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ORIGINAL ARTICLE

Prevalence and risks factors of overweight/obesity among Undergraduate students: An institutional based cross-sectional study, Ghana

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Obesity and overweight are lifestyle conditions affecting more than half of the younger adult population. This study determined the prevalence and risks factors of obesity and overweight among undergraduate students in Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. This institutional based cross-sectional study conducted between November, 2013 and February, 2014 recruited three hundred (300) students from the various academic colleges. Self-structured questionnaire was used to obtain socio-demographic and lifestyle related characteristics. Blood pressure, weight, height, waist circumference (WC) and hip circumference (HC) were measured. The overall prevalence of obesity and overweight was 1.7% (5/300) and 16.0% (48/300) using BMI; 13.3% (40/300) and 8.7% (26/300) using WC; 19.0% (57/300) and 20.0% (60/300) respectively using WHR while obesity was 28.7% (86/300) using WHtR. Generally, obesity was higher in females than males (p=0.0149**)**. Drinking 2-4 bottle of alcohol per day was associated with obesity than overweight (40.0% (2/5) vs. 8.3% (4/48); p=0.0175). Increased prevalence of obesity was associated with fourth year students. About 22.9% (11/48) of students in Agric and natural science were more likely to be overweight while 40.0% (2/5) from health sciences were more likely to be obese. Akans and Ga-Adangbes' were more likely to be overweight and obese respectively. Being female was an independent risk factor for obesity/overweight (OR = 12.67, 95% CI = 0.926-17.042; p=0.0020). This study indicated that obesity and overweight were predominantly associated with female undergraduate students. The use of WC, WHR and WHtR in combination with BMI is essential**.**
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INTRODUCTION

Globally, over 300 million and 1.1 billion cases of adult obesity and overweight respectively are reported annually (WHO, 2000). The trend of obesity tends to peak since 1960's predisposing individuals to hypertension, diabetes, and other cardiovascular-related morbidities and mortalities (Sturm, 2002). Obesity does not only occur in older adult population, but also in children, teenagers and young adults (Gopalakrishnan *et al.*, 2012). Several studies have indicated that increased prevalence of obesity in sub-Saharan African countries is common among women (Kruger *et al.*, 2005; Mogre *et al.*, 2012).

There is convincing evidence that obesity play a role in the development of insulin resistance and metabolic syndrome (McKeigue *et al.*, 1991). A number of factors such as physical inactivity combined with high-calorie intake, smoking, alcohol intake, low-cost foods have been implicated in obesity and overweight (Gupta *et al.*, 2009). Academic stress also plays an important role leading to irregularities in diet and hence obesity.

Increased prevalence of obesity among undergraduate students has been extensively explored by several authors (Beatrice Adderley-Kelly PhD, 2007; Gopalakrishnan *et al.*, 2012; Mogre *et al.*, 2014). How-

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ever, these pattern are inconsistent due to ethnicity and culture difference and more importantly environment and lifestyle changes emanating from economic development, modernization, and urbanization.

The routine use of BMI to determine obesity has not proven to be sufficient though other anthropometric measurements like WC, waist-to-hip ratio (WHR) and waist-to-height (WHtR) are underutilized. There is paucity of data on institutional based prevalence of obesity and overweight across the globe. No study in the southern part of Ghana has so far considered the prevalence in the various academic levels and colleges as well as ethnic origin of these students. The need to create earliest awareness of obesity associated risk factors among students would go a long way to curb future obesity and related medical conditions including diabetes and hypertension. Therefore, this study determined the prevalence of overweight and obesity and associated risk factors among undergraduate students in Kwame Nkrumah University of Science and Technology, Ghana.

MATERIALS AND METHODS

Study design/settings

This institutional based cross-sectional descriptive study took place at Kwame Nkrumah University of Science and Technology (KNUST), Ghana between the periods of November, 2013 and February, 2014. KNUST is a public university located in Kumasi in the Ashanti Region of Ghana. The main university campus which is about seven square miles in area is situated about eight (8) miles (13km) to the east of Kumasi. There are six halls of residence at the main campus. The university has about 40000 undergraduate students and it consists of six (6) colleges and thirty departments.

