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Cardiovascular and Other Risk Factors Among Kwame Nkrumah University of Science and Technology Students

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Abstract

Cardiovascular diseases (CVD) risk factors can be classified as non-modifiable risk factors such as age and a family history of premature CVD and modifiable risk factors including hypertension, obesity, smoking, dyslipidaemia, diabetes mellitus (DM), excessive alcohol consumption, physical inactivity and unhealthy dietary habits, including low consumption of vegetable and fruits. The aim of this study was to determine the prevalence of cardiovascular and other risk factors as well as the association between these risk factors among students of Kwame Nkrumah University of Science and Technology. This cross sectional study enrolled 100 apparently healthy students aged 19 and 25 years. A questionnaire was filled and anthropometric measurements were taken. Fasting blood glucose, urea, creatinine, uric acid, total cholesterol (TC), high density lipoprotein cholesterol (HDL) and triglycerides (TG) were determined on venous blood samples. The level of low-density lipoprotein cholesterol (LDL) was calculated using the Friedwald formula. The estimated glomerular filtration rate (eGFR) was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation. Family history of DM (24.0%) and hypertension (21.0%) were common. The prevalence of alcohol consumption was 7%, high waist-hip ratio 6%, BMI ≥ 30 3%, hypertension 9%, DM 3%, impaired fasting glucose 4%, high TC 37%, high LDL 15%, low HDL 1% and hyperuricaemia 9%. Only one female had eGFR 30 – 59, 17% had eGFR 60 – 89 while 82% had eGFR > 90. None of the students had ever smoked and there were no cases of high TG and high waist circumference. There were clustering of these risk factors with 74 participants having at least one of these risk factors and 26 with no risk factor. These risk factors were therefore common among these students and there is the need for more frequent assessment. Pharmacological and non-pharmacological treatment may be necessary for some of these conditions.

Keywords

Risk Factors, CVD, Cardiovascular, Hypertension, DM

1. Introduction

Cardiovascular diseases (CVD) including hypertensive heart disease, coronary artery disease, cerebrovascular accidents (strokes), aortic aneurysms, peripheral vascular disease and hypertensive renal disease have been known to be very common in the industrialised world for many years. However in these industrialised countries the prevalence of CVD is now on the decline. [1] On the contrary even though early reports showed that CVD were not common in sub-Saharan Africa, there is now evidence of an emerging epidemic of CVD in developing countries, including countries in sub-Saharan Africa. [2], [3] At Komfo Anokye Teaching Hospital (KATH) stroke, heart failure and kidney disease accounted for 23% of all acute medical admissions and CVD

was responsible for 29% of deaths. [4]

Risk factors for CVD can be classified as modifiable risk factors and non-modifiable risk factors. The non-modifiable risk factors are age (>45 years for men and > 55 years for women) and a family history of premature CVD (<55 years in men and <65 years in women). The modifiable CVD risk factors include hypertension, obesity, smoking, dyslipidaemia, diabetes mellitus (DM), excessive alcohol consumption, physical inactivity and unhealthy dietary habits, including low consumption of vegetable and fruits.

Hypertension is a risk factor for CVD as well as itself being a CVD in its own right. [5] It is the most important independent risk factor for death from CVD. [6] It is the major risk factor for CVD, such as cerebrovascular disease, hypertensive heart disease and chronic kidney disease (CKD), in Africa and the world over. [7] The prevalence of hypertension in Ashanti Region was 29% while studies from Accra reports a prevalence of 37%-45%. [8], [9] DM is associated with significant morbidity and mortality from CVD. These include coronary artery disease, cerebrovascular disease and CKD. The prevalence of DM in Kumasi and Accra ranges between 4% and 9%. [10], [11] Dyslipidaemia and smoking are major risk factors for coronary artery disease and cerebrovascular disease. The prevalence of hyperlipidaemia in Ghana ranges between 17% and 23% while smoking prevalence was 6%. [10] - [12] Obesity is a risk factor for CVD as well as being associated with the other risk factors for CVD such as hypertension, DM and dyslipidaemia. The prevalence of overweight or obesity in women aged 15-49 years in Ghana was 30%. [12] Alcohol consumption is one of the highest risk factor for disability and death. It increases the risk of hypertension. The proportion of women in Ghana who drink alcoholic beverages was 18% which was lower than 35% in men. [12]

