Diabetes risk score assessment and some adiposity indices in a young adult population in Umudike, Nigeria

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Abstract

Background: The prevalence of diabetes mellitus is increasing globally. Risk scores are useful tools for identifying individuals at risk of developing the disease. There is a dearth of data on the diabetes risk profile and indices of adiposity in young adult Nigerians.

Objective: The study was aimed at determining the prevalence of some adiposity indices and predict the 10-year risk of developing type 2 diabetes mellitus in a young adult population in Umudike, South East, Nigeria using the FINDRISC tool.

Data source: This study was carried out in Umudike, Nigeria and involved a total of 165 participants (90 males and 75 females), aged 18-30 years.

Methods: Blood pressure measurements and anthropometric readings were taken based on standard procedures and body mass index was determined. Diabetes risk scoring was done using the validated Finnish Diabetes Risk Scoring (FINDRISC) tool.

Results: Overweight and obesity was found in 27.9% and 3.6% of the population while hypertension was found in 18.8% of the population. The females had a higher mean BMI (24.7 ± 2.9 vs 22.0 ± 2.4), waist circumference (77.7 ± 7.8 vs 75.9 ± 5.9), waist-to-height ratio (0.47 ± 0.05 vs 0.43 ± 0.03), risk score (6.1 ± 4.0 vs 4.3 ± 3.3) and a higher prevalence of overweight and obesity, abdominal obesity, waist-to-height ratio and high risk score relative to males.

Conclusion: The study reported a 66.7% low risk, 24.2% slightly elevated risk, 8.5% moderately elevated risk and 0.6% high risk of developing diabetes mellitus within the next 10 years. There is an urgent need for lifestyle modification in the population with particular emphasis on the females. This will prevent a potential boom in diabetes prevalence in the future.

Summary: This population based study was carried out amongst young adults in Umudike, Nigeria. The study was carried out to assess the risk of developing type 2 diabetes mellitus using the validated Finnish Diabetes Risk Scoring (FINDRISC) tool. The young adults in the study population had a 9.1% moderate to high risk of developing diabetes with a female preponderance of diabetes risk. An urgent lifestyle modification is recommended.

Keywords: FINDRISC; Diabetes; Young adults; Nigeria.

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Introduction

Diabetes mellitus, a chronic non-communicable disease of the endocrine system results from multiple aetiologies involving insulin secretion and/or utilization.[1,2] A common manifestation of uncontrolled diabetes is an elevation in blood glucose level which leads to significant damages to vital body organs.[3] Consequently, people living with diabetes are at increased risk of cardiac, peripheral, arterial and cerebrovascular morbidity and mortality. This increased risk is linked to a combination of traditional risk factors such as hypertension, dyslipidaemia and obesity as well as non-traditional risk factors that are involved in the development of atherosclerotic conditions from endothelial function to clinical events.[4,5]

On a global scale and in most populations, there is an increasing prevalence of diabetes mellitus.[6] This implies that there is an urgent need to stem the tide of global diabetes prevalence. Efforts aimed at preventing the disease should be targeted at high risk individuals.[7] The identification of such individuals can be achieved using multivariate risk scores. Diabetes risk scoring tools are clinically relevant predictive tools that have been successfully employed in prevention, treatment and management of diabetes.[8]

The derivation of risk scores result from a variety of methods and parameters.[9] Several risk scoring tools such as the Finnish Diabetes Risk Score (FINDRISC), Framingham risk score, UK

Research Article

Diabetes risk score, American Diabetes Association Risk Score (ADARISK), Canadian Diabetes Risk Score (CANDRISK), Indian Diabetes Risk Score (IDRIS) are commonly available and are quite effective in diabetes risk prediction. The Finnish Diabetes Risk Score (FINDRISC) appears to be most commonly used because it is simple, cheap, non-invasive, easy to use, reliable, fast and scores common diabetes risk factors. It performs excellently in the prediction of 10-year incident diabetes and has been validated in European and Nigerian populations.[7,10-15] Additionally, it has been used to screen and identify individuals at high risk for undetected type 2 diabetes mellitus, abnormal glucose tolerance and metabolic syndrome.[16]

