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Full Length Research Paper

Risk assessment of cardiovascular disease among staff of the University of Buea, South Western Cameroon

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Current changing lifestyles of Africans may impact on their risk of developing cardiovascular diseases. This study aimed at identifying the pattern of the major risk factors of CVD and the total risk of CVD among workers of the University of Buea. A cross-sectional study was carried out involving 313 teaching and support staff of the institution. Fasting blood sugar, total cholesterol, Triglycerides and HDL cholesterol levels were measured by spectrophotometry. LDL cholesterol was calculated. Calculation of Risk Scores Estimation of the individual risk of developing subsequent cardiovascular disease and the absolute risk of CHD within 10 years was done using the Framingham Heart Study Prediction Score charts. The mean (± SEM) age of the workers was 39.8 ± 0.48 years (range of 23 – 64 years). 38.7% (121) of the workers were overweight, while 27.8% (87) were obese. Total cholesterol level was significantly different among the different age groups (F = 4.776, P = 0.003). There was a significant positive correlation between total cholesterol (r = 0.144, P = 0.011) and TG (r = 0.242, P < 0.001) levels with age. Total cholesterol, LDL-C and triglycerides significantly correlated with BMI. Ten-year CHD absolute risk score correlated positively with average quantity of alcohol consumed per unit time (r = 0.248, p < 0.001). The prevalence of the risk factors of CVD was relatively low among the workers of the University of Buea, except for overweight and obesity, alcohol consumption and low HDL-C.

Key words: Cardiovascular disease, lipid profile, cholesterol, triglycerides, risk factors.

INTRODUCTION

Cardiovascular disease (CVD) is a broad, all-encompassing term, a general diagnostic category consisting of diseases of the heart and circulatory (vascular) system. These diseases include coronary heart disease (CHD), stroke, peripheral artery disease (PAD), and rheumatic heart disease amongst others. Coronary heart disease and stroke are the leading CVDs. They accounted for 23% of all deaths in the world in 2002, while malaria, HIV and tuberculosis contributed to only 10% (WHO, 2005). In sub-Saharan Africa, CHD was ranked 8th among the leading causes of death in men and women in 2006 (Mensa, 2008). In Cameroon, the disability adjusted life years (DALYs) per 1000 population for CHD in 2002 was 10 – 19 and 10,000 – 99,999 people were estimated to die from stroke (WHO, 2005).

Residents of developing countries develop CVDs at an earlier age than their developed country counterparts. For example, in 1990, the proportion of deaths occurring below the age of 70 years was 26.5% in the developed countries compared to 46.7% in the developing countries (Reddy and Yusuf, 1998), thus it is a cause for concern.

In the second half of the 20th century, cardiovascular diseases were the dominant cause of global mortality and a major contributor to disease related disability (WHO, 2001). The World Health Organisation reported a striking shift in the distribution of death and disease from younger to older ages and from infectious, peri-natal and maternal causes to non-communicable diseases. Even in Africa, where the population remains younger, smoking, elevated blood pressure and cholesterol were among the top 10 risk factors in terms of overall disease burden (WHO, 2008) It is thus envisaged that in the first half of the 21st century, this pattern will become even more pervasive as

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the CVD epidemic accelerates in many developing regions of the world (WHO, 2005; Reddy and Yusuf, 1998) though it still retains its primacy as the leading public health problem in the developed world (WHO, 2005). The observed increase in developing countries may be due to a shift from nutritional deficiencies and infectious diseases as the major cause of death and disability to degenerative disorders; economic ascent of nations as they industrialize leading to increasing longevity; urbanization and lifestyle changes (Howson et al., 1998; Reddy, 2003). Other proposed mechanisms that propel a CVD epidemic in developing countries include the “Thrifty gene” effect, postulated to be a factor promoting selective survival over generations of persons who encountered an adverse environment of limited nutritional resources (Reddy, 2003); maternal-foetal exposures where there is an inverse relationship between low birth weight and CVD in the later life (Martyn et al., 1995; Jeffrey and Mark, 2008).

CVD (especially CHD and stroke) are multifactorial in cause and the predisposing factors are referred to as risk factors. Over 300 risk factors have been associated with CHD and stroke (WHO, 2005). A risk factor must fulfil the criteria of causality, strength of association, temporal relationship (cause preceding the effect), dose-response relationship, biological plausibility, experimental evidence and evidence from human studies (Reddy, 2003). Risk factors are grouped into modifiable factors and include elevated cholesterol, hypertension, smoking, diabetes, obesity, socioeconomic status, psychological stress, alcohol consumption, dietary quality and certain medications (WHO, 2005). Non-modifiable risk factors include advancing age, hereditary or family history of CVD, gender and ethnicity or race (Reddy, 2003).

