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# Prevalence and Risk Factors for Diabetes Mellitus in an Apparently Healthy Population in the Niger Delta Region of Southern Nigeria

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**ABSTRACT**

**Introduction:** Diabetes Mellitus is a chronic progressive metabolic disorder due to a lack of or resistance of body tissues to the action of insulin leading to persistent hyperglycemia and subsequent target organ damages. The prevalence of Diabetes is on the rise in this part of the world mainly as a result of adoption of Western lifestyle and diet.
**Materials and Methods:** This was a cross-sectional descriptive study involving 107 voluntary participants in 2 suburban communities in Rivers State, Southern Nigeria. The participants were first administered a structured questionnaire after which their biometric measurements and blood pressure was taken. Thereafter, blood specimen was taken for blood sugar sugar and lipid profile. Data was analysed with the SPSS version 23.0. A p-value of 0.05 was taken to be statistically significant.
**Results:** The prevalence of Diabetes Mellitus in this study was found to be 16.8%. Diabetes was more common in females, those aged 40 years and above, married and low income earners. Although no risk factor had any statistically significant association with Diabetes Mellitus in this study, there was a higher preponderance of Diabetes in smokers, non-drinkers, high salt consumers, the physically inactive, hypertensives, those with a family history of Diabetes and those with dyslipidemia.
**Conclusion:** This study revealed a high prevalence of Diabetes Mellitus in the population studied. The higher preponderance of Diabetes in participants with known risk factors for the disease, calls for appropriate intervention targeting such risk factors in order to curb its rising prevalence.

## INTRODUCTION

Diabetes .mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia. It results from either insufficient production of insulin by the pancreas or the inability of the body to effectively utilize the insulin produced.

Type 1 DM results from insufficient production of insulin by the pancreas while type 2 DM results from ineffective use insulin produced by the pancreas. Other less common types of DM include- gestational DM, maturity onset diabetes of the young, steroid induced diabetes, latent autoimmune diabetes in adults, type 3C diabetes, etc. Majority of cases of DM worldwide (90%) are Type 2[1]. Predisposing factors to type 2 DM are obesity and lack of exercise.

DM is a disease that has a worldwide burden and its prevalence has continued to increase over the years. It rose from4.5% in1980 to 8.5% in 2014[2]. It is a major cause of blindness[3], stroke, heart disease and kidney disease[4], as well as non-traumatic lower limb amputation.

Type 2 DM used less common in non-Western countries where the diet contains less calories with a higher daily caloric expenditure. However, with the adoption of a western lifestyle (westernization) in these countries, and subsequent development of obesity, the incidence of Type 2 DM has continued to rise. Here in Nigeria, DM affects all parts of the country. The highest prevalence is in the south-south geo-political zone where the Niger Delta is located. Urban dwelling, physical inactivity, advancing age and unhealthy diets are some of the important risk factors for Type 2 DM in Nigeria[5].

The World Health Organization (WHO) estimated a 4.3% prevalence of DM in Nigeria in 2016[6]. A recent study reported about 4.7million Nigerians had type 2 DM[7].

Type 2 DM accounts for >90% of total cases of DM in Nigeria[8,9]. Majority of people living with DM (about 2/3) are undiagnosed and therefore untreated. This majority may later present with complications like stroke, myocardial infarction, kidney disease or even death due to untreated DM.

In 2015, more than 40,000 Nigerians died from DM complications[10]. These deaths were primarily due to the poor state of health care delivery in the country, as well as ignorance, poverty and superstitious beliefs on the part of the patients that prevent them from seeking access to orthodox medical care. It is for this reason that it is recommended that governments make provision for proper screening and diagnosis of DM and ensure adequate health education and care for the diabetic patients in order to reduce the burden of this life-threatening disease.

## MATERIALS AND METHODS

This was a cross-sectional, descriptive, community-based study that was carried out between October and November 2020. A total of 107 adults were enrolled in this study which took place in Amadi-ama and Fimie communities in Port-Harcourt City Local Government Area of Rivers state, in Southern Nigeria. Ethical approval for this study was obtained from the Ethics Committee of the Rivers State Ministry of Health, Port-Harcourt.

