

ORIGINAL ARTICLE

Obesity and hypertension among market men and women in the Tamale metropolis

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Obesity and hypertension are emerging problems in the Tamale metropolis in the northern region of Ghana. This study investigated the prevalence of obesity and hypertension among market men and women in the Tamale Metropolis. This is from a viewpoint of the market place, being an occupational environment that predisposes individual to obesity, mainly due to sedentary living and enhanced access to all sorts of food. A total of 220 market men and women were contacted. 15 individuals refused to take part in the study and 5 returned incomplete questionnaires, leaving 200 complete and evaluable respondents comprising 100 men and 100 women. The study population was selected randomly from four major markets (Lamashegu market, Aboabo market, Tamale central market and Kukuo market) in the city. Obesity was measured using the various anthropometric parameters (BMI, WHR, WC and %BF) and blood pressure was measured. The prevalence of hypertension was 3% while the prevalence of obesity was 25.0%, 35.5%, 30.0% and 52.5% using BMI, WHR, WC and %BF respectively among the entire study population. Among the men, 27.0%, 8.0%, 8.0% and 37.0% were obese using BMI, WHR, WC and %BF respectively; whilst the women recorded 23.0%, 63.0%, 52.0% and 68.0% as the prevalence of obesity using BMI, WHR, WC and %BF respectively. Among the men, 5.0% were hypertensive while 1.0% of women had hypertension. Prevalence of obesity and Blood pressure values increased with increase in age. The prevalence of obesity is a common phenomenon among the market men and women in the metropolis. Irrespective of the criteria used, obesity is more common among the market women. The prevalence of obesity from this study is age dependent; it also depends on educational level as well as marital status. The prevalence of hypertension on the other hand is low and it is common among the men as compared to the women and also increased with age. Education on hypertension and obesity should be prioritized among the market men and women as a greater proportion of our study population who were obese were found to be illiterates.

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INTRODUCTION

Excessive body fat accumulation to the extent that it may affect health, leading to reduced life expectancy has reached epidemic proportions with an estimated 400 million people being affected globally (Hjartaker *et al.*, 2008) and this would increase to 700 million by

2015 (WHO, 1997). This disturbing trend raises public health concerns because of the risk of developing conditions such as hypertension, dyslipidaemia, type 2 diabetes, coronary artery disease, cardiovascular attack (stroke), osteoarthritis as well as cancer (Hjartaker *et al.*, 2008). Over the years, variations in the prevalence of obesity and hypertension across the world have been reported depending on the population, lifestyle as well as the occupational environment (Abubakari *et al.*, 2008; Amole *et al.*, 2011; Pasco *et al.*, 2012).

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The market place as an occupational environment can predispose individuals to obesity and hypertension partly due to their sedentary lifestyles and enhanced access to food (Ajani, 2003). Within the total of 16 hours daily (domestic and market activities) they spend on a sedentary lifestyle, increased intake of high fat and sugar containing meals as well as in-between meals food consumption are common features (WHO, 2000; Ajani, 2003; Hjartaker *et al.*, 2008; Gonzalez-Suarez *et al.*, 2009; Suleiman *et al.*, 2009; Ziraba *et al.*, 2009).

In sub-Saharan Africa, prevalence rates of 13.6% and 18% have been recorded within the adult population in Ghana and Benin respectively (Benkeser *et al.*, 2012). Estimates from the World Health Organization (WHO) indicate that one out of every five persons diagnosed with hypertension could be obese and this may account for a greater chunk of essential hypertension in men and women (Haslam *et al.*, 2005). According to the WHO (WHO, 1997), there is a global shift in diet towards increased intake of “junk foods” which are low in vitamins, minerals and other micronutrients, which sets the stage for the development of obesity and hypertension. In Ghana, there is paucity of data on the incidence of obesity among this target group, as such the need for this study.

MATERIALS AND METHODS

Study design

This descriptive cross-sectional study was carried out in the Tamale metropolis of the Northern Region of Ghana among market men and women aged 18 years and above from May to June 2013. Four (4) markets within the metropolis were purposively selected for the study and this comprised the Lamashegu market, Aboabo market, Tamale central market and Kukuo market, after which simple randomized sampling was used to recruit 55 participants from each market.

Data collection

Data was collected at the various markets with the assistance of a trained nurse. Data collected from respondents ranged from Anthropometric param-

eters, socio-demographic information as well as blood pressure readings after a brief education on the need for the prevention of obesity and hypertension. A semi-structured questionnaire was used to obtain socio-demographic information.