CKD is a leading cause of morbidity and mortality in both the developing and developed countries. [13] - [14] Type 2 DM is the leading cause of end-stage kidney disease in the Western world while hypertension remains the second most common cause. [15] According to Mate-Kole, there is an epidemic of kidney disease in Ghana where increasing numbers of end-stage kidney disease patients require haemodialysis. [16] Each year 3,000 Ghanaians develop CKD with the majority falling within the youthful age brackets of 20-50 years. [17]

There are a number of CVD risk factors associated with hyperuricaemia and these include obesity, hypertension, DM and metabolic syndrome. Severe kidney failure of any aetiology may be associated with hyperuricaemia and in certain instances the severe kidney failure may be the cause of the hyperuricaemia while the reverse is also true in other instances in which hyperuricaemia causes kidney failure. [18] - [19] The overall prevalence of hyperuricaemia was 29.8% among hospital attendants in Kumasi. [20]

In the same individual, there is often clustering of risk factors. Clustering of cardiovascular risk factors including DM, raised plasma glucose, high blood pressure and raised cholesterol levels have been described as the metabolic syndrome. [21] - [22] Various definitions of this syndrome have been described. Metabolic syndrome has been associated with adverse outcomes such as CKD, coronary artery disease and DM which are reaching alarming proportions worldwide. [23] - [24] There were at least three risk factors in 56% of adults in the chronic NCD risk factors survey of Greater Accra Region 2006. [25]

These cardiovascular risk factors are supposed to be uncommon among young adults and therefore most studies focus on older participants who are assumed to be at increased risk. Consequently there are few studies on young adults and certainly to date there is no published study on young students from Kwame Nkrumah University of Science and Technology (KNUST). We studied 100 young KNUST students and in this paper our aim was to present the prevalence of cardiovascular and other risk factors as well as the association between these risk factors among these students.

2. Materials and Methods

This prospective cross sectional study was carried out on the KNUST campus in the Ashanti Region of Ghana in February and March 2015. A simple random sample of 100 students who consented to the study were enrolled. The inclusion criteria were students within the ages of 19 and 25 years, who were apparently healthy without any illness and who intended to stay on KNUST for the next 3 months. The exclusion criteria were students who were pregnant, acutely sick and those who were known DM or known hypertension patients.

An interviewer used questionnaires to obtain demographic data (i.e. name, sex, and age), information on smoking, alcohol consumption and physical activity as well a personal and family medical history. A 24 - hour dietary recall and food frequency questionnaire was also administered.

The weight of the participant (measured to the nearest 0.1 kg) and visceral fat were measured using a combined weighing scale and body composition monitor (Omron BF511, Omron Matsusaka Co, Japan) after participants had removed their footwear. Using a wooden platform with height rule the height of the participant was measured to the nearest 0.5 cm with their footwear removed. A plastic tape measure was used to record hip and waist circumferences to the nearest 0.5 cm. Blood pressure and pulse rate were measured with an automated sphygmomanometer (Omron BP 710, Omron Matsusaka Co, Japan) using appropriate cuff size after participants had sat undisturbed for at least 5 minutes. Three readings were taken 1 minute apart. The first was discarded, and the mean of the last two used in the analysis.

