)[5]. The African figure is questionable and more research is required as there is no doubt paucity of data on the prevalence of diabetes in the African continent[6]. In the International Diabetic Federation publication of 2021 figures for diabetes, the data collected for the African study were mostly old from only 25 data. Only Zambia published data from past 5 years[5]. From the 2021 edition of the international Diabetes Federation's World atlas. Nigeria has 3,3,623,000 – 5,000,000 of the underestimated 24,000,000 living with diabetes in the African region.[5]

The last nationwide survey on the prevalence of diabetes was in 2002 and nationwide prevalence of 2.2% was obtained [1]. A meta-analysis of community-based survey, published in 2018, showed an increase in prevalence of diabetes in Nigeria from the former of 2.2% to 5.77%[2.] This was based on data collected over time from studies conducted in different parts of the country. Data was from 1992- 2017. The highest prevalence was seen in the South-South and south east study. Nigeria is a nation with different ethnic groups and sociocultural, practices which may account for variation in the prevalence of the disease in this country. There is a wide disparity with communities in Ibadan showing a prevalence as low as 0.8% and communities in south south; Port Harcourt, showing a high prevalence of 26.3%, amongst oil company workers.

The result presented in this study showed a total prevalence rate of 7.96%, from south east and south south communities, with a higher relative prevalence amongst the Enugu community 10%, followed closely by Akwa-Ibom state with 9.5% and Rivers State community with 8.6%. The lowest was in the Abia state (0%) having no diabetic amongst the population studied.

Whilst the disparity between communities in the states covered by the study, may be accounted for by population sizes of the various groups, as majority of the study population were residents of Rivers State. Nevertheless, from a South eastern state, a study published in 2018 gave an age adjusted prevalence for a community in Enugu as 11% which compares with the high prevalence, we got of 10% in our study population [29].

An Uyo based study, gave a prevalence rate of 10.0% for an urban community [30]. This study gave a similar prevalence rate of 9.5% but from a rural community. This shows the prevalence of Diabetes in the rural community quickly catching up with urban values.

A Rivers state, community-based study by Nyenwe et al [31], gave a crude prevalence rate of 6.8%; with crude prevalence rates of, 7.7% for males and 5.7%% in females from a study carried out in 2003 in an urban setting (Port Harcourt). Though there was a huge variation in the study population, the Nyenwe et al study population was made up of adults above 40yrs.The index study population was for ages between 20yrs and 79yrs and gave a crude prevalence rate of 8.6% in urban communities of Rivers State.

An age adjusted analysis of the data from this study (table 4) showed diabetes occurring in 55 subjects of the 568 subjects aged 40 yrs. and above, accounting for a crude prevalence of 9.7%. Which shows an estimated increased prevalence rate of about 42.7% when compared with the study of 2003. A higher increase is postulated against the backdrop that Nyenwe et al studied urban dwellers that have been shown to have higher diabetes prevalence in Nigeria when compared to this study that analysed data from rural populace with a relatively lower diabetes prevalence and yet obtained an estimated increase of 42.7%. The population size compared favourably with the Nyenwe et al studied, this study had 682 rural dwellers of rivers state out of which 568 were aged 40 and above, the Nyenwe et al study population size was 502. In both studies the population was skewed towards the females.

A very important observation from this study is the impact of urbanization of rural communities on the prevalence of diabetes as corroborated in previous studies [32-33]. The Rivers State data and Akwa Ibom state clearly illustrates it. The development of the rural communities with better roads and electricity is a very important dividend of democracy for the inhabitants of Rivers State. The recent and immediate past government, has done much to improve the welfare of the inhabitants of the state, however better roads mean shorter walks and less physical activities like farming, less farming results in eating fewer fresh fruits and vegetable and more alternatives like processed food and substitutes. All these developments are at the high price of diabetes.

The picture of diabetes in Abia State from this study does not correlate with other studies for Abia State, this may be because of the small study population, a 10 years retrospective study of data collected from an urban setting; a government house clinic gave a crude prevalence rate of 4.40% [34], another community-based study gave an overall prevalence of 3.3% [35]. From these studies it is clear that Abia state has a low prevalence rate of Diabetes, which can explain the absence of Diabetes amongst the indigenes of Mbubo community in Abia state.

The female preponderance goes to show a better health seeking attitude of the female folks when compared to males [36]. In addition, cultural practices which encourage weight gain in these geopolitical zones, as being fat is seen as healthy and a reflection of affluence as well as evidence of a good marriage; evidence of being well taken care of by a spouse. It may also be a reflection of multiparity which is a common trend in the rural areas. Multiparity [37-38] has been associated with obesity and gestational diabetes which foster type 2 diabetes.

Type 2 diabetes has an important pre-diabetic state characterised by impaired glucose tolerance, the chances to be diabetic is further heightened with truncal obesity and hypertension; metabolic syndrome. Early identification of this stage will retard or stop the progression to an overt disease. An important limitation of this study was its inability to evaluate the prediabetic state.

## V. Conclusion

The prevalence rate of diabetes in the rural communities is increasing and surpassing previous urban values. With urbanization and loss of our rural communities with its added value of healthy diet and increased physical activity, the huge burden of diabetes may see an exponential rise.