Ethical consideration

Ethical approval was sought for and granted by the Committee on Human Research, Publications and Ethics (CHRPE), Kwame Nkrumah University of Science & Technology (KNUST). Participants were then informed about their rights to not participate in the study and verbal consent was taken before they answered the questionnaire. Confidentiality of participants' information given was preserved.

Study population/Subjects selection

A clustered randomized sampling technique was used to recruit three hundred (300) undergraduate students (122 (first year), 65 (second year), 58 (third year) and 55 (fourth year) for this study. Sample size was calculated using distribution response rate of 50%, with the 95% confidence interval (CI), significance level 0.05 and power of the study is 80%. Thus the minimum size required was 300.

Data collection

A self-structured questionnaire was designed by reviewing relevant literatures and questionnaires previously used in similar studies. The study questionnaire was first pre-tested and suitable modifications were made. Information such as socio-demographic characteristics, physical activity, alcohol intake, sedentary activities, smoking and family history of hypertension were obtained using a structured questionnaire. Students aged between 18-31 years who have registered and are undertaking courses from various colleges (Agric & Natural Science, Architecture and Planning, Engineering, Art and Social Science, Health Sciences and Sciences) were included for this study. Students who did not consent for the study were excluded.

Blood pressure and Anthropometric measurements

Blood pressure was measured by a trained Nurse with the participants -remaining seated for 10 minutes using an automated BP monitor (*Omron* HEM711DLX, UK) at the student clinic facilities. Weight of the students was measured in the upright position to the nearest 0.5kg using a weight measuring scale (Seca, Hamburg, Deutschland). Height was measured without shoes to the nearest 0.1m using a well calibrated wall mounted rule. BMI was calculated based on weight in kilograms divided by the square of the *height* in metres (kg/m^2). Waist circumference (WC) was measured to the nearest 0.1 cm horizontally at the narrowest point between lower end of the rib cage and iliac crest. Hip circumference was measured to the nearest 0.1 cm at the greatest horizontal circumference below the

iliac crest at the level of greater trochanter (the widest portion on the buttocks). Waist and hip circumference were measured with an inelastic tape measure. Waist-to-hip ratio (WHR) and waist-to-height (WHtR) ratios were calculated.

Definition of anthropometric terms and academic levels

BMI were classified based on WHO definition for adults as underweight (<18.5kg/m^2), normal (18.5-24.9kg/m^2), overweight (25-29.9kg/m^2) and obese (>30kg/m^2) (Status, 1995). Level 100 represented first year undergraduate students while 200, 300 and 400 characterized second, third and fourth year students respectively. Male students with a waist circumference of <94, 94–101.9 and ≥ 102 cm were classified as normal weight, overweight and obese respectively, while female were classified in the same obesity categories on the basis of WC <80, 80–87.9 and ≥ 88 cm. Male students with WHR < 0.90, 0.90 -0.99 and ≥ 1.0 were classified as normal weight, overweight or obese respectively, while female students were classified in the same categories on the basis of WHR of < 0.80, 0.80 – 0.84 and ≥ 0.85 (Croft *et al*., 1995; WHO, 2000). Concerning WHtR the cut-off value of ≥0.5 indicates obesity (Ashwell, 2009).

Statistical analysis

Data were entered into Microsoft Excel 2010 and statistical analyses performed using GraphPad Prism 6.0 (Graph Pad software, San Diego California USA, www.graphpad.com). Categorical variables are presented in frequency (proportion) and test of association between proportions was done using Chi-square. Multiple logistic regression was employed to determine the associated risk factors of overweight/obesity. Unpaired sample t-test was used to compare between two means of continuous variables, which were expressed as means ± Standard error of mean (SEM). $p<0.05$ was considered as statistically significant level.

RESULTS

Socio-demographic characteristics of study participant are shown in table 1. Majority of the participants were males 59.7% (179/300). Participants within the age range of 19-24years were the most represented group while only 1.0% (3/300) of them were 30 years and above. Exactly 97.3% (292/300) of them were single, while 2.3% (7/300) and 0.3% (1/300) were married and cohabiting respectively. Most of the participants 40.7% (122/300) were in first year followed 21.7% (65/300) in second year, third year 19.3% (58/300) and fourth year 18.3% (55/300). Higher proportions 22.7% (68/300) of the participants were from the College of Art and Social Science, Engineering 18.0% (54/300), Health Science 17.7% (53/300), Agric and Natural sciences 15.7% (47/300), Sciences 14.0% (42/300) and Architecture and Planning 12.0% (36/300) respectively (Table 1).

