SCHOOL OF PUBLIC HEALTH,
COLLEGE OF HEALTH SCIENCES,
UNIVERSITY OF GHANA

ASSESSMENT OF FACTORS CONTRIBUTING TO OBESITY AMONG STUDENTS OF SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA.

BY

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE MASTER OF PUBLIC HEALTH DEGREE.

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DECLARATION

I, Birukundi Furgence Ferdinand, declare that except for the other people's investigations which have been duly acknowledged, this work is the result of my own original research, and that this dissertation, either in whole or in part has not been presented elsewhere for another degree.

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Supervisor's Signature…….

Prof. col. (retired) EDWIN.A. AFARI

ABSTRACT

Background

Understanding the determinants of obesity in adults is important due to its association with other chronic diseases. A study done in Ghana to determine Socio-demographic variation in obesity among Ghanaians adults reported that overweight and obesity had high prevalence in Accra metropolis. The study identified high prevalence among women and other upper- class residents. A similar study done at the University for Development Studies (UDS) in Tamale, Ghana, found that risk factors for general obesity were being female, engaging in light Physical Activity, being aged 28-37 years and being married. The School of Public health environment have some exposures (such as lack of sleep, fast foods, peer influence that may influence overweight and obese.This study aimed at determining the prevalence of obesity and assessment of risk factors contributing to obesity among students at the School of Public health, University of Ghana, Legon.

Methods. A cross-sectional study design was used. A systematic random sample of 180 students aged 18 to 49 years were interviewed from both undergraduate and postgraduate degree programmes from a total population of 352 students. This sample was made up of 87 males (48.3%) and 93 females (51.7%). Demographic characteristics such as age, sex, marital status and lifestyle (tobacco use, alcohol consumption and physical activity) were recorded. Weight and height were also measured with appropriate equipment. Physical activity level was assessed using the WHO Global Physical Activity Questionnaire. Results were expressed as frequencies, percentages, median and interquartile range (IQR). Chi-square test for trends at $\alpha=0.05$ was used for checking association between risk factors and obesity. Multiple logistic

regression was finally used to determine significant risk factors on obesity. STATA version 13 software was be used for data analysis.

Results

Prevalence of Body Mass Index (BMI) categories were 3(1.7%) underweight, 98(55.1%) normal, 58(32.6%) overweight and 19(10.7%) Obese. Prevalence of obesity was high (15.6%) in postgraduate students compared to undergraduate students (6.9%). Being married was also significantly associated with obesity (P-value=0.002). Physical activity, smoking and alcohol drinking did not show association with obesity. However prevalence of overweight (12.4%) and obesity (5.1%) was high among individuals engaged in light physical activity compared to those engaged in vigorous physical activity. Female had high odds of being obese compared to males (AOR=25, CI= 2.73-232.42, P-value=0.004). These results showed that as age group was the least predictor of obesity status of an individual (P-value=0.041). This is because its P-value is close to 0.5 (significance level).

Conclusion

The prevalence of obesity in this study was relatively high. This implies that obesity epidemic is a health problem among students attending tertiary institutions in Ghana. In this study, female sex was found to be the most significant factor associated with obesity among School of Public Health students. Health interventions addressing obesity associated risk factors are still needed in order to reduce this burden among universities' students and adults in general.

DEDICATION

I dedicate this work to all those whose shoulders I stood on to make this far in my education and my family (especially my wife) that allowed me to stay away from them for the whole period of study.

ACKNOWLEDGEMENT

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LIST OF ACRONYMS AND ABREVIATIONS

BMI	Body Mass Index
CVD	Cardiovascular diseases
GPAQ	Global Physical Activity Questionnaire
HDL	High density lipoprotein
LDL	Low density lipoprotein
PA	Physical Activity
WGHSA	Wave 1 of women's Health Study of Accra (WHSA-1)
WHO	World Health organization

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CHAPTER ONE

1.0 INTRODUCTION

1.1Background information

Obesity is a condition in which the fat stores (adiposity) are excessive for an individual's height, gender and race to an extent that produces adverse health outcomes (Omari and Caterson, 2007). In clinical practice and epidemiological research, obesity is most often defined by the body mass index (BMI), a calculation that gives a reasonable approximation of adiposity. Adults with a BMI between 25 and 29.9kg/m² are categorized as overweight, and those with BMI greater than 30kg/m² are categorized as obese (Omari et al. 2007*)*. Obesity has become a disease of public health concern both in developed and developing countries. Globally obesity has been estimated to be a fifth leading cause of mortality. The World Health Organization (WHO) estimates that 1.1 billion adults living in both developed and developing countries are overweight in which 300 million of them are obese. Most of these being women (Seidell, 2005). Overweight and obesity is due to interaction of several factors (Chhabra & Chhabra, 2007). Thus in dealing with this global problem many public health agencies worldwide have taken action through promotion of policies or other motivation to overcome the problem (Campos, Saguy, Ernsberger, Oliver, & Gaesser, 2006).

The prevalence of obesity in USA has increased from 12% to 19.8% and half of its adult population is now overweight or obese. In Brazil and Columbia it is reported that 40% are overweight (Olufemi & Ph, 2013). Obesity causes serious medical complications and impairs quality of life. Moreover in older persons, obesity can exacerbate the age-related decline in physical function and lead to frailty. The American society for Nutrition and obesity society

reviews the clinical issues related to obesity in older persons and provide health professionals with appropriate weight management guidelines for obese older patients. Current data show that weight loss therapy improves physical function, quality of life and the medical complications associated with obesity in older persons. Studies have shown that, weight-loss therapy that minimizes muscle and bone losses is recommended for older persons who are obese and who have functional impairments or medical complications that can benefit from weight loss. (Villareal, Apovian, Kushner, & Klein, 2005).

It is reported that overweight and obesity in most Europeans countries shows rising trends, and are predicted to continue rising if not addressed (Rennie & Jebb, 2005).Studies have also reported that more than 50% of the total European adult population is now overweight (body mass index (BMI) ≥25) and obesity rates (BMI ≥30) among adults now exceed 20% in many EU Member States. Overweight and obesity are, however, not evenly distributed across the European region, with large differences among and within countries, with the problem greatest among those in lower socio-economic groups (Crawford D, Jeffery RW, Ball K, n.d.). In Saud Arabia (ASIA) it has been reported that an increase in the prevalence of overweight and obesity respectively reaching to 65.4% in eastern region among female aged 18-19 years old (Al Qauhiz, 2010).

Studies in India indicates that more that 30 million are obese and the number keeps on increasing (Gouda & Prusty, 2014). A study done in Belgrade University reported high number male students being overweight and obese than female students (Gazibara, Tepavcevic, Popovic, & Pekmezovic, 2013). The prevalence of obesity in West Africa rapidly increased during the last two decades of the 20th century and continues to increase in the 21st century. A recent review of obesity prevalence in West Africa reported that between 2000 and 2004,

10% of West African adults were obese. In this time period, from the same study, half of the urban population in general and 60% of urban, West African women were either overweight or obese. Specifically 18% in the Republic of Benin population was found to be obese (Amoah, 2003).

Several studies have revealed that the prevalence of obesity in Ghana and other sub-Saharan Africa is increasing especially among women (Duda et al., 2007). As in earlier reviews of socioeconomic status and obesity in developing countries, this review also found a direct relationship between obesity prevalence and increased socioeconomic status. Though the public health and medical consequences of the rise in obesity in West Africa are evident, the reasons for the rapid increase in body size and body mass remain speculative. This rising trend of obesity is worrying as studies have shown increased risk of morbidity, disability and mortality associated with it.

In Ghana a study conducted in Tamale, Ghana, reported the prevalence of central adiposity to be 31.2% among civil servants (Mogre, 2014). The GDHS survey indicate that percentage of women aged 15-49 overweight or obese grew from 25-30% between 2003 and 2008 with the highest value among urban women. Wave 1 of women's Health study of Accra (WHSA-1) found 62.2% of 1,237 non-pregnant women living in Accra were overweight or obese; the same study found no relationship between obesity prevalence and socioeconomic status of an individual woman (Duda et al., 2007). In Ghana, the prevalence of obesity is reported to be high particularly among women who are educated, married, has children and employed (Dual, 2011). A study done on Prevalence of obesity among undergraduate students of Tai Solarin University of Education, Ijagun, Ijebu-Ode, Nigeria reported based on BMI classification that, the prevalence of overweight and obesity was more common among female students compared

to male (10%and5.1% vs. 4.6% and 1.3 respectively).Additionally, findings revealed that age was the most predictor of obesity followed by gender while family backgrounds and recreational activities did not significantly predict obesity (Olusanya & Omotayo, 2011). A study in Tamale, Ghana identified major obesity associated risk factors as physical activity, female gender, alcohol and coffee consumption (Mogre, 2014).