Anthropometric measurements and blood pressure readings

Obesity was assessed using four indicators (body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR) and percentage body fat (%BF). Weight, to the nearest 0.1 kg in light clothing was measured using a digital flat floor weighing scale (with weighing capacity of 250 kg) manufactured by SECA (Hamburg, Germany) and height to the nearest 1 cm was measured using a portable stadiometer (measuring range : 20 cm to 205 cm) manufactured by SECA. Body Mass Index (BMI) was calculated as the ratio of the weight (kg) and the square of height (m²).

Waist circumference (to the nearest centimeter) was measured with a Gulick II spring-loaded measuring tape (Gay Mill, Wisconsin, USA) mid-way between the inferior angle of the ribs and the suprailiac crest. Hip circumference was measured as the maximal circumference over the buttocks in centimetres and the waist to hip ratio (WHR) calculated by dividing the waist circumference (cm) by the hip circumference (cm).

%BF was estimated from the BMI of respondents with the formulae $\%BF = (1.20 \times BMI) + (0.23 \times Age) - (10.8 \times sex) - 5.4$; where sex is 1 for males and 0 for females (Deurenberg *et al.*, 1991). Internal and external cross-validation of the prediction formulas showed that they gave valid estimates of body fat in males and females at all ages (Deurenberg *et al.*, 1991).

Blood pressure was measured using the left arm in the sitting position with the aid of a sphygmomanometer using the auscultation method. The systolic blood pressure was recorded at phase I Korotkoff sounds while the diastolic blood pressure was recorded at phase V Korotkoff sounds. All measurements were taken twice by the same person and

the average of the two readings was taken as final. Respondents were also given a 5 minute period of rest before and after the first blood pressure reading.

Definition of terms

BMI (kg/m^2) was categorized using the current World Health Organization (WHO) definitions; BMI of $<20 \text{ kg}/\text{m}^2$, $20\text{-}24.9 \text{ kg}/\text{m}^2$, $25\text{-}29.9 \text{ kg}/\text{m}^2$ and $\geq 30 \text{ kg}/\text{m}^2$ were used to define underweight, normal, overweight and obese respectively. Waist circumference (WC) was defined for both males and females with WC <94 , $94\text{-}101.9$ and ≥ 102 cm defined as normal, overweight, and obese respectively for males and <80 , $80\text{-}87.9$ and ≥ 88 cm defined as normal, overweight and obese respectively for females. Waist-to-hip ratio (WHR) was also defined for both males and females with WHR <0.90 , $0.90\text{-}0.99$ and ≥ 1.0 defined as normal, overweight, and obese respectively for males and <0.80 , $0.80\text{-}0.84$ and ≥ 0.85 defined as normal, overweight and obese respectively for females. %BF greater than 25% and 30% for males and females respectively, was considered as obese. Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg.

Statistical analysis

Results are presented as Means \pm SD. Unpaired *t*-test was used to compare the means of all continuous variables. The Chi-square test statistic was used to assess the statistical significance of categorical variables. A *p*-value < 0.05 was considered to be statistically significant. GraphPad Prism for Windows version 5.0 (GraphPad Software, San Diego, CA, USA) was used for all statistical analysis.

RESULTS

General and socio-demographic characteristics of the studied population

Out of the 220 market men and women contacted, 15 individuals refused to take part in the study, 5 returned incomplete questionnaire, leaving 200 complete and evaluable questionnaires leading to a response rate of 90.9%. The age range of the studied population was 18 to 72 years and the mean \pm SD was 35.0 ± 9.7 years. Majority of the studied partici-

pants were married (56.0%), had attained at least basic education (74.0%) and the mean income level was about GH¢ 137.8 ± 159.9 as shown in Table 1. Most of the participants operate in the open market system (60.0%), do not consume alcoholic beverage (85.5%) and are non-smokers (94.0%). About 45.0% are engaged in active exercise (45.0%). The mean time at which the participants normally take their supper is at $7:07 \pm 1:42$ p.m. (Table 1).

When the studied population was stratified based on gender, significantly ($p = 0.0037$) higher proportion of the females (35.0%) were illiterates as compared to the 17.0% among the males. On the other hand, higher proportion of the males (19.0%), had attained tertiary education as compared to their female (9.0%) counterparts (Table 1). A higher proportion of the male participants consumed alcoholic beverages (22.0%) and smoked cigarettes (10.0%) compared to the 7.0% and 2.0% for the females respectively (Table 1).

