ORIGINAL ARTICLE

Prevalence of traditional cardiovascular risk factors among staff of Ladoke Akintola University of Technology, Ogbomoso, Nigeria

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Abstract

Aim: The aim was to describe the frequency of occurrence of traditional cardiovascular (CV) risk factors among selected university workers in Ladoke Akintola University of Technology (LAUTECH) Nigeria.

Materials and Methods: A cross-sectional study of 206 staff of LAUTECH, Ogbomoso, Nigeria had an assessment for nine traditional CV risk factors. Demographic and clinical parameters were taken. Blood sample was taken to determine the random blood sugar and lipid profile. 12-lead resting electrocardiography (ECG) was done for all participants. Statistical analysis was performed with the aid of Statistical Package for Social Sciences (SPSS) version 17.0 (Chicago Ill., USA)

Results: The study population included 96 males (46.6%) and 110 females. The mean age was 45.3 ± 7.9 years (range 27-73 years). The prevalence of CV risk factors were as follows: Hypertension 84 (40.8%), visceral obesity 92 (44.7%), generalized obesity 79 (38.3%), low high density lipoprotein 113 (54.9%), impaired blood glucose 16 (7.8%), diabetes mellitus 3 (1.5%), hypercholesterolemia 102 (49.5%), left ventricular hypertrophy-ECG 24 (11.7%), elevated low density lipoprotein-cholesterol 99 (48.1%). About – (72.3%) had two or more CV risk factors clustered together. Females had a higher prevalence of CV risk factors and its clusters than their male counterparts. Of those diagnosed with hypertension in this study, more than half had never been told they were hypertensive 48 (57.1%).

Conclusion: This study suggests a very high prevalence of CV risk factors among University Staff in LAUTECH, Ogbomoso, Nigeria. Clustering of CV risk factors is more prevalent among women. Appropriate preventive strategy in terms of education and modification of risk factors are important to reduce the burden of CV diseases among this population.

Key words: Cardiovascular risk factors, dyslipidemia, hypertension, obesity, prevalence, university

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Introduction

Cardiovascular disease (CVD) is the number one cause of death worldwide.[1,2] It is increasingly responsible for a progressively higher degree of mortality in Africa over the decades due to mortalities and incapacitations from stroke, kidney failure, heart failure, and hypertensive emergencies among others.[3,4] Despite the persistent scourge of infectious diseases and evolving polymicrobial antibiotic resistance, multidrug-resistant tuberculosis and HIV/AIDS, CVD continues to ravage Africa like an epidemic.[2,5] Hypertension and other CV risk factors and disease are being reported in astronomical proportions from different

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population.[6] Okunola *et al*. recently reported that a large percentage of medical admissions at a Teaching Hospital in Nigeria were due to CVD.[7]

The cost of care when CVD finally evolves will be too expensive to bear for most if not all African countries. In US, a sizable proportion of their budget is for treatment and diagnosis of CVD.[6,8] CVD are often preceded by associated risk factors.[9] A major preventive strategy to combat CVD worldwide is to aggressively identify and treat CV risk factors. The pattern of CV risk factors is often inexorably directly proportional to the risk of CVD and treating these CV risk factors have been shown to reduce significantly the risk of death and morbidities from CVD, especially among the Caucasians.[10,11] It is known that the pattern of CVD in developed countries has plateau in the recent time due to massive population targeted CV risk preventive strategies.[12] The identification of these CV risk factors in a University Community where one naturally expects a high level of awareness and commitment to preventive care will be one-way of reducing the burden of CVD among the population in the future. Prevention of CVD remains a major way to achieve a healthy workforce in a University Community. Very few data exist on the pattern of CV risk factors in University Communities in Nigeria. We aimed to determine the prevalence of traditional CV risk factors among staff of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria.

Materials and Methods

This was a cross-sectional study done among the staff of LAUTECH, Ogbomoso, Nigeria and was carried out between November 2013 and February 2014. This study was supported by a Senate Research Grant from the LAUTECH Research and Consultancy Service (LAU/SRC/13/001).