The relative unavailability of risk scoring tools specific for young adults is compounded by the fact that most of the established risk scores are purposely designed for middle-aged and older adults. This ultimately leads to a growing concern on their utility in a young adult population.[17] It is equally significant to note that, a possible consequence of the age-dependent increasing prevalence and increasing incidence of diabetes in the elderly[18,19] is the prioritization of diabetes in the elderly. Until recently, much attention and intervention efforts have not been focused on young adults. There is thus, scanty literature on the diabetes risk susceptibility of young adults, especially in a developing nation like Nigeria.

This study was therefore designed to determine the prevalence of some adiposity indices and predict the 10-year risk of developing type 2 diabetes mellitus in a young adult population in Umudike-Umuahia, Abia State ,South-East geopolitical zone, Nigeria-West Africa..

Materials and Methods

This study was carried out in Umudike, a semi-urban centre in Abia State in the South-East region of Nigeria.

Recruitment of participants

Apparently healthy male and female participants, aged 18-30 years, were recruited by convenience sampling without any form of bias. Their self-reported age at last birthday was used for the study. The study protocol was thoroughly explained to the participants. Thereafter, they freely signed the informed consent form which was designed according to the guidelines of the research ethics review committee of World Health Organization.

Ethical approval

The ethical approval for this study was obtained from the Research Ethics Committee of College of Natural Sciences, Michael okpara University of Agriculture, Umudike-Umuahia, Abia State, Nigeria.

Exclusion criteria

Participants were excluded from the study on the basis of any of the following: a previous diagnosis of diabetes, fasting blood glucose of ≥ 126 mg/dL, use of prescribed drugs or diets for the control and management of diabetes, pregnancy, drug addiction, diagnosis of hypertension, use of anti-hypertensive drugs as well as a decline of consent.

Sample size

The sample size was determined using the Vaughan's formula.[20]

$$N = \frac{PQ}{(E/1.96)^2}$$

N is sample size

P is maximum expected prevalence rate of diabetes mellitus

Q is 100-P

E is margin of sample error tolerated in percentage (5% being the maximum accepted value)

Considering a 3.5% error margin and a diabetes prevalence rate of 3.3% in Abia State, Nigeria,[21] a minimum sample size of 100 participants was recommended for the study. However, in order to make adequate provisions for errors in filling of questionnaires due to inconsistency and possible data losses, a total sample size of 165 was adopted.

Anthropometric measurements

Participants' weight (to the nearest 0.1 kg) was measured using a weighing scale while dressed in light clothing and with bare feet. Height (to the nearest 0.1 cm) was measured using a stadiometre with participant on bare feet. Thereafter, body mass index (BMI) was calculated by dividing the weight by the square of the height. The measurement of waist circumference (to the nearest 0.1 cm) was done using a non-stretchable measuring tape with participant in an erect posture. Thereafter, waist-to-height ratio was determined arithmetically.

Blood pressure measurement

Blood pressure measurement was done by trained medical personnel. The determination of systolic blood pressure (SBP) and diastolic blood pressure (DBP) was done at the 1st and 5th Korotkoff sounds, respectively. Each participant had two separate measurements while the average of both measurements was eventually recorded.

Risk scoring

The validated Finnish Diabetes Risk Scoring (FINDRISC) questionnaire was used for risk scoring and participants' risk scores were determined as the sum of the scores of the variable components of the FINDRISC tool.

Statistical analysis

Descriptive data analysis was done using Statistical Package for the Social Sciences (SPSS) version 23.0 (SPSS Inc Chicago IL) while charts were generated with Microsoft Excel 2003 (Microsoft Corporation US).