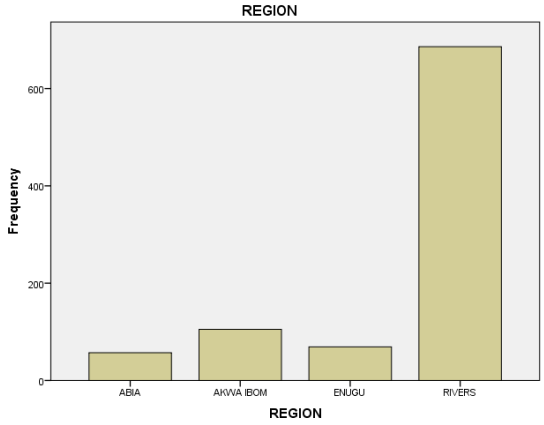

**Table 1: Clinical Parameters of the Diabetic Patients.**

| Parameters | Minimum | Maximum | Mean ± Std. Deviation |
|---|---|---|---|
| AGE (yrs.) | 21.0 | 79.0 | 48.17 ±13.42 |
| BMI (kg/m$^2$) | 17.76 | 49.77 | 30.28 ±7.76 |
| SBP (mmHg) | 92.0 | 220.0 | 147.76 ± 27.54 |
| DBP (mmHg) | 58.0 | 121.0 | 85.02 ±15.36 |
| Blood Glucose (mmol/l) | 6.70 | 29.30 | 14.96 ± 4.87 |

SBP: systolic blood pressure, DBP: Diastolic blood pressure

**Table 2: Comparison of Clinical Parameters Between Male And Female Diabetics**

| Clinical Parameters | MEAN ± STD. DEVIATION | STD. ERROR MEAN |
|---|---|---|
| AGEM(yrs) | 55.89 ±12.84 | 3.03 |
| AGEF(yrs) | 33.44 ±7.52 | 1.77 |
| BMIM(kg/m$^2$) | 27.15 ±3.18 | 2.25 |
| BMIF(kg/m$^2$) | 34.95 ±0.04 | 0.03 |
| SBPM(mmHg) | 154.52 ±25.85 | 5.65 |
| SBPF(mmHg) | 138.15 ±28.79 | 6.28 |
| DBPM(mmHg) | 87.19 ± 16.69 | 3.64 |
| DBPF(mmHg) | 82.10 ±15.46 | 3.37 |
| Blood GlucoseM(mmol/l) | 15.69 ± 6.06 | 1.268 |
| Blood GlucoseF(mmol/l) | 14.71±4.46 | 0.93 |

AGEM, age for males, AGEF; age for females, BMIM; body mass index males, BMIF : body mass index for females, SBPM: systolic blood pressure for males and SBPF: systolic blood pressure for females, DBPM: diastolic blood pressure for males and DBPF: diastolic blood pressure for females, Blood GlucoseM: blood glucose in males and Blood GlucoseF: blood glucose in females.

**TABLE 3: COMPARISON BETWEEN MALE AND FEMALE DIABETICS**

| PARAMETERS | MEAN ± STD. DEVIATION | STD. ERROR MEAN |
|---|---|---|
| AGEM(yrs) | 55.89±12.84 | 3.03 |
| AGEF(yrs) | 33.44 ±7.52 | 1.77 |
| BMIM(kg/m) | 27.15 ± 3.18 | 2.25 |
| BMIF(kg/m) | 34.95 ± 0.04 | 0.03 |
| SBPM(mmHg) | 154.52 ± 25.85 | 5.65 |
| SBPF(mmHg) | 138.15 ±28.79 | 6.28 |
| DBPM(mmHg) | 87.19 ± 16.69 | 3.64 |
| DBPF(mmHg) | 82.10 ±15.46 | 3.37 |
| Blood GlucoseM(mmol/l) | 15.69 ±6.06 | 1.27 |
| Blood GlucoseF(mmol/l) | 14.71±4.46 | 0.93 |

AGEM, age for males, AGEF; age for females, BMIM; body mass index males, BMIF : body mass index for females, SBPM: systolic blood pressure for males and SBPF: systolic blood pressure for females, DBPM: diastolic blood pressure for males and DBPF: diastolic blood pressure for females, Blood GlucoseM: blood glucose in males and Blood GlucoseF: blood glucose in females.

**Table 4: Comparison of Clinical Parameters Between Male And Female Diabetics**

| | Mean<br>Std. Deviation | Std. Error<br>Mean | T | Sig. (2-Tailed) |
|---|---|---|---|---|
| AGEM – AGEF(yrs) | 22.44± 9.31 | 2.1936 | 10.232 | .000 |
| BMIM-BMIF ($kg/m^2$) | -7.79 ±3.22 | 2.27500 | -3.426 | .181 |
| SBPM – SBPF(mmHg) | 16.43± 40.78 | 8.8980 | 1.846 | .080 |
| DBPM-DBPF(mmHg) | 5.10 ±23.00 | 5.0185 | 1.015 | .322 |
| Blood Glucose M – Blood Glucose F(mmol/l) | 0.98 ±7.06 | 1.47281 | .665 | .513 |

**TABLE 5: AGE SPECIFIC CRUDE PREVALENCE RATE**

| **AGE RANGE** | **TOTAL POPULATION** | **NO WITH DIABETES** | **AGE CRUDE PREVALENCE (%)** |
|---|---|---|---|
| **20-29yrs** | 132 | 8 | 6.06 |
| **30-39yrs** | 217 | 10 | 4.61 |
| **40-49yrs** | 187 | 15 | 8.02 |
| **50-59yrs** | 177 | 22 | 12.43 |
| **60-69yrs** | 125 | 12 | 9.60 |
| **70-79yrs** | 79 | 6 | 7.60 |
| **Total** | 917 | 73 | 7.96 |

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