1.2 Problem statement

Obesity is stated to be associated with five of ten leading causes of death and disability such as heart disease, diabetes, cancer, hypertension and stroke (Sidik & Rampal, 2009). It is estimated that 300,000 people die each year of illness related to obesity, more than the number killed by pneumonia, motor vehicle accidents and airline crashes. A study done in Lebanese university (Beirut) reported a high prevalence of overweight and obesity in male students compared to female students with 37.5% and 12.5% against 13.6% and 3.2% respectively (Yahia, Achkar, Abdallah, & Rizk, 2008). Studies on obesity prevalence among university students in West Africa have been done in various countries including Nigeria and Ghana with similar findings in trends.

A study done in Nigeria Lagos state university on male undergraduates found that 14% and 2.3% of the population were overweight and obese respectively (Onyechi & Okolo, 2009). Another study conducted in Nigeria state university, Nsukka campus on undergraduate students living in Halls (Agatha & Christiana, 2008) found that 21% students were obese (13.1% females and 8.1% males). In Ghana a similar study done in Tamale has found comparable results with those in Nigeria where the prevalence of central overweight was

60.9% (55.9% males and 69.7% females) and 9.8% obese (0.0% males and 27% females) respectively.

Obesity is linked with an interaction of environmental factors (community characteristics, family influences, peer influences, marketing and state policies) and individual factors (genetic predisposition, socioeconomic/demographic such as employment status, age, marital status and lifestyle behaviour such as food consumption and physical inactivity). Physical inactivity has been reported to have high influence on overweight and obesity (Al-Nuaim et al., 2012).

Generally in universities some of these factors contributing to obesity include physical inactivity, alcohol consumption, diet, socioeconomic status, age and coffee use. (Campos et al., 2006). If these factors contributing to obesity in population are not identified and measures taken to address them, the prevalence will continues to increase with related diseases. This study therefore aimed at assessing factors contributing to obesity among students of the School of Public Health University of Ghana, Legon.

1.3 Conceptual framework

The prevalence of overweight and obesity is increasing in sub-Saharan Africa (SSA). There is a need for theoretical framework to catalyse further research and to inform the development of multi-level, context appropriate intervention(Scott, Ejikeme, Clottey, & Thomas, 2013). Obesity risk factors can be categorized into environmental and individual factors. Environmental factors include community characteristics, school environment, peer and family influence. On the other hand individual factors include genetic, socio-economic characteristic, age lifestyle (diet, physical inactivity, alcohol and tobacco use).The interaction

of these two categorical factors consequently leads to overweight and obesity in a given population.

The factors assessed in this study include, age, sex, dietary habits, alcohol and tobacco use, physical activity, smoking, employment and marital status.

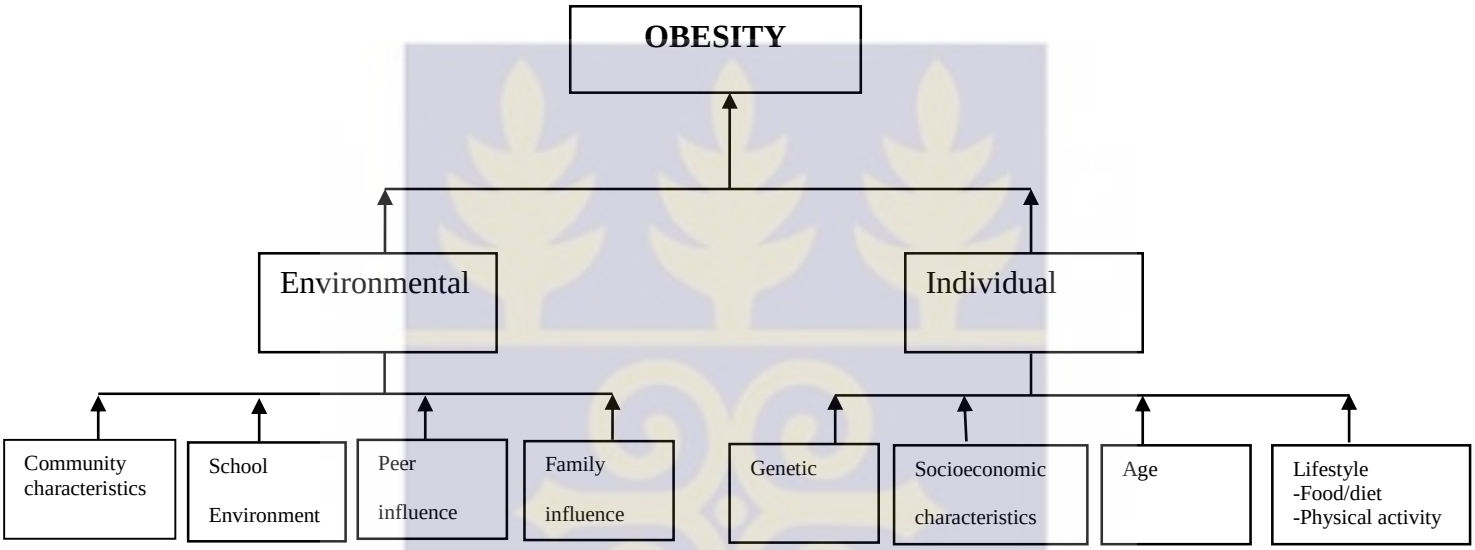

Figure 1: Conceptual framework on factors contributing to obesity.

1.4 Justification

The increased prevalence of overweight and obesity in many societies and countries has been accompanied by an increased risk of many associated diseases and health disorders as well as premature mortality. Reducing the obesogenic environment will not only help to stem the tide of the obesity epidemic and its consequences, but will facilitate weight reduction in those who are already overweight and obese. Despite the fact that studies have been done in the past, obesity is still a problem in tertiary institution in Ghana and West Africa in general. This study sought to assess the risk factors contributing to obesity among students. Results obtained from

this study could inform measures to be undertaken by the school to promote healthy lifestyle of students attending different degree programmes.

1.5 Objectives

1.5.1 General Objective

To asses factors contributing to obesity among school of Public Health students.

1.5.2 Specific objectives

1. To determine the prevalence of students with obesity.
2. To assess factors associated with obesity among students.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 General information on overweight and obesity

Overweight and obesity are very common conditions in developed societies, and they are becoming more common in developing countries and those in transition (Omari and Caterson 2007, pg233). In clinical practice and epidemiological research, obesity is most often defined by body mass index (BMI), a calculation that gives a reasonable approximation of adiposity. Adults with a BMI of between 25 and 29.9kg/m² are categorized as overweight and those above 30kg/m² as obese. However, in children, or the aged, or the very fit and muscular, the BMI definitions given above are not as useful as an obese measure. In children BMI for age charts may be used to assess overweight and obesity in this age group *(*Omari *et al. 2007).* Studies show that overweight and obesity are well understood to be the results of energy imbalance-consuming more calories than are equivalently expended in physical activity.

Obesity epidemic in West Africa has been postulated under two theories; urbanization and westernization. The two theories states that, the problem is said to be associated with decrease physical activity and increased access to high calorific foods, processed foods with high fats, sugar or salt contents (Benkeser, Biritwum, & Hill, 2012).

Many other factors such as marital status, income level, education and occupation contributes to metabolic syndrome((Al-Daghri et al., 2014) which are normally associated with obesity. Historically, in some West African societies weight gain was found to be desirable especially girls who were preparing for marriage were fattened in rooms, for example in Nigeria. Because behavioural intervention are only possible if individuals are ready and willing to participate, understanding body size preference to some individuals is important in addressing the

information to the community in respect to the consequences associated with obesity. Women's Healthy population based study, a survey done to assess the burden of communicable and none-communicable diseases of which one was obesity and its associated factors in Accra, showed that there is unexpected high prevalence of obesity among women in the respective population (Duda et al., 2007).

2.2 Prevalence of overweight and obesity

Obesity and overweight are very common and affect most regions in the world, despite the many public health interventions that have been implemented over the past several decades. Obesity increases with age, and in the developed world, prevalence is greater in among lower socioeconomic groups than amongst the more affluent. Obesity prevalence has been increasing steadily in most countries over the last few decades. At all ages and throughout the world, women are generally found to have a higher mean BMI and higher rates of obesity than men. Overall, the prevalence of obesity in men in developed or western societies is approximately 20% while in women it tends to be a few percentage points higher. Studies show that in the USA prevalence of obesity is greater amongst African-American people than amongst of European ethnicity (Omari, 2007).

The prevalence in obesity trends in USA was found to be associated with age and ethnic groups ((Ogden, Carroll, Kit, & Flegal, 2013). In the Middle East almost 25% of the population is obese. Alarming statistics have been reported from some African countries. For example, 44% of the black female population in the Cap Peninsula in South Africa were found to be obese using current criteria. This is in contrast to Ghana where only 0.8% of the population is obese.

Overweight is far more common than obesity, though interestingly in some countries men have higher rates of overweight than women, despite the reverse applying to obesity rates. For

example, in Australia, 62% of adult males and approximately 50% of adult females are overweight, whereas almost 20% of adults are obese. In China, 27% of men and 31% of women are overweight, using BMI cut-offs more appropriate for European population. This is of particular concern since it suggests that the degree of adiposity and associated disorders has been underestimated in these study populations.