Prevalence of obesity and hypertension within the studied population

When the studied anthropometric variables were stratified based on gender, males (76.6 ± 14.9 kg) were heavier than their female (71.6 ± 15.8 kilograms) counterparts (Table 2). The mean %BF was significantly ($p = <0.0001$) higher among the females ($34.3 \pm 7.0\%$) compared to their male counterparts ($23.9 \pm 6.8\%$). However, the mean SBP and DBP were significantly higher among the males as compared to the females (Table 2).

As shown in Figure 1, 29.0% and 25.0% of the studied population were overweight and obese respectively using BMI as the indicator of body weight (Figure 1A). Using WHR as the indicator, 48.5% and 35.5% were overweight and obese respectively (Figure 1B). Using waist circumference as indicator of central obesity, about 21.0% and 30.0% were overweight and obese respectively (Figure 1C) whilst 52.5% were obese when percentage body fat was used as the indicator of obesity as shown in Figure 1D.

Table 1: The distribution of socio-demographic characteristic of the studied population stratified by gender

Variables	Total (n = 200)	Female (n = 100)	Male (n = 100)	P values
Age (years)	35.0 ± 9.7	34.4 ± 10.9	35.7 ± 8.4	0.3581
Marital status				
Single	78(39.0%)	37(37.0%)	41(41.0%)	0.5620
Married	112(56.0%)	59(59.0%)	53(53.0%)	0.3927
Divorce	3(1.5%)	1(1.0%)	2(2.0%)	0.5607
Widow	7(3.5%)	3(3.0%)	4(4.0%)	0.7004
Educational level				
Illiterate	52(26.0%)	35(35.0%)	17(17.0%)	0.0037
Basic	49(24.5%)	29(29.0%)	20(20.0%)	0.1390
Secondary	61(30.5%)	24(24.0%)	37(37.0%)	0.0459
Technical	10(5%)	3(3.0%)	7(7.0%)	0.1944
Tertiary	28(14%)	9(9.0%)	19(19.0%)	0.0416
Income (GHC)	137.8 ± 159.9	95.9 ± 95.1	179.7 ± 195.8	< 0.0002
Market type				
Open	120(60.0%)	62(62.03%)	58(58.0%)	0.5637
Shop	80(40.0%)	38(38.0%)	42(42.0%)	0.5637
Exercise				
Yes	90(45.0%)	39(39.0%)	51(51.0%)	0.0881
No	110(55.0%)	61(61.0%)	49(49.0%)	0.0881
Alcohol				
Yes	29(14.5%)	7(7.0%)	22(22.0%)	0.0026
No	171(85.5%)	93(93.0%)	78(78.0%)	0.0026
Smoking				
Yes	12(6.0%)	2(2.0%)	10(10.0%)	0.0172
No	188(94.0%)	98(98.0%)	90(90.0%)	0.0172
Supper time	7:07 ± 1:42	7:15 ± 1:27	7:00 ± 1:57	0.0346

Categorical data are presented as proportion and compared using chi-square whilst continuous data are presented as mean ± s.d and compared using unpaired t-test.

Using WHR, WC as well as %BF as a marker of obesity, the prevalence of obesity was significantly higher among the market women as compared to the market men (Table 2). However, the prevalence of hypertension was significantly higher among the men as compared to the women (Table 2).

When body weight indicators were stratified by age, the prevalence of obesity using the various indicators generally increased with age (Table 3). Using BMI, the highest prevalence of obesity, 39.3%, was noted among the 45-54 age group followed by

24.1% among the 35-44 age group, 22.1% among the 23-34 age group, 19.2% among the 19-24 age group and 16.7% among those who are 55 years or older. Using WHR, WC and %BF as indicators, there was significant age dependent increase in the prevalence of obesity as the population age from 19-24 years to those who are 55 years or older group (Table 3).

