Original Article

Prevalence of Non-Invasive Risk Factors of Type 2 Diabetes among Higher Education Teachers in North-Western Nigeria

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Abstract

Background: Teaching is associated with a number of stressful circumstances that promote unhealthy lifestyles capable of fuelling risk factors for metabolic and cardiovascular disorders. This study investigated the prevalence of selected non-invasive risk factors of Type 2 Diabetes (T2D) among higher education teachers.

Methods: Higher education teachers numbering 876 from three tertiary institutions in Kano, North-Western Nigeria were assessed on selected non-invasive risk factors of T2D including Body Mass Index (BMI), Waist Circumference (WC), Waist-Hip-ratio (WHR), Percent Body Fat (PBF) and family history of diabetes. Lifestyle including smoking, alcoholism and physical inactivity were also assessed.

Results: Female-male ratio of participants was 1:5 while the age range was 24-58 years. Female teachers had higher prevalence of poor adiposity markers represented by overweight (33.8%), obesity (12.7%), high PBF (21.7%) and WC in the high risk domain (53.5%). They also had higher prevalence of hypertension (22.5%) while men had higher prevalence of WHR (31.2%) in the high risk domain. Positive family history of diabetes was 6.5% (males), 7.5% (females); physical activity at walking level 46.0% (males), sedentary activity 85.9% (females); current smoking habit 42.8% (males), 4.3% (females) and current alcohol consumption was 11.9% for males and 0% for female teachers.

Conclusion: There may be considerable chances of developing T2D among the higher education teachers based on prevalence of the selected risk factors and the risk may be higher among the female teachers. Measures to change the modifiable risk factors for the better in this population are urgently needed.

Keywords: Diabetes, stress, adiposity, lifestyle, prevention

Individuals from diverse occupational backgrounds may present with various non-invasive risk factors that have been widely accepted as correlates of diabetes, conferring on them higher likelihood of developing Type 2 Diabetes (T2D). The non-invasive risk factors that are generally accepted to predict T2D include a family history of diabetes, physical inactivity, high Body Mass Index (BMI) [1], moderate and high body-fat-percent[2], large Waist Circumference (WC), increase in age, hypertension and dyslipidaemia[3, 4].

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Evidences are also available showing association between diabetes and each of cigarette smoking[5] and alcohol consumption[6,7]. Even when individulas are not yet confirmed to have diabetes, presence of these risk factors will go a long way in predicting individuals who are at risk of developing diabetes.

Though not necessarily peculiar, higher educational teachers may present with higher risks for developing T2D based on a number of observations. Research by Higher Education Funding Council for England shows that stress from working in higher education is significantly greater than stress involved in working in other types of industry and research identified work relationships as a major stressor for lecturers[8]. Work stress may be higher in teachers of higher education from resource-low, sub-Saharan Africa with high

levels of socioeconomic deprivation. Burnout or work stress occurs when workload is combined with lack of personal control, insufficient rewards, absence of fairness, breakdown of the working community or conflicting values[9] and job strains were associated with higher BMI[10]. Potential explanations for the association between work **stress** and high BMI involved diet and physical activity as **stress**ed workers may skip lunch during workdays, promoting overeating in the evenings[10]. Also in stress, men for instance had higher blood pressures than women; used more "maladaptive" coping strategies, drank more alcohol, and ate less healthily[11].

There appears to be links between stress, metabolic disorders and cardiovascular diseases. In older men, pathways occurred from chronic stress to distress to the metabolic syndrome, which in turn predicted coronary heart disease[12]. In recent studies, stress at work was tagged an important risk factor for the metabolic syndrome[13] while Willi et al[5] recommend that future studies focus on plausible causal mechanisms or mediating factors such as obesity, lack of physical activity, dietary habits, and stress levels. Identification of individuals at high risk of developing T2D is a prerequisite for prevention of the disease[1]. In approximately one-third of all older people with diabetes, the condition remains undiagnosed, untreated and at risk of complications,[3] however, when such individuals are identified early enough, other cardiovascular morbidities may be put under check. Intitial diagnosis may be through identification of simple non-invasive risk factors such as general and abdominal obesities, lifestyle factors and cardiovascular parameters that may point at a possibility of underlying T2D. This study assessed the prevalnece of these risk factors in a group of higher education teachers.