Obesity is largely determined by modifiable lifestyle behaviours such as low physical activity levels, sedentary behaviour and consumption of energy dense diets foods: Study done in Mongolia medical university reported overweght7.6% among students with high prevalence in male compared to females (Chen et al., 2013a).A study done in Accra to investigate the distribution of obesity and its association with pre-adult wealth and adult socio-economic factors in urban Ghanaian central government ministries civil servants shows that, prevalence for obesity was 10% for men and 36% in women. In this study men of higher pre-adult or current socio-economic position generally had higher mean BMI and waist circumference. In women, however the mean waist circumference was higher in those of lower socio-economic position (lower education, less pre-adult wealth), though mean BMI did not differ significantly between socio-economic groups (Scott et al., 2013).

Nevertheless, a positive grade association between pre-adult and adult wealth (determined by the availability of selected household amenities) and the risk of obesity in men was observed, contrary a weak negative association between adult level of wealth and obesity in women under 45 years of age. The high prevalence of obesity in this population indicates the need for appropriate interventions for its prevention and treatment. Programmes and interventions to control obesity need to address different needs of men and women in the various social strata, and must not be limited to adults.(Scott et al., 2013).

2.3 Perceptions of overweight and obesity

Perceptions on body size differ from country to country, among individual society or community. This difference influences public health and clinical approaches to the management of obesity. It is stated that in western countries, people who are obese are perceived as poorly by the community and health professionals and the patients themselves often have low self-esteem.

In most cases women tends to see themselves as fatter than they should be , thus seek to be thinner than is necessary or practically possible, predisposing any overweight or obese woman to failure in treatment programmes due to unrealistic expectations. Centrally, men often do not see overweight as a problem, this make them not to present themselves in weight control or treatment programmes, unless compelled to do so due to co morbidity. However in some culture, overweight and obesity may be regarded as desirable attribute (Omari and Carterson, 2007).

2.4 Genetics of Obesity

Studies show that many genes are involved in contributing to overweight and obesity in most people (polygenic). However, a number of single gene mutations that cause obesity have been discovered. Example of such genes includes, melanocortin-4 receptor, Leptin, Leptin receptor, Pro-opiomelanocortin and Prohormone.

2.5 Energy balance

Energy homeostasis involves complex mechanism in the body. Weight stability implies a balance between energy intake (calories consumed) and energy expenditure (calories expended). In a normal weight individual the two forms of energy are relatively equal. On the other hand, an individual may experience either negative (under nutrition) or positive (over nutrition) energy balance. If positive energy balance exist for a prolonged period of time, obesity is likely to occur. Normally feeding behaviour is influenced by many factors such as, energy deficiency, social influences, food palatability and mood. This is balanced by energy expenditure, which includes basal metabolic rate, dietary thermo genesis (meal- induced heat production) and physical activity.

2.6 Consequences of obesity

Obesity as stated earlier is associated with many adverse health conditions. The risks intensity depends on the degrees of obesity. Some of these includes, metabolic (insulin resistance, impaired glucose tolerance and type 2 diabetes), dyslipedemia (reduced HDL cholesterol, increased VLDL. Triglycerides, increased LDL cholesterol), cardiovascular diseases, cancer, mechanical and social problems.eg. Low self-esteem, adverse judgement by society.

2.7 Factors associated with overweight and obesity

2.7.1 Unhealthy diet and eating habits

The shift in population levels of weight towards obesity is related to the 'nutrition transition' – the increasing consumption of fats, sweeteners, energy-dense foods (including beverages both soft and hard alcoholic), highly processed foods and diets lacking fruits and vegetables. This together with marked reductions in energy

expenditure, is believed to contribute to the global obesity epidemic. The nutrition transition tends to begin in cities. This is due to a variety of factors including the greater availability, accessibility, and acceptability of bulk purchases, convenience foods, and 'supersized' portions.

2.7.2 Genetics

Studies has shown that some genes may affect the amount of body fat to be stored and where that fat is distributed. Genetics may also play a role in how efficiently your body converts food into energy and how your body burns calories during exercise. Even when someone has a genetic predisposition, environmental factors ultimately influences individual weight gain.

2.7.3 Family lifestyle

Obesity tends to run in families. That's not just because of genetics. Family members tend to have similar eating, lifestyle and activity habits. If one or both parents are obese, an individual's risk of being obese increases.

2.7.4 Physical inactivity

The intensity of physical activity (vigorous, moderate or sedentary) determines the amount of calories burnt in the body. Studies have shown that with a sedentary lifestyle, one can easily take in more calories every day than that burn off through exercise and normal daily activities. Urbanization, motorization and television watching all reduce physical activity.

2.7.5 Age

Obesity can occur at any age, even in young children. But as one advances in age, hormonal changes and a less active lifestyle increase the risk of obesity. In addition, the amount of muscle in the body tends to decrease with age. This lower muscle mass leads to a decrease in metabolism. These changes also reduce calorie needs and can make it harder to keep off excess weight. If a control of what one eats and consciously become more physically active as age increases, one is likely to gain weight leading to increased risk of obesity.

2.7.6 Lack of sleep

Studies have shown that not getting enough sleep or getting too much sleep at night can cause changes in hormones that increase eating appetite. One may also crave foods high in calories and carbohydrates, which can contribute to weight gain.

2.7.7 Social and economic issues

Certain social and economic issues may be linked to obesity. A person may not have safe areas to exercise, not have been taught healthy ways of cooking or one may not have money to buy healthier foods. In addition, people with whom one spend time with may influence person's weight e.g. A person is more likely to become obese if she/he have obese friends or relatives.

2.7.8 Medical problems.

Researches have reported that obesity can rarely be traced to a medical cause, such as Prader-Willi syndrome, Cushing's syndrome, and other diseases and conditions.

However, some evidence suggests that some medical problems, such as arthritis, can lead to decreased activity, which may result in weight gain.

2.7.9 Certain medications.

Studies have reported that some medications can lead to weight gain if an individual doesn't compensate through diet or activity. These medications include some antidepressants, anti-seizure medications, diabetes medications, antipsychotic medications, steroids and beta blockers.

2.7.10 Quitting smoking

Researches have also reported that quitting smoking is often associated with weight gain. And for some, it can lead to enough weight gain that the person becomes obese. In the long run, however, quitting smoking is still a greater benefit to a person's health than continuing to smoke. This is because smoking is further a major risk factor for cancer e.g. Lung cancer.

2.7.11 Pregnancy

During pregnancy, a woman's weight necessarily increases. Some women find this weight difficult to lose after the baby is born. This weight gain may contribute to the development of obesity in women.

2.8 Management and prevention of obesity

Obesity as a public health problem needs for its management and prevention have to be addressed precisely in order to secure individual's life and costs involved. Public health approaches to reduce the risks of becoming overweight or obese are the priority for those who

are ready overweight and societal attempts to reduce the obesonicity of the environment to facilitate weight loss. For the healthy overweight and obese individuals and those with no family history of diabetes and heart diseases, nutrition advice and encouragement to increase activity may suffice. Facilities for physical activities are required in both rural and urban environments. Appropriate food choices must be available at reasonable costs. Advertising of energy-dense foods for children should be restricted. Development programmes that aim to prevent excessive weight gain in children and adults and that are appropriate for specific groups must be one of the most important challenge for preventive medicine in both developing and developed countries (Omari, 2007).

An integrated study on obesity in Europe suggested that, effective obesity prevention strategies should go beyond intervention that only focus on a specific individual, social or environmental level and instead embrace system-based multi-level intervention approach that address both the individual and environment .

CHAPTER THREE

3.0 METHODS

3.1 Study design

Descriptive cross –sectional study was used. Data was collected by use of structured questionnaire and direct physical measurements (height and weight). The questionnaire captured data on socio-demographic characteristics (age, sex, marital and employment status) and four parameters related to alcohol consumption, tobacco use, diet and physical activity level. Weighing scale and stadiometer were used to measure weight and height of study participants respectively. Body mass index (kg/m²) was calculated from values of weight and height measurements and used to measure obesity status of the participants.

3.2 Study area

The school of Public health under the college of health sciences is part of the University of Ghana and was established in 1994. The school is made up 6 departments, Biological, Environmental and Occupational Health Sciences, Biostatistics, Epidemiology and Disease Control, Health Policy, Planning and Management, Population, Family planning and Reproductive Health and Social and Behavioral Sciences. Some of the social services found around the school are fast foods/drinks and recreational facilities (though slightly distant but accessible) such as swimming pool and play ground. The school had a total number of 352 students for 2014/15 academic year.

3.3 Variables

Independent variables studied to achieve the study objectives include:

- Age
- Sex
- Marital status
- Occupation and
- Life style behaviour (alcohol use, smoking, eating habit and physical activity).