Study participants were all apparently healthy adults aged between 20-80 years and were chosen via convenience sampling. Participation in this study was voluntary. Prior to the study, the communities were sensitized via town criers and church announcements and those that met the inclusion criteria were told to meet in church halls for screening. The inclusion criteria for participation include being >18yearsof age with no previous history of hypertension or diabetes. Individuals that gave their consent were included in the study. Pregnant and lactating women as well as those who are obviously ill or wheel-chair bound were excluded from the study. Strict Covid-19 prevention protocols were also adhered to.

A structured screening questionnaire was given to participants to collect data on their socio-demographic variables, behavioral characteristics, as well as medical history. Thereafter, well trained examiners measured the anthropometric indices and participants were required to wear light, thin clothing and no shoes.

The indices measured were:

a) BMI (Body mass index) which is the body weight/square of height, and the unit is in kg/metre $^2$.
b)Waist circumference
c) Blood pressure
d) Blood sugar
e) Lipid profile

The body weight was measured using an analogue medical scale while the height was measured with a standard stadiometer. They were measured to the nearest 0.1kg and 0.1cm respectively.

The classes of BMI reported by WHO are:

18.5-24.9kg/m$^2$-normal
25.0-29.9kg/m$^2$-overweight
>30kg/m$^2$–obese

Classes of obesity include: Class I - 30-34kg/m$^2$, Class II- 35-39.9kg/m$^2$, and Class III- >40Kg/m.$^2$

Blood pressure was measured with a clinically validated electronic sphygmomanometer - OMRON digital fully automated blood pressure monitor. Values were obtained after resting for 5mins in a seated position, with 30 seconds interval between cuff inflation.

Assessments were performed in a dedicated room, with optimum temperature and lighting while respecting privacy.

Blood pressure values were categorised as follows:

(1) Normal: <120/80mm/hg
(2) Pre-hypertension: 120-139/80-89mm/hg
(3) Stage 1: 140-159/90-99mm/hg
(4) Stage 2: > 160/100mm/hg

Biochemical measurements- Blood sugar was assessed using a Finetest glucometer and strip which uses a capillary blood sample which is set to plasma serum standard. Capillary blood is obtained by pricking the participant's thumb and then placing the drop of blood on the glucometer strip after which the value is read. The diagnosis of diabetes was based on the American Diabetes Association (ADA) Criteria viz : A fasting blood glucose level of 7.0mmol/l or higher or a random blood glucose level of 11.1 mmol/l or higher. The lipid levels were obtained using a 5ml syringe and needle to collect at least 5mls of venous blood into a heparin containing bottle and samples sent to the chemical pathology laboratory for analysis.

Data were analysed using the IBM SPSS Version 23.0

## RESULTS

### 1. Socio-demographic characteristics

A total of 107 respondents were studied, 80 (74.8%) were females, 79 (73.8%) were above 40 years of age (mean age was 49.4 years and standard deviation was 13.7 years), 87 (81.3%) were currently married or had been married before and 43 (40.2%) had tertiary level of education. Close to half of the respondents (46.7%) were self-employed and the monthly income of 67 (62.6%) was low (table 1).

**Table 1: Socio-demographic Characteristics**

| | Frequency (n=107) | Percent |
|---|---|---|
| **Gender** | | |
| Male | 27 | 25.2 |
| Female | 80 | 74.8 |
| **Age group** | | |
| ≤40 | 28 | 26.2 |
| >40 | 79 | 73.8 |
| Mean Age (SD) | 49.4 (13.7) | |
| **Marital status** | | |
| Never married | 20 | 18.7 |
| Ever married | 87 | 81.3 |
| **Level of education** | | |
| Non-formal | 5 | 4.7 |
| Primary | 27 | 25.2 |
| Secondary | 32 | 29.9 |
| Tertiary | 43 | 40.2 |
| **Occupation** | | |
| Self-employed | 50 | 46.7 |
| Unemployed | 19 | 17.8 |
| Student | 7 | 6.5 |
| Others | 24 | 22.4 |
| Civil servant | 5 | 4.7 |
| Retired | 2 | 1.9 |
| **Monthly income** | | |
| Low | 67 | 62.6 |
| Medium | 20 | 18.7 |
| High | 20 | 18.7 |

