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