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Assessment of risk of developing diabetes mellitus among local government employees in Onitsha, south-eastern Nigeria

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Abstract

Background: Diabetes is of growing global concern with a knowledge gap on how best to assess individuals on their risk of developing Diabetes Mellitus.

Objective: The aim of this study is to identify individuals with high risk of developing Diabetes Mellitus using a simple scoring system so as to contribute to the knowledge in the prevention of Diabetes Mellitus.

Methodology: A pre-tested self-administered questionnaire survey was carried out during the period 1st January to 30th June 2011.

Setting: The study was conducted at the Onitsha North Local Government Area Headquarters, Anambra State, Nigeria. A multistage study design was used. One hundred and forty-three persons were selected from the various Departments in the Local Government Area's headquarters using a systematic sampling method.

Results: There was a high prevalence of physical inactivity of 38.5%, obesity (BMI≥30 kg/m^2) of 42.6%, large waist circumference of 74% and positive family history of Diabetes Mellitus of 36.4%. Overall, 9% of the participants have a high risk of developing the disease within 10 year, while about 29% have moderate to high risk of developing Diabetes Mellitus.

Conclusion: This study has shown that 9% of the local government employees studied have a high risk of developing Diabetes Mellitus due to high prevalence of obesity, physical inactivity, sedentary life style, family history of Diabetes Mellitus and large waist circumference.

Keywords: Diabetes mellitus, early detection of diabetes, risk assessment profile, local government employees, southeastern Nigeria

Introduction

Diabetes Mellitus (DM) is growing in prevalence globally with 171 million people in the year 2000, while it is estimated to rise to 366 million by the year 2030 [1]. Fifty percent or more of those with the disease are unaware of their condition [2]. Most of these have Non-insulin Dependent Diabetes Mellitus (NIDDM).

In sub-Saharan Africa, where resources are often lacking, the proportion of people with undiagnosed diabetes may be between 20%-100% [3,4]. In Nigeria, a study show that the proportion of undiagnosed DM could reach up to 27% [5].

The onset of NIDDM may occur 4-7 years before the clinical diagnosis of the disease [6]. During this time, diabetic complications are silently setting in. Studies have shown that many people with undiagnosed DM already have complications such as chronic kidney disease, heart failure, retinopathy and neuropathy [7-9].

Those who are not diagnosed of DM will not take steps to manage their blood glucose or change their life styles. Early detection and treatment reduce the complications of DM. Near normal blood glucose can prevent and delay the development of complications. Early detection can be enhanced by screening people even when consulting the physician for other ailments.

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Type 2 DM can be prevented by life style modifications in high risk individuals [10,11]. The challenges encountered are to identify these high risk individuals and encourage them to modify their life styles. Measuring blood glucose is an invasive method and as a tool for identifying these high risk individuals are relatively costly and labor intensive [12-14]. Measuring blood glucose only provides information about current glycaemic status. Risk scores based on routinely available non-invasive information, which is easily collected in the clinics or by using questionnaires could be used to identify potential beneficiaries such as individuals or population sub groups who might benefit from more comprehensive risk assessment, e.g. additional determination of blood glucose levels, or institution of preventive action [15]. To prevent NIDDM, there is need to identify these persons when they are still normoglycaemic.

Risk scores have been developed and proven to be reliable for predicting those that might develop the disease [16,17]. These scores were developed using models to predict individuals that may develop the disease. Various variables such as age, body mass index, waist circumference, antihypertensive drug treatment, physical activity were used in these models. Most of these scores have been tried in some countries and have been found to be reliable with high specificity and sensitivity [18,19]. These variables can easily be completed by lay people and these can be used by the individuals to determine their diabetic risk.

The aim of this study is to identify individuals with a high risk of developing the disease using a simple scoring system, which have been validated in similar population surveys [20,21]. The findings of this study are expected to provide data needed by health planners in promoting education to prevent or delay the onset of the disease. Identifying those at risk of developing the disease will preempt the individuals to begin life style modifications early enough.

Methods

The study was conducted at the Onitsha North Local Government Area Headquarters, Anambra State, Nigeria. The local government headquarters have many departments which include, General and Administration, Treasury, Health, National Population Commission, Treasury, works, and Agriculture.

The design adopted for the study was a cross sectional survey. The study population consisted of civil servants in the Local Government Area Secretariat.