The students after an overnight fast reported the following morning after being enrolled to the Clinical Analysis Laboratory, KNUST where blood samples were taken and analysed. Ten millilitres of whole venous blood was collected from the median cubital vein into sterile fluoride and gel-activated tubes. The blood samples were left undisturbed at room temperature for 30 minutes to clot and were then centrifuged in the laboratory to obtain the serum. Fasting

blood glucose (FBG), urea, creatinine, uric acid, total cholesterol (TC), high density lipoprotein cholesterol (HDL) and triglycerides (TG) were determined. The level of low-density lipoprotein cholesterol (LDL) was calculated using the Friedwald formula. [26]

The serum creatinine values obtained were used in the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation to calculate the estimated glomerular filtration rate (eGFR). The CKD-EPI equation, expressed as a single equation, is: "GFR = 141 × min(Scr/k,1)$^{\alpha}$ × max(Scr /k,1)$^{)-1.209}$× 0.993^{Age} × 1.018 (if female) ×1.159 (if black), where Scr is serum creatinine, k is 0.7 for females and 0.9 for males, α is −0.329 for females and−0.411 for males, min indicates the minimum of Scr/k or 1, and max indicates the maximum of Scr/k or 1". The eGFR was classified into GFR > 90 ml/min/1.73 m^2, GFR 60 - 89 ml/min/1.73 m^2, GFR 30 - 59 ml/min/1.73 m^2, GFR 15 - 29 ml/min/1.73 m^2 and < 15 ml/min/1.73 m^2. [27] Because urine protein was not determined the participants could not be staged into the various stages of CKD.

The following definitions were adopted for this study. Hypertension was defined as systolic blood pressure ≥ 140 and / or diastolic blood pressure ≥ 90.mmHg. [28] Body mass index (BMI) was calculated from the equation: BMI = weight (kg) / height (m)^2. BMI was classified into Underweight BMI < 18.5, Normal BMI 18.5 - < 25, Overweight BMI 25 - < 30 and Obese BMI ≥ 30. [29] High Waist Hip Ratio (WHR) was defined as WHR > 0.9 for males and > 0.8 for females. [29] High Waist Circumference (WC) was defined as WC ≥ 94cm in men or ≥ 80 cm in women. [21] WHO 1999 Glucometabolic Classification was used in classifying the glycaemic state: Normal glucose regulation was defined as fasting venous blood glucose < 6.1 mmol/L, impaired fasting glucose (IFG) was defined as fasting venous glucose ≥ 6.1 mmol/L and < 7.0 mmol/L and DM was defined as fasting venous blood glucose ≥ 7.0 mmol/L. [30] [31] Lipid disorders were defined as follows; high serum TC was TC >5.2mmol/L, high serum TG was TG >1.7mmol/L, high serum LDL was LDL >3.42mmol/L and low serum HDL was HDL <1.05mmol/L. [32] [33] Hyperuricaemia was defined as uric acid level ≥ 360 µmol/L in females and ≥ 420 µmol/L for males. [34]

The data was entered into Microsoft Excel 2010 and was analysed using Microsoft Excel 2010 and Stata version 8.0 statistical package (Stata Corporation, College Station, Texas, USA). The mean and standard deviation were computed for continuous variables, and were compared using standard t-test. For the discrete variables, percentages were calculated and these were compared using Pearson Chi-square test. The association between categorical variables was determined using univariate and multivariate logistic regression analysis, controlling for age and sex in multivariate analysis. For the purpose of logistic regression analysis, a categorical variable BMI was created consisting of the combination of the overweight and obese participants as compared to the rest, a categorical variable eGFR made of participants with GFR 30 – 59 and 60 – 89 compared to those with GFR <90 and a categorical variable DM was created combing the participants with DM and IFG. P-values of less than 0.05 were taken as statistically significant.

The study was approved by Committee on Human Research, Publication and Ethics, of School of Medical Sciences, College of Health, KNUST and KATH, Kumasi. All the participants after careful consideration and explanation gave a formal consent by signing an informed consent form.