Observational studies like the Framingham study (Castelli et al., 1992) have clearly revealed that the coexistence of multiple risk factors confer a magnified risk which is multiplicative rather than merely additive (Reddy, 2003). The demonstration of such multiplicative risk has led to the concept of “comprehensive cardiovascular risk” or “total risk”, quantifying an individual’s overall risk of CVD resulting from the confluence of risk factors. The study systematically created a quantitative link and provided a scoring system. The Framingham equations give an acceptable prediction of risk of CVD and CHD (Robson et al., 2000).

Though CVD still remains the major public health problem in the developed world, there is a recent decline of CVD epidemic in almost all developed countries (Welton et al., 1995). Very few studies are being carried out on CVD in the developing world, especially in Africa (WHO, 2005), though it is currently experiencing a rise in CVD. This increase in Africa and particularly Cameroon is probably linked with increased sedentary life style, relative increase in industrialisation, increased availability and affordability of refined foods, changing diets from a once predominantly vegetarian diet with low consumption of oils, increased rural to urban migration, availability of more corporate jobs, high consumption of alcohol and lack of adequate health education amongst others. Furthermore, changes in lifestyle and dietary habits are taking place amidst declining health services which is not affordable by the average citizen. In addition, access to health care especially in the peripheral areas is greatly limited or in some areas unavailable. In China, given the actual absolute benefit of anti-hypertensive drugs, only 23% of those who acknowledged the CVD risk of hypertension were willing to pay the annual cost for the drugs. Many were willing to pay only when the 5-year cardiovascular disease risk was 35% or even higher (Jin-Ling et al., 2009). Given the high prevalence of such common cardiovascular risk factors such as hypertension, treatment is beyond the budgetary possibilities of any of these countries (Nchinda, 2003).There is therefore urgent need for cost effective prevention and case management strategies. Improved surveillance of all diseases within sub-Saharan Africa is needed in order to place non-communicable diseases (especially CVD) in general properly within the context of the overall burden of disease.

This study was therefore aimed at identifying the pattern of the major risk factors of CVD and the total risk of CVD among workers of the University of Buea, thus providing information that may be useful in the implementation of preventive strategies and also serve as a motivation for further investigations in this area.

MATERIALS AND METHODS

This prospective cross-sectional study was carried out in the University of Buea located in South western Cameroon between May and August 2007. The indigenes of this area are the Bakweri people and the majority of residents are civil servants and peasant farmers with a few of them involved with business. The staple food of the indigenes is processed coco-yams although residents from other regions eat other diets essentially, maize, cassava products and oily vegetables. Buea has been transformed within the last ten years into a cosmopolitan town due to the presence of the university and new industries. There were 680 workers in the University of Buea in 2007 and include 230 teaching (holders of at least a Masters degree) and 450 non-teaching staff with qualifications ranging from primary school certificate to Bachelors degrees. The majority of non teaching staff had undergone secondary education. They came from almost all the ethnic groups in Cameroon, making the community a cosmopolitan and genetically heterogeneous one. The study participants consisted of apparently healthy staff on the payroll of the University of Buea who consented to participate in the study after adequate sensitisation on the project objectives and protocol. As expected volunteers signed the consent form before they were enrolled into the study. Staffs on any medication related to cardiovascular diseases were excluded from the study. Study participants reported to the Health centre of the University of Buea between 7:30 - 10:00 am after an overnight fasting and were given a structured questionnaire designed to obtain information on socio-economic status (SES) which included information on level of education, employment status, monthly income, car ownership and marital status, smoking status, alcohol consumption, physical activity, family history of CVD and health status to complete. Blood pressure was measured by a Physician following a standard operational procedure developed and validated for the study using a calibrated sphygmomanometer (Sanitas, Hans Dinslage GmbH, Germany) and recorded as systolic blood pressure (SBP) and diastolic blood pressure (DBP); body weight was measured using a calibrated weighing scale to the nearest 1 Kg, height was determined with a stadiometer, and waist circumference was measured using a tape at the level of the navel. Body mass index (BMI) was calculated using the height and weight as weight divided by square of height (w/h^2). Those with more than two readings of blood pressure >130 / 80 mmHg were requested to come for a second measurement next day and if different from the day before a third measurement was taken by the Physician.

Blood samples (5 ml) were collected from the participants by venepuncture and divided into fluoride-oxalate tubes (1 ml) and anticoagulant-free dry tubes (4ml) using a 5 ml non-toxic, pyrogen-free, sterilized disposable syringes (CATHY YOUGO®, France). The blood samples were then centrifuged (BECKMAN Instruments Inc, USA) at 2500 rpm for 5 min and plasma/serum transferred into separate eppendorf tubes using disposable micropipettes. The samples were stored at -20°C until batch analysis.