Exclusion criteria

All patients who had DM were excluded from the study. Diabetes was excluded by asking the subjects if they have had high blood glucose during a medical examination or were on prescribed diet or drugs to control it.

The instrument used in the collection of data was a pretested questionnaire. This was used to obtain their demographic characteristics and other parameters for the diabetes risk assessment. The eight parameters assessed family history of DM, consumption of vegetables in diet, history of hypertension on medical examination, exercise and anthropometric measurements. A minimal sample size of 112 was calculated using the Vaughan's formular [22]. The formula is shown below:

$$N=PQ/(E/ 1.96)^2$$

Where N is the sample size
P is the maximum expected prevalence rate of DM
Q is 100–P
E is the margin of sample error tolerated in percentage (5% being the maximum accepted value).

Using a prevalence rate of 7% of DM in Nigeria [23], a minimum sample size of 112 was recommended. The sample size of 150 was selected to account for attrition and improperly filled questionnaire. Altogether, 143 copies of the questionnaire were analyzed giving a response rate of 95.3%.

The instrument used to collect data was self-administered questionnaire. In order to ensure the reliability of the data collected, the questionnaire was pre-tested in another L.G.A, (Onitsha South), which shares similar characteristics with the area of study. The sample was selected using a multistage sampling technique. The first stage used stratified sampling technique to group respondents according to their departments.

Then, using systematic random sampling technique, every third respondent from the nominal roll of the department was selected. If the staff strength in the department was less than twenty, all the respondents were studied. The maximum selected from larger departments was twenty five. Altogether, twenty five subjects were selected randomly from each of five departments, while fifteen and eighteen were selected from two other departments.

Anthropometric measurements obtained included heights, weights and waist circumference. Weight was measured in kilograms, to the nearest 0.1 kg, using weighing scale (Seca model, Germany), and ensuring that the individual wore light clothing and were without shoes. Height was measured to the nearest 0.1 cm using Stadiometer. Waist circumference was measured to the nearest 0.1 cm using a non-stretchable measuring tape while the subject stood in erect posture. Measurement was taken midway between the umbilicus and pubic symphysis. Body Mass Index (BMI) was computed using the formula of weight (kg)/height^2 (m^2). These parameters were graded and scored. The Finnish risk assessment model was adopted for this study and their eight parameters included in the questionnaire. Presence of family history of DM scored 3 if it occurred in the grandparent, aunt, uncle or first cousin, or 5 if it was present in the parent, brother or sister or zero if there was no family history. Consumption of vegetables in diet scored zero if they consumed fruits/vegetables daily or score 1 if they did not. A history of taking regular anti-hypertensive medication scored 2 if this was positive or zero if it was negative. Daily exercise of at least 30minutes scored zero if positive and 2 if negative. Presence of high blood glucose in

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past examinations scored 2 if it was positive or zero if it was negative BMI<25 scored zero, 25-29.9 scored 1 while >/30 scored 3. Age in years <45 scored zero, 45-54 scored 2, 55-64 scored 3 while 65 and above scored 4. Waist circumference of <95cm in a male and 80cm in a female scored zero, 95-102cm in a male and 80-88cm in a female scored 3 while >102cm and >88cm in a female was scored 4. The total risk score for each participant were summated. Risk score values ranged from 0-20. The risk of developing type 2 diabetes within ten years was stratified into different scores; low risk (<7), slightly elevated risk (7-11), moderately elevated risk (12-14), high risk (15-20) and very high risk (>20).

The data was analyzed using statistical package for social sciences, (SPSS) version 15 and graph pad prism version 5.

Ethical considerations

Administrative approval was received from the Local Government Authority, while ethical approval was obtained from the Ethical committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi. The concept of the study was explained to the study subjects and they were made to understand that they had rights to opt out of the study any time they wished before the conclusion of the study. Their refusal to participate in the study did not and would not affect them in any way. They were not given any inducement to entice them to participate in the study.

Results

A total of 143 subjects were surveyed. The demographic characteristics of the subjects are as shown in **Table 1**. The age range of the participants was 23 (minimum) to 69 years (maximum). The modal age group was 36-40 year. The mean age and standard deviation (mean±SD) was 41±8.8 years. The participants were predominantly females (88.1%), one hundred percent were Christians and ninety eight percent were of the Ibo tribe. One hundred and twenty five (87.4%) were married, while one hundred and fifteen (80.4%) had post-secondary school education. Sixty-seven (46.8%) had incomes greater than N20,000 while seventy-six (53.2%) had less. The minimum height was 112 cm, while the maximum was 190cm. The median and standard deviation of height was (mean±SD) 166.24±9.08 cm. The minimum weight was 45kg, while the maximum was 130kg. The mean and standard deviation of weight was (mean ±SD) 82.66±16.4 kg.