Calculations

For the anthropometric risk factors, the percentage (%) calculation for the individual risk scores based on the FINDRISC tool was based on the formula:

$$\frac{\text{Number of subjects in an individual risk factor sampled}}{\text{Total number of subjects sampled for the risk factors}} \times 100\%$$

Results

The characteristics of the participants are presented in Table 1. Among the 165 young adults, 90 (54.6%) were male and 75 (45.4%) were female. The participants' age ranged from 18 to 30 years with the modal age range being 23-28 years.

Characteristics	Frequency (%)
Gender	
Male	90 (54.6%)
Female	75 (45.4%)
Total	165 (100.0%)
Age (Years)	
18-22	85 (51.5%)
23-28	69 (41.8%)
29-30	11 (6.7%)
Total	165 (100.0%)
Height (cm)	
150-159	20 (12.1%)
160-169	51 (30.9%)
170-179	61 (37.0%)
≥ 180	33 (20.0%)
Total	165 (100.0%)
Weight (kg)	
50-59	3 (1.8%)
60-69	29 (17.6%)
70-79	62 (37.6%)
≥ 80	71 (43.0%)
Total	165 (100.0%)
Family History	
None	109 (66.1%)
Yes[*]	31 (18.8%)
Yes[**]	25 (15.1%)
Total	165 (100.0%)
Daily Physical Activity	
Yes	78 (47.3%)
No	87 (52.7%)
Total	165 (100.0%)
Daily intake of fruits/vegetables	
Yes	47 (28.5%)
No	118 (71.5%)
Total	165 (100.0%)
Yes[*]=parent, brother, sister, child	
Yes[**]=grandparent, aunt, uncle, first cousin	

Table 1: Characteristics of study participants

***Table 2:** Mean data of participants*

Participants	Age (Years)	BM1 (kg/m2)	WC (cm)	WHtR	SBP (mmHg)	DBP (mmHg)	Risk Score
Male	22.9 ± 3.4	22.0 ± 2.4	75.9 ± 5.9	0.43 ± 0.03	124.9 ± 10.9	74.9 ± 5.0	4.3 ± 3.3
Female	22.6 ± 3.7	24.7 ± 2.9	77.7 ± 7.8	0.47 ± 0.05	122.7 ± 12.8	75.3 ± 5.0	6.1 ± 4.0
Total	22.8 ± 3.5	23.3 ± 2.9	76.7 ± 6.9	0.45 ± 0.04	100.1 ± 8.0	98.8 ± 8.9	5.1 ± 3.7
BMI=Body Mass Index; WC=Waist Circumference; SBP=Systolic Blood Pressure; DBP=Diastolic Blood Pressure; FBG=Fasting Blood Glucose							
Values are expressed as Mean ± Standard Deviation							

The values (mean ± SD) of participants' age, body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and risk score are presented in Table 2. Females had higher BMI, waist circumference, waist-to-height ratio and risk score values when compared to the males in the study population.

The distribution of participants' waist circumference (Table 3) shows that all the males and 53.3% of the females had waist circumference below the threshold value of 94 cm and 80 cm for male and female respectively. Also, 37.3% of the females and 9.3% of the females had waist circumference between 80 cm to 88 cm and greater than 88 cm respectively. In summary, 4.2% of the participants had waist circumference above the recommended threshold value of 102 cm for male and 88 cm for female although only the female participants in the study population attained the recommended threshold value. The result also shows that 17.6% of the participants had waist-to-height ratio ≥ 0.5 with 34.7% of the females and 3.3% of the males attaining the threshold value.