Table 2 shows mean blood pressure and anthropometric measurement of study participants in relation to gender. The mean age of participants was 20.88±0.80years. Males (21.25±0.6years) were older than female (20.35±0.3years) ($p=0.002$). However, no statistical significance difference was observed in mean SBP (115.4±1.5 vs. 114.5±1.1mmHg; $p=0.248$) and DBP (70.6±0.3 vs. 71.0±0.4mmHg; $p=0.654$) of male compared to females. Females had increased BMI (22.78 ± 0.3kg/m^2) compared to male (21.28 ± 0.2 kg/m^2) ($p<0.0001$). A significantly increased waist/hip ratio ($p=0.033$) and waist/height ratio ($p<0.0001$) were observed among female compared to male. Conversely, the mean waist circumference of females did not significantly differ from their male counter (Table 2).

Table 3 depicts demographic and lifestyle related characteristics stratified in order of BMI severity. Obesity was prevalent among aged group 19-24 years 60.0% (3/5) compared to the other age groups. Age was not significantly associated with BMI (<18years ($p=0.7924$); 19-24years ($p=0.8207$); 25-30years ($p=0.7679$); ≥31year ($p=0.5890$)). Females 80.0% (4/5) were more obese than male 20.0% (1/5) ($p=0.0149$). Drinking 2-4 bottle of alcohol per day was associated with obesity than overweight (40.0% (2/5) vs. 8.3% (4/48); $p=0.0175$). However, smoking ($p=0.893$), physical activities ($p=0.2829$), fast food intake ($p=0.500$), family history of HTN ($p=0.3209$) and sleep imme-

Table 1-Sociodemographic characteristics of study population stratified by gender

Variable	Total, n(%)	Males, n(%)	Females, n(%)	p-value
Age range (year)				
<18	50 (16.7)	22 (12.3)	28 (23.1)	0.0175
19-24	229 (76.3)	142 (79.3)	87 (79.9)	0.1661
25-30	18 (6.0)	13 (7.3)	5 (4.1)	0.3268
≥31	3(1.0)	2 (1.1)	1 (0.8)	1.0000
Marital status				
single	292 (97.3)	174 (97.2)	118 (97.5)	1.0000
married	7 (2.3)	5 (2.8)	2 (1.7)	0.7055
Cohabiting	1 (0.3)	0 (0.0)	1 (0.8)	0.4033
Academic year				
First year	122 (40.7)	72 (40.2)	50 (41.3)	0.9048
Second year	65 (21.7)	32 (17.9)	33 (27.3)	0.0633
Third year	58 (19.3)	36 (20.1)	22 (18.2)	0.7662
Fourth year	55 (18.3)	39 (21.8)	16 (13.2)	0.6851
College				
ANS	47 (15.7)	28 (15.6)	19 (15.7)	1.0000
AP	36 (12.0)	15 (8.4)	21 (17.4)	0.0286
EG	54 (18.0)	42 (23.5)	12 (9.9)	0.0033
ASS	68 (22.7)	37 (20.7)	31 (25.6)	0.3281
HS	53 (17.6)	26 (14.5)	27 (22.3)	0.0911
S	42 (14.0)	31 (17.3)	11 (9.1)	0.0611
Ethnicity				
Akan	134 (44.7)	90 (50.3)	44 (36.4)	0.0184
Ga-Adangbe	54 (18.0)	29 (16.2)	25 (20.7)	0.3594
Ewe	45 (15.0)	26 (14.5)	19 (15.7)	0.8693
Mole-Dagbani	60 (20.0)	32 (17.9)	28 (23.1)	0.3036
Fante	7 (2.3)	2 (1.1)	5 (4.1)	0.1225

Values are presented as frequency (percentage). Comparison was done using Fischer exact test. Level of significance was p<0.05. ANS: Agric. & Natural Science; AP: Architecture and Planning; EG: Engineering ASS: Art and Social Science; HS: Health Science; S: Sciences