Table 1 also show that 52 of 143 participants had Family history of DM and 91 of 143 (63.6%) had no family history of DM, while 12 of 143 (8.4%) had history of diabetes in the grandparents, aunt, uncle, first cousin, while 40 of 143 (28.0%) had positive history of DM in the parents, brothers, sisters or own children.

Table 2 shows that 33 (23.1%) participants had a risk score of 0 for BMI<25, while 49 (34.3%) scored 1 (BMI 25-29.9) and 61 (42.6%) with BMI≥30 scored 3. Risk scoring by age show that 91 (63.6%) scored 0, while 44 (30.8%) and 7 (4.9%) had risk scores of 2 and 3, respectively. A participant scored 4, which is the highest risk score for age.

Risk scoring using waist circumference (**Table 3**) show that six (4.2%) males and 21 (14.7%) females scored 0 (see **Table 3**). Two male (1.4%) and 28 (19.5%)) female participants had risk score of 3, while 8 male and more than half of female participants (78 or 54.5%) had risk score of 4. The table show

Table 1. Distribution of socio-demographic characteristics of the participants.

Age (years)	Number	Percent (%)
20-25	4	2.7
26-30	15	10.5
31-35	20	14.0
36-40	31	21.7
41-45	28	19.6
46-50	27	18.9
51-55	10	7.0
56-60	5	3.5
>60	3	2.1
Total	143	100
Gender	**Number**	**Percent (%)**
Male	16	11.2
Female	127	88.8
Total	143	100
Marital status	**Number**	**Percent (%)**
Single	16	11.2
Married	125	87.4
Separated	1	0.7
Divorced	1	0.7
Total	143	100
Educational level	**Number**	**Percent (%)**
None	1	0.7
Primary	2	1.4
Secondary	25	17.5
Post secondary	115	80.4
Total	143	100
Income	**Number**	**Percent (%)**
<N5000	23	16.1
N5000-N10,000	18	12.6
N11000-N20,000	35	24.5
>N20,000	67	46.8
Total	143	100
Family history of DM	**Number**	**Percent (%)**
None	91	63.6
Yes 1*	12	8.4
Yes 2**	40	28.0
Total	143	100

Yes 1*: Grandparent, aunt, uncle, first cousin.
Yes 2**: Parent, brother, sister, own child.

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Table 2. Risk scoring of BMI and age of participants.

BMI (kg/m²)	Score	Frequency	Percentage (%)
<25	0	33	23.1
25-29.9	1	49	34.3
>/30	3	61	42.6
Total	-	143	100
Age (years)	**Score**	**Frequency**	**Percentage (%)**
<45	0	91	63.6
45-54	2	44	30.8
55-64	3	7	4.9
≥65	4	1	0.7
Total	--	143	100

Table 3. Risk scoring of waist circumference of participants.

Waist circumference (cm) Male (m), female (f)	Score	Male (frequency)	Female (frequency)	Total frequency (%)
<95 (m), <80 (f)	0	6(4.2%)	21(14.7%)	27
95-102 (m), 80-88 (f)	3	2(1.4%)	28(19.6%)	30
>102 (m), >88 (f)	4	8(5.6%)	78(54.5%)	86
Total	--	16(11.2%)	127(88.8%)	143

that 116 of 143 or 81.1% of participants had high risk scores in waist circumference.

Table 4 shows that Majority of the participants (88 of 143 or 61.5%) did daily exercises scoring 0), while 55 or 38.5% did not do any exercise (scoring 2). History of previous hypertension during pregnancy was positive in 25 or 17.5%, while majority

Table 4. Risk scoring of daily physical exercise of participants.