Methods

Within a six month period, higher education teachers from three tertiary institutions were assessed for selected non-invasive risk factors of T2D. The institutions were Bayero University, Federal College of Education and Kano State Polytechnic, all within Kano State, Nigeria. The protocol was approved by the Ethical Committee on Research of the Aminu Kano teaching Hospital, Kano and the participants gave their respective consent. Participants had put at least two years of unbroken teaching services in their respective institutions while those who refused unrestricted access to measurements were excluded. A female assistant assessed all female participants because of concerns due to assessment by an opposite sex. The selected non-invasive risk factors of diabetes that were assessed included family history of diabetes, BMI, WC, Waist-Hip-Ratio (WHR), Percent Body Fat (PBF) and blood pressure. Lifestyle habits such as smoking, alcohol consumption and physical activities were also assessed.

The BMI was calculated as weight (kg) divided by height squared (m^2), WC was measured in centimeters and WHR as waist divided by hip circumference. Percent body fat was measured using the Omron BF306 body fat monitor[14], while the systolic and diastolic blood pressures were measured using the mercury sphygmomanometer. For the purpose of interpretation of analyses, our cut-offs for selected adiposity risks of T2D were BMI ≥25 kg/m^2 for overweight and ≥30 kg/m2 for obesity[15]; PBF of 20 to 25% (over-fat) and >25% (higher-body-fat) [2]. A WC >102 centimetres in men and >88 cm in women and WHR >0.9 for men and >0.85 for women were both used as measures of central obesity[16]. High blood pressure was taken as Systolic Blood Pressure (SBP) ≥140 mmHg or Diastolic Blood Pressure (DBP) ≥90 mmHg[17]. The participants were also asked to state whether they had a family history of diabetes or not or unaware of this fact. They were also asked whether they were current, never or relinquished tobacco smoking and alcohol comsumption. Their level of participation in physical activity was investigated using the International Phsyical Activity Questionnaire and this grouped them

into those who were sedentary, active at walking level, moderately active or vigorously activ[18].
Descriptive statistics on each patient's age, gender, BMI, WC, WHR, PBF and lifestyle factors were generated. Prevalence was estimated by calculating proportions of the participants with the risk factors from the whole participants.

Results

Data from the higher institutions were analysed by gender because this was likely to confer key implications for the results. Our study participants included 876 teachers of higher education with more males than females on a female-male ratio of 1:5. The male participants were between the ages of 24 and 58 years with mean of 49.36 ± 8.25, while the females were between the ages of 28 and 49 years. The mean BMI of 23.22 Kg/m^2 and 24.72 Kg/m^2 for males and females respectively was averagely within the normal although the 50th percentile for the females was 25.21 Kg/m^2 (Table 1).

Table 1: Mean distribution and percentile scores of the selected risk factors of Type 2 diabetes among the higher education teachers

Variables	Mean ± SD	Percentiles 25th	50th	75th
Age (years)				
Males	49.36 ± 8.25	27	36	49
Females	43.73 ± 5.33	31	38	42
Body Mass Index (Kg/m^2)				
Males	23.22 ± 3.75	20.31	24.21	26.1
Females	24.72 ± 4.85	23.47	25.21	28.51
Waist Circumference (cm)				
Males	103.1 ± 2.57	97.40	101.61	103.11
Females	86.53 ± 3.16	79.5	89.75	92.33
Waist-Hip-Ratio				
Males	0.98 ± 0.12	0.94	1.02	1.41
Females	0.84 ± 0.19	0.76	0.78	0.82
Percent Body Fat (%)				
Males	25.26 ± 5.35	18.72	20.71	22.98
Females	34.18 ± 8.35	23.00	28.20	30.55
Systolic Blood Pressure (mm/Hg)				
Males	130 ± 7.98	118	125	130
Females	125 ± 6.65	120	130	150
Diastolic Blood Pressure(mm/Hg)				
Males	80 ± 5.54	80	86	95
Females	90 ± 4.82	80	95	102