Biochemical measurements

The serum and plasma samples were later analysed in batches for Fasting blood sugar, Total cholesterol, Triglycerides and HDL cholesterol by spectrophotometry using commercial reagent kits and strictly according to the manufacturers' instructions (Fortress Diagnostics Limited, UK). In all assays commercial quality control (Qc) materials was included in the assay and results were only accepted when the readings of the Qc material was validated by the quality control manager of the laboratory. LDL-cholesterol was calculated according to the standard and modified Friedewald equation using measured values of total cholesterol, HDL-cholesterol and triglycerides as follows:

LDL-C = Total-cholesterol – (Triglycerides / 2.2 + HDL-C) in mmol/L

Calculation of Risk Scores Estimation of the individual risk of developing subsequent cardiovascular disease and the absolute risk of CHD within 10 years was done using the Framingham Heart Study Prediction Score charts. Calculating risk involved allocating a point system for the risk factors. Different risk points were assigned according to gender and to the severity of the risk factor. A CVD risk score was obtained by adding the sub scores for each risk factor. Higher values reflected a more unfavourable risk profile. Data from the questionnaires was entered using the package EpiData version 3.0 (The EpiData association, Odense, Denmark). The data entered was checked for consistency and legal values. Data analysis was done using the package STATA version 8.2 (StataCorp, 4905 Lakeway Drive, College Station, Texas 77845 USA). Statistical significance was set at $P < 0.05$.

RESULTS

A total of 313 workers of the University of Buea were recruited into the study consisting of 70 (22.4%) teaching staff and 243 (77.6%) support staff. The mean (± SEM) age of the workers was 39.8 ± 0.48 years with a range of 23 to 64 years. Most of the study participants (122, 39.0%) were between the ages of 30 and 39 years. 166(53.0%) study participants were males, while 147 (47%) were females. The ethnic origin of the participants consisted mainly of the Bantu (53.7%) and the Semi-Bantu (45.0%). A total of 189 (60.3%) workers indicated that they had no knowledge of CVD Participants with tertiary education constituted the highest percentage (52.1%) followed by secondary education (35.5%) and primary education (12.5%). Majority of the participants (54.3%) had a monthly income less than 100,000 frs CFA, while 18.8% had income greater than 200,000 francs CFA and 26.8% between 100,000 and 200,000 frs CFA (500 frs CFA = 1 USD); 23.6% of the workers owned cars.

Overweight and obesity

The mean (± SEM) BMI was 27.4 ± 0.26 (range: 18.2 - 47.2). Overweight was prevalent in 38.7% (121) of the workers, while 27.8% (87) were obese. Of these, 37.4% (55) females were overweight and 43.5% (64) were obese, while 39.8% (66) males were overweight and 13.9% (23) were obese. With regards to overweight, there was no significant difference ($p = 0.317$) between males and females. In contrast females were more obese than males ($\chi^2 = 19.32$, $p < 0.001$).

BMI was highest amongst the 40 to 49 years age group; in females than males and in those who owned cars (Table 1). There was no association between monthly income and mean BMI. Furthermore, there was no association between BMI with level of education ($p = 0.207$) and employment status ($p = 0.207$). After controlling for age, BMI correlated positively with SBP ($r = 0.1833$, $p = 0.001$) and DBP ($r = 0.2032$, $p <0.001$).

Lipid profile

Approximately 80.2% (251) of the workers reported that they consumed plant and/or animal fats on a daily basis. Their mean (±SEM) total cholesterol was 4.57 ± 0.05 mmol/l (range: 1.95 to 8.71 mmol/l). Seventy eight (24.9%) workers had cholesterol levels ≥ 5.17 (high CVD risk). One hundred and sixty three (52.1%) participants had HDL-C levels ≤ 0.90mmol/l (low) and only 11.5% (36) had values ≥ 1.17 (optimal). The mean (±SEM) LDL-C among the workers was 3.29 ± 0.05 mmol/l (range: 1.29 to 6.87 mmol/l). Forty-nine (15.6%) workers had LDL-C ≥ 4.14 mmol/l (high CVD risk).

Total cholesterol levels was significantly different between the different age groups ($F = 4.776$, $P = 0.003$) with the prevalence of cholesterol levels > 5.17 (high CVD risk) highest in the age group 40 to 49 years (50.0%). There was a significant positive correlation between total cholesterol ($r = 0.144$, $P = 0.011$) and TGs ($r = 0.242$, $P < 0.001$) levels with age. There were no significant differences between mean HDL-C ($P= 0.580$) and LDL-C ($P = 0.055$) with age group. There were significant differences between mean total cholesterol, HDL-C, LDL-C and TGs levels with gender. The mean

Table 1. Relationship between body mass index (BMI) with age group (years), gender and socio-economic status among the study participants.