Table 2: Clinical and Anthropometric measurement of study participants in relation to Gender

Variables	Total(n=300)	Males(n=179)	Females(n=121)	p-value
Age (years)	20.88 ± 0.80	21.25 ± 0.6	20.35 ± 0.3	0.002
SBP (mmHg)	115.1 ± 1.3	115.4 ± 1.5	114.5 ± 1.1	0.248
DBP (mmHg)	70.8 ± 0.41	70.6 ± 0.3	71.0 ± 0.4	0.654
BMI (Kg/m^2)	21.85 ± 0.32	21.28 ± 0.2	22.78 ± 0.3	<0.0001
WC(cm)	80.21 ± 0.59	80.41± 0.67	80.00 ± 0.71	0.702
WHR	0.85 ± 0.07	0.83 ± 0.07	0.85 ± 0.06	0.033
WHtR	0.475 ± 0.001	0.465 ± 0.004	0.491 ± 0.006	<0.0001

Values are in Mean ± standard error of means (SEM). P value defines the level of significance when males are compared to female (unpaired t test). WC: Waist circumference; WHR: Waist/hip Ratio; WHtR: Waist to height ratio

Table 3: Demographic and lifestyle related characteristics in association with BMI classifications

Variable	Underweight, n(%)	Normal, n(%)	Overweight, n(%)	Obese,n(%)	p-value
Age range /years					
<18	8 (22.2)	34 (16.1)	7 (14.6)	1 (20.0)	0.7924
19-24	27 (75.0)	163 (77.3)	36 (75.0)	3 (60.0)	0.8207
25-30	1 (2.8)	14 (6.6)	3 (6.2)	0 (0.0)	0.7679
≥31	0 (0.0)	0 (0.0)	2 (4.2)	1 (20.0)	0.5890
Gender					
Male	25 (69.4)	132 (62.6)	21 (43.8)	1 (20.0)	0.0149
Female	11 (30.6)	79 (37.4)	27 (56.2)	4 (80.0)	0.0149
Smoking					
Yes	3 (8.3)	13 (6.2)	3 (6.2)	0 (0.0)	0.893
No. of sticks smoked					
<10/day	3 (8.3)	11 (5.2)	2 (4.2)	0 (0.0)	0.787
>10/day	0 (0.0)	2 (0.9)	1 (2.1)	0 (0.0)	0.604
Alcohol intake					
Yes	7 (19.4)	51 (24.2)	14 (29.2)	2 (40.0)	0.6573
bottle of alcohol intake					
1-2/day	6 (16.7)	49(23.2)	10 (20.8)	0 (0.0)	0.6513
2-4/day	1 (2.8)	2 (0.9)	4 (8.3)	2 (40.0)	0.0175
Physical inactivity					
Yes	7 (19.4)	49 (23.2)	17 (35.4)	1 (20.0)	0.2829
Fast food intake					
everyday	11 (30.6)	62 (29.4)	19 (39.6)	2 (40.0)	0.5542
Once a week	17 (47.2)	90 (42.7)	17 (35.4)	1 (20.0)	0.5166
once a month	6 (16.7)	44 (20.9)	8 (16.7)	2 (40.0)	0.5432
Family history of HTN					
Yes	6 (16.7)	54 (25.6)	15 (31.2)	2 (40.0)	0.3209
Sleep after diet					
Yes	4 (11.1)	20 (9.5)	5 (10.4)	0 (0.0)	0.7856

Values presented as* n (%): *frequency (percentage). Comparison was done using Fischer exact test. Level of significance was p<0.05. HTN: hypertension

diately after diet (p=0.7856) did not show any significant association with BMI (p>0.05) (Table 3).

The overall prevalence of obesity in this study was 1.7% (5/300). High prevalence of obesity were amongst the fourth year students 1.8% (1/55) followed by third year 1.7% (1/58) and then first year 1.6% (2/122). However, no significance difference in prevalence of obesity proportion was observed among the academic year group (1st year vs 2nd year (p=0.988); 3rd year vs 4th year (p=0.999)). Participants in second year recorded the highest proportion 21.5% (14/65) of overweight compared to other academic year (first year 12.3% (15/122), third year 13.8% (8/58) and 20.0% (11/55) in fourth year) (Figure 1).