3. Tables and Figures

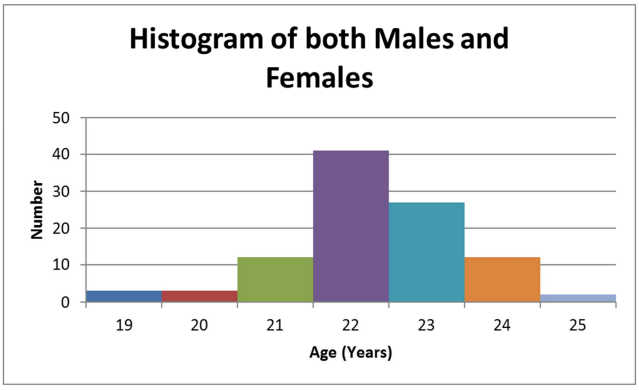

Figure 1. *The histogram of both males and females.*

Table 1. *The clinical characteristics of participants by sex.*

	Male (n=55)	Female (n=45)	All (n=100)	P (χ^2 test)
	Number (%)	Number (%)	Number (%)	
Age Range (yr)	19 - 25	19 - 23	19 - 25	
Alcohol	5 (9.1)	2 (4.4)	7 (7.0)	0.37
Smoking	0 (0)	0 (0)	0 (0)	N/A
FHHPT	10 (18.2)	11 (24.4)	21 (21.0)	0.44
FHDM	10 (18.2)	14 (31.1)	24 (24.0)	0.13
BMI				
< 18.5	4 (7.3)	8 (17.8)	12 (12.0)	0.11
18.5 - < 25	42 (76.4)	30 (66.7)	72 (72.0)	0.28
25 - < 30	8 (14.6)	5 (11.1)	13 (13.0)	0.61
≥ 30	1 (1.8)	2 (4.4)	3 (3.0)	0.44
High WHR	1 (1.8)	5 (11.1)	6 (6.0)	0.05
High WC	0 (0)	0 (0)	0 (0)	N/A
Hypertension	9 (16.4)	0 (0)	9 (9.0)	< 0.01

	Mean (SD)	Mean (SD)	Mean (SD)	(t test)
Age (years)	22.8 (1.1)	21.7 (0.9)	22.3 (1.2)	< 0.0001
Weight (kg)	65.0 (9.8)	57.2 (10.7)	61.5 (10.9)	< 0.001
Height (m)	1.73 (0.07)	1.63 (0.06)	1.68 (0.08)	< 0.0001
BMI (kg/m 2)	21.7 (2.9)	21.6 (3.8)	21.7 (3.3)	0.90
WC (cm)	29.3 (2.7)	28.2 (3.4)	28.8 (3.0)	0.07
HC (cm)	37.3 (2.7)	37.9 (3.4)	37.6 (3.0)	0.35
WHR	0.79 (0.03)	0.74 (0.06)	0.77 (0.05)	< 0.001
SBP (mmHg)	126.6 (13.7)	110.8 (9.2)	119.5 (14.2)	< 0.0001
DBP (mmHg)	72.5 (9.6)	66.2 (7.2)	69.7 (9.1)	< 0.001

Table 2. *The biochemistry results and eGFR of participants by sex.*

	Male (n=55) Mean (SD)	Female (n=45) Mean (SD)	All (n=100) Mean (SD)	P (t test)
FBG (mmol/L)	4.47 (0.97)	4.25 (0.46)	4.37 (0.78)	0.16
TC (mmol/L)	4.90 (1.16)	4.93 (1.05)	4.91 (1.11)	0.91
HDL (mmol/L)	1.82 (0.43)	1.97 (0.43)	1.89 (0.43)	0.07
LDL (mmol/L)	2.71 (1.10)	2.67 (0.89)	2.69 (1.01)	0.85
TG (mmol/L)	0.77 (0.25)	0.67 (0.21)	0.73 (0.24)	0.03
Urea (mmol/L)	3.74 (1.21)	3.46 (1.01)	3.61 (1.13)	0.22
Creatinine (µmol/L)	99.9 (14.9)	82.1 (16.7)	91.9 (18.0)	< 0.0001
Uric Acid (µmol/L)	316.7 (90.3)	207.1 (67.5)	267.4 (97.4)	< 0.0001
eGFR (mL/min/1.73 m^2)	107.0 (18.0)	105.1 (22.9)	106.1 (20.3)	0.64