SD=Standard deviation

**2. Life style characteristics/Medical history**

Only 11 (10.3%) of the respondents' smoke tobacco and were all previous smokers, 28 (26.2%) currently drink alcohol, 84 (78.5) do not consume adequate amount of fruits and vegetables, 16 (15.0%) add extra salt to their meal and 51 (47.7%) do no engage in physical activities. Thirty-five (32.7%) of the respondents reported history of hypertension while 43 (40.2%) reported family history of hypertension, similarly, 14 (13.1%) reported history of diabetes while 19 (17.8%) reported family history of diabetes (table 2).

**Table 2: Life style characteristics/medical history**

| | Frequency (n=107) | Percent |
|---|---|---|
| **Tobacco Use** | | |
| Never Smoked | 96 | 89.7 |
| Previous Smoker | 11 | 10.3 |
| **Alcohol Consumption** | | |
| Current Drinker | 28 | 26.2 |
| Previous Drinker | 31 | 29.0 |
| Never Drank | 48 | 44.9 |
| **Fruit and Vegetable Consumption** | | |
| Adequate | 23 | 21.5 |
| Inadequate | 84 | 78.5 |
| **Salt Consumption** | | |
| High | 16 | 15.0 |
| Normal | 91 | 85.0 |
| **Engage in Physical Activity** | | |
| Yes | 56 | 52.3 |
| No | 51 | 47.7 |
| **History of Hypertension** | | |
| Yes | 35 | 32.7 |
| No | 72 | 67.3 |
| **Family History of Hypertension** | | |
| Yes | 43 | 40.2 |
| No | 64 | 59.8 |
| **History of Diabetes** | | |
| Yes | 14 | 13.1 |
| No | 93 | 86.9 |
| **Family History of Diabetes** | | |
| Yes | 19 | 17.8 |
| No | 88 | 82.2 |

**3. Prevalence of Diabetes**

The prevalence of Diabetes was 16.8% (n=18) among the study population (figure 1).

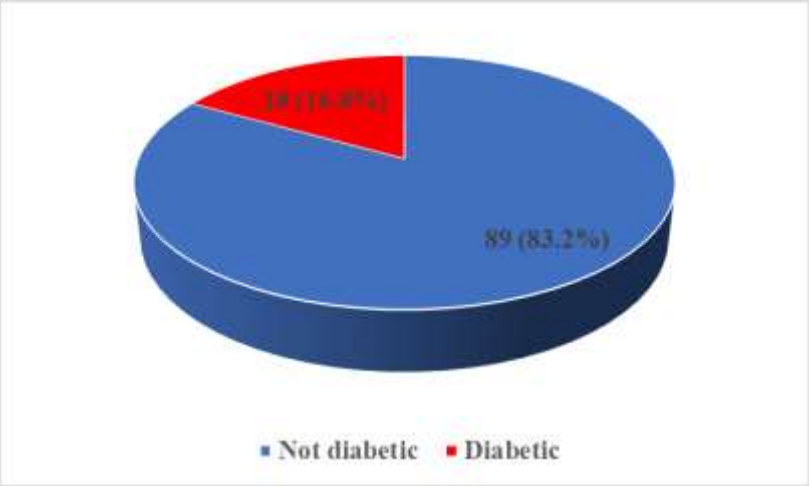


**Figure 1: Prevalence of diabetes among study population**

The prevalence of diabetes did not show any statistically significant relationship with the socio-demographic characteristics of respondents (p>0.05). See table 3.

Also, diabetes prevalence did not show any statistically significant relationship with life style characteristics of respondents (p>0.05). See table 4.

