Original Article

Risk Factors for Diabetes Mellitus among adult Residents of a Rural District in Southern Nigeria: Implications for Prevention and Control

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Abstract

Introduction: Diabetes Mellitus is a non-communicable disease that affects people worldwide and poses major public health and socioeconomic challenges. **Methods:** This was a descriptive cross-sectional community based survey carried out in Abua, a rural district located in the Niger Delta region of Nigeria among 462 adults recruited through multi-stage sampling. Data was collected using the structured WHO STEPS instrument for Chronic Disease Risk Factor Surveillance. The questionnaire included questions that assessed socio-demographic characteristics, diabetic risk factors, anthropometric measures, and biochemical parameters. Fasting blood glucose and blood pressure was measured using the WHO recommendations. **Results:** Equal number of males and females aged between 18 and 82 years were recruited. Mean age of 40.4614.36 years and median age of 38.5 years. The prevalence of diabetes mellitus was 37 (8.0%), of which 28 (6.1%) were previously diagnosed while 9 (1.9%) were newly diagnosed. Alcohol intake (AOR = 10.69; 95% CI = 2.60-43.87; P = 0.001) physical activity (AOR = 4.78; 95% CI = 1.16-19.65; P = 0.03), diastolic blood pressure (AOR= 32.67; 95% CI = 3.68-289.65; P = 0.002), age and family history of DM showed significant independent association (OR 1.09, 95% CI: 0.000, P < 0.001, OR 0.072, 95% CI: 0.014–0.380, P = 0.007) with diabetes mellitus. **Conclusion:** Study findings underscore the need for diabetes prevention and control activities that address the four major risk factors identified by WHO. These interventions will positively impact prevalence of diabetes and other NCDs. Intervention strategies should not only target urban populations but also focus on education and health promotion among rural populations in a bid to forestall rising prevalence of diabetes.

Keywords: *Diabetes Mellitus, prevention and control, risk factors*

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Introduction

Diabetes affects people worldwide and poses major public health and socioeconomic challenges. According to a declaration made in 2010 by the United Nations Secretary-General Ban Ki-moon, he described diabetes and other noncommunicable diseases (NCDs) as "a public health emergency in slow motion." This is because they now present a greater threat than infectious diseases such as HIV/AIDS, malaria, and tuberculosis.[1] Globally, diabetes as a chronic metabolic disorder of multiple etiologies is assuming epidemic proportions[2] with an estimated 415 million adults affected in the world,[3] and 14.2 million adults aged 20–79 years have diabetes in the African region.[3] There are more than 1.56 million cases of diabetes in Nigeria and by 2040 this figure will be more than double.[3] Besides, three-quarters of people with diabetes live in low- and middle-income countries, while 12% of global health expenditure is spent on diabetes.[3]

The prevalence of diabetes in Nigeria varies from 0.65% in rural Mangu (North) to 11% in urban Lagos (South).[4]

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Data from the World Health Organization (WHO) suggest that Nigeria has the greatest number of people living with diabetes in Africa.[5] The excess global mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million deaths, equivalent to 5.2% of all deaths. Excess mortality attributable to diabetes accounted for 2%–3% of deaths in poorest countries.[6] Diabetes is a serious illness with multiple complications and premature mortality accounting for at least 10% of total health-care expenditure in many countries. Diabetes is often perceived as a disease of affluent countries; a serious chronic disease leads to a substantial reduction in life expectancy, decreased quality of life, and increased costs of care.[6]

According to Chinenye,[7] "as Nigeria modernizes and copies Western lifestyles, the disease frequency is on the rise among top executives, politicians, academicians, civil servants, farmers, traditional rulers, traders, businessmen, teachers, students, pupils, preschool children, and pregnant women".

Anecdotal evidence indicates that the residents of rural districts in the country may not be exempt from this transition. People who once had active lifestyles now exhibit sedentary lifestyles (such as hiring others as labor in farming activities, use of machines, and replacement of walking and using bicycles with using motorcycles and cars). Many have also adopted Western diets. Rural districts are therefore unlikely to be insulated from the challenges posed by diabetes mellitus (DM) and its complications. There is, therefore, a need to empirically determine the prevalence of diabetes and its associated risk factors among adult residents in a representative rural district in the region.

Materials and Methods

Study area

The study was carried out in Abua, a rural district located in Abua/Odual Local Government Area in Rivers West Senatorial zone of Rivers State in the Niger Delta region of Nigeria. It covers a land area of about 11 km^2. Abua has a population of 372,781 at an annual growth rate of 3.2%.[8] It consists of 8 wards out of the 13 wards in the local government area. The predominant occupation of the people is farming, fishing, and trading.