As indicated in Figure 2, the prevalence of hypertension increased from 0.0% among the 19-24 years group to 1.2% among the 25-34 age group to 3.7%

Table 2: The distribution of anthropometric characteristics of the study population stratified by gender

Variables	Female (n=100)	Male (n=100)	P values
Weight	71.6 ± 15.8	76.6 ± 14.9	0.0228
Height	1.7 ± 0.1	1.7 ± 0.1	0.0001
BMI	26.5 ± 5.3	26.54 ± 5.1	0.9084
WC	88.8 ± 13.4	86.2 ± 10.6	0.1362
HC	101.5±11.4	99.03±12.7	0.144
WHR	0.9 ± 0.1	0.9 ± 0.1	0.9258
%BF	34.3 ± 7.0	23.9 ± 6.8	< 0.0001
SBP	113.1±11.7	119.0±11.5	0.0004
DBP	71.3 ± 8.5	78.8 ± 11.1	< 0.0001
BMI			
Underweight	10(10.0%)	6(6.0%)	0.2971
Normal	33(33.0%)	43(43.0%)	0.1452
Overweight	34(34.0%)	24(24.0%)	0.1192
Obese	23(23.0%)	27(27.0%)	0.5136
WHR			
Normal	4(4.0%)	28(28.0%)	< 0.0001
Overweight	33(33.0%)	64(64.0%)	< 0.0001
Obese	63(63.0%)	8(8.0%)	< 0.0001
WC			
Normal	24(24.0%)	74(74.0%)	< 0.0001
Overweight	24(24.0%)	18(18.0%)	0.2976
Obese	52(52.0%)	8(8.0%)	< 0.0001
%BF			
Normal	32(32.0%)	63(63.0%)	< 0.0001
Obese	68(68.0%)	37(37.0%)	< 0.0001
Hypertensive	1(1.0%)	5(5.0%)	0.0973

Continuous data presented as mean ± s.d and com-

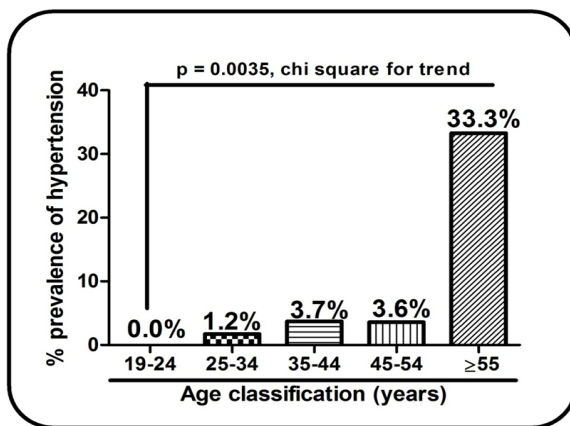


Figure 2: The percentage prevalence of hypertension among the studied population stratified by age

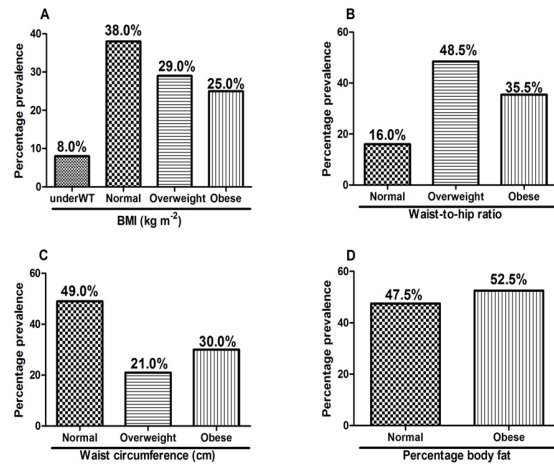


Figure 1: Prevalence of overweight and obesity from the total studied population using BMI (A), WHR (B), WC(C) and %BF (D) as indicator.

among the 35-44 age group. It decreased slightly to 3.6% among the 45-54 age groups before increasing sharply to 33.3% among those who were 55 years and older group (Figure 2).

DISCUSSION

This cross-sectional study, conducted among adult market men and women in the Tamale Metropolis, used the four criteria of WHO for determining obesity: WC, WHR, BMI and %BF. The prevalence of obesity as recorded in this study ranged from 25% to 52.5% depending on the criteria used. This is in agreement with the findings of Ajani *et al.* (2003), who reported 28% rate of obesity using BMI among market men and women in Ibadan, Nigeria and the 31.2% using WHR among civil servants in the Tamale metropolis (Mogre *et al.*, 2012). However, this finding is higher than the national prevalence rate of 5.5% as well as the 1.5% reported for Northern region according to Biritwum *et al.*, (2005), on the Epidemiology of Obesity in Ghana. The observed difference could be due in-part to differences in the study population as well as the change in lifestyle. Tamale metropolis has been reported as the fastest growing city in Ghana due to the rapid development accompanied by westernization and urbanization.