Table 3: *Waist circumference of participants*

Waist circumference (cm) Male (M), Female (F)	Male frequency (%)	Female frequency (%)	Total frequency (%)
<94 (M), <80 (F)	90 (100.0%)	40 (53.3%)	130 (78.8%)
94-102 (M), 80-88 (F)	0 (%)	28 (37.3%)	28 (17.0%)
>102 (M), >88 (F)	0 (%)	7 (9.3%)	7 (4.2%)
Waist-to-height ratio	**Male frequency (%)**	**Female frequency (%)**	**Total frequency (%)**
<0.5	87 (96.7%)	49 (65.3%)	136 (82.4%)
≥ 0.5	3 (3.3%)	26 (34.7%)	29 (17.6%)

In table 4, the result shows that 82.2% of the males and 52.0% of the females had a healthy weight while 17.8% of the males and 48.0% of the females were either overweight or obese. The gender distribution of the risk scores showed that 77.8% of the males and 53.3% of the females had a low risk (score <7) while 3.3% of the males and 16.0% of the females had a moderate to high risk (score ≥ 12) of developing diabetes mellitus.

Table 4: *Distribution of BMI and Risk score across gender*

BMI (kg/m²)		Male (%)	Female (%)
<25	Healthy weight	74 (82.2%)	39 (52.0%)
25-29.9	Overweight	15 (16.7%)	31 (41.3%)
≥ 30	Obesity	1 (1.1%)	5 (6.7%)
Risk score	**Risk**	**Male (%)**	**Female (%)**
<7	Low	70 (77.8%)	40 (53.3%)
7-11	Slightly elevated	17 (18.9%)	23 (30.7%)
12-14	Moderate	3 (3.3%)	11 (14.7%)
15-20	High	0 (%)	1 (1.3%)

The distribution of blood pressure in the entire study population is shown in Figure 1. The result shows that 50.3% of the participants were normotensive, 30.9% of the participants were pre-hypertensive while 18.8% of the participants were hypertensive.
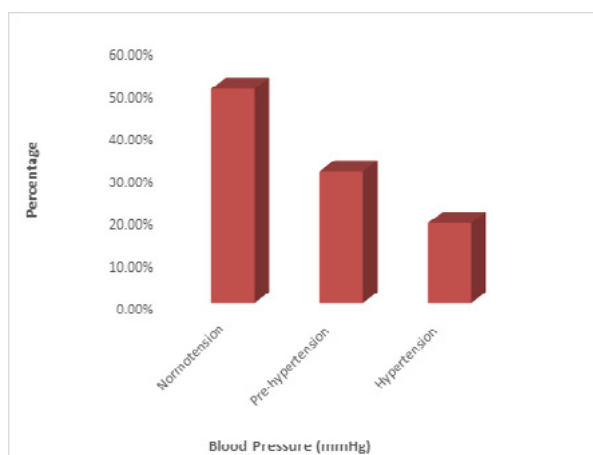

Figure 1: *Distribution of blood pressure among participants (n=165).*

The distribution of BMI in the entire study population is shown

in Figure 2. It shows that 68.5% of the participants had a BMI less than 25, indicating a healthy weight; 27.9% of the participants had a BMI between 25 and 29.9, indicating overweight and 3.6% of the participants had a BMI greater than 30, indicating obesity. Taken together, 31.5% of the participants were either overweight or obese (BMI ≥ 25).
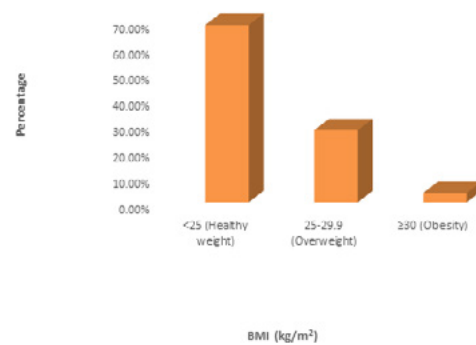