Study design, sample size, and sampling method

The study was a descriptive, cross-sectional, community-based survey. Sample size was estimated as 480 adults using the formula for prevalence studies by Daniel,[9] with 2.3% as prevalence of DM (Alikor and Emem-Chioma),[10] 2% precision, 10% nonresponse rate, and a multiplication factor of 2 to compensate for design effect. A multistage sampling method was applied in the selection of participants for the research. Three stages were involved: Stage 1: simple random sampling was done to select two wards out of the eight wards in Abua; Stage 2: two communities (one from each of the selected wards) were then selected from the communities in the wards by simple random sampling; and Stage 3: 480 respondents were finally selected from households in the two selected communities (240 from each community) by systematic sampling.

Study population

The study included all adults (18 years and above irrespective of sex and previous diagnosis of diabetes) who reside in the area of study. Pregnant women, breastfeeding mothers, those on steroids, and nonconsented adults were excluded from the study.

Data collection

Data were collected using the structured WHO STEPS instrument/questionnaire for chronic disease risk factor surveillance. The questionnaire included questions that assessed sociodemographic characteristics, diabetic risk factors, anthropometric measures, and biochemical parameters. Fasting blood glucose was measured using the WHO recommendations. Peripheral blood samples by finger puncture were collected early in the morning before participants took their breakfast.

Fasting blood glucose levels were classified using the WHO and the International Diabetic Federation Criteria. Anthropometric measurements were taken using standardized techniques and calibrated equipment. Subjects were also weighed to the nearest 0.1 kg in light indoor clothing and barefeet. Height was measured using a stadiometer; participants stood in erect posture on barefoot, and the results were recorded to the nearest 0.5 cm. Measures were taken twice, and the average was used for the analysis.[11] Body mass index (BMI) was estimated as the ratio of weight in kilograms to the square of height in meters. Waist circumference was measured by placing a plastic tape to the nearest 0.5 cm horizontally, at the midpoint of the 12th rib and iliac crest along the midaxillary line. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor and the waist-to-hip ratio (WHR) was then determined.[12]

Blood pressure was also measured after the subject had rested for 5 min. House-to-house data collection was performed by trained field workers. However, anthropometric measures, blood pressure, and biochemical parameters were checked at a nearby primary health-care

facility. Research assistants were trained by the principal investigator for 3 days on the study procedures. To ensure the quality of the interview and data quality, random checks were carried out by the principal investigator.

Ethical consideration

Ethical clearance was obtained from the Research Ethics Committee of the University of Port Harcourt before conducting the study. In addition, written informed consent was obtained from each participant before data collection. Confidentiality was observed.

Data analysis

The data collected for the study were analyzed using the Statistical Package for Social Sciences (SPSS), Statistics® version 20 International Business Machine (IBM). Means and proportions were calculated for continuous and discrete variables, respectively. Confidence interval (CI) was also determined. Other inferential statistics used for the analysis were the Chi-square test, for test of association for categorical/discrete data and student's *t*-test for continuous variables. Logistic regression analysis model was also used to test for the association between DM and its risk factors. The cutoffs for the diagnosis of DM, obesity, and elevated blood pressure were fasting blood glucose of ≥7 mmol/L, BMI of ≥25 kg/m^2, WHR of 0.85, and blood pressure of ≥140/90 mmHg, respectively. The level of significance was $P \leq 0.05$.

Results

Sociodemographic, anthropometric, and biochemical characteristics of the study population

Four hundred and sixty-two adults participated in this survey giving a response rate of 96.25%. Out of the 462 selected participants, 231 (50.0%) were male and 231 (50.0%) were female. The respondents were aged between 18 and 82 years with a mean age of 40.46 ± 14.36 years and median age of 38.5 years. The distribution of other sociodemographic characteristics is shown in Table 1.