Variable		n	BMI (Kg/m^2) Mean ± SEM	Level of significance
Age (years)	< 30	35	26.989 ± 0.70	F = 2.926; p = 0.034
	30-39	122	26.647 ± 0.41	
	40-49	110	28.411 ± 0.48	
	≥ 50	46	27.433 ± 0.61	
Gender	Male	166	25.749 ± 0.30	t = -7.2; p < 0.001
	Female	147	29.307 ± 0.40	
Monthly income (× 10^3 FCFA)	< 100	170	27.102 ± 0.37	F = 2.958; p = 0.053
	100 - 200	84	27.137 ± 0.48	
	> 200	59	28.742 ± 0.59	
Own car	Yes	74	28.496 ± 0.48	t = 2.28; p = 0 .023
	No	239	27.087 ± 0.31	

levels of total cholesterol (4.45 ± 0.08), HDL-C (0.83 ± 0.02) and LDL-C (3.18 ± 0.07) were significantly higher (p=009, p<0.001 and p<0.007, respectively) in males compared to their female counterparts (total cholesterol = 4.71 ± 0.08, HDL-C = 0.95 ± 0.02 and LDL-C =3.42 ± 0.07). In contrast, females (0.71 ± 0.03) had significantly (p<0.001) lower levels of TG than male study participants (0.94 ± 0.04).

Mean HDL-C was significantly higher (F = 5.942, p= 0.001), in the Bantu (0.94 mmol/l) than in the Semi-Bantu (0.82mmo/l) study participants.

Mean total cholesterol (F = 3.214, p = 0.042) was significantly different between the different educational levels. Those with tertiary education had higher levels of total cholesterol (4.72 ± 0.08 mmol/l) than those with primary (4.44 ± 0.16 mmol/l). There was a significant difference of total cholesterol (t = 2.074, p = 0.039) between teaching and support staff. Teaching staff had higher mean value of total cholesterol (4.803 ± 0.13 mmo/l) than support staff (4.51 ± 0.06 mmol/l).

Hypertension

Thirty eight (12.1%) workers responded that they were hypertensive and 31 (81.6%) of them were on hypertensive treatment. Of these, 34 (89.5%) were > 40 years old. Fifty (16.6%) of the workers had mean SBP ≥ 140mmHg. More males (24.5%) had SBP ≥ 140 than females (12.2%).

SBP and DBP were significantly associated with age, gender, monthly income range, university employment and car ownership (Table 2). SBP (r = 0.379, p < 0.001) and DBP (r = 0.323, p < 0.001) correlated positively with age, increasing with increasing age. SBP and DBP were higher in males than females, higher for teaching than support staff and higher for those who owned cars (Table 2). In addition, those with monthly income > 200,000 frs CFA had higher SBP and DBP (Table 2).

Diabetic status

Six (1.9%) workers reported that they were diabetic. Following sample analysis, 11 (3.5%) participants were found to be diabetic (mean FBS ≥ 7.00 mmol/l), 4 (1.3%) had impaired glucose tolerance (6.11 – 6.99 mmol/l) and the rest (95.2%) had normal FBS values (< 6.11 mmol/l). Furthermore, ten (90.9%) of the diabetics were males.

There was a significant difference between mean FBS and age groups. Age was positively correlated with FBS level (r = 0.3044, p < 0.001). FBS level was significantly higher in males than females even when controlled for BMI (Table 3). The teaching staff had significantly higher FBS levels than support staff (Table 3). Monthly income ranges were also significantly associated with FBS, being highest with those with the highest monthly income (Table 3).

Smoking status

Information on smoking status was obtained through self reporting. Only males smoked cigarettes and 22 (7.0%) men smoked on a daily basis while 6 (1.9%) men reported that they smoked only occasionally. Twenty five (89.3%) of those who smoked were support staff. The number of smoking years significantly correlated positively with SBP (r = 0.6359, p = 0.001) and DBP (r = 0.6472, p = 0.001) when controlled for age.

Table 2. Relationship between mean (± SEM) blood pressure with age group, gender and socio-economic status of the study participants.

Variable		n	SBP (mmHg)	DBP(mmHg)	Level of significance	
					SBP	DBP
Age (years)	< 30	35	116.7 ± 1.6	75.5 ± 1.1		
	30-39	122	119.3 ± 1.1	77.2 ± 0.8	F = 17.564 p < 0.001	F = 10.805; p < 0.001
	40-49	110	128.2 ± 1.9	82.5 ± 1.3		
	≥ 50	46	135.4 ± 2.7	85.6 ± 1.8		
Gender	Male	166	127.7 ± 1.4	82.1 ± 0.9	t = 3.697 p < 0.001	t = 3.314, p = 0.001
	Female	147	120.9 ± 1.2	77.9 ± 0.8		
Monthly Income (× 10^3 FCFA)+	< 100	170	121.0 ± 1.0	77.6 ± 0.7		
	100 - 200	84	124.9 ± 1.9	80.9 ± 1.3	F = 15.196 p < 0.001	F =14.050, p < 0.001
	> 200	59	134.2 ± 2.6	86.2 ± 1.8		
Own car	Yes	74	133.9 ± 2.2	86.12 ± 1.9	t = 5.185 p < 0.001	t = 4.832, p < 0.001
	No	239	121.6 ± 1.0	78.2 ± 0.7		
University Staff Status	Teaching	70	131.9 ± 2.4	85.2 ± 1.6	t = 3.709 p < 0.001	t = 3.709, p < 0.001
	Support	242	122.4 ± 1.0	78.6 ± .7		

+500 F CFA = I $US.