**Table 3. Prevalence of Diabetes by Socio-demographic Characteristics**

| | Not diabetic (n=89) | | Diabetic (n=18) | | | |
|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | □2 | p-value |
| **Marital status** | | | | | | |
| Never married | 19 | 95.0% | 1 | 5.0% | 2.457 | 0.117 |
| Ever married | 70 | 80.5% | 17 | 19.5% | | |
| **Age group (years)** | | | | | | |
| ≤40 | 25 | 89.3% | 3 | 10.7% | 1.011 | 0.315 |
| >40 | 64 | 81.0% | 15 | 19.0% | | |
| **Gender** | | | | | | |
| Male | 23 | 85.2% | 4 | 14.8% | 0.104 | 0.747 |
| Female | 66 | 82.5% | 14 | 17.5% | | |
| **Level of education** | | | | | | |
| Non-formal | 4 | 80.0% | 1 | 20.0% | 2.497 | 0.476 |
| Primary | 20 | 74.1% | 7 | 25.9% | | |
| Secondary | 27 | 84.4% | 5 | 15.6% | | |
| Tertiary | 38 | 88.4% | 5 | 11.6% | | |
| **Occupation** | | | | | | |
| Self-employed | 40 | 80.0% | 10 | 20.0% | 3.436 | 0.633 |
| Unemployed | 15 | 78.9% | 4 | 21.1% | | |
| Student | 7 | 100.0% | 0 | 0.0% | | |
| Others | 20 | 83.3% | 4 | 16.7% | | |
| Civil servant | 5 | 100.0% | 0 | 0.0% | | |
| Retired | 2 | 100.0% | 0 | 0.0% | | |
| **Monthly income** | | | | | | |
| Low | 54 | 80.6% | 13 | 19.4% | 1.032 | 0.597 |
| Medium | 18 | 90.0% | 2 | 10.0% | | |
| High | 17 | 85.0% | 3 | 15.0% | | |

*=Statistically significant

**Table 4. Prevalence of Diabetes by Life Style Characteristics**

| | Not diabetic (n=89) | | Diabetic (n=18) | | | |
|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | □2 | p-value |
| **Tobacco use** | | | | | | |
| Never smoked | 80 | 83.3% | 16 | 16.7% | 0.016 | 0.899 |
| Previous smoker | 9 | 81.8% | 2 | 18.2% | | |
| **Alcohol consumption** | | | | | | |
| Current drinker | 26 | 92.9% | 2 | 7.1% | 3.160 | 0.206 |
| Previous drinker | 26 | 83.9% | 5 | 16.1% | | |
| Never drank | 37 | 77.1% | 11 | 22.9% | | |
| **Fruit and vegetable consumption** | | | | | | |
| Adequate | 18 | 78.3% | 5 | 21.7% | 0.506 | 0.477 |
| Inadequate | 71 | 84.5% | 13 | 15.5% | | |
| **Salt consumption** | | | | | | |
| High | 12 | 75.0% | 4 | 25.0% | 0.899 | 0.343 |
| Normal | 77 | 84.6% | 14 | 15.4% | | |
| **Engage in physical activity** | | | | | | |
| Yes | 47 | 83.9% | 9 | 16.1% | 0.047 | 0.828 |
| No | 42 | 82.4% | 9 | 17.6% | | |
| **History of hypertension** | | | | | | |
| Yes | 27 | 77.1% | 8 | 22.9% | 1.354 | 0.245 |
| No | 62 | 86.1% | 10 | 13.9% | | |
| **Family history of hypertension** | | | | | | |
| Yes | 37 | 86.0% | 6 | 14.0% | 0.423 | 0.516 |
| No | 52 | 81.3% | 12 | 18.8% | | |
| **History of diabetes** | | | | | | |
| Yes | 10 | 71.4% | 4 | 28.6% | 1.589 | 0.207 |
| No | 79 | 84.9% | 14 | 15.1% | | |
| **Family history of diabetes** | | | | | | |
| Yes | 14 | 73.7% | 5 | 26.3% | 1.488 | 0.223 |
| No | 75 | 85.2% | 13 | 14.8% | | |

*=Statistically significant

**Physical and biochemical measurements of the population**

*Physical measures of the population*

Thirty-four (31.8%) of the respondents had normal waist circumference. The mean waist circumference was 89.0±12.5cm for males and 91.7±16.2cm for females. Seven (6.5%) of the respondents were underweight, 38 (35.5%) had normal weight, 31 (29.0%) were overweight, and another 31 (29.0%) were obese. The mean BIM, weight and height were 27.9±8.9Kgm$^2$, 70.3±16.8Kg and 160.6±12.0cm respectively. It was also shown that 46 (43.0%). The mean SBP and DBP were 143.2±32.4mmHg and 87.1±18.3mmHg respectively.