Dependent variable that was studied was obesity, measured by body mass index BMI (kg/m²).

3.4 Study population

The study population was made up of the School of Public Health students from all departments taking different degree programmes (undergraduate 200-400 levels and postgraduate students i.e. Masters and PhD). The study population ranged from 18 to 49 years. Exclusion criteria was women who were pregnant or had given birth within three months before the commencement of this study according to WHO protocols (Sidik & Rampal, 2009).

3.5. Sampling

3.5.1 Sample size

The sample size of this study was 180 students. This sample size was calculated based on prevalence of obesity (P=1.9%) from similar study done at the university of Development studies Tamale, Ghana (Mogre, 2014)

The **Cochrane**'s formula was used to calculate the minimum sample size required (Kothari, 2004)

$$n = \frac{Z^2 * (p) * (1-p)}{e^2}$$

Where

n= minimum sample size required

Z= Z value (1.96, that corresponds to 95% CI

e = Marginal error or precision required (0.02)

P= Prevalence of obesity among students from previous studies.

Thus

$$n = \frac{1.96^2 * (0.019) * (1-0.019)}{0.02^2}$$

180 students.

3.5.2 Sampling method

Study participants were stratified into post graduates and undergraduate students in order to get a representative sample from each group. Proportionate to size, systematic random sampling was then used to select study participants from each degree programme based on class list. In this regard 102 undergraduate (34 from each level i.e. Level 200 - 400) and 78 (53 masters and 25 PhD students) graduate students were selected for the study. Therefore a total number of 180 students were sampled for the study.

3.6 Data collection techniques and tools

Data was collected from February to May 2015.Structured questionnaire and anthropometric measurements of weight and height were used for data collection. Questionnaire to be used was adapted from WHO (2002) with some modification to suit the study setting. Participants were interviewed one at a time. Measurement for anthropometric parameters were done using inbuilt calibrated weighing scales and height measuring instrument respectively.

***Anthropometric* measurements:** These were measured without shoes and with light clothes by trained personnel. This means that participants with heavy clothes such as jackets and sweaters were asked to remove them. Also participants were asked to remove sandals or shoes, belts, watches and other jewellery on their wrist and items from their pockets prior to taking of measurements.

Weights were measured to the nearest 0.1kg using electronic weighing scale manufactured by TANITA (model TBF-300A, TANITA Corporation, USA). Prior to use all scales were adjusted according to standards procedure (a bubble was adjusted to the centre). Two measurements were taken for each study participant to obtain average weight of the person.

Heights were measured by using a wall-mounted height rod/stadiometer (model HR-200, TANITA Corporation, USA) to the nearest 0.1cm. Two measurements were made for each study participant to obtain average height. Subjects stood straight with buttocks, shoulders and back of the head touching the wall, with heels flat and together, shoulders relaxed, and arms hanging down. The head was erect and look straight forward, the lower border of the orbit in line with the external auditory meatus (Frankfurt plane). The headpiece (plastic bar) was lowered gently, pressing down the hair. Body mass index (BMI) was calculated as weight kg/height m^2. General overweight and obesity definition was based on the current

WHO(Bonita, De Courten, Dwyer, Jamrozik, & Winkelmann, 2001) criteria: underweight: BMI<18.5kg/m^2,normalweight BMI 18.5-24.9 kg/m^2, overweight(pre-obese) BMI 25-29.9 kg/m^2 and obese BMI >=30 kg/m^2.

Physical Activity level: The Global Physical Activity Questionnaire (GPAQ) was used to measure participants' physical activity level. It consisted of 16 questions on physical activity in a typical week. Frequencies and time duration spent on each activity was measured in three domains: At work, travelling to and from places as well as recreational activities. The GPAQ was used because it is standardized and easy to administer. It has been tested in various settings with the general adult population and found to have high reliability and validity respectively. Because of using local examples slight modification of the GPAQ was done for the study in order to suit the Ghanaian context. The GPAQ guideline on data collection and processing was adhered to. Physical activity duration spent were converted into minutes.

Metabolic Equivalents (MET) was used to express energy expenditure, intensity of physical activity from the duration and frequency of performance within 7 days. MET is the ratio of person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy of sitting quietly, and is equivalent to a calorific consumption of 1Kcal/kg/hour. A MET minute showed a total activity volume on weekly basis, and was calculated by multiplying the time spent on each activity during a week by the MET values of each activity. With reference to the GPAQ compendium guideline, different levels for physical activity were established. In this regard four MET's were assigned to the time spent in moderate activities and eight MET's to the time spent in vigorous activities. Physical activity of the participants were then classified as moderate light, moderate or vigorous intensity as defined by the GPAQ analysis framework based on total MET/minutes/week.

Vigorous

This was classified as either of the following categories

I. Vigorous- intensity activity on at least 3 days achieving at least MET 1500 minutes/week, or

II. Seven or more days of any combination of walking, moderate or vigorous intensity activities achieving 3000 MET minutes/week

Moderate

This was classified as not achieving the criteria for high category, but fulfilling any of the following three criteria;

I. 3 or more days of vigorous –intensity activity of at least 20 minute/day

II. 5 or more days of moderate-intensity activity and/or walking at least 30 minutes /day or

III. 5 days of any combination of walking. Moderate or vigorous intensity activities, accumulating at least 600 MET minutes/week

Light: This was classified as reported activity that was lower than the other stated categories, or no activity at all.

3.7 Quality control

Principal Investigator and research assistants were trained prior to data collection on the use of both weighing scales and height measuring instruments. Additionally training on interviewing process of subjects was done. Also, the Principal Investigator was available in the field every day to ensure consistency of interviewing process, taking of anthropometric measurements and data recording. Data consistency was ensured by randomly selecting and reviewing of completed questionnaire and taking of anthropometric measurements on selected

participants. Daily adjustment of weight and height measuring instruments were done prior to taking of measurements. Data storage and management was ensured through keeping them in cabinets in researcher's room as hard copy and restricted to the research team only.

3.8 Ethical issues

Ethical clearance was sought from the Ghana Health Service Ethics- committee for approval of the study (Appendix 3) and an official permission from the school was obtained for conducting the study. The importance of the study, aims and processes as well as any possible risks involved was fully explained to the participants before obtaining their informed consent. Participants had the right to take part in the study or not. All subjects who agreed to participate signed a written consent form. No compensation (e.g. monetary payment) were given to participants for their involvement. Confidentiality of participants was protected using coded questionnaire. Completed data collection tools were well secured in researcher's room and access restricted to the research team only. The researcher had no conflict of interest in this study.

3.9 Pilot or pre-test study

A pilot study was conducted by interviewing and taking measurements (weight and height) from 15 students of other schools within the University of Ghana before going to the field. This enhanced editing of the questionnaire in order to avoid ambiguity to some questions and proper calibration of weight and height measuring instruments.

3.10 Data processing and analysis

3.10.1 Processing

Data were cleaned by looking for proper questionnaire filling and completeness. Where a doubt arose due to improper completion of the questionnaire, a call was made to the subject since their contacts were on the questionnaire. Codes on the questionnaire were adapted with some modification in order to suit the study setting. Data were then entered in Epi info software (version 7). Furthermore Epi info was used to clean the data for physical activity level as explained in the Global Physical Activity questionnaire (GPAQ) analysis guide. Finally data were exported into Statistical software (STATA, SE version 13) for analysis.

Class intervals for age groups/categories and body mass index (BMI i.e. underweight, normal weight, overweight and obesity) were created during analysis. Tabulation was done for independent variables (such as age and sex) against outcome (BMI) to enhance easy analysis based on background characteristics. This helped to identify easily the proportion of participants based on a specific risk factor with their respective proportion of the outcome distribution.

3.10.2 Analysis

Descriptive statistics (univariate analysis) using frequency distribution tables were used to summarize the results by frequencies and proportions. Median and interquartile range (IQR) were used to summarize continuous variables (age) while percentages were used to summarize categorical variables. BMI classification was based on the current WHO definition and the proportion of overweight/obesity was obtained from the same frequency distribution table. Bivariate analysis using cross tabulation (chi-square and Fisher's exact test) test statistics for

determination of association of risk factors with obesity was performed at 5% significance level (95% C.I).

Multivariate analysis using logistic regressions for odds ratio (both crude and adjusted to control for confounding effect of specific risk factors (eg. Age, sex) was performed. The logistic regression analysis was performed to determine the strength of the association among risk factors with significant effect on the outcome (obesity) at 95% confidence interval. Odds ratio >1 indicated strong association (increased risk) and odds ratio<1 indicated weak association (decreased risk/ protective effect) respectively taking into account of the confidence interval.