Two hundred and six consenting adults who are full time academic and nonacademic staff of LAUTECH, Ogbomoso participated in this study. All full-time workers of the university were eligible and were recruited if they gave their informed consent. People who were not willing to participate or who had other medical illness necessitating admission during data collection were excluded from this study. Also excluded were those who were pregnant or who had advanced chronic diseases such as malignancy, heart failure, or renal failure. They were selected though stratified random sampling of all the faculties and units of the university including health center, security unit and the senate building. Each participant was invited to fill a data form which included information such as age, gender, department (unit), highest level of education, previous history of hypertension or diabetes, known family history of hypertension or diabetes or of sudden death, whether they were on long-term medications, history of alcohol or cigarette intake and their marital status. Clinical parameters including weight, height and waist circumference at the mid portion between anterior superior iliac spine and lowermost rib during mid-expiration were also taken. The blood pressure was taken from the left arm according to standardized protocols with the subject having rested for at least 5 min.[13] An average of three blood pressure readings was taken and this was used to classify the subject into normal blood pressure, prehypertension and hypertension according to JNC VII criteria.[14] Each participant also had 12-lead resting electrocardiography (ECG) done using the Schiller AT III machine at 25 mm/s. The ECGs were interpreted by the two cardiologists in the studies who reviewed their findings and agreed on the results and who were blinded to the clinical and demographic profile of the participants at that time. They were interpreted to identify the heart rate, rhythm, axis, PR interval, presence of left and right atrial enlargement and left ventricular hypertrophy (LVH). Blood sample (7 ml. each divided into the lithium heparin and fluoride bottles) was taken for random blood sugar and serum lipid profile including triglycerides (TGs), total cholesterol (TC), high density lipoprotein (HDL)-cholesterol, low density lipoprotein (LDL)-cholesterol. The sample was analyzed by the chemical pathologist who is a member of the study team. Blood glucose was done using the glucose oxidase method. History of smoking including duration and number of pack years was obtained.

Hypertension was defined according to standardized protocols as average blood pressure ≥ 140/90 mmHg or someone on antihypertensive drugs.[12,14] The body mass index (BMI) was determined using the standard technique of dividing weigh in kilogram by the square of height in meters. Overweight was defined as BMI 25-29.9 kg/m^2 while obesity was defined as BMI ≥ 30 kg/m^2. Visceral obesity was defined as waist circumference > 88 cm in female and > 102 cm in males. Elevated TGs was defined as serum TG ≥ 1.7 mmol/l. Serum lipid profile were analyzed and classified according to the National Cholesterol Education Program adult treatment panel IV.[15-17] TC was defined as borderline high when serum TC was between 5.17 and 6.11 mmol/l. Hypercholesterolemia was defined as TC > 6.2 mmol/l. Low HDL was defined as HDL < 1.03 mmol/l (males) and < 1.3 mmol/l (females). Borderline high LDL-cholesterol was defined as LDL-C 3.36-4.4.13 mmol/l while elevated LDL cholesterol was defined as > 4.13 mmol. ECG-LVH was defined using Araoye and/or Sokolow-Lyon criteria. Diabetes was defined as random blood sugar > 11.1 mmol/l while impaired blood glucose was defined as blood sugar 10.0-11.1 mmol/l. The research assistants were well-trained and a pretest done before the commencement of this study.

Gender specific frequencies of occurrence were determined. The participants were also stratified into age groups to find out the age distribution of the traditional CV risk factors

among the study participants. The traditional CV risk factors identified in this study were smoking, hypertension, impaired glucose tolerance/diabetes mellitus (DM), obesity (either whole body or visceral), elevated TGs level, elevated LDL-cholesterol, low HDL-cholesterol, elevated TC and presence of LVH on ECG. Count of the total number of CV risk factors was done for each participant.

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 17.0 (Chicago Ill. USA) $P < 0.05$ was taken as statistically significant. Quantitative data were summarized as means ± standard deviation, while qualitative data were summarized in frequencies and percentages. Student's *t*-test and Chi-square were used to check for the difference between groups appropriately.

Institutional Ethical Approval was obtained for this study and all participating adult gave their written informed consent. Participants were provided with a summary sheet of all the investigations and clinical findings and appropriately advised to commence treatment and follow-up at the University Health Center/Teaching Hospital as appropriate.