*Biochemical measures of the population*

The study also found that 38 (35.5%) of the respondents had normal total cholesterol level (mean±SD=5.5±1.0mmol/l), 101 (94.4%) had triglyceride level (mean±SD=0.9±0.3mmol/l), 105 (98.1%) had normal high-density lipoprotein (mean±SD=0.94±0.2mmol/l) and 23 (21.5%) had low-density lipoprotein (mean±SD=4.14±0.9mmol/l). See table 5 below.

**Table 5: Physical and biochemical measurements of the population**

| | Frequency (n=107) | Percent |
|---|---|---|
| ***Physical parameter*** | | |
| **Waist circumference** | | |
| Normal | 34 | 31.8 |
| Abnormal | 73 | 68.2 |
| **Mean waist circumference (SD)** | | |
| Male (n=27) | 89.0 (12.5) | |
| Female (n=80) | 91.7 (16.2) | |
| **BMI Category** | | |
| Underweight | 7 | 6.5 |
| Normal weight | 38 | 35.5 |
| Overweight | 31 | 29 |
| Obese | 31 | 29 |
| Mean BMI (SD) | 27.9 (8.9) | |
| Mean weight (SD) | 70.3 (16.8) | |
| Mean height (SD) | 160.6 (12.0) | |
| **Blood pressure status** | | |
| Normal | 46 | 43 |
| High | 61 | 57 |
| Mean SBP (SD) | 143.2 (32.4) | |
| Mean DBP (SD) | 87.1 (18.3) | |
| ***Biochemical parameter*** | | |
| **TC Category** | | |
| Normal | 38 | 35.5 |
| High | 69 | 64.5 |
| Mean TC (SD) | 5.5 (1.0) | |
| **TG Category** | | |
| Normal | 101 | 94.4 |
| High | 6 | 5.6 |
| Mean TG (SD) | 0.9 (0.3) | |
| **HDL Category** | | |
| Abnormal | 105 | 98.1 |
| Normal | 2 | 1.9 |
| Mean HDL (SD) | 0.94 (0.2) | |
| **LDL Category** | | |
| Normal | 23 | 21.5 |
| Abnormal | 84 | 78.5 |
| Mean LDL (SD) | 4.14 (0.9) | |

*=Statistically significant

**Prevalence of Diabetes by physical and biochemical characteristics**

There was no statistically significant difference in the prevalence of diabetes across respondent's physical measures such as waist circumference, BMI and blood pressure status; and across respondent's biochemical measures such as total cholesterol, triglyceride, HDL and LDL levels (p>0.05). See table 6 below.

**Table 6. Prevalence of Diabetes by physical and biochemical characteristics**

| | Not diabetic (n=89) | | Diabetic (n=18) | | | |
|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | □2 | p-value |
| ***Physical measures*** | | | | | | |
| **Waist circumference** | | | | | | |
| Normal | 30 | 88.2% | 4 | 11.8% | 0.911 | 0.340 |
| Abnormal | 59 | 80.8% | 14 | 19.2% | | |
| **BMI Category** | | | | | | |
| Underweight | 6 | 85.7% | 1 | 14.3% | 1.142 | 0.767 |
| Normal weight | 33 | 86.8% | 5 | 13.2% | | |
| Overweight | 24 | 77.4% | 7 | 22.6% | | |
| Obese | 26 | 83.9% | 5 | 16.1% | | |
| **Blood pressure status** | | | | | | |
| Normal | 40 | 87.0% | 6 | 13.0% | 0.823 | 0.364 |
| High | 49 | 80.3% | 12 | 19.7% | | |
| ***Biochemical measures*** | | | | | | |
| **TC Category** | | | | | | |
| Normal | 31 | 81.6% | 7 | 18.4% | 0.108 | 0.743 |
| High | 58 | 84.1% | 11 | 15.9% | | |
| **TG Category** | | | | | | |
| Normal | 85 | 84.2% | 16 | 15.8% | 1.238 | 0.265 |
| High | 4 | 66.7% | 2 | 33.3% | | |
| **HDL Category** | | | | | | |
| Abnormal | 88 | 83.8% | 17 | 16.2% | 1.603 | 0.309 |
| Normal | 1 | 50.0% | 1 | 50.0% | | |

*=Statistically significant

**DISCUSSION**

This study assessed the prevalence and risk factors for diabetes mellitus in a suburban community in the Niger Delta region of Southern Nigeria.