Table 3: The distribution of body weight indicators of the studied population stratified by age

Variables	19-24 (n=26)	25-34 (n=86)	35-44 (n=54)	45-54 (n=28)	≥55 (n=6)	P-values
BMI						
Underweight	3(11.5%)	10(11.6%)	1(1.9%)	1(3.6%)	1(16.7%)	0.1721
Normal	9(34.6%)	36(41.9%)	21(38.9%)	9(32.1%)	1(16.7%)	0.7642
Overweight	9(34.6%)	21(24.4%)	19(35.2)	7(25.0%)	3(50.0%)	0.6468
Obese	5(19.2%)	19(22.1%)	13(24.1%)	11(39.3%)	1(16.7%)	0.1812
WHR						
Normal	8(30.8%)	19(22.1%)	8(14.8%)	2(7.1%)	0(0.0%)	0.0982
Overweight	15(57.7%)	42(48.8%)	26(48.1%)	13(46.4%)	1(16.7%)	0.1435
Obese	3(11.5%)	25(29.1%)	20(37.0%)	13(46.4%)	5(83.3%)	0.0028
WC						
Normal	12(46.2%)	54(62.8%)	26(48.1%)	6(21.4%)	0(0.0%)	0.0006
Overweight	8(30.8%)	12(14.0%)	9(16.7%)	11(39.3%)	2(33.3%)	0.1815
Obese	6(23.1%)	20(23.3%)	19(35.2%)	11(39.3%)	4(66.7%)	0.0214
%BF						
Normal	15(57.7%)	53(61.6%)	20(37.0%)	7(25.0%)	0(0.0%)	< 0.0001
Obese	11(42.3%)	33(38.4%)	34(63.05)	21(75.0%)	6(100.0%)	< 0.0001

Table 4: Distribution of the studied population stratified by Waist to Hip Ratio (WHR)

Variables	Obese	Non-obese	P-values
Age (years)	37.2 ± 11.5	33.8 ± 8.5	0.0177
Marital Status			
Single	16(22.5%)	62(48.1%)	0.0004
Married	51(71.8%)	61(47.3%)	0.0008
Divorce	1(1.4%)	2(1.6%)	0.937
Widow	3(4.2%)	4(3.1%)	0.6788
Educational Level			
Illiterate	32(45.1%)	20(15.5%)	< 0.0001
Basic	21(29.6%)	28(21.7%)	0.2155
Secondary	12(16.9%)	49(38.0%)	0.0019
Technical	2(2.8%)	8(6.2%)	0.2933
Tertiary	4(5.6%)	24(18.6%)	0.0114
Income (Ghc)			
	95.9 ± 63.4	160.9±188.9	0.0055
Market Type			
Open	47(66.2%)	73(56.6%)	0.1844
Shop	24(33.8%)	56(43.4%)	0.1844
Exercise			
Yes	29(40.8%)	61(47.3%)	0.3809
No	42(59.2%)	68(52.7%)	0.3809
Alcohol			
Yes	5(7.0%)	24(18.6%)	0.0263
No	66(93.0%)	105(81.4%)	0.0263
Smoking			
Yes	2(2.8%)	10(7.8%)	0.1597
No	69(97.2%)	119(92.2%)	0.1597
Supper time	7:04 ± 1:51	7:09 ± 1:39	0.8213
SBP	114.6±12.0	116.8 ± 11.8	0.2037
DBP	72.6 ± 9.4	76.4 ± 10.9	0.0155
Hypertension	2(2.8%)	4(3.1%)	0.9103

About a decade ago, majority of the population in Northern Ghana were heavily dependent on bicycles and also utilized walking as means of transportation. Since bicycle riding and walking are considered as one of the various mechanisms of exercise, they probably may have been exposed to some level of physical activity hence the low prevalence of obesity (1.5%) at that time (Biritwum *et al.*, 2005). Also, the predominant occupation some years back in Northern Ghana was basically farming. Even though the same could be said today, it is obvious that the trend is gradually shifting towards white-collar and other sedentary jobs which are less stressful and involve less physical activity.