Higher proportion 22.9% (11/48) of students from the college of Agric and Natural science were overweight while students 40.0% (2/5) from the college of health sciences were more likely to be obese using BMI classification (Figure 2).

Table 4 shows an association of WC, WHR and WHtR with socio-demographic characteristics. There was a significant association between the WHR status and gender (p<0.0001). WC was significantly associated with gender (p<0.0001), year of academia (p<0.0001) and the affiliate college of study (p=0.0212). WHtR status was significantly associated with gender (p<0.0001), year of academia (p=0.0037) and the affiliate college of study (p=0.0150).

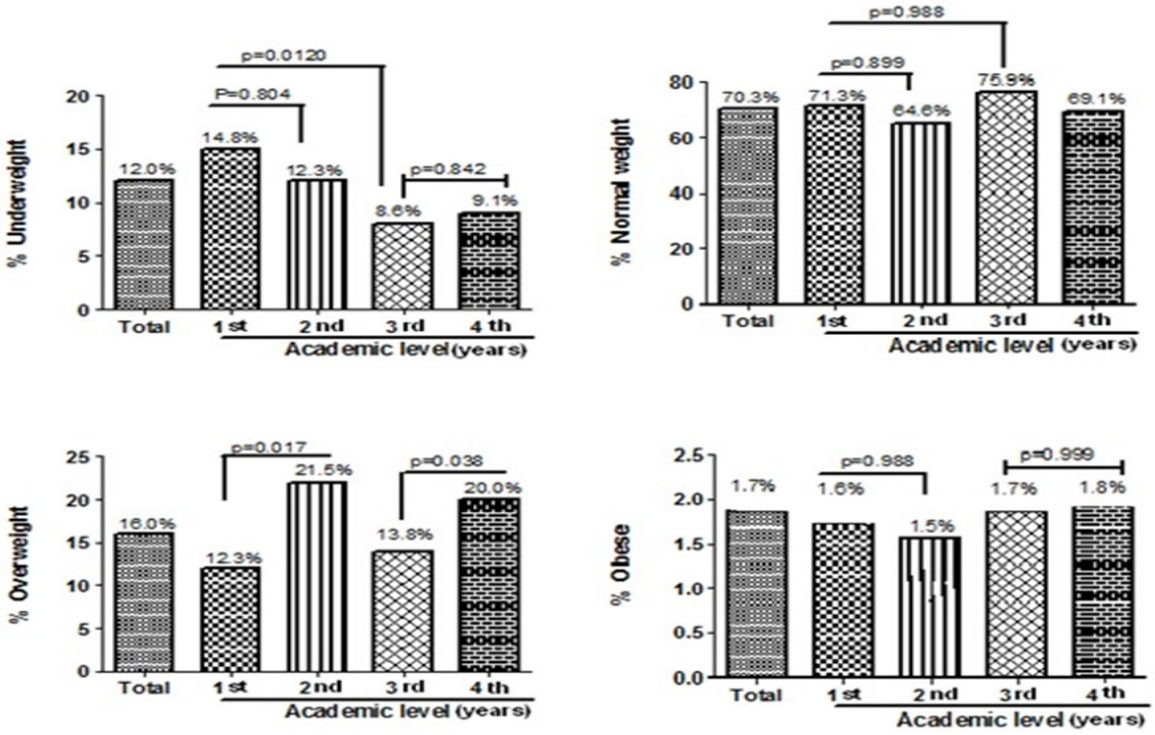

Figure 1-Prevalence and association between BMI status and student's academic level