Table 1: Sociodemographic characteristics (*n*=462)

Variables	Frequency (%)
Age (years)	
20-29	12 (2.6)
30-39	114 (24.7)
40-49	165 (35.7)
50-59	101 (21.9)
60-69	54 (11.7)
70+	16 (3.5)
Mean age (years)±SD	40.46±14.35
Sex	
Male	231 (50.0)
Female	231 (50.0)
Marital status	
Never married	136 (29.4)
Currently married	256 (55.4)
Separated	12 (2.6)
Divorced	3 (0.6)
Cohabiting	1 (0.3)
Widowed	54 (11.7)
Educational status	
No formal education	89 (19.3)
Primary education completed	67 (14.5)
Secondary education completed	203 (43.9)
High school/tertiary education completed	100 (21.7)
Postgraduate degree	3 (0.6)
Occupation	
Government employed	84 (18.2)
Self-employed	242 (52.4)
Unemployed (able to work)	80 (17.3)
Student	45 (9.7)
Retired	11 (2.4)

SD=Standard deviation

Prevalence of diabetes mellitus by gender and age

The crude prevalence of DM in the study population was 37 (8.0%), of which 28 (6.1%) were previously diagnosed for diabetes while 9 (1.9%) were newly diagnosed. The age- and sex-specific prevalence of diabetes in the study population is shown in Table 2.

Table 2: Prevalence of diabetes mellitus by sex and age

Variable	Frequency (%)
Age (years)	
20-29 (*n*=108)	1 (0.9)
30-9 (*n*=132)	6 (4.5)
40-49 (*n*=93)	10 (10.8)
50-59 (*n*=73)	11 (15.1)
60-69 (*n*=40)	9 (22.5)
70+ (*n*=16)	0
Sex	
Male (*n*=231)	20 (8.7)
Female (*n*=231)	17 (7.4)
Crude prevalence of DM	37 (8)

DM=Diabetes mellitus

Modifiable risk factors for diabetes mellitus

The prevalence of alcohol use (χ^2 = 12.692, $P < 0.001$), physical activity (χ^2 = 21.632, $P < 0.001$), BMI (χ^2 = 18.457, $P < 0.001$), and WHR (χ^2 = 9.072, P = 0.003) was significantly higher among diabetics compared with nondiabetics. The prevalence of systolic and diastolic hypertension was significantly higher in diabetics compared to nondiabetics (χ^2 = 33.252, $P < 0.001$; and χ^2 = 47.590, $P < 0.001$, respectively) [Table 3].

Nonmodifiable risk factors of diabetes mellitus

The proportion of persons aged 40 years and above

Table 3: Modifiable risk factors of diabetes mellitus

Variables	Diabetic (*n*=37), *n* (%)	Nondiabetic (*n*=425), *n* (%)	χ^2	*P*
Tobacco use				
Yes	6 (16.2)	42 (9.9)	1.467	0.226
No	31 (83.8)	383 (90.1)		
Alcohol intake				
Yes	25 (67.6)	160 (37.6)	12.692	<0.001*
No	12 (32.4)	265 (62.4)		
Eats vegetable/fruits frequently				
Yes	33 (89.2)	350 (82.4)	1.122	0.289
No	4 (10.8)	75 (17.6)		
Physical activity				
Yes	26 (70.3)	395 (92.9)	21.632	<0.001*
No	11 (29.7)	30 (7.1)		
BMI				
<25	15 (40.5)	314 (73.9)	18.457	<0.001*
≥25	22 (59.5)	111 (26.1)		
WHR				
<0.85	9 (24.3)	213 (50.1)	9.072	0.003*
≥0.85	28 (75.7)	212 (49.9)		
SBP				
Hypertensive	24 (64.9)	93 (21.9)	33.252	<0.001*
Nonhypertensive	13 (35.1)	332 (78.1)		
DBP				
Hypertensive	23 (62.2)	66 (15.5)	47.590	<0.001*
Nonhypertensive	14 (37.8)	359 (84.5)		

*Significant at $P \leq 0.05$. BMI=Body mass index; WHR=Waist hip ratio; SBP=Systolic blood pressure; DBP=Diastolic blood pressure

Table 4: Nonmodifiable risk factors of diabetes mellitus

Variable	Diabetic (*n*=37), *n* (%)	Nondiabetic (*n*=425), *n* (%)	χ^2	*P*
Age in years				
<40	7 (18.9)	233 (54.7)	17.578	<0.001*
≥40	30 (81.1)	192 (45.1)		
Sex				
Male	20 (54.1)	211 (49.6)	0.264	0.607
Female	17 (45.9)	214 (50.4)		
Family history of diabetes				
Yes	4 (10.8)	5 (1.2)	16.540	<0.001*
No	33 (89.2)	420 (98.1)		