Minimum of 30 minutes of daily physical activity	Score	Frequency	Percentage (%)
Yes	0	88	61.5
No	2	55	38.5
Eats vegetables/fruits everyday			
Yes	0	55	38.5
No	1	88	61.5
Presence of high blood glucose in past (pregnancy, health exam etc)			
Yes	2	25	17.5
No	0	118	82.5
Taking regular anti-hypertensive drugs			
Yes	2	26	18.2
No	0	117	81.8
Family history of diabetes mellitus			
No	0	91	63.6
Yes 1*	3	12	8.4
Yes 2**	5	40	28.0

Yes 1*: Grandparent, aunt, uncle, first cousin.
Yes 2**: Parents, brother, sister, own child

(118 or 82.5%) scored 0. Majority were not on anti-hypertensive drugs (117 or 81.8%), thereby scoring 0, while 26 or 18.2% scored 2. Risk scoring using family history of Diabetes Mellitus show that 91 or 63.6% scored 0, while 12 or 8.4% and 40 or 28.0% scored 3 and 5, respectively.

Aggregate risk scoring show that 33 (or 23%) participants had low risk, while 68 or 47% had slightly elevated risk (see **Table 5**). Twenty percent of the participants (29) had moderately elevated risk, while 13 or 9% had high risk. No participant had very high risk on risk aggregation. Moderate to high risk exist in 52 of 143 or 29% of the participants.

Table 5. Total risk for developing diabetes mellitus.

Risk score for developing DM	Frequency	Percentage (%)
<7 (low risk)	33	23.1
7-11 (slightly elevated risk)	68	47.6
12-14 (moderately elevated)	29	20.3
15-20 (high risk)	13	9.0
>20 (very high risk)	0	0

Discussion

This study was conducted among civil servants in an urban setting. Urban dwellers have been shown to have higher risk of developing diabetes due to the higher prevalence of sedentary life styles and obesity [24,25].

Increased body weight and lack of exercise are major non- genetic factors that are responsible for the increasing incidence of type 2 diabetes [26,27]. Intensive life style modification reduces the risk of type 2 diabetes by 42-58% [27]. In studies in Nigeria, the prevalence of obesity ranges between 6%-22.1% [28-30]. In this study the prevalence was higher with 42.6% of the study population having BMI ≥30. This difference is probably due to the difference in the study settings and timeline. One of the studies by Iloh et al had a rural setting, while the other was a hospital-based study with different set of the population. The population of this study consists of civil servants with steady monthly income [28].

In this study, daily exercise was not performed by 38.5% of the study population. This figure is higher than 11.6% inactivity reported by a study in Kaduna [24]. The difference in the figures is probably due to the fact that this study population consists of civil servants in urban settings, who go to work on motorized transport and have to stay in office during the working hours and come back exhausted at the end of the day. It has been observed that inactivity promotes the development of type 2 DM [27], while walking briskly for half an hour every day reduces the risk of DM by 30% [31].

Waist circumference is related to obesity, especially, visceral fat which is a risk factor for diabetes and cardiovascular events [32]. A value greater than 102cm in males and 88cm in females is considered a higher risk. In this study we had more of the females attaining this threshold. This was similar to those

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by Alebiosu in Ogun State, Nigeria [21]. The contribution of waist circumference to the overall risk scoring is large with 116 of participants having 3 to 4 scores as a result of large waist circumstance. The implication of this finding is that by reducing abdominal circumference, 81.1% of the respondents would reduce their overall risk profile by at least 3 or 4 scores.

Family history of diabetes had a high score in its risk scoring for the development of the disease. Almost 36.4% had a family history of diabetes.

Overall, nine percent of the participants have a high risk of developing DM in 10 year period (or 29% moderate to high risk). This was similar to a study in Ogun state where they had a 9.1% risk of developing diabetes in 10 years [21]. This means that the prevalence of diabetics will continue to rise astronomically if something is not done to check this trend.

Conclusion

This study has shown that about 9% of the local government employees studied have a high risk of developing DM due to high prevalence of obesity, physical inactivity, family history of DM and large waist circumference.

Recommendation

Obesity and sedentary life style are modifiable risk factors. We, therefore recommend that health education should be stepped up among this civil servants on the need to increase their physical activities by having organized exercises possibly on a daily basis. It is also recommended that obesity reduction through exercises and dieting be included as a topic for the health education of the workers.

There is need for the development of simple screening tools for use by health provider to identify those who are at high risk of developing DM in order to institute preventive and health promotive activities and follow up.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Authors' contributions	UA	MCA	GAN
Research concept and design	✓	✓	--
Collection and/or assembly of data	✓	✓	--
Data analysis and interpretation	✓	✓	✓
Writing the article	✓	✓	✓
Critical revision of the article	✓	--	✓
Final approval of article	✓	✓	✓
Statistical analysis	✓	--	✓

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