Table 3. *Risk factors of participants by sex.*

	Male (n=55)	Female (n=45)	All (n=100)	P (χ^2 test)
	Number (%)	Number (%)	Number (%)	
Glycaemic State				
Normal	49 (89.1)	44 (97.8)	93 (93.0)	0.09
IFG	3 (5.5)	1 (2.2)	4 (4.0)	0.41
DM	3 (5.5)	0 (0)	3 (3.0)	0.11
High TC	22 (40.0)	15 (33.3)	37 (37.0)	0.49
Low HDL	1 (1.8)	0 (0)	1 (1.0)	0.36
High LDL	9 (16.4)	6 (13.3)	15 (15.0)	0.67
High TGL	0 (0)	0 (0)	0 (0)	N/A
eGFR				
> 90	47 (85.4)	35 (77.8)	82 (82.0)	0.32
60 - 89	8 (14.6)	9 (20.0)	17 (17.0)	0.47
30 - 59	0 (0)	1 (2.2)	1 (1.0)	0.27
Hyperuricaemia	8 (14.6)	1 (2.2)	9 (9.0)	0.03

Table 4. *Clustering of risk factors by sex.*

	Male (n=55)	Female (n=45)	All (n=100)	P (χ^2 test)
	Number (%)	Number (%)	Number (%)	
0	13 (23.6)	13 (28.9)	26 (26.0)	0.55
1	15 (27.3)	12 (26.7)	27 (27.0)	0.95
2	12 (21.8)	9 (20.0)	21 (21.0)	0.82
3	8 (14.6)	5 (11.1)	13 (13.0)	0.61
4	3 (5.5)	5 (11.1)	8 (8.0)	0.30
5	1 (1.8)	0 (0)	1 (1.0)	0.36
6	3 (5.5)	0 (0)	3 (3.0)	0.11
7	0 (0)	1 (2.2)	1 (1.0)	0.27
Any	42 (76.4)	32 (71.1)	74 (74.0)	0.55

Table 5. *Association between various categorical variables unadjusted and adjusted by age and sex.*

		Unadjusted			Adjusted		
		OR	CI	P	OR	CI	P
Alcohol	High LDL	5.06	1.01 – 25.46	< 0.05	5.49	1.02 – 29.59	< 0.05
FHHPT	FHDM	5.58	1.97 – 15.84	< 0.01	6.28	2.09 – 18.89	< 0.01
FHHPT	BMI	3.89	1.24 – 12.19	0.02	4.47	1.37 – 14.62	0.01
FHDM	BMI	8.33	2.60 – 26.67	< 0.001	8.59	2.54 – 29.04	< 0.01
DM	BMI	11.86	1.01 – 139.67	< 0.05	15.03	1.15 – 195.96	0.04
High WHR	BMI	6.23	1.13 – 34.25	0.04	6.29	1.00 – 39.49	0.05
High TC	eGFR	2.55	0.90 – 7.19	0.08	3.16	1.06 – 9.40	0.04

4. Results

A total number of 100 students partook in this study with 55 males and 45 females. The ages of the students were between 19 to 25 years (Figure 1), the modal age was 22 years and the mean age was 22.3 years. (Table 1) None of them smoked, and only 7 of them took alcohol. There were statistically significant differences in the ages, heights, weights, WHR, systolic and diastolic blood pressures between males and females but not in the BMI, waist and hip circumferences. All the 9 participants with hypertension were males, giving a prevalence of hypertension of 9% and none of the participants met the criteria for high WC.

Table 2 shows the results of the biochemistry test conducted and eGFR. The results of TG, creatinine and uric acid were significantly higher in the males than the females. The females had a higher mean HDL than the males but this was not up to statistical significance. All the other parameters including eGFR were similar in the sexes. When these results were used to determine various risk factors (Table 3), all the females except one had normal FBG. The prevalence of IFG was 4% and DM was 3%. All the cases of DM were males. The commonest risk factor overall was high TC with a prevalence of 37% and the prevalence of high LDL was 15%. There were no cases of high TG and one male had low HDL. All the 15 participants with high LDL had high TC while the only male with low HDL had neither high LDL nor high TC. Most of the students (82%) had eGFR > 90, 17 had eGFR 60 – 89 while only one female had eGFR 30 – 59. This female was a 23 year old with neither hypertension nor DM, who had a urea of 2.41 mmol/L, creatinine of 138.9 µmol/L, eGFR of 53.1 mL/min/1.73 m^2 and the only other risk factor she had was a high WHR of 0.83. The prevalence of hyperuricaemia was 9% and this was significantly higher in the males compared to the females (8% vs 1%). The only female with the hyperuricaemia was a 20 year old student with a uric acid level of 422 µmol/L.