Results

The mean age of the study participants was 45.27 ± 7.87 years. Their age ranged from 27 to 73 years. The mean age of the male participants was higher, albeit not statistically significant compared with the female participants (46.1 ± 8.0 years vs. 44.56 ± 7.8 years, respectively, $P = 0.166$). Most were in the middle-aged group with those between 45 and 60 years formed the largest percentage of participants accounting for 43.7% of total participants. This age group was followed by those between 36 and 45 years of age which formed 40.3% of total participants. Those < 35 years of age formed only 11.3% of all participants while the rest were those > 60 years of age. 96 (46.6%) of all participants were males. The mean BMI was 28.45 ± 6.03 kg/m^2. The mean BMI was significantly higher among female participants than in males (29.9 ± 6.7 vs. 27.0 ± 4.7 kg/m^2, $P = 0.000$). The mean waist circumference was higher among females than male participants, although this was not statistically significant (93.9 ± 12.4 cm vs. 91.4 ± 11.1, $P = 0.138$). The average systolic and diastolic blood pressures were significantly higher among males although they were also not statistically significant. The mean pulse pressure of the study participants was 52.2 ± 15.3 mmHg. These are shown in Table 1.

Table 2 shows the pattern of CV risk factors stratified to gender among the study participants. The mean age of male and female study participants were similar. Mean TC (5.52 ± 1.44 vs. 5.2 ± 1.34 mmol/l, $P = 0.07$), LDL-cholesterol (3.96 ± 1.42 mmol/l vs. 3.58 ± 1.38, $P = 0.060$) and HDL-cholesterol (1.16 ± 0.48 vs. 1.11 ± 0.28 mmol/l, $P = 0.203$) were higher, though not statistically significant among female participants in this study.

Table 1: Clinical and demographic parameters of study participants

Variable	Values
Age (years)	45.27±7.87
Gender males (*n*/%)	96 (46.6)
BMI (kg/m^2)	28.45±6.03
WC (cm)	92.76±11.85
Marital status (married) (*n*) (%)	200 (97.1)
Mean SBP (mmHg)	135.76±22.99
Mean DBP (mmHg)	83.56±13.45
Pulse pressure (mmHg)	52.2±15.31

Values are expressed as mean±SD. BMI=Body mass index; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; SD=Standard deviation; WC=Waist circumference

Table 2: Prevalence of cardiovascular risk factors stratified according to gender

Variable	Males (*n*=96) (%)	Females (*n*=110) (%)	*P* value
Age (years)	46.1±8.0	44.6±7.8	0.166
BMI (kg/m^2)	27.0±4.7	29.9±6.7	<0.001*
WC (cm)	91.4±11.1	93.9±12.4	0.138
SBP (mmHg)	137.7±22.6	134.1±23.3	0.263
DBP (mmHg)	84.4±13.8	82.8±13.1	0.385
TC (mmol/l) (*n*)	5.2±1.34	5.52±1.44	0.073
Visceral obesity (*n*)	22 (22.9)	70 (63.6)	<0.001*
BP≥140/90 mmHg (*n*)	37 (38.5)	47 (42.7)	0.542
Low HDL-C (*n*)	37 (38.5)	76 (69.1)	<0.001*
ECG LVH (*n*)	16 (16.7)	8 (7.3)	0.109
BMI≥30 kg/m^2 (*n*)	23 (24.0)	56 (50.9)	0.001*
IGT/DM (*n*)	5 (5.2)	14 (12.72)	0.041*
↑ TC (*n*)	39 (40.6)	63 (57.3)	0.034*
↑ LDL-C (*n*)	46 (47.9)	65 (59.1)	0.104
↑ TG (*n*)	12 (12.5)	11 (10.0)	0.148
Family HX of HTN (*n*)	13 (13.5)	29 (26.4)	0.029*
Number of CV risk factors (*n*)	1.5±1.6	3.3±1.6	<0.001*

*Statistically significant. BMI=Body mass index; IGT=Impaired glucose tolerance; DM=Diabetes mellitus; LDL-C=Low density lipoprotein cholesterol; TG=Triglycerides; HTN=Hypertension; CV=Cardiovascular; WC=Waist circumference; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; HDL=High density lipoprotein; ECG-LVH=Left ventricular hypertrophy diagnosed with electrocardiography, TC=Total cholesterol; BP=Blood pressure, ↑=Increased

The proportion of those with hypertension was higher, albeit statistically insignificant among females than males (42.7% vs. 38.5%, respectively), likewise the frequency of occurrence of hypertriglyceridemia. The prevalence of low HDL (69.1% vs. 38.5%, $P = 0.000$), generalized obesity (50.9% vs. 24.0%, $P = 0.001$), impaired blood glucose/DM (12.7% vs. 4.6%, $P < 0.05$), hypercholesterolemia (57.3% vs. 47.9%, $P = 0.034$) were significantly higher among females than males in this study. The average number of clusters of CV risk factors was also significantly higher among female participants in this study (3.3 ± 1.6 vs. 2.6 ± 1.6, $P = 0.000$, respectively).