Table 3. Relationship between plasma Fasting Blood Sugar (mmol/l) with age group, gender, monthly income and employment status of the study participants.

Variable		n	Mean ± SEM (mmol/l)	Level of significance
Age (years)	< 30	35	4.53 ± 0.07	
	30-39	122	4.77 ± 0.07	F = 12.256; p <0.001
	40-49	110	5.25 ± 0.12	
	≥ 50	46	5.27 ± 0.18	
Gender	Male	166	5.12 ± 0.09	t = 2.629; p = 0.009
	Female	147	4.83 ± 0.07	
Monthly Income (x 10^3 FCFA)	< 100	170	4.89 ± 0.08	
	100-200	84	4.93 ± 0.08	F = 4.759; p = 0.009
	>200	59	5.34 ± 0.15	
Employment status	Teaching	74	5.21 ± 0.13	t = 2.166; p = 0 0.031
	Support	239	4.92 ± 0..96	

Alcohol consumption

Analysis of questionnaire revealed that 273 (87.2%) of the study participants consumed alcohol. The most frequent type of alcohol consumed was beer (73.8%) followed by wine (25.8%). The mean (± SEM) quantity of pure alcohol consumed per unit time was 42.79 ± 1.83 g and most people (44.0%) consumed between 20 to 39.9 g pure alcohol per unit time while 18.5% participants consumed > 60 g pure alcohol per unit time.

There were significant differences between gender, age group and level of education with average quantity of alcohol consumed/unit time (Table 4). Quantity consumed was higher in males than females, highest in the age group 40 - 49 and consumption decreased with increasing level of education (Table 4). Twenty two (45.8%) of those who consumed alcohol > 60g /unit time also smoked cigarettes. Average quantity of alcohol consumed/unit time correlated positively with SBP (r = 0.1395, p = 0.025) and DBP (r = 0.1563, p = 0.012) when

Table 4. Relationship between mean quantity of alcohol consumed (g) with age group, gender and level of education of the study participants.

Variable		n	Mean ± SEM (g)	Level of significance
Age (years)	< 30	35	36.0 ± 4.2	F = 3.269; p = 0.022
	30-39	122	38.6 ± 2.9	
	40-49	110	50.5 ± 3.4	
	≥ 50	46	42.2 ± 4.5	
Gender	Male	144	55.4 ± 2.7	t = 9.480; p < 0.001
	Female	115	26.9 ± 1.3	
Level of education	Primary	36	54.9 ± 6.5	F = 4.238; p = 0.015
	Secondary	90	43.5 ± 3.0	
	Tertiary	133	39.0 ± 2.3	

Table 5. Correlation between lipid profile with SBP, BMI, FBS, quantity of alcohol consumed and number of smoking years of the study participants from the University of Buea

	SBP	BMI	FBS	Alcohol quantity	No of smoking years
Total- C	r = 0.078 p = 0.167	r = 0.205 p < 0.001	r = 0.181 p = 0.001	r = -0.112 p = 0.072	r = -0.016 p = 0.939
HDL-C	r = 0.039 p = 0.496	r = -0.1.9 p = 0.054	r = 0.002 p = 0.970	r = -0.91 p = 0.145	r = -0.405 p = 0.045
LDL-C	r = 0.004 p = 0.944	r = 0.176 p = 0.002	r = 0.101 p = 0.074	r = -0.144 p = 0.02	r = 0.033 p = 0.876
TGs	r = 0.209 p < 0.001	r = 0.239 p < 0.001	r = 0.292 p < 0.001	r = 0.223 p < 0.001	r = 0.384 p = 0.058

controlled for age. It also correlated negatively with BMI (r = -0.167, p = 0.004).

Physical inactivity

Weekly leisure-time physical activity was used as the tool to assess physical inactivity. It was observed that 124 (39.6%) of workers were mostly sedentary; while 140 (44.7%) were walking or active at corresponding levels at least four hours/week and the rest (15.4%) were either involved with jogging or heavy activity at least three hours/week or long distance running or competitive sports several hours/week.

There was a significant difference (χ^2 = 10.431, p = 0.015) only in gender with the level of physical activity, males being physically more active than females There was no significant relationship between weekly leisure–time physical activity and levels of total cholesterol (p = 0.557), HDL-C (p = 0.182), TGs (p = 0.577) and LDL-C (p = 0.417).