Going by our cut-off, the mean WC of male teachers places them on higher risk of cardio-metabolic disorders (103.1 cm) than female teachers (86.53 cm) while the mean WHR of both the male and female teachers were within moderate risk. Whereas about 50% of the male teachers had their PBF below 20.71%, about 75% of the female teachers had theirs above 23.0% (25th percentile = 23%). The result of blood pressure is also presented in Table 1. The prevalence of high general adiposity represented by overweight, obesity and high PBF among the male teachers were 16.0%, 6.6% and 14.1% respectively (Table 2). Comparatively, the female teachers had higher prevalence of the

general adiposity markers. The female teachers also had higher prevalence of hypertension (22.5%) and WC in the high risk domain (53.5%) but lower prevalence of the high risk WHR than male teachers.

Table 2: Prevalence proportion of diabetes risk factors per 100 among the higher education teachers

	Males (n = 702)%	Females (n =174)%
General adiposity		
Overweight	16.0	16.0
Obesity	6.6	12.7
High PBF	14.1	21.7
Central adiposity		
High risk WC	33.7	53.5
High risk WHR	31.2	16.2
Cardiovascular		
Hypertension	18.7	22.5

Only 2.1% of the participants confirmed a previous diagnosis of diabetes while most of the participants were unaware of their family history of T2D. The prevalence of unawareness for family history of diabetes was 76.2% and 89.4% among male and female teachers respectively (Table 3). Activity at walking level was the highest (46.0%) in male teachers while sedentary activity (85.9%) was the highest in the females. The prevalence of current smoking habit among the teachers was 42.8% for males and 4.3% for females. Although 90.8% of female teachers never smoked, 4.9% of them had smoked sometimes in their lifetime but had quit the habit. None of the female participants was taking any alcohol as at data period while 11.9% of the male teachers were current alcohol consumers. The prevalence for those who never took alcohol in their lifetime was 76.7% and 97.9% for male and female teachers respectively.

Discussion

This study revealed that on the average, the higher education teachers were middle aged, had normal BMI, high WC and WHR, high

Table 3: Prevalence proportion of diabetes risk factors per 100 by family history and lifestyle of participant

	Males (n = 702)%	Females (n = 174)
Family History of diabetes		
Yes	6.5	7.5
No	17.3	2.8
Not aware	76.2	89.4
Exercise levels		
Sedentary	28.8	85.9
Walking	46.0	12
Moderate	22.5	2.1
Vigorous	2.7	0
Smoking		
Yes	42.8	4.3
No	30.1	90.8
Quit	27.1	4.9
Alcohol		
Yes	11.9	0
No	76.7	97.9
Quit	11.4	2.1

PBF but were not hypertensive. Generally, the selected risk factors of T2D were prevalent among the teachers and the prevalence of general adiposity markers was higher in the females than the males. The females also had higher prevalence of hypertension and WC in the high risk domain while the males had higher prevalence of WHR in the high risk domain. For the lifestyle, females also had higher prevalence of sedentary activity life but lesser prevalence of current smoking and alcohol consumption compared with the male teachers.

The high male gender bias in our sample was not predetermined as study aimed at surveying as many higher education teachers as were willing to participate. The bias could however be because more men were involved in higher education teaching in the studied institutions or because more men agreed to participate in the survey. Although the average BMI of the participants was normal, the percentile analysis revealed those who

were overweight and above. The second quartile for female BMI was 25.51 Kg/m^2 indicating that about half of them could be overweight and beyond. Looking at the prevalence of general adiposity markers (overweight, obesity and PBF) among the participants, the female teachers had higher prevalence of these three indices thereby placing them on higher risk of developing T2D than males. In a previous study, history of hypertension, high BMI and large WC were increased risk of both diagnosed and undiagnosed diabetes [3]. For the selected central adiposity markers, although the female teachers had higher prevalence of WC in the high risk level, the males had higher prevalence of WHR in the high risk level. Lower prevalence of high risk WHR among the females could be due to relatively wide hips lowering the ratio of the waist to hip circumference. This may be pointing to a limitation of the WHR considering that other selected adiposity risk factors in this study consistently pointed at female teachers as having higher prevalence of the risk factors. The cluster of high prevalence of both general and central adiposities may predispose more of the female teachers to diabetes because central obesity (approximated by waist circumference or waist/hip ratio) for instance is known to generate diabetogenic substances[19]. Specifically in women, it was discovered that risk of T2D increased progressively with increasing BMI and WC and with decreasing physical activity levels[20]. The prevalence of hypertension was also higher in the female teachers indicating the possibility of more female teachers being hypertensive than male teachers.