The prevalence of diabetes in the studied population was found to be 16.8%. This figure is higher than that obtained from previous studies on the prevalence of diabetes in Nigeria which ranged from 2-12%. [11-14] However, a previous study done in the South-south region of this country revealed a higher prevalence of 13.9%[15]. These figures are all lower than that noted in this study.

This increase in prevalence is most likely due to population growth and aging, urbanization, increasing prevalence of obesity as well as inadequate exercise being experienced worldwide. This is also in keeping with the predicted global increase in diabetes globally, including Africa [16-18].

In this study, there was no socio-demographic characteristic that was significantly associated with diabetes mellitus, however, diabetes had a higher

preponderance in the participants who are married, >40 years of age, females, have only primary level of education, unemployed, and low income earners. Other studies done previously have reported a lower prevalence of diabetes mellitus in married people, in contrast to this study [19,20] ; however, the lower preponderance of diabetes mellitus noted in the married participants in this study may be attributable to the fact that married persons (esp. females) in this part of the country tend to become obese [21] .

Another, well known risk factor for diabetes mellitus is advancing age. In this study, participants that are above 40 years of age had a higher preponderance of diabetes mellitus. This is in keeping with other studies done elsewhere [8,22]. The increase in diabetes mellitus ith increasing age is mainly due to the fact that aging induces a decrease in insulin sensitivity as well as inadequate compensation of beta cell functional mass despite increasing insulin insulin resistance [23]. There is also a correlation between aging and reduction in beta cell proliferation and also increased sensitivity to apoptosis [24].

Female participants were also found to have a higher preponderance of diabetes mellitus in this study. Although, this is not statistically significant, it is in keeping with other studies done in this part of the country [25,26]. These studies also reported a higher number of females than males with diabetes mellitus. However, worldwide, more males than females have been reported to have diabetes mellitus [27]. This contrast with the global picture may be attributable to the cultural practice in this part of the country that encourages obesity in women, especially the practice of the 'fattening room' that is prevalent in the Niger Delta region of Southern Nigeria [28].

None of the lifestyle characteristics studied has any statistically significant association with diabetes mellitus. This may be due to the small sample size used in this study.

Overweight and obese individuals were also found to have a higher preponderance of diabetes mellitus in this study. This is in keeping with other studies that have emphasized the link between diabetes mellitus and obesity. Obesity is a well known risk factor for diabetes mellitus [29-31].

Diabetes mellitus also has a higher prevalence in participants who are hypertensive. Other previous studies have noted a similar trend [32,33]. This may be explained by the common pathways shared by both diseases which may ultimately lead to the development of the metabolic syndrome [34].

Participants with abnormally high levels of triglycerides also had a higher prevalence of diabetes mellitus. This is not surprising as hypertriglyceridaemia has been noted to be a risk factor for type 2 diabetes mellitus [35,36].

Low HDL-cholesterol and high total cholesterol are both known risk factors for the development of type 2 diabetes mellitus [37-39]. However, the reverse is the case in this study. This may be due to the possible presence of other confounding risk factors for diabetes mellitus in this study.

## CONCLUSION:

This study revealed a high prevalence of Diabetes Mellitus in a suburban region of the Niger Delta area of Southern Nigeria. There was no statistically significant risk factor associated with diabetes, however there was a higher preponderance of Diabetes in participants who are above 40 years of age, married, smokers, consume excess salt, physically inactive, hypertensive, and have dyslipidemia. This result may be attributed to the small sample size used in this study. In view of the findings in this study, appropriate intervention targeting these risk factors will go a long way to curb the rising prevalence of Diabetes in this part of the world.

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