Relationship between lipid profile and some modifiable risk factors of CVD

Total cholesterol, LDL-C and triglycerides significantly correlated with BMI, increasing with increasing BMI (Table 5). In addition, HDL-C correlated negatively with BMI, though the relationship was not significant. Only HDL-C significantly correlated negatively with number of smoking years. Furthermore, levels of LDL-C significantly correlated negatively with the quantity of alcohol consumed /unit time, while TGs correlated positively with the quantity of alcohol consumed /unit time. This indicated that levels of LDL-C decreases, while TGs increases with increasing quantity of alcohol consumed /unit time. Only TGs levels significantly correlated with SBP, increasing with increasing SBP (Table 5).

Risk assessment of CVD

The total CVD risk score ranged from -12 to 13, with a mean score of <1 (0.5 ± 0.3). Only 2.9% (09) of the

Table 6. Relationship between 10-year CHD absolute risk with gender, monthly income, car ownership, university employment status, level of education and quantity of alcohol / unit time.

Variable		n	Mean ± SEM	Level of significance
Gender	Male	165	6.5 ± 0.4	t = 8.739; p < 0.001
	Female	147	2.5 ± 0.2	
Monthly income (× 10^3 FCFA)	< 100	170	3.5 ± 0.3	F = 20.365; p < 0.001
	100 - 200	84	4.9 ± 0.5	
	> 200	59	7.7 ± 0.7	
Own car	yes	74	7.4 ± 0.6	t = 5.360; p < 0.001
	no	239	3.8 ± 0.3	
University staff status	Teaching	70	6.9 ± 0.6	t = 4.300; p < 0.001
	Support	242	4.0 ± 0.3	
Level of education	Primary	39	6.2 ± 0.9	F = 5.860; p = 0.003
	Secondary	111	3.6 ± 0.4	
	Tertiary	162	5.0 ± 0.4	
Average quantity of alcohol consumed / unit time (g)	≤ 20	28	3.8 ± 0.9	F = 4.749; p = 0.003
	21 - 39.9	114	4.1 ± 0.4	
	40-60	69	5.0 ± 0.5	
	> 60	47	7.0 ± 0.9	

workers had a 10-year absolute risk of CHD ≥ 20% (high risk). 9.9% (31) workers had absolute risk between 10 – 19% (moderate risk) and 87.2% (272) had < 10% (low risk). More Semi-Bantus (15.7%, 22/140) had moderate to high 10-year CHD risk than Bantus (10.1%, 17/168). There were significant relationships between mean 10 – year CHD absolute risk with gender, level of education, monthly income, university employment status, car ownership and average quantity of alcohol consumed/unit time (Table 6). Males had a higher mean value than females, mean values increased with increasing monthly income, teaching staffs had a higher mean value than support staff and the mean value decreased with increasing level of education (Table 6). There was no significant difference between CHD absolute risk with BMI groups ($F = 1.518$, $p = 0.210$). Ten-year CHD absolute risk score correlated positively with average quantity of alcohol consumed per unit time ($r = 0.248$, $p < 0.001$), even when controlled for age ($r = 0.243$, $p < 0.001$).

DISCUSSION

There is little information on the prevalence of the various risk factors of CVD and their contribution to the risk of developing a CVD in Africa and particularly in Cameroon. This study was aimed at elucidating the prevalence of the modifiable risk factors of CVD and their relationship with the risk of developing CVD among the workers of the University of Buea.

Results of this study demonstrated that a majority of the workers were overweight and obesed, with females presenting a higher prevalence than males and a peak occurring between the ages of 40 to 49 years. Our observations confirm report from a previous study involving urban Cameroonians where obesity and overweight was also found to be more prevalent in women and the peak age was also found to be between 40 and 49 years (pasquet et al., 2002; Fezeu et al., 2006). The high prevalence of overweight and obesity observed in this study may partly be attributed to the high consumption of carbohydrates and plant and animal fats as reported by the participants. This was probably exacerbated by reduced physical activity observed in females.

Workers with higher monthly income and those who owned cars (indicators of high social economic status - SES) had higher BMI, suggesting that overweight and obesity was more prevalent among those with higher SES. Most studies in the developed world suggest that overweight and obesity is more prevalent among those with lower SES, though the disparity is reducing with increasing prevalence of overweight and obesity in all classes of SES (Zhang and Wang, 2004; Himes and Reynolds, 2005; Minna et al., 2009). A study involving adult Nigerians also demonstrated an inverse relationship between SES and overweight and obesity similar to that observed in developed countries (Mbada et al., 2009).It is possible that those with higher SES status in this study can readily afford the foods rich in fats and carbohydrates and may not be physically active enough to burn down the excess calories consumed.