CHAPTER FOUR

4.0 RESULTS

4.1 Background characteristics of participants

Total number of the study participants was 180 made up of 93 females (51.7%) and 87 males with median age of 29 years. High proportion of participants (93(51.7%)) were aged 20-30 years. There was (1(0.6%)) smoker, (58(32.2%)) ever drinkers and (79(45.7%)) married among all participants. A proportion of (2(1.1%)) and (6(3.3%)) of study participants reported not to consume either fruits or vegetables within a week. In addition (82(45.6%)) and (84(46.7%)) of participants reported to consume fruits and vegetable between 1 to 3 days per week. Large number of females (39(41.9%)) compared to males (16(18.4%)) reported to engage in light physical activities. On the other hand high proportion of females (52(55.9%)) Compared to males 42(48.3%) were employed. With respect to body mass index (BMI) categories, there were (3(1.7%)) underweight, (98(55.1%)) normal, (58(32.6%)) overweight and (19(10.7%)) Obese. Prevalence of overweight and obesity was high in females (39.1% and 19.6%) compared to males (24.7% and 1.2% respectively) as shown in table 1 (a & b).

Table 1 a): Background characteristics of participants (N=180)

Variable	Total n (%)	Male n (%)	Female n (%)
Age groups			
<20	11(6.1)	5(5.7)	5(5.4)
20-30	93(51.7)	47(54.0)	46(49.5)
31-40	59(32.8)	24(27.6)	35(37.6)
41-50	10(5.6)	6(6.9)	4(4.3)
Missing values	7(3.8)	4(5.8)	3(3.2)
Median (IQR: Q3-Q1)	29.5(IQR : 35-24)	29 (IQR:34-24)	30 (IQR:35-25)
Smoking			
Non- smoker	179 (99.4)	85(97.6)	93(100)
Current smoker	1 (0.6)	1(1.2)	0.00
Missing value		1(1.2)	
Drinking alcohol			
Never drinker	122(67.8)	53(60.9)	69 (74.2)
Ever drinker	58(32.2)	34(39.1)	24 (25.8)
Current marital status			
Married	79(45.7)	31(37.4)	48(53.9)
Never married	91(52.6)	50(60.2)	40(44.9)
Others	10(0.6)	2 (2.4)	1(1.2)
Degree level			
Undergraduate	102(56.7)	47(54)	55(59.1)
Post graduate	77(42.7)	39(44.8)	38(40.9)
Missing	1(0.6)	1(1.2)	

Table 1(b): Cont' Background characteristics of participants (N=180)

Variable	Total n (%)	Male n (%)	Female n (%)
Fruits consumption (days/week)			
1-3	82(45.6)	46(52.9)	36(38.7)
4-6	48(26.7)	21(24.1)	27(29.0)
Other	25(13.9)	8 (9.2)	17(18.2)
Don't know	18(10)	8 (9.2)	10(10.8)
None	2(1.1)	1(1.15)	1(1.1)
Missing values	5(2.8)	3(3.4)	2(2.2)
Vegetables			
1-3	84(46.7)	43(49.4)	41(44.1)
4-6	40(22.2)	15(17.2)	25(26.9)
Other	23(12.8)	8(9.2)	15(16.1)
Don't know	19(10.6)	11(12.6)	8(8.6)
None	6(3.3)	5(5.7)	1(1.1)
Missing values	8(4.4)	5(5.7)	3(3.2)
Physical activity			
Light	55(30.6)	16(18.4)	39(41.9)
Moderate	50(27.8)	27(31.0)	23(24.7)
Vigorous	72(40.0)	42(48.3)	30(32.3)
Missing values	3(1.6)	2(2.3)	1(1.1)
Employment status			
Yes	94(52.2)	42(48.3)	52(55.9)
No	77(42.8)	40(46.0)	37(39.8)
Missing values	9(5.0)	5(5.7)	4(4.3)
BMI status			
Underweight	3(1.7)	3 (3.4)	0.0
Normal weight	98 (55.1)	60(69.0)	38(40.9)
Overweight	58 (32.6)	21(25.3)	36(38.7)
Obese	19(10.7)	1(1.15)	18(19.4)
Missing values	2(1.1)	1(1.15)	1(1.0)

4.2 Prevalence of overweight and obese against risk factors

Prevalence of obesity and overweight varied among participants according to risk factors (Table 2).With respect to age group, prevalence of overweight and obesity was high in 31-40 age group (29(49.2%)) and (11(18.6%)) respectively compared to other age groups. With respect to sex, prevalence of overweight and obesity was high in females (36 (39.1%)) and 18(19.6%) compared to males (21(24.7%)) and 1((1.2%)) respectively.

On the other hand prevalence of overweight and obesity was high in post graduates (28(35.9%)) and (12(15.4%)) compared to undergraduate students (30(30%)) and (7(7%)) respectively. Based on physical activity level, overweight prevalence was high in participants engaged in light physical activity (12.4%) compared to participants engaged in vigorous physical activity (11.3%).Obesity prevalence was also high among individuals engaged in light physical activity (5.1%) compared to those engaged in vigorous physical activity (2.3%). With respect to fruits consumption, prevalence of overweight (25 (14.2%)) was high (7(40%)) in participants reported to consume fruits in 4 -6 days per week while obesity had high 10(5.7%) prevalence in participants reported to consume fruits 1-3 days per week . High prevalence of overweight (27(15.6)) and obesity (9(5.2%)) was observed in participants reported to consume vegetables 1-3 days per week.

Table 2: Prevalence of overweight and obesity against risk factors

Variable	Overweight n (%)	Obese n (%)
Age		
<20	6(54.6)	0(0.00)
20-30	17 (18.7)	4(4.4)
31-40	29(49.2)	11(18.6)
41-50	3(30)	3(30)
Sex		
Male	21(24.7)	1(1.2)
Female	36(39.1)	18(19.6)
Degree level		
Undergraduate	30(30)	7(7)
Post graduate	28(35.9)	12(15.4)
Smoking		
Non-smoker	58(32.6)	19(10.7)
Current smoker	0	0
Alcohol drinking		
Ever drinker	17(30.4)	6(10.7)
Never drinker	41(33.6)	13(10.7)
Fruits consumption (days/week)		
1-3	19(10.8)	10(5.7)
4-6	25(15.6)	3(1.7)
Other	7(40)	3(1.7)
Don't know	6(3.4)	2(1.1)
None	1(0.6)	0.00
Vegetables (days/week)		
1-3	27(15.6)	9(5.2)
4-6	13(7.5)	5(2.9)
Other	10(5.8)	2(1.2)
Don't know	7(4.1)	2(1.2)
None	1(0.58)	0.00
Employment status		
Yes	40(41.7)	15(15.6)
No	18(22)	4(4.90)
Marital status		
Never married	19(20.7)	3(3.3)
Married	39(47)	15(18.1)
Other	0	1(33.3)
Physical activity level		
Light	22(12.4)	9(5.1)
Moderate	16(9.0)	5(2.8)
Vigorous	20(11.3)	4(2.3)

4.3 Relationship between risk factors and obesity status.

Association between obesity status and risk factors was determined (Table 3). A significant association between obesity status and age groups ((P-value=0.004), sex (P-value<0.001), marital status (P-value=0.002) and employment (P-value =0.022) were observed. However no association that was observed between obesity and physical activity (P-value=0.147), smoking status (P-value=1), degree level (P-value=0.381) and alcohol consumption (P-value =0.979)

Table3 a): Relationship between risk factors and obesity status.

Variable	**Not obese n (%)**	chi2	P-value	**Obese** n (%)	chi2	P-value	**Total**
Age groups							
<20	11(100)			0			11
20-30	88(95.7)			4(4.3)		0.004*	92
31-40	48(81.4)		0.004*	11(18.6)			59
41-50	7(70)			3(30)			10
Smoking							
Non- smoker	159(89.3)		1*	19(10.6)		1*	178
Current smoker	1(100)			0			1
Drinking alcohol							
Ever drinker	51(87.9)			6(10.3)			57
Never drinker	109(89.3)	0.0007	0.979	13(10.7)	0.0007	0.979	122
Current marital status							
Never married	89(96.7)			3(3.3)			92
Married	69(83.5)		0.002*	15(16.5)		0.002*	84
Others	2(66.7)			1(33.3)			3
Degree level							
Undergraduate	94(92.2)			7(6.9)	2.1		102
			0.381*			0.381*	
Post graduate	66(84.6)			12(15.4)	2.1		78
Sex							
Male	84(96.6)	0.7		1(1.1)	7.2		
			<0.001			< 0.001	87
Female	75(80.6)	0.7		18(19.4)	6.8		93

P*=P-value for Fisher's exact test

Table3 b): Cont' Relationship between risk factors and obesity status

Variable	**Not obese n (%)**	chi2	P-value	**Obese**	chi2	P-value	**Total**
Fruits consumption							
(days/week)	73(86.9)			10(13.1)			82
1-3	45(93.8)			3(6.2)			48
4-6	22(88)		0.780*	3(120)		0.780*	25
Other	16(88.9)			2(11.1)			18
Don't know	2(100)			0(0.00)			2
None	4(800			1(20)			5
Missing values							
Vegetables consumption							
(days/week)	76(89.4)			9(10.6)			84
	35(87.5)		0.990*	5(12.5)			40
1-3	21(91.3)			1(8.7)			23
4-6	17(89.5)			2(10.5)		0.990*	19
Other	6(100)			0(0.00)			6
Don't know							
None							
Physical activity							
Light	47(85.5)	0.2		9(14.5)	1.6		56
Moderate	45(90)	0.0	0.147	5(10)	0.0	0.147	50
Vigorous	68(94.4)	0.3		4(5.6)	1.7		72
Employment status							
Yes	82(84.5)	0.3	0.022	15(15.5)	2.1	0.022	97 86
No	78(86)	0.3		4(3.5)	2.5		

P*= P-value for Fisher's exact test.