As the female teachers presented with higher prevalence of hypertension and adiposity variables than the males, they also presented with higher prevalence of low activity levels. Their most prevalent activity level was sedentary and the highest level of activity attained by a few of them was only at ordinary walking level where actually less than one-fifth of them belonged. Although most of the male teachers on the contrary had their highest prevalence of activity only at the walking level, more than one-fifth of them were also active at the moderate level. Moderate to vigorous physical activity and weight loss independently reduce the risk for T2D and improve glucose/insulin metabolism via different mechanisms [21]. The higher level of activity may as well be responsible for the fairly lower prevalence of high risk adiposity and hypertension noticed among the male teachers compared with the females further underscoring the possibility of low activity levels begetting higher adiposities and poor cardiovascular health.

The male teachers had higher prevalence of smoking and alcohol consumption as risk factors of diabetes. While about half of the male teachers were current smokers, about 90 out of 100 female teachers had never smoked. The risk of diabetes was greater for heavy smokers than for lighter smokers and lower for former smokers compared with active smokers, consistent with a dose-response phenomenon[5]. Smoking may correlate with diabetes due to a direct effect of nicotine or other components of cigarette smoke on beta cells of the pancreas, as suggested by the association of cigarette smoking with chronic pancreatitis and pancreatic cancer [22]. About 30 out of 100 of the male teachers however claimed to have quit smoking. For the alcohol consumption, only about one tenth of the male teachers were current consumers whereas none of the females claimed to be taking alcohol. Both the male and female teachers reported similar prevalence of positive family history of diabetes which was less than 10 out of 100. A family history of diabetes confers an increased risk of developing T2D [1]. However, most of the teachers were not aware of their family histories of diabetes pointing to an insufficient knowledge of diabetes aetiology even among the higher education teachers.

The relevance of this study does not lie only in the fact that it surveyed risk factors of T2D among higher education teachers, a data that is rarely available but also because the data can be applied to other uses as well. Generally, there is a dearth of information on the non-invasive risk factors of T2D for the

sub-Saharan population and the result of this study can stimulate further studies in this area since risk factors for T2D may differ between ethnic, occupational and social groups. This study also clearly reveals that generally, the risk of developing T2D may be high among the higher education teachers based on the prevalent and clustering nature of these diabetes risk factors. Because diabetes remains undiagnosed in approximately one-third of all older individuals [3], it is very imperative to study the prevalence of diabetes red flaggers in different groups in order to provide interventions that will nip the spread of diabetes.

This study had a number of limitations. First, it was difficult having equal number of males and females surveyed. This was particularly difficult because of the fewer female teachers in the employment list of these higher education institutions. In addition, many of the female teachers did not consent to the measurements even with the female research assistant. All these made randomization impossible. We were also unable to confirm whether the prevalence of diabetes risk factors translated to actual presence of T2D in the participants since only 2.1% of the participants confirmed a previous positive diagnosis. We also had to rely on adiposity court-offs drawn from other populations since normative data specific for the African sub region were not readily available.

In conclusion, this study revealed that female teachers of higher education had higher prevalence of non-invasive risk factors of T2D represented by overweight, obesity, high WC and high PBF compared to their male colleagues. They also had higher prevalence of hypertension and sedentary activity levels whereas the male teachers had higher prevalence of high WHR, higher prevalence of smoking and alcohol consumption but more physically active. There is the need to consistently monitor risk factors of metabolic and cardiovascular disorders in order to control morbidities and improve health. For further studies, we recommend nationwide diagnostic survey of risk factors for T2D in higher educational institutions and relate this with actual or perceived stress among the higher education teachers.

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