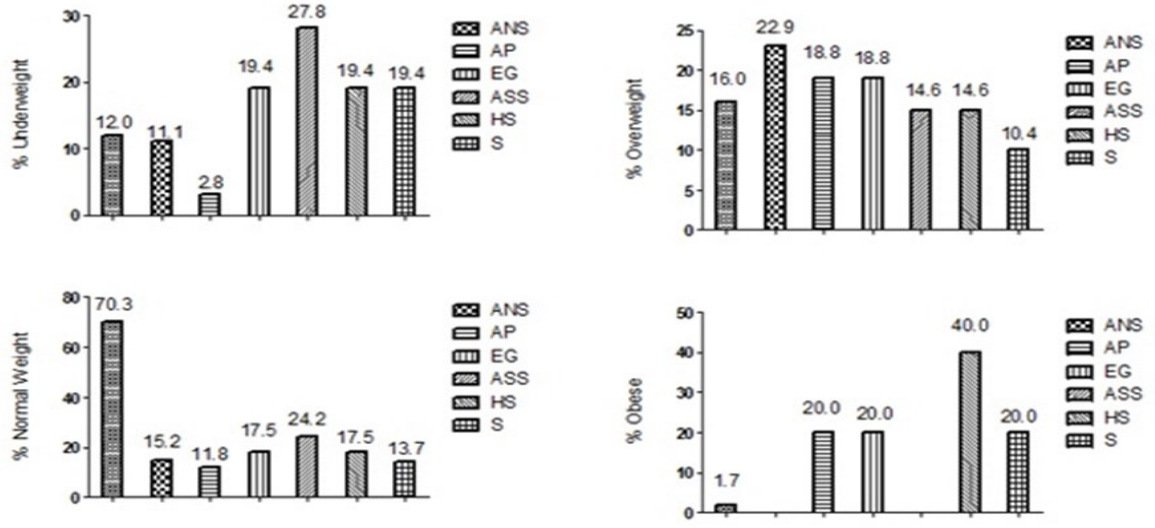

Figure 2-Prevalence of BMI in association with various colleges. ***Agric. & Natural Science; AP: Architecture and Planning; EG: Engineering ASS: Art and Social Science; HS: Health Science; S: Sciences***

Table 4: Association of WC, WHR and WHtR with socio-demographic characteristics

	WC				WHR				WHtR		
Variables	Normal n (%)	Overweight n (%)	Obese n (%)	X2(p-value)	Normal n (%)	Overweight n (%)	Obese n (%)	X2(p-value)	Normal n (%)	Obese n (%)	X2(p-value)
Gender											
Male (n=179)	170(72.6)	6(15.0)	3(11.5)	74.6(<0.0001)	143(78.1)	35(61.4)	1(1.7)	109.9(<0.0001)	143(66.8)	36(41.9)	15.9 (<0.0001)
Female (n=121)	64(27.4)	34(85.0)	23(88.0)		40(21.9)	22(38.6)	59(98.3)		71(33.2)	50(58.1)	
level											
First (n=122)	103(44.0)	12(30.0)	7(26.9)	40.1(<0.0001)	93(50.8)	20(35.1)	19(31.7)	12.01 (0.0617)	97(45.3)	25(29.1)	13.5 (0.0037)
Second (n=65)	48(20.5)	11(27.5)	6(23.1)		34(18.6)	15(26.3)	16(26.7)		53(24.8)	12(13.9)	
Third (n=58)	44(18.8)	11(27.5)	3(11.5)		29(15.8)	12(21.1)	17(28.3)		37(17.3)	21(24.4)	
Fourth (n=55)	40(17.1)	6(15.0)	9(34.6)		37(20.2)	10(17.5)	8(13.3)		27(12.6)	28(32.6)	
College											
ANS(n=47)	33(14.1)	12(30.0)	1(3.8)	20.9(0.0212)	23(12.6)	13(22.8)	11(18.3)	14.5 (0.1528)	28(13.1)	14(16.3)	14.1 (0.0150)
AP (n=36)	24(10.3)	6(15.0)	6(23.1)		19(10.4)	6(10.5)	11(18.3)		19(8.8)	17(19.8)	
EG (n=54)	45(19.2)	7(17.5)	2(7.7)		37(20.2)	10(17.5)	7(11.6)		40(18.7)	14(16.3)	
ASS (n=68)	59(25.2)	3(7.5)	6(23.1)		44(24.0)	15(26.3)	9(15.0)		56(26.2)	12(13.9)	
HS (n=53)	37(15.8)	9(22.5)	7(26.9)		32(17.5)	6(10.5)	15(25.0)		34(18.2)	19(22.1)	
SC (n=42)	35(14.9)	4(10.0)	3(11.5)		29(15.8)	7(12.3)	6(10.0)		32(14.9)	10(11.6)	

Values are presented as frequency (percentage). Comparism was done using Fischer exact test. Level of significance was p<0.05 WC: Waist circumference; WHR: Waist/hip Ratio; WHtR: Waist to height ratio.