4.4 Logistic regression analysis results for risk factors of obesity.

Logistic regression (Table 4) was performed to predictor variables on obesity. Female sex was found to be a significant predictor variable of obesity status (COR=20.2, 95% CI=2.6-154.67and P-value=0.004).Being in age group of 20-30 years had reduced odds by 0.89 times (COR=0.11, 95% CI=0.02-0.57, P-value=0.010) compared to less than 20 years age group.

Physical activity was not a significant predictor variable of obesity status, however participants that reported to engage in vigorous physical activity had a reduced odds of obesity by 0.69 times compared to those engaged in light physical activity.

Table 4. Logistic regression analysis results for risk factors of obesity.

Variable	Not obese n (%)	Obese n (%)	COR(95% CI)	P-value
Age groups				
<20	11(100)	0	Ref	
20-30	88(95.7)	4(4.3)	0.11(0.02 - 0.57)	0.010
31-40	48(81.4)	11(18.6)	0.53(0.12 2.40)	0.414
41-50	7(70)	3(30)	1	
Physical activity				
Light	47(83.9)	9(16.1)	Ref	
Moderate	45(90)	5(10)	0.58(0.18- 1.86)	0.361
Vigorous	68(94.4)	4(5.6)	0.31(0.09-1.06)	0.061
Current marital status				
Never married	89(96.7)	3(3.3)	Ref	
Married	69(82.1)	15(17.9)	6.45(1.80-23.17)	0.004
Others	2(66.7)	1(33.3)	14.83(1.04-212.47)	0.047
Employment status				
Yes	82(84.5)	15(15.5)	Ref	
No	78(95.1)	4(4.9)	0.28(0.09- 0.88)	0.030
Sex				
Male	84(98.8)	1(1.2)	Ref	
Female	75(80.7)	18(19.3)	20.2(2.6 - 154.67)	0.004

1. Ref= Reference category
2. COR= Crude odds ratio

4.5 Multivariable analysis results for risk factors associated with obesity

Multiple logistic regression was performed to adjust for confounders of risk factors of obesity (Table 5). After adjusting for other independent variables (age groups, physical activity, Current marital and employment status), sex was the major significant predictor of obesity status. Female had 25 times odds of being obese compared to males (AOR=25.12, 95% CI=2.73- 232.42 and P-value=0.004). Participants in age group 20-30 years had reduced odds

of obesity compared to those in age group less than 20 years(AOR=0.07, 95% CI=0.01-0.9, P-value=0.041). On the other hand after adjusting for confounders (age groups, physical activity and sex), marital and employment status were not significant predictor variables of obesity status in this study (P-value>0.05, at 95% C I).

Table 5: Multivariable analysis results for risk factors associated with obesity

Variable	Not obese (%)	Obese (%	AOR(95% CI)	P-value
Age groups				
<20	11(100)	0	Ref	
20-30	88(95.7)	4(4.3)	**0.07(0.01 - 0.90)**	**0.041**
31-40	48(81.4)	11(18.6)	0.26(0.03 - 2.17)	0.213
41-50	7(700	3(30)	1	
Current marital status				
Never married	(96.7)	3.3	Ref	
Married	(82.1)	17.9	0.92(0.12- 7.19)	0.939
Others	(66.7)	33.3	11.14(0.06 - 1956.70)	0.361
Physical activity				
Light	47(83.9)	9(16.1)	Ref	
Moderate	45(90)	5(10)	1.16(0.30 - 4.53)	0.832
Vigorous	68(94.4)	4(5.6)	0.97(0.22 - 4.20)	0.966
Employment status				
Yes	82(84.5)	15(15.5)	Ref	
No	78(95)	4(95.1)	0.48 (0.09 - 2.54)	0.392
Sex				
Male	84(98.8)	1(1.2)	Ref	
Female	75(80.7)	18(19.3)	**25.12(2.73- 232.42)**	**0.004**

1. Ref= Reference category
2. AOR= Adjusted odds ratio

CHAPTER FIVE

5.0 DISCUSSION

5.1 Prevalence of overweight and obesity

The purpose of this study was to determine the prevalence of obesity and factors associated with obesity among School of Public Health students. Based on body mass index classification (BMI) majority of participants were of normal weight.

Obesity and overweight prevalence in this study were high compared to that found among University for Development Studies medical students in Tamale, Ghana(V Mogre, 2014) which reported a relatively low prevalence. This may be explained by the difference in the age structure of the study participants. In this study participants aged 18-49 years while in the latter participants aged 20-34 years. There were no obese participant in a less than 20 years age group. This might be due to the fact that participants in this age group are likely to engage in vigorous and moderate physical activities such as sports, walking and cycling compared to the rest of the age groups. Overweight and obesity prevalence was high in age group greater than 30 years relative to lower age groups. This is likely to be caused by less participation in physical activities (sedentary life style) leading to high accumulation of energy than that expended resulting in putting on more weight. This increases their likely chance of becoming overweight and obese. These findings concurs with a study done in India (Chhabra & Chhabra, 2007) which reported a significant association between age and risk of obesity. This implies that if measures to control overweight and obesity do not take into account of age structure of the population, the prevalence of overweight and obesity will continue.

Prevalence of overweight and obesity was zero based on smoking status of participants. This is different from that reported in a study done in Brazil (Alves, Falcão, Pinto, & Correia, 2011)

which reported high prevalence of overweight and obesity. This may be due to the fact the study population was smaller compared to the latter. Although quitting from smoking have been reported to be associated with weight gain it does not mean that smokers should continue the habit since the disadvantages of smoking are more compared to the advantages of not smoking.

Overweight and obesity prevalence were higher in females compared to males. These findings were different from findings reported from a study done among students of the Belgrade University, Serbia (Gazibara, 2013) and Lebanese university students, (Yahia et al., 2008) which found high prevalence of overweight and obesity in males than females. This may be due to different factors such as life styles differences between males and females in this setting compared to the later. This is because females in western countries are concerned much with slender body image in contrast to African settings where fatty body is counted as a sign of wealth. However these findings concurs with those reported in a study done in Nigeria (Olusanya & Omotayo, 2011) and findings from the University for Development Studies (Tamale, Ghana) which found high prevalence of overweight and obesity in females compared to male. This is likely to be due to the fact that this study setting is similar with the later in cultural and socio-economic aspects. Being female is highly associated with risk of overweight and obesity. This is because females tends to deposit more fats in their body especially during reproductive ages. This means therefore that females have high risk of being overweight and obese compared to males.

With respect to alcohol, prevalence of overweight and obesity was almost the same in both ever drinkers and nerve drinker participants. This finding is similar to that reported in a study done in Ghana, Tamale(V Mogre, 2014).This similarity may be due to the fact that these two

setting have similar cultural characteristics since large number of participants come from the same country (Ghana).However, though alcohol consumption showed no significant effect on overweight and obesity, its consumption should be in moderation since alcoholic drinks contains high energy and alcohol is known to be associated with increased risk of liver cirrhosis in the human body.

With respect to marital status, results showed that married participants had high prevalence of overweight and obesity compared to unmarried participants. The effects of marriage and divorce on weight may be due to the influence of marriage on inducement to eat (e.g., shared meals) or on motivation for weight control (Sidik & Rampal, 2009).These findings concurs with those reported in a study done in Urban India among women based on economic stratum (Gouda & Prusty, 2014) which found that being married was associated with an increased risk of overweight and obesity. This finding implies that being married is associated with increased risk of overweight and obesity.

Prevalence of overweight and obesity was high in participants reported to engage in light physical activities compared to those reported to engage in either moderate or vigorous physical activities. In addition, large number of males engaged in physical activities compared to females as reported in many other studies (Carlson, Fulton, Pratt, Yang, & Adams, 2014). This might explain the high prevalence of overweight and obesity among females compared to males. These findings concurs with those reported from a study done in Tamale, Ghana (V Mogre, 2014) which found that prevalence was high in females and individuals reported to engage in light physical activity. On the other hand these findings contrast to those reported from a study in China (Chen et al., 2013b) which found a significant association between physical activity and obesity. This is probably due to the reasons that most Chinese students

are likely to engage in regular physical activity compared to students in many African countries including this study setting. The implication from these findings is that physical activities such as gymnastics, walking and bicycling should be encouraged from individual to population level by respective authorities (household to governmental level). This finding implies that participation in physical activities reduces the risk of overweight and obesity in the population. Prevalence of obese was high in post graduate students compared to undergraduate students. This may be due to the fact that large number of graduate students are older than the undergraduate students and hence less active. In addition, most post graduate students are likely to be employed compared to undergraduates. This makes them to have a likelihood of diverse eating habits leading to weight gain.