Table 3 shows that age was closely related to many of CV risk factors. There was an increase in prevalence of almost all of the CV risk factors as age increased in this study. Those in the age group 46-60 years and those >60 years of age were more likely to have more CV risk factors and its clusters together than younger participants.

Discussion

With the evolving increased prevalence of CV disease and as a major cause of mortality worldwide including Africa, the university communities where active and productive researches are being carried out requires energetic, productive and healthy workforce. Prevention of CVD remains a major way to achieve a healthy workforce in the university workforce as in the general population. Very few data exists on the pattern of CV risk factors in university communities across Nigeria. With the massive campaign of population oriented which were aimed at salt intake reduction, reduction in TC, increasing physical activity, etc., the pattern of CV disease seems to have at least reach a plateau in the developed nations while it is said to be increasing at alarming proportion in the developing nations Nigeria inclusive. It has also been suggested that about 70% of the total increase of worldwide prevalence of CVD in the next decade will come from developing nations.[18]

This study revealed a very high prevalence of CV risk factors among LAUTECH university staff in South West Nigeria. It also revealed a high frequency of occurrence of multiple CV risk factors among participants as about three-fourth of all participants had two or more CV risk factors. These risk factors include hypertension, obesity, dyslipidemia (Low HDL-C, high LDL-C, high TC and high TGs), smoking, LVH, and impaired blood glucose/DM. These risk factors have been shown to predict the development of CV disease in the future.[19] The modification of these risk factors by drugs or other strategies have also been shown to reduce the risk of developing CVD and associated complications.[20-22] It is worthy of note that in this study, the age groups 36-45 years and 46-60 years were particularly affected by the burden of these CV risk factors. These are the active working class and the implication of this on the health status of university workforce and the nation economy at large might be enormous if appropriate intervention is not implemented.

Similar studies have been carried out among medical school lecturers in Port Harcourt, Nigeria. The outcome of the study shows that the prevalence of hypertension in our study is far higher than among the medical school lecturers in that study.[23] We suggest this might be due to increased awareness for control and prevention among those in that study compared to those who are in our study who came from all subunits and Department of University.[23] Earlier studies have reported low prevalence of CV risk factors among Nigerians including those carried out in university communities. Adedoyin *et al*. concluded in a study about a decade ago that the level of CV risk was low among workers at Obafemi Awolowo University, Ile-Ife, a university in South Western Nigeria. Similarly Kadiri and Salako. in a population survey about two decades ago showed that the prevalence of CV risk factor was generally low.[24,25] However, more recent studies from the same region suggests progressive increase in prevalence of CV risk factors. Oladapo *et al*. recently in a study strongly suggested a high prevalence of cardiometabolic risk factors among the rural population in South Western Nigeria and that the epidemiologic transition is not restricted to the urban population.[26] Other studies have produced similar results from other parts of the country.[27,28] Emerole *et al*. reported that the cardiac risk indices of staff of Federal University of Technology, Owerri, Nigeria was high especially among the senior staff.[29]

The prevalence of CV risk factors in our study was found to be higher than most institutional based study/reports from Nigeria.[27-29] It was also higher that reports from the Abia state noncommunicable diseases and CV risk factors survey where the prevalence of hypertension was found to be 31%.[28] This and many similar studies therefore suggest a rapid epidemiologic transition to the high prevalence of noncommunicable diseases (often preceded by CV risk factors) in the nearest future in Nigerian Universities and the need to institute preventive programs to reduce the burden.

The prevalence of hypertension reported in this study (40.8%) is similar to that reported by Capingana

Table 3: Pattern of cardiovascular risk factors stratified by age groups

Age groups number (*n*)	≤35 years (23) (%)	36-45 years (84) (%)	46-60 years (90) (%)	>60 years (9) (%)	*P* values
TG>1.7 mmol/l (*n*)	1 (4.34)	11 (13.1)	8 (8.9)	1 (11.1)	0.640
LDL>3.4 mmol/l (*n*)	10 (43.5)	34 (40.5)	59 (65.6)	6 (66.7)	0.029*
Visceral obesity (*n*)	9 (39.1)	37 (44.0)	42 (46.7)	3 (33.3)	0.311
Low HDL-C (*n*)	12 (52.2)	46 (54.8)	51 (56.7)	4 (44.4)	0.881
Hypertension (*n*)	8 (34.8)	24 (28.6)	44 (48.9)	8 (88.9)	0.006*
Impaired glucose tolerance/DM (*n*)	0 (0.0)	6 (7.1)	11 (12.2)	2 (22.2)	0.08
Total (*n*) cholesterol>5.2 mmol/l (*n*)	8 (34.8)	32 (38.1)	55 (61.1)	5 (55.6)	0.040*