When all the risk factors (family history of DM (FHDM), family history of hypertension (FHHPT), alcohol, smoking, BMI, high WC, high WHR, hypertension, DM, high TC, low HDL, high LDL, high TG, eGFR and hyperuricaemia) were considered, 26 had none while 74 participants had at least one of these risk factors (Table 4). When FHDM and FHHPT were excluded, 36 participants had no risk factor. Because none of the students had high WC or high TG, metabolic syndrome could not be determined by any of the definitions available. However clustering of these risk factors were found with 21%, 13, 8%, 1%, 3% and 1% with 1, 2, 3, 4, 5, 6 and 7 risk factors respectively. The student with 7 risk factors was a 22 year female with a FHDM, FHHPT, who had a BMI of 27.1 kg/m^2, with IFG (FBG of 6.2 mmol/L), high TC (TC of 7.5 mmol/L), high LDL (LDL of 5.27 mmol/L) and eGFR of 84.7 mL/min/1.73 m^2. There was no significant sex difference in the clustering of these risk factors.

The association between various categorical variables which were statistically significant is shown in Table 5. BMI (being overweight or obese) was the variable with most of the associations, being significantly associated with FHHPT, FHDM, DM and high WHR. Variables such as hypertension, hyperuricaemia and low HDL were not significantly associated with any other variables before and after adjusting for age and sex.

5. Discussion

This study was undertaken among apparently healthy young university students who were supposed to have undertaken a comprehensive medical examination by the university hospital as part of the admission requirements into the university. They would therefore have known whether they had cardiovascular risk factors such as hypertension and DM and also they may have had their renal function determined. Furthermore all these risk factors are not supposed to be common among young adults as increasing age is a known non-modifiable risk factor for CVD. The assumption therefore was not to expect that these risk factors to be common among these KNUST students. Our results however show that while certain risk factors were absent among these students, the prevalence of others were quite high. Additionally there were clustering of these risk factors and certain risk factors were significantly associated with other risk factors.

Laudably none of these 100 young participants smoked cigarettes as compared to the national smoking rates of 0.1% in females and 2.8% in males of the age group 20 – 24 years in Ghana. [12] In the GSHS study which was undertaken in senior high school students (aged < 15 to > 20 years), 1.5% of students smoked cigarettes, 1.9% males and 0.9% females. [35] Alcohol consumption was 7% (5% in males, 2% in females) and this was also low compared to the national prevalence of 26.5% for males and 16.7% for females in the age group 20 – 24 years nationwide. [12] From the GSHS survey, 17.4% male and 12.6% female students consumed alcohol giving an overall prevalence of 15.3%. [35]

The prevalence of hypertension was 9% and all the students with hypertension were males while the prevalence of DM was 3% and all these DM students were also males. There was only one female with IFG out of the 4 students with IFG. These were previously undiagnosed hypertension, DM and IFG patients since students with known hypertension and DM were excluded from the study. Almost all the students identified with hypertension, DM and IFG were males apart from the single female with IFG. However, only one male with IFG had hypertension while all the other DM and IFG participants did not have hypertension. There was therefore no association between having hypertension and either DM or IFG.