Figure 2: *Distribution of BMI among participants (n=165).*

Figure 3 shows the risk score distribution in the entire study population. It shows that 66.7% of the participants had a risk score less than 7, indicating a low risk; 24.2% of the participants had a risk score 7-11, indicating a slightly elevated risk; 8.5% of the participants had a risk score 12-14, indicating a moderately elevated risk while 0.6% of the participants had a risk score 15-20, indicating a high risk. Taken together, 9.1% of participants had a moderately elevated to high risk (score ≥12) of developing type 2 diabetes mellitus in the next 10 years.
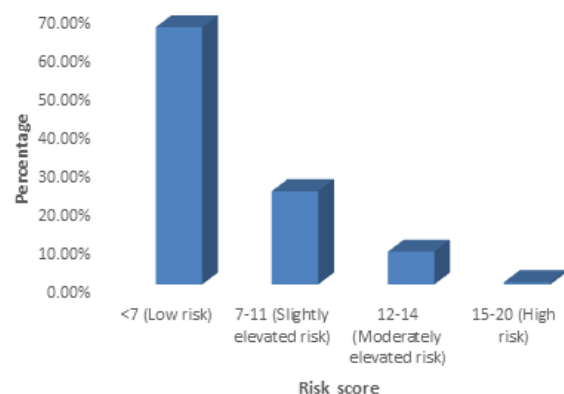

Figure 3: *Distribution of risk score among participants (n=165).*

Research Article

Discussion

There has been a dramatic increase in the prevalence of type 2 diabetes mellitus in adolescents and young adults.[22] This early onset of diabetes adds to the already increasing global burden of diabetes which is worrisome. This is compounded by the fact that the disease remains undiagnosed until major complications have set in.[23] In addition to mortality, the metabolic consequences of uncontrolled diabetes are so severe that they cause significant damages to vital organs of the body.[3] The early detection of type 2 diabetes mellitus may lead to reduction of the complications and metabolic consequences of the disease.[6] A first line action towards achieving this is the identification of individuals who are at risk of developing the disease. Generally, risk scores are effective tools for the identification of persons at risk of developing type 2 diabetes mellitus.[24] This study was therefore designed to determine some adiposity indices and identify individuals who are at risk of developing type 2 diabetes mellitus in a young adult population in Umudike, South-East, Nigeria using the FINDRISC tool.

This study reported an 8.5% moderate risk and 0.6% high risk of developing type 2 diabetes mellitus in the population. This is higher than the moderate risk of 5.2% but lower than the high risk of 1.8% reported in a young Jordanian population.16 Previous studies conducted amongst adult Nigerian populations had reported 9.0% high risk,15 9.1% high risk12 and 13.73% high risk25 of developing diabetes. While one may not be so certain, the higher age of the study participants may be implicated as a plausible reason for the higher risk profiles observed in these Nigerian studies. This is because increasing age is linked with increasing susceptibility to diabetes risk.[25,26] For convenience and ease of comparison, a cut off value of 12 is usually adopted by authors in determining high risk individuals. Consequently, this study reported that 9.1% of the study participants had a moderately elevated to high risk of developing diabetes having obtained a FINDRISC score above the cut off value of 12. A similar study conducted recently amongst young undergraduate students in Nigeria reported that 38.8% of the participants were at risk of developing diabetes mellitus.[27] Although this study involved a young student population in Nigeria, methodological differences may pose a challenge in comparing both results. A FINDRISC cut off value of 7 was adopted in defining risk as against the cut off value of 12 adopted in this present study. Thus, the higher percentage of high risk participants may be due to the reduced cut off value. Also, the findings of this study is lower than the 13%,[28] 22.61%[23] and 29%[15] reported in previous studies. The earlier cited disparities in the age of the study participants may account for the higher figures observed in other studies. However, this does not attenuate the significance of the findings in this study. The fact that the young adults in this population are supposedly healthy makes the findings in this study worrisome and suggest the need for proactive action. Additionally, the mean risk score was higher in females (6.1 ± 4.0) relative to males (4.3 ± 3.3) in the study population. A similar pattern has been previously reported.[26] The higher risk scores observed in the female participants of this study suggests that the females are even at a greater risk of developing type 2 diabetes mellitus in the nearest future. This suggests a particular need for urgent action.