*Significant at $P \leq 0.05$

Table 5: Logistic regression analysis for risk factors of diabetes mellitus

Risk factor	Crude OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
Sex (male)	0.84 (0.43-1.64)	0.610	0.67 (0.19-2.38)	0.53
Family history (yes)	10.18 (2.61-39.74)*	0.001	6.25 (0.56-70.48)	0.14
Age	0.95 (0.93-0.97)*	0.000	0.99 (0.95-1.04)	0.74
BMI (overweight/obese)	4.15 (2.08-8.28)*	0.000	1.99 (0.55-7.27)	0.29
WHR (overweight/obese)	3.13 (1.44-6.78)*	0.004	2.87 (0.68-12.2)	0.15
DBP (hypertensive)	8.94 (3.37-18.26)*	0.000	32.67 (3.68-289.65)*	0.002
SBP	6.59 (3.23-13.45)*	0.000	2.98 (0.35-25.22)	0.32
Alcohol use	3.45 (1.69-7.06)*	0.001	10.69 (2.60-43.87)*	0.001
Tobacco use	0.57 (0.22-144)	0.230	1.54 (0.30-7.90)	0.61
Fruit intake	0.57 (0.20-1.65)	0.300	2.41 (0.40-14.47)	0.34
Physical activity	5.57 (2.51-12.38)	0.000	4.78 (1.16-19.65)*	0.03

*Significant at $P \leq 0.05$. SBP=Systolic blood pressure; DBP=Diastolic blood pressure; WHR=Waist hip ratio; OR=Odds ratio; BMI=Body mass index; CI=Confidence interval

and those with a family history of hypertension was significantly higher among diabetics than nondiabetics in the study ($\chi^2 = 17.58$, $P < 0.001$ and $\chi^2 = 0.26$, $P = 0.61$, respectively) [Table 4].

Association between modifiable and nonmodifiable risk factors and diabetes mellitus

Regression analysis revealed that alcohol intake (adjusted odds ratio [AOR] = 10.69; 95% CI = 2.60–43.87; $P = 0.001$), physical activity (AOR = 4.78; 95% CI = 1.16–19.65; $P = 0.03$), and diastolic blood pressure (AOR = 32.67; 95% CI = 3.68–289.65; $P = 0.002$) were independently associated with DM, respectively. Nonmodifiable risk factors such as age and family history of DM also showed significant independent association (OR: 1.09, 95% CI: 0.000, $P < 0.001$, OR: 0.072, 95% CI: 0.014–0.380, $P = 0.007$), [Table 5].

Discussion

The main findings of this research include a high prevalence of diabetes involving 8% of the study population with newly diagnosed diabetics accounting for almost 2% of the study population. The risk factors associated with diabetes were alcohol use, lack of physical activities, and elevated diastolic blood pressure.

The crude prevalence of diabetes identified in this study is comparable to findings in many other studies.[13-18] Some community-based surveys conducted on type 2 diabetes documented higher prevalence than this study[4,19,20] while others documented lower prevalence of diabetes.[10,21-26] This variation can be attributed to differences in the study area (urban versus rural), study population, time of the study, and method of data collection. The WHO has a global NCDs action plan for reducing the mortality from NCDs by 25% by 2025. It focuses on four main risk factors which include tobacco use, misuse of alcohol, unhealthy diet, and physical inactivity. Our study identified two out of these four as significant risk factors for diabetes in the study population. These findings have been corroborated by researchers who identified family history of diabetes,[1,20] physical inactivity,[21,27,28] alcohol and tobacco use,[11,17,25] hypertension,[12,17,19,27.29] and overweight and obesity[29-31] as risk factors for diabetes.

The prevalence of diabetes identified among the study population, which consists of rural farmers and traders, as well as the risk factors for diabetes identified in this population, provides some evidence of the epidemiological transition with an upsurge in the prevalence of NCDs. This is buttressed by the percentage of newly diagnosed diabetics identified during the household survey. The underlying risk factors identified indicate a probable shift from an active lifestyle that was characteristic of rural agrarian communities to a less active lifestyle characteristic of urban populations which have been exposed to westernization. In this study, only two of the four major risk factors were identified in the study population. However, as urbanization and westernization advances rapidly, other identified risk factors such as unhealthy diet and tobacco use may come into play further increasing the prevalence of diabetes. There is therefore need to target rural communities with health education and health promotion activities targeting the identified risk factors to stem the tide of the diabetes epidemic in Sub-Saharan Africa.

Conclusion

Our study findings underscore the need for diabetes prevention and control activities that address the four major risk factors identified by the WHO. These interventions will positively impact the prevalence of diabetes and other NCDs. Intervention strategies should not only target urban populations but also focus on education and health promotion among rural populations in a bid to forestall rising prevalence of diabetes.

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Conflicts of interest

There were no conflicts of interest.

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