The use of fruits and vegetables, whole grains and lean meats have been reported to help in weight control programmes (Pobee, Plahar, & Owusu, 2013).This may be described by the fact that fruits and vegetables do contain little energy that contributes to weight gain (Yahia et al., 2008,). According to Tetens and Alinia, (2009) "fruits and vegetables consumptions help in the control of overweight and obesity". The association between fruits (P-value=0.78) and vegetable (P-value=0.990) consumption against obesity status was not significant, though obesity was observed to be high in participants reported to consume fruits one to three days per week. These findings are consistent with those reported in a study conducted in Nigeria (Onyechi & Okolo, 2009) which found no association between fruits and vegetables consumption against overweight and obesity. However these findings does not mean that fruits and vegetables are not important in a diet but rather they should always be part of the food in order to provide the body with vitamins and minerals respectively. In addition apart from vitamins and minerals, fruits and vegetables also provide fibres and other substances that are

good for health. Fibres reduces the risk of some cancers and other chronic diseases (Flegal, Carroll, Ogden, & Curtin, 2010).. Overweight and obese individuals are advised to eat more fruits and vegetables before main meal in order to reduce the amount of food (energy dense) to be eaten at a time. This helps to prevent more weight gain in these individuals.

With respect to employment status, prevalence of overweight and obesity was high in employed individuals compared to unemployed individuals. However no significant association observed between employment and obesity status. Similar findings were reported in a study done in Delhi, India (Chhabra & Chhabra, 2007) which reported high prevalence of overweight and obesity in employed participants relative to unemployed ones. This might be attributed to the fact that a person's employment status determine what he or she eats. Also a person with good economic status is likely to use motor cars in traveling from one place to another compared to a person with poor economic status.

5.2 Factors associated with obesity

In this study it was observed that female had greater odds of obesity compared to males. This results concurs with a study done in Tamale (Mogre, 2014), Korea among elderly (Kim, Chun, & Kwon, 2011) and Accra Ghana, among adults (Addo, Smeeth, & Leon, 2009). This similarity may be due to the fact that biologically females deposit more fat than males. However this study findings are in contrast to those found from among Inner Mongolia Medical students in China (Chen et al., 2013b). This difference may be due to the fact that female subjects involved in Mongolia study were being the only child in their families and staying up late in the night. This criteria might have contributed to most female to have less risk of being obese. In addition this may be accounted by the life styles differences among

male and females in these study settings. This implies that gender is a risk factor for overweight and obesity.

Age have been reported to be one of the determinants of overweight and obesity in different populations. In this study, results showed that as age advances the odds of being obese increases compared to lowest age. This finding is similar to that reported in a study done in Ghana among Urban women (Benkeser et al., 2012) and that reported in study conducted in Saudi Arabia population (El-Hazmi & Warsy, 2002). This similarity might be attributed to the fact that as an individual advances in age, fats content in the body increase due to reduced metabolic and physical activities.

Marital status have been reported to influence obesity from various studies. Findings from this study showed that marital status was not a predictor for obesity. These findings contrasts a study done in Greek among adults (Tzotzas et al., 2010) and those found in a study conducted in Selangor, Malaysia (Sidik & Rampal, 2009) which reported a significant marital status in predicting obesity. These differences might be attributed to low proportion of married participants in this study compared to the later studies which reported high proportion of married participants. Results from this study implies that marital status has no effect on the risk of overweight and obesity.

Employment status have been reported by various studies to be one of good predictor of obesity. In this study being employed was not a predictor of obesity, though unemployed participants had reduced odds of obesity compared to the employed ones. This finding concur with that reported by a study that was conducted in Accra and Kumasi, Ghana (Martín, Nieto, Ruiz, & Jiménez, 2008) which reported that employed people had increased odds of becoming obese compared to unemployed people. This may be due to the fact that employed people are

highly exposed to modifiable risk factors associated with obesity (e.g. Physical inactivity, alcohol consumption and unhealthy diet) in developing countries. On the other hand contrast findings were reported in a study done in Korea, among elderly population and Spanish adults (Kang, Lee, Lee, Linton, & Shim, 2013; Martín et al., 2008), where unemployed individuals had high risk of becoming obese compared to employed people. This differences may be attributed to the fact that employed people with good economic status in developed countries like Spain are likely to eat healthy foods compared to people with low economic status. This finding implies that being employed is associated with an increased risk of overweight and obesity.

Physical inactivity have been reported to be associated with overweight and obesity (Al-Nuaim et al., 2012). This is because individuals who do not perform physical activity regularly accumulates more energy in their body than the energy which they spend leading to weight gain. In this study physical activity showed no significant effect on obesity prediction. However it was realized that individuals engaged in physical activities had a reduced odds of being obese compared to those who did not engage in physical activities. This finding is consistent with those reported by other studies including Tamale, Ghana (Victor Mogre, Nyaba, & Aleyira, 2014). This means that individuals who regularly engage in physical activities reduces the risk of overweight and obesity e.g. At the school level, use of bicycles and gyms may help to reduce the obesity incidence while community and national levels provision of recreational areas and good designing of town and cities by allowing possibility of walking (pedestrians) may help to reduce the problem.

In general these findings implies that comprehensive and multsectorial approach is needed in order to design health intervention on obesity epidemic in universities and young/middle

adults' population in Ghana. Otherwise healthy education on health living lifestyle is still needed in order to overcome obesity among students since it is a risk factor for other diseases like type 2 diabetes, hypertension, cancer and cardiovascular diseases.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

Prevalence of obesity among university students in this study was high. This shows that, obesity is a growing public health problem in higher learning institution in Ghana. In addition prevalence of obesity was relatively high among participants who did not engage in regular physical activities that meets WHO recommendation for achieving better health. Age group and being female were found to be significant risk factors of obesity. Smoking status, physical activity, fruits and vegetable consumption showed no effect in obesity prediction.

6.2 Recommendation

The School cannot do anything on the assessed significant risk factors of Obesity (Age group and female sex). However further studies should be done to assess other possible significant risk factors of obesity in academic environment e.g. Duration of sleep, stress, peer influences and eating habits.

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APPENDICES

Appendix 1: Questionnaire

Topic: Assessment of factors contributing to obesity among school of Public Health Students University of Ghana

STUDENT INFORMATION

Student identification and Date		Response	Code
1	Degree programme ID	⌊_⌊_⌊_⌊_⌋	11
2	Degree programme name		12
3	Interviewer ID	⌊_⌊_⌊_⌋	13
4	Date of completion of the instrument		14

Student Id Number ⌊_⌊_⌊_⌋ ⌊_⌊_⌊_⌊_⌋ ⌊_⌊_⌊_⌊_⌋			
Consent, Interview Language and Name			
5	Consent has been read and obtained		15
6	Time of interview (24 hour clock)		16
Additional Information that may be helpful			
7	Contact phone number where possible		18

Step 1 Demographic Information

Question		Response	Code
8	Sex	**Male 1** **Female 2**	C1
9	How old are you?	**Years** ⌊_⌊_⌋	C3

12	What is your marital status?	Never married 1	C7

		Currently married 2 Separated 3 Divorced 4 Widowed 5 Cohabitating 6 Refused 88	
13	Which of the following best describes your main work status over the past 12 months?	Government employee 1 Non-government employee 2 Self-employed 3 Non-paid 4 Unemployed (able to work) 8 Unemployed (unable to work) 9 Refused 88	**C8**

Step 1 Behavioural Measurements

Tobacco Use			
Now I am going to ask you some questions about various health behaviours. This includes things like smoking, drinking alcohol, eating fruits and vegetables and physical activity. Let's start with tobacco			
Question		**Response**	**Code**
13	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes?	Yes 1 No 2, if No, go to T6	T1
14	Do you currently smoke tobacco products **daily**?	Yes 1 No 2, if No, go to T6	T2
15	How old were you when you **first started** smoking daily	Age (years) Don't know 77 ⌊_⌋⌊_⌋ *If Known, go to T5a*	T3
16	Do you remember how long ago it was?	In Years ⌊_⌋⌊_⌋ *If Known, go to T5a*	T4a
		OR in Months ⌊_⌋⌊_⌋ *If Known, go to T5* *Don't know 77a*	T4b
		OR in Weeks ⌊_⌋⌊_⌋	T4c
23	On average, **how many** of the following do you smoke each day?	Manufactured cigarettes ⌊_⌋⌊_⌋	T5a
		Hand-rolled cigarettes ⌊_⌋⌊_⌋	T5b
		Pipes full of tobacco ⌊_⌋⌊_⌋	T5c
		Cigars, cheroots, cigarillos ⌊_⌋⌊_⌋	T5d
		Other ⌊_⌋⌊_⌋ *If Other, go to T5other, else go to T9* *Don't know 77*	T5e