This study reported a hypertension prevalence rate of 18.8%. This value is lower than the previously reported 27.7% prevalence rate,26 35.7% prevalence rate[29] and 46.8% prevalence rate[30]

in other Nigerian populations. The disparities may be as a result of differences in the age of the study subjects and study design. Although, the complete medical history could not be fully ascertained from the research protocols, most of these studies were conducted on elderly and aged adults who are possibly dealing with other underlying ailments in contrast to this present study conducted on young adults who in addition to being apparently healthy are usually considered to be outside the at-risk zone for developing cardiovascular diseases.

In developing countries, the growing spate of uncontrolled and excessive weight gain in young adults portends grave danger for non-communicable diseases especially cardiovascular diseases and diabetes mellitus.[31] This study reported that 68.5% of the study participants had normal weight while 27.9% and 3.6% of the study participants were overweight and obese respectively. The findings of this study are within the overweight prevalence range of 17.2%-35.1% but less than the obesity prevalence range of 4.2%-22.2% previously reported in Nigerian populations.[26,32-34] The high prevalence of undesirable weight may be due to previously cited factors such as urbanization, a high tendency towards a sedentary lifestyle and unhealthy dietary practices amongst these young adults.[29] The higher prevalence of overweight and obesity in females (47.0%) relative to males (17.8%) which corresponds to a higher mean value of BMI in females (24.7 ± 2.9 kg/m²) relative to males (22.0 ± 2.4 kg/m²) in this study is noteworthy. This is a common pattern amongst young adult Nigerians.[31,35,36] The possible reasons that have been adduced for this observation include low levels of physical activity, gender differences in metabolism and hormonal functioning[37,34] as well as socio-cultural behaviours that encourage weight gain amongst women[38] but discourage their participation in sports and involvement in rigorous tasks.[31]

Abdominal obesity is linked with increased susceptibility to cardiometabolic diseases.[39] A common determinant of abdominal obesity is the waist circumference measurement. A waist circumference value greater than 88 cm (for females) and 102 cm (for males) indicates a high risk of cardiovascular diseases like diabetes. In this study, female participants (9.3%) attained the threshold value (>88 cm for women) but no male participant attained the threshold value (>102 cm for men). The female preponderance of abdominal obesity observed in this study is a recurring decimal in most Nigerian studies.[12,26,15,40] This is probably due to the earlier cited socio-cultural factors and a lack of physical activity amongst the female participants. Since a large waist circumference greatly increases the risk of developing type 2 diabetes mellitus even amongst low and normal weight individuals,[41] the females in this population are at increased risk of developing cardiovascular diseases such as diabetes mellitus. More so, the higher prevalence of abdominal obesity is in tandem with the higher risk scores earlier mentioned.

A waist-to-height ratio ≥ 0.5 performed better than other adiposity indices such as body mass index, waist circumference and waist-to-hip ratio in determining undiagnosed type 2 diabetes mellitus.[42] This study reported that 17.6% of the participants with a female preponderance (34.7% vs 3.3%) had a waist-to-height ratio ≥ 0.5. Waist to height ratio is a useful screening tool for diabetes risk. Increased values of waist to height ratio has been associated with the development of diabetes after 4 years.[43]

The small sample size may limit the statistical reliability of this

Research Article

study. However, the sampling of apparently healthy young adults who were previously not considered for risk scoring due to age-related reasons and absence of chronic health complications is a major strength of this study.

Conclusion

The findings of this study revealed that 9.1% of the study participants had a moderately elevated to high risk of developing type 2 diabetes mellitus within the next 10 years. The higher prevalence of some indices of adiposity amongst the female participants implies that the females in this study population are at greater risk of developing diabetes mellitus and other cardiovascular diseases relative to their male counterparts. In order to mitigate the modifiable predisposing factors for type 2 diabetes mellitus in the study population, there is an urgent need for lifestyle modification in the study population while placing particular emphasis on the female participants. This will prevent a potential boom in diabetes prevalence in the near future.

Conflict of Interest

All authors declare that they have no conflict of interest.

Acknowledgement

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