The disparity between those who knew their hypertensive status and those who actually had raised SBP and DBP is suggestive of the low level of awareness within the population as highlighted in a study in Yaoundé, Cameroon (Kamadjeu et al., 2006). This low awareness of hypertensive –status was also observed amongst Mozambicans. One third of Mozambican adults aged 25 to 64 years were found to be hypertensive, meanwhile less than 15% of these subjects were aware of their condition, among which half were under pharmacological treatment (Albertino et al., 2009) SBP and DBP were found to increase with advancing age, confirming that hypertension increases with age due to age-related changes in blood pressure (Izzo et al., 2000; Fulberg and Psaty, 2003). The higher prevalence of hypertension in males than females agrees with results obtained in a previous study in Cameroon (Mbanya et al., 1998) and this has been associated with the beneficial effect of female sex hormones, especially oestrogen (Maric, 2005).

Increase in the level of education, monthly income, employment status and car ownership are all indicators of increasing SES. Consequently it could be suggested from the results of this study that blood pressure increased with increase in SES. This is in contrast to what occurs in the developed world where those with lower SES have higher risk of hypertension (Fulberg and Psaty, 2003; Winkleby et al., 1992). This disparity may be attributed to the cheap cost of fatty and carbohydrate rich diets in the developed world, and also lack of awareness even among those in higher SES that these foods are unhealthy when taken in excess.

The prevalence of diabetes was relatively low with just a few cases of impaired glucose tolerance. Mainly males were diabetic and the mean FBS was higher in males than females, contrasting with a study conducted in urban and rural Cameroon which observed that females had higher prevalence of diabetes than males (Sobngwi et al., 2002). FBS levels increased with age, indicating that age could be an independent risk factor for diabetes. This observation was corroborated by findings which suggested that increasing glucose concentrations with age may play a role in the age-related risk in CVD incidence and mortality (Rhee et al., 2006). Also FBS levels increased with increase in some indicators of SES (monthly income and employment status) implying that SES could also be a predisposing risk factor for diabetes.

Only males smoked cigarettes and almost all of them were support staff. Though the number of smokers was small, increasing number of years of smoking corresponded with increasing blood pressure. Studies have observed that prolonged smoking leads to the development of hypertension (Narkiewicz et al., 2005), but the mechanism of pathogenesis remains unclear.

Alcohol consumption is relatively common in Cameroon and its consumption increases at most social and cultural events. Very few study participants did not consume alcohol suggesting that the majority of Cameroonians consume at least a minimum quantity of alcohol consistently. Beer was the most frequently consumed alcohol, probably because it is more available and affordable than wine and whisky.

A 650 ml (65 cl) bottle of Cameroonian beer contains averagely 5% alcohol, which corresponds to 25.6 g of pure alcohol. The recommended daily or weekly quantity of alcohol differs from country to country, but most often not more than two standard drink (SD) (1 SD = 10 g of pure alcohol) should be consumed daily (Goatcher, 2002). This indicates that a bottle of 650ml is equivalent to 2.6 SD, indicating that most of the people consumed above the recommended daily allowance. Excessive drinking on particular occasions is referred to as “binge-drinking” of which most participants were victims.

Light to moderate consumption of alcohol has been associated with reduced risk of CVD by increasing levels of HDL-C (Hoffmiester et al., 1999). A study in France observed that after adjustment for age, moderate male and female drinkers were more likely to display clinical and biological characteristics associated with lower CVD risk. Alcohol intake was found to be strongly associated with raised plasma levels of high-density lipoprotein-cholesterol in both sexes. Multivariate analysis confirmed that moderate and low drinkers displayed better health status than did those who never drank alcohol (Hansel et al., 2010). However, excessive drinking has been shown to predispose to hypertension (alcohol related hyper-tension) and CVD especially stroke, in the long term (mennen et al., 1999; Mukamal, 2006). This may explain why SBP and DBP increased with increasing quantity of alcohol consumed per unit time.

The decrease in BMI with increase in average quantities of alcohol consumed per unit time recorded in this study agrees with Djoussé et al. (2004) who reported decreased BMI and metabolic syndrome with increased alcohol consumption in France. Some studies have demonstrated decrease in BMI only in moderate alcohol consumption, but increase in overweight and obesity with increase alcohol consumption and binge-drinking (Arif and Rohrer, 2005). The inverse relationship between average quantities of alcohol consumed per unit time with educational level indicates that the unhealthy habit of binge-drinking reduces with increase in SES.

Most of the workers did some form of leisure-time physical activity; especially farming that was equated to walking or active at corresponding levels at least four hours per week. The study showed that men were physically more active than women.

Hypercholesterolaemia was more prevalent among the age group 40 to 49 year and females had higher mean total cholesterol than their male counterparts. The positive correlation observed between total cholesterol and LDL-C with BMI confirms results from previous studies which demonstrated that cholesterol increases with increase in BMI, especially in women (Pasquali et al., 1997; Schröder et al., 2004). The prevalence of low HDL-C was relatively high, with higher levels in the Bantu ethnic group compared to the Semi-Bantu. This observation suggests that genetics may have an effect on HDL-C levels. Specific genes have previously been incriminated in lower levels of HDL-C in Turkish subjects (Hodoglugil and Mahley, 2006). There was no significant relationship between alcohol consumption and HDL-C in contrast to what previous studies have revealed (Hoffmiester et al., 1999). Maybe the effect was attenuated due to the prevalent binge-drinking practiced by the participants.