Table 5 shows the association between BMI and Ethnicity. Akan students were more likely to be overweight than being obese (45.8% (22/48) vs. 20.0% (1/5)) while students from Ga-Adangbe were more obese than overweight (40.0% (2/5) vs. 20.8% (10/48)). There was a significant association between BMI status and ethnicity (p=0.0367) (Table 5).

Table 6 depicts multivariate logistic regression analysis of predictor or risk factor for obesity. Risk factors of general obesity were being female (OR = 12.67, 95% CI = 0.926-17.042; p=0.0057). Age, smoking, alcohol intake, family history of hypertension and obesity, physical inactivity, fast food intake did not show any significant predictive ability for obesity condition (Table 6).

DISCUSSION

Obesity is a global epidemic affecting about 1.1 billion of adult population (WHO, 2000). This study assessed the prevalence and risk factors associated with overweight/obesity among undergraduate students at KNUST, Ghana and also to create public health awareness on the need to foster healthy lifestyle to prevent future risk of obesity. The overall prevalence of obesity and overweight observed in this study was 1.7% and 16.0% respectively. Similar findings have been observed in previous studies conducted by Mogre *et al.* (2014) in Ghana (1.9% vs. 9.3%), Chhabra *et al.* (2006) in Delhi (2.0% vs. 11.4%) and Gopalakrishnan *et al.* (2012) in Malaysia (5.2% vs. 14.8%). The prevalence rate of overweight observed in the current study is higher compared to that observed by Morge and colleagues in the University of Development studies in the Northern part of Ghana.

The prevalence of overweight and obesity using WC, WHR and WHtR was significantly higher compared to using BMI. This is consistent with findings from previous studies that reported increased prevalence of obesity using WHR and WC (Akpinar *et al.*, 2007; Bhurosy and Jeewon, 2013), and WHtR (Ashwell, 2009). However, other cohort study found both WC and BMI to have equal diagnostic accuracy for obesity as a component for met-

Table 5-Association between BMI and Ethnicity

Ethnicity	Underweight, n(%)	Normal, n(%)	Overweight, n(%)	Obese, n(%)	X^2	p-value
Akan	16(44.4)	101 (47.8)	22 (45.8)	1 (20.0)	4.613	0.0367
Ga-Adangbe	5 (13.9)	37 (17.5)	10 (20.8)	2 (40.0)		
Ewe	6 (16.7)	30 (14.2)	9 (18.8)	1 (0.0)		
Dagbani-Mole	9 (25.0)	43 (20.4)	7 (14.6)	1 (20.0)		

Values are presented as frequency (percentage). Comparism was done using Chi-square test, P<0.05 was statistically significant

Table 6- Multiple logistic regression analysis to determine predictors of overweight/obesity

Variables	B	Adjusted OR	95% CI of OR	p-value
Age	-0.252	0.777	0.601-1.005	0.0550
Smoking	16.474	1.427	0.049-3.056	0.9980
Alcohol intake	-0.697	0.498	0.068-3.655	0.4930
FH HTN and Obesity	-0.613	0.542	0.075-3.929	0.5440
Physical inactivity	-0.151	0.860	0.731-1.012	0.0700
Gender (Female)	2.538	12.656	0.926-17.042	0.0020
Fast food intake	-0.003	0.997	0.296-3.363	0.4200

FH HTN: family history of hypertension. OR: odds ratio; B: regression coefficient

abolic syndrome (Han *et al.*, 2002). Discrepancies in results suggest that prognostic ability of each index of obesity may differ by age, gender and ethnic group. Based on this study, we found that using WHtR reported the highest prevalence of obesity (28.7%) compared to using BMI (1.7%).

Several authors have consistently reported that increase prevalence of overweight and obesity are associated with females in various studies (Oghagbon *et al.*, 2009; Mogre *et al.*, 2014; Onyechi and Okolo, 2017). Findings from this study concur with reports from earlier authors as increased prevalence of overweight and obesity was observed in female students compared to the male counterparts. The proportion of obesity in females was extremely high in this study compared to a current study by Mogre *et al.* (2014).