We determined 3 measures of obesity, BMI, WC and WHR. None of the students met the criteria for high WC. The prevalence of high WHR was 6% with only one male student having a high WHR. Two female students had BMI ≥ 30 while only one male student had BMI ≥ 30. However more males

(15%) compared to females (11%) had BMI 25 - < 30 or were overweight, though this difference was not statistically significant. These measures of obesity are in most studies more common in females than in males even in the teenagers and young adults, but in these university students this difference was not demonstrated. In the GSHS study the prevalence of overweight students was 6.6% (11.9% in females vs 2.4% in males) while the prevalence of obesity was 1.2% (2.0% in females vs less than 0.5% in males). [35]

Hyperlipidaemia (high TC with a prevalence of 37%) and high LDL (15%) were very common among these young students while low HDL (1%) was rare and there were no cases of high TG. There were more males with these lipid disorders and the only participant with low HDL was a male, though all these differences were not statistically significant. All the 15 participants with high LDL also had high TC while the only male with low HDL had neither high LDL nor high TC. In a study assessing the effect of exercise on plasma cholesterol in Accra in physically active and physically inactive groups, 23% and 17% of the physically inactive and active groups respectively had a serum TC higher than 5.2 mmol/L. [36] Asibey-Berko and Avorkliyah also found about 18% of 141 healthy male blood donors at Korle-Bu Teaching Hospital had a serum TC above 5.2 mmol/L. [37] These high TC prevalence results were lower than the 37% found in our study but these were healthy participants with neither no DM nor hypertension.

We assessed the renal function assaying urea and creatinine and calculated eGFR using the CKD-EPI equation. Because we did not determine other indicators of kidney damage such as urine albumin-creatinine ratio, albumin excretion rate on a morning urinary sample or a 24-hour urine sample or proteinuria with urine dipsticks, we were unable to determine the CKD stage of these participants. The only exception is the female with eGFR 30 – 59 who could be classified with certainty as having CKD stage 3. When eGFR was analysed as a categorical variable, the only significant association was with high TC and this was after but not before controlling for age and sex. There was no association between eGFR and hypertension, DM or hyperuricaemia, relationships which have been shown in a number of studies. [38] - [39]

The prevalence of hyperuricaemia in males was significantly higher than that of the females. Hyperuricaemia and gout have been found to be more common in males than in females. In a study by Liu et al., the prevalence of hyperuricaemia was 21.6% in males and 8.6% in females and a cross sectional study in Thailand showed a prevalence of 10.6% in the total population, 18.4% in men and 7.8% in women. [40] - [41] Among patients reporting at KATH, 30.3% of men and 29.5% of women had hyperuricaemia. [20] Apart from this association with sex, hyperuricaemia was not associated with any of the other categorical risk factors such as obesity, hypertension, DM and eGFR. Such associations have been demonstrated in other studies. [42] - [43]

Most of the risk factors were more common in the males than the females even though it was only in hypertension and hyperuricaemia that these differences were statistically significant and further when the clustering of the risk factors were considered this sex difference was not statistically significant. Metabolic syndrome could not be determined by any of the definitions available because none of the students had high WC or high TG. There were however clustering of risk factors with 74 participants having at least one of these risk factors and 26 with no risk factor. Though it was reassuring that none of these young students had metabolic syndrome these clustering of risk factors still exposed them to an increased risk of CVD and would require interventions to monitor these risk factors and in some cases to go ahead and treat these conditions.

To date this is the first study of risk factors among students of KNUST. This is the major strength of this simple cross sectional study which has established the risk factors prevalence and associations among these students. The limitations of this study include the small sample size of 100, which limits the ability to detect statistically significant difference because of the lack of power. Also all the laboratory measurements were done only once and others like urine analysis and urine albumin creatinine ratio were not done. For purposes of following up of the students in the clinical settings, most of these analysis will need to be repeated several times and at intervals. Notwithstanding these shortcomings we believe that this study contributes in no small way to the wealth of knowledge of CVD in KNUST in particular and Ghana in general. We would also recommend further studies among these students with a larger sample size and also studies involving students with known hypertension and DM. Since these students undertook a screening medical examination before admission into the university we would also recommend that students are made to undergo these screening at the beginning of each academic year they spend in the university and those who are found to have some of these risk factors are assessed at more frequent intervals. Pharmacological and non-pharmacological treatment may be offered to those with treatable risk factors like DM and hypertension.

6. Conclusion

This study has shown that some CVD risk factors are very common while others are absent in this population of students. Since these risk factors do in addition cluster in a large proportion of these students, they expose them to increased risk of CVD and other non-communicable diseases.

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