		Other (please specify): ⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌋ *Go to T9*	T5other

Tobacco Use			
Question		**Response**	Code
24	In the past, did you **ever** smoke **daily**?	Yes 1 No 2 *If No, go to T9*	T6
25	How old were you when you **stopped** smoking **daily**?	Age (years) Don't Know 77 ⌊_⌊_⌋ *If Known, go to T9*	T7
26	How **long ago** did you stop smoking daily?	Years ago ⌊_⌊_⌋ *If Known, go to T9*	T8a
		OR Months ago ⌊_⌊_⌋ *If Known, go to T9*	T8b
		OR Weeks ago ⌊_⌊_⌋ *Don't know 77*	T8c
27	Do you **currently use** any **smokeless tobacco** such as *[snuff, chewing tobacco, betel]*?	Yes 1 No 2 *If No, go to T12*	T9
28	Do you **currently use smokeless tobacco** products **daily?**	Yes 1 No 2 *If No, go to T9* *Don't know 77*	T10
29	On average, how many **times a day** do you use ….	Snuff, by mouth ⌊_⌊_⌋	T11a
		Snuff, by nose ⌊_⌊_⌋	T11b
		Chewing tobacco ⌊_⌊_⌋	T11c
		Betel, quid ⌊_⌊_⌋	T11d
		Other ⌊_⌊_⌋ *If Other, go to T11other, else go to T13*	T11e
		Other (specify)	T11other

		⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌋ *Go to T13* *Don't know 77*	
30	In the **past**, did you **ever use** smokeless tobacco such as *[snuff, chewing tobacco, or betel]* **daily**?	Yes 1 No 2	T12
31	During the past 7 days, on how many days did someone **in your home** smoke when you were present?	Number of days Don't know 77 ⌊_⌊_⌋	T13
32	During the past 7 days, on how many days did someone smoke in closed areas **in your workplace** (in the building, in a work area or a specific office) when you were present?	Number of days Don't know or don't work in a closed area 77 ⌊_⌊_⌋	T14

Alcohol Consumption			
The next questions ask about the consumption of alcohol.			
Question		**Response**	**Code**
33	Have you **ever** consumed an alcoholic drink such as beer, wine, spirits, fermented cider or *[add other local examples]*?	Yes 1 No 2 *If No, go to D1*	A1a
34	Have you consumed an alcoholic drink within the **past 12 months**	Yes 1 No 2 *If No, go to D1*	A1b
35	During the past 12 months, **how frequently** have you had at least one alcoholic drink?	Daily 1 5-6 days per week 2 1-4 days per week 3 1-3 days per month 4 Less than once a month 5	A2
36	Have you consumed an alcoholic drink within the **past 30 days**?	Yes 1 No 2 *If No, go to D1*	A3
37	During the past 30 days, on how many **occasions** did you have at least one alcoholic drink?	Number Don't know 77 ⌊_⌊_⌋	A4
38	During the past 30 days, when you drank alcohol, **on average**, how many **standard alcoholic drinks** did you have during one drinking occasion?	Number Don't know 77 ⌊_⌊_⌋	A5

39	During the past 30 days, what was the **largest number** of standard alcoholic drinks you had on a single occasion, counting all types of alcoholic drinks together?	Largest number Don't Know 77 ⌊_⌋⌊_⌋	A6
40	During the past 30 days, how many times did you have for **men**: **five or more** for **women**: **four or more** Standard alcoholic drinks in a single drinking occasion?	Number of times Don't Know 77 ⌊_⌋⌊_⌋	A7

Alcohol Consumption			
41	During the past 30 days, when you consumed an alcoholic drink, how often was it with meals? Please do not count snacks	Usually with meals 1 Sometimes with meals 2 Rarely with meals 3 Never with meals 4	A8
42	During each of the **past 7 days**, how many standard alcoholic drinks did you have each day?	Monday ⌊_⌋⌊_⌋	A9a
		Tuesday ⌊_⌋⌊_⌋	A9b
		Wednesday ⌊_⌋⌊_⌋	A9c
		Thursday ⌊_⌋⌊_⌋	A9d
		Friday ⌊_⌋⌊_⌋	A9e
		Saturday ⌊_⌋⌊_⌋	A9f
		Sunday ☐☐ *Don't know 77*	A9g

Diet			
The next questions ask about the fruits and vegetables that you usually eat.			
Question		**Response**	**Code**
46	In a typical week, on how many days do you **eat fruit**?	Number of days Don't Know 77 ⌊_⌋⌊_⌋ *If Zero days, go to D3*	D1
47	How many **servings** of fruit do you eat on **one** of those days?	Number of servings Don't Know 77 ⌊_⌋⌊_⌋	D2

48	In a typical week, on how many days do you **eat vegetables**?	Number of days ⌊_⌋⌊_⌋ *If Zero days, go to D5* Don't Know 77	D3
49	How many **servings** of vegetables do you eat on one of those days?	Number of servings ⌊_⌋⌊_⌋ Don't know 77	D4

Diet			
50	What type of **oil or fat is most often** used for meal preparation in your most consumed foods?	Vegetable oil Lard or suet Butter or ghee Margarine Other *If Other, go to D5 other* None in particular None used Don't know Other ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋	D5 D5other
51	On average, how many meals per week do you eat that are not prepared at a home/room? By meal, I mean breakfast, lunch and dinner.	Number Don't know 77 ⌊_⌋⌊_⌋	D6

Physical Activity			
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed]*. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.			
Question		**Response**	**Code**
Work			
52	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously? *[*	Yes 1 No 2 *If No, go to P 4*	P1
53	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days ⌊_⌋	P2

54	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ☐☐ : ☐☐ hrs mins	P3 (a-b)
55	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10minutes continuously?	Yes 1 No 2 *If No, go to P 7*	P4
56	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days ☐	P5
57	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ☐☐ : ☐☐ hrs mins	P6 (a-b)
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. *[Insert other examples if needed]*			
58	Do you walk or use a bicycle *(pedal cycle)* for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
59	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ☐	P8
60	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ☐☐ : ☐☐ hrs mins	P9 (a-b)

Physical Activity		
Question	**Response**	**Code**
Recreational activities		
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), *[Insert relevant terms]*.		
61 Do you do any vigorous-intensity sports, fitness or recreational *(leisure)* activities that cause large increase in breathing or heart rate like *[running or football]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P 13*	P10

62	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational *(leisure)* activities?	Number of days ⌊_⌋	P11
63	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs mins	P12 (a-b)
64	Do you do any moderate-intensity sports, fitness or recreational *(leisure)* activities that cause a small increase in breathing or heart rate such as brisk walking, *[cycling, swimming, and volleyball]* for at least 10minutes continuously?	Yes 1 No 2 *If No, go to P 16*	P13
65	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational *(leisure)* activities?	Number of days ⌊_⌋	P14
66	How much time do you spend doing moderate-intensity sports, fitness or recreational *(leisure)* activities on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs mins	P15 (a-b)

Physical Activity			
Sedentary behaviour			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.			
67	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs mins	P16 (a-b)

Step 2 Physical Measurements

Height and Weight			
Question		**Response**	**Code**
74	Interviewer ID	⌊_⌋⌊_⌋⌊_⌋	M1
75	Device IDs for height and weight	Height ⌊_⌋⌊_⌋ Weight ⌊_⌋⌊_⌋	M2a M2b
76	Height	in Centimetres (cm)	M3
77	Weight *If too large for scale 666.6*	in Kilograms (kg)	M4

Appendix 2: Informed Consent form for participants

Research Topic: Assessment of factors contributing to Obesity among School of Public Health students, University of Ghana-Legon.

Principal Investigator. FURGENCE. F. BIRUKUNDI

You are invited to participate in this research study. The purpose of the research is for academic and policy development for the school on health life style for students. Your participation will include taking body measurements (weight and height) twice (in order to get average weight and height) and filling of questionnaire to be provided to you if agreed. It will take just about 10 minutes to complete the activity.

Risks and discomforts

There are no known risks associated with this research.

Potential benefits

There are no direct benefits to you that would result from your participation in this research. However, this research will help us to know your health condition and the health condition of students at the school of Public Health in general.

Protection of confidentiality

Your name will not be revealed in questionnaire or any publication resulting from this study. Otherwise all your answers will be treated private and confidential as much as possible.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study. No compensation expected for your participation (neither monetary nor any other incentive). However, your participation will be highly appreciated.

Participant

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study.

Participant's signature_____ Date_____

Investigator declaration

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Investigator's signature_____ Date_____

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact:

Ms Hannah Frimpong (Ghana Health Service Ethical Review Committee administrator)

Mobile phone no: 0243235225 or 0507041223

Appendix 3: Ethical Approval Letter