The higher rate of obesity and overweight among the female students is expected because there is a social perception in Ghana that females who are fat are considered to be living good in the society compared to those with slender body. Some contraceptives containing progestogen may cause the body to produce increase amount of fat in the females (Reid *et al.*, 1992) and thus might also be a contribution factor to the increment in weight among females in this study; though our present study did not purposively recruit female students on contraceptives.

Results from this study found that obesity was increasing with increasing academic level. High prevalence of obesity was observed among the fourth year (1.8%), followed by third year (1.7%) students. Meanwhile the highest prevalence of overweight was recorded among level 200s. The long duration spent using computer, eating more during time of stress and snacking between meals are the most important life style factors likely to contribute to increased prevalence of overweight/obesity (Bakr *et al.*, 2001).

The prevalence of underweight using BMI classification decreased with increasing academic level up to third year (in this order 14.8%, 12.3%, 8.6%) but transiently rises in fourth year (9.1%). This finding support the fact that first year students undergo a

lot of stress and other difficulties trying to adapt to their new environment but as the year progresses they successfully adapt to their new environment and try to take things lighter even with examination (Nakalema and Ssenyonga, 2014).

Fourth year students are confronted with two challenges i.e. passing their final exams and submitting their project work. These no doubts present them with a huge workload which may lead to their restlessness thereby causing loss in weight. The stress also explains why there was high prevalence of obesity among fourth year students (Gupta *et al*., 2009). Although the mechanism of cortisol a stress releasing hormone involvement in the development of obesity is not clear, several researchers have identified an association between stressful environment and visceral obesity (French *et al*., 2010).

The relationship between obesity and alcohol consumption is complex. Factors such as smoking, sedentary activity, physical inactivity, psychosocial factors, caffeine consumption and medication may further modify this association (French *et al*., 2010). A significant association between taking 2-4 bottles of alcohol per day and obesity was observed (Table 3). This is in line with a study that identified a higher BMI in heavier drinkers (Breslow and Smothers, 2005). Experimental evidence from several metabolic studies showed a suppression of lipid oxidation by alcohol and thus the enhancement of a positive fat accumulation (Suter and Tremblay, 2005).

The effects of ethnicity are also quiet significant and may pose an increased risk for obesity. Students originating from the Akan and Ga-Adangbe tribes were more likely to report higher prevalence of overweight and obesity respectively. The increase obesity among Ga-Adangbe students is consistent with Biritwum *et al.* (2005). The possible reason for high rate of obesity in Ga-Adangbe could be their 'kenkey' diet of the predominantly Ga people (Biritwum *et al*., 2005).

Training for health science education is stressful and the amount of material to be absorbed, social isolation, pressure of examination, and discrepancies between expectation in exams results may play a key role as stressful condition leads to irregularity in diet, lack of exercise and addiction, each being considered independent factors leading to obesity (Gupta *et al*., 2009).

The present study also indicated that obesity and overweight were more likely to be associated with student from the College of Health Sciences and the College of Agric and Natural Sciences respectively. Previous works done among undergraduate health science students showed an increased prevalence of obesity and overweight (Gupta *et al*., 2009; Gopalakrishnan *et al*., 2012; Mogre *et al*., 2014). Overweight among the College of Agric and Natural sciences students is a new area emerging into the cascade of young adult obesity and thus early public health attention would help prevent future risk of obesity.

Logistic analysis showed that female students were at 12-folds increased odds of developing obesity/ overweight. This corresponds with finding of several studies authors (Oghagbon *et al*., 2009; Mogre *et al*., 2014; Onyechi and Okolo, 2017). Even though sample size and cross-sectional study design were limitation for this study and thus the findings can't conclusively represent general prevalence in young adults, the pattern of obesity and overweight are consistent with several authors.

CONCLUSION

Obesity and overweight is still increasing among young adults' population and female than male students are at increased risk. Being a fourth year student, reading health science related programmes and ethnicity of being Ga-Adangbe were more likely to be obese. Increase prevalence of underweight among first year students may have compounded the risk of obesity in fourth year student and thus public health especially institutional-based awareness on healthy lifestyle and nutrition are essential in early onset admission and students' orientation. Using other anthropometric measurements such as WC, WHR and WHtR in conjunction with BMI would be useful for better diagnosis of obesity condition.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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