*Statistically significant. LDL=Low density lipoprotein; HDL=High density lipoprotein; TG=Triglycerides; DM=Diabetes mellitus; HTN=Hypertension

et al. (45.2%) among public health sector workers in Angola. However, the prevalence in our study was far higher for hypercholesterolemia, low HDL and obesity compared to that study among Angolan public sector workers.[30] The prevalence of hypertension in this study was also far higher than that from a similar survey in another Nigerian university by Ige *et al.*[31] although the prevalence of diabetes was lower in our study. We suggest that the difference may be due to the fact that the different universities are at a different level of urbanization. Similarly, the frequency of occurrence of many CV risk factors in this study were significantly higher than what has been reported even among other Nigerians who are apparently not working in the University community. Sani *et al.* have reported the prevalence of hypertension among healthy adult Nigerians to be 25.7%, hypercholesterolemia 28.3%, elevated LDL-cholesterol 25.7% and generalized obesity 21.3% all of which are far lesser than what was reported in this study.[32] In the same vein, the frequencies of occurrence for obesity and other CV risk factors reported in this study were far significantly higher than that reported in similar studies in a Canadian University.[33] The prevalence is however similar to what was reported among University personnel in Saudi Arabia.[34]

The availability of reliable data on the pattern of CV risk factor is the first step in making appropriate health policies for increasing awareness and modification of risk factors to prevent CVD in the future. Lowering blood pressure by 5-10 mmHg has been shown to reduce the risk of developing cerebrovascular disease by 35-40%, ischemic heart disease by 20-30% and all cause CV mortality by up to 23%.[35] In this study, these CV risk factors tend to occur in clusters especially with low HDL and obesity. The presence of multiple CV risk factors have been suggested to have a multiplicative effect on CV risk of such individuals.[36] Why there was such a high prevalence of CV risk factors among LAUTECH staff in this study may partly be due to lifestyle and environmental factors of reduced activity, increasing obesity, dietary indiscretion, excessive consumption of salt and poor health seeking attitude of workers, although this was not investigated in this study. These can be taken care of by aggressive education for identification and treatment of CV risk factors, improving workplace ethics to reduce obesity, introduction of exercise program, regular health screening and provision of good quality drugs at the health center to manage these patients. The level of control blood pressure among those who were already aware they were hypertensive in this study was very poor as more than 70% had poor blood pressure control as at the commencement of this study.

This study is not without certain limitations. First, the blood samples were in the nonfasting state and conventional CV risk stratification using these parameters may not be totally correct. However, it has also been suggested that lipids, lipoprotein and apolipoproteins were not much different in fasting and nonfasting state with the exception of TG, which may be higher in the nonfasting state.[16] Furthermore, the results of the study may not be totally generalizable to other university workers in Nigeria. Further studies are encouraged in this regard. Furthermore, not all the CV risk factors were screened for in this population.

Conclusion

This study revealed a high prevalence of CV risk factors among staff of LAUTECH, Ogbomoso. It also revealed a high frequency of cluster of CV risk factors especially obesity and low HDL-C among study participants. Hypertension and other CV risk factors were related to increasing age, although only that of hypertension and low HDL were statistically significant in this study. Females also had a higher prevalence of CV risk factors and the most common clusters of CV risk factors in this study were low HDL and obesity. Less than half of those who were diagnosed to be hypertensive in this study were never aware they were hypertensive before the commencement of this study. A large portion (more than 70%) of those who had been diagnosed with hypertension also had poor blood pressure control. There is therefore an urgent need for the institution of comprehensive CV prevention program such as concerted health education programs to increase awareness, aggressive treatment of CV risk factors, insistence on periodic medical check-up and certificate of fitness, introduction of programs that involve staff active participation to reduce obesity and provision of health insurance to cover CV care for all staff of the University. This will also form the basis to mount medical education/awareness program in the University in conjunction with the health center to achieve a reduction in CV morbidity and mortality.

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