The age dependent prevalence of obesity from these market men and women, irrespective of the criteria used is in agreement with the finding of (Amoah, 2003a), among the general populace in Accra, Ghana. It is also in agreement with the report of Odenigbo *et al.* (2008), among civil servant in Nigeria as well as the findings of Amole *et al.* (2011), in their research on the prevalence of abdominal obesity and hypertension amongst adults in Ogbomoso, Nigeria. The proportion of fat deposited in the abdomen increases as body shape becomes more android with age, due to decreasing height and increasing slackness of the abdominal wall muscle (Kaye *et al.*, 1990). During adulthood,

weight gain occurs in the abdominal region, emphasizing the importance of hypertrophic obesity, which is generally android (Kaye *et al.*, 1990). The irrefutable connection between age and excess abdominal adiposity may be inspired by this alteration in adult body stature as one age.

Biritwum *et al.* (2005), Ajani *et al.*, (2005), Afolabi *et al.* (2004) and Odenigbo *et al.*(2008) reported higher prevalence of obesity among the participant women as compared to the men which is in agreement with our finding. This could partly be due to the fact that women have higher tendency of depositing adipocyte as compared to the males (Delavier, 2003) or possibly due to the higher rate of physical inactivity among the women in this study. Kruger *et al.* (2002), found that physical inactivity showed the strongest association with measures of obesity. In addition, the consumption of high-energy diet is one of the major contributing factors to the development of obesity. Generally, market women are usually seen eating junk foods intermittently (personal observation) which can be a contributing factor to the high rate of obesity.

Our findings indicate a higher prevalence of obesity among the married than the unmarried. This compares well with the findings of Biritwum *et al.* (2005); in their research on the Epidemiology of obesity in Ghana in which prevalence of obesity was common among the married than unmarried. Weight gain in marriage is perceived to be an indicator of good marital life and an enviable socio-economic status among Ghanaians hence many people will do whatever they deem fit to put on weight so as to look pleasing to society immediately after marriage.

The inverse relation between educational attainment and obesity from this study is consistent with the findings of Tagoe and Dake (2011). This may be partly due to the fact that education creates exposure to health knowledge, facilitates the creation of disease awareness and aids in the selection of healthy life choices.

However, contrary to the findings of Fezue *et al.* (2006), where obesity was strongly associated with

high income level, the obese population had lower income level as compared to the non-obese population. The reason for this observation is not clear from this study and it may warrant further research. It is however worth noting that, higher income level may facilitate access to well prepared and varied nutritious food which may not come cheap as well as access to quality education, which has been shown to have a direct relationship with the prevalence of obesity.

A significant number of participants in this study do not consume alcohol in our findings. Wang *et al.* (2010), Kahn *et al.*, (1997), reported alcohol consumption had little effect on the development of obesity which is in agreement with our finding. Alcohol also appears to increase metabolic rate significantly, thus causing more calories to be burned rather than stored in the body as fat (Klesges *et al.*, 1994).

The prevalence of hypertension in our study was 3.0% which is lower than the 25.4% found by Ad-do *et al.* (2006), in the Ga district of Ghana and national prevalence of 28.3% (Amoah, 2003b). The variance in prevalence may be partly due to the difference in population and the difference in geographical location. Market men and women in Tamale may be exposed to a different culture due to their location in the country, hence, a different way of living. Northern Ghana has the predominant occupation of most of its populace to be involved in active farming, which is more aerobic (cardiovascular exercise) and physically active. Wallace (2003), reports that cardiovascular exercise is the most effective mode of exercise in the prevention and treatment of hypertension.

Our findings indicate the prevalence of hypertension to be higher among the male population as compared to the female population, which is in line with the findings of Ajani *et al.*, (2003), among market men and women in Ibadan, Nigeria. This is however in contrast with the findings of Owiredu *et al.* (2008) who found the prevalence of hypertension to be higher in females than in the males in their study on the prevalence of obesity and cardi-

obesities and cardiovascular risk factors in a Pentecostal population in Kumasi, Ghana.

The higher prevalence of hypertension in the male population of our study could be attributed to the fact that significant fractions of the studied male population were butchers and as such, had little difficulty in consuming or having access to animal products (red meat). Miura *et al.* (2004), reports that meat intake was associated with larger increases in blood pressure, while vegetable and fruit intake was associated with smaller increases in blood pressure over time among middle aged men in Chicago, USA.

CONCLUSION

The prevalence of obesity range from 25% to 52.5% and is more common among the market women. The prevalence of obesity from this study is age dependent; it also depends on educational level as well as marital status. The prevalence of hypertension on the other hand is low and is common among the men as compared to the women and also increased with age.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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