Teaching staff and those with higher educational level had higher levels of total cholesterol and LDL-C, implying that total cholesterol and LDL-C increased with increase in SES. This is in contrast with studies in the developed world where higher educational level was associated with decreased cholesterol and other risk factors of CVD (Winkleby et al., 1992; Vassiliki, 2000; Kilander et al., 2001). This may be attributed to the fact that there is still lack of education and sensitization on certain health habits even among the educated elites, since a significant percentage of the workers indicated that they had no knowledge of CVD.

Total cholesterol, LDL-C and TGs increased with increasing BMI while in contrast HDL-C decreased with increase in BMI. This results correlate with previous reports that overweight and obesity leads to increased levels of cholesterol and reduced HDL-C due to increased activity of hepatic lipase (Van Gaal et al., 2006). The reduction in LDL-C with increasing quantity of alcohol consumed per unit time suggests that alcohol consumption may be beneficial in reducing LDL-C. It was interesting to note that HDL-C levels (protective cholesterol) decreased with the number of smoking years, portraying an adverse effect of cigarettes smoking on CVD risk (Ira and Nancy, 1997; Pechacek et al., 2003).

No data is available in Cameroon and very little data within Africa that group the major risk factors of CVD to assess the total risk of developing a CVD. Most industrialized countries have developed statistical models like the Framingham CVD prediction model. This is yet to be done in Africa and it is a call for concern since the prevalence of CVD is projected to increase further in the developing world. The relatively high prevalence of family history of CVD may indicate higher risk of future CVD as postulated by a study which indicated that family history of CVD was associated with heightened cardiovascular stress responsivity in subjects and may thus contribute to risk of future CVD (Wright et al., 2007). This study applied the Framingham CVD risk model to calculate the total CVD risk score and to estimate the 10-year absolute risk of developing CHD among the workers of the University of Buea without an incidence of a CVD. Normally there is no need to estimate the 10-year absolute risk of CHD for a person with a score ≤ 1 and/or the presence of < 2 risk factors because they are invariably associated with low risk of CVD and low 10-year absolute risk of CHD. Higher risk scores indicated higher risk of CVD.

The prevalence of high CVD risk score and high 10-year CHD absolute risk was relatively low. There were more men with moderate to high risk of CHD than women. Most of the females were pre-menopausal, which corroborates results from previous studies which suggested that the female sex hormones (especially oestrogen) may play a protective role against CVD development (Maric, 2005; Howard et al., 2005). 10-year CHD absolute risk increased with increase in monthly income and was higher in those who owned cars and also among teaching compared to support staff. This suggests that CHD absolute risk increases with increase in SES. Conversely, low income earners in industrialized nations have higher risk of CHD and CVD (Osler et al., 2000). Level of education, considered to be a more consistent indicator of SES (Choinière et al., 2000) instead had an inverse association with 10-year CHD absolute risk. This observation corresponds with studies in the developed world where those with lower educational level have increased risk of CVD (Kilander et al., 2001; Choinière et al., 2000). This may be due to the fact that certain unhealthy habits like smoking and excessive alcohol consumption are easily adopted and maintained within the less educated group.

The 10-year CHD absolute risk increased with increase average quantity of alcohol consumed per unit time since most people were drinking above the recommended allowance. Excessive alcohol consumption has been incriminated in CVD development, especially stroke and some forms of cardiomyopathies by increasing fibrinogen levels thus, enhancing clot formation and subsequent blood vessel obstruction (Mennen et al., 1999). Increased levels of γ-GT, an indicator of alcohol consumption, have also been incriminated in the pathogenesis of stroke (Bots et al., 2002).

Conclusion

It is important to note that the sample size was relatively smaller compared to some cross-sectional studies carried out in this area of study and thus, may have contributed to some of the disparities observed in previous studies. In view of this and based on the data obtained, it can however, be concluded that the prevalence of the risk factors of CVD was relatively low among the workers of the University of Buea, except for overweight and obesity, alcohol consumption and low levels of HDL-C. The high prevalence of overweight and obesity may be due to a high consumption of carbohydrates, plants and animal fats coupled with a sedentary lifestyle. The prevalence of high total CVD risk score and 10-year absolute risk of CHD was low among the workers of the University of Buea probably due to the low prevalence of the risk factors, but the10-year absolute risk of CHD is influenced by the quantity of alcohol consumed per unit time. Future multicentric studies are needed to establish the CVD risk status of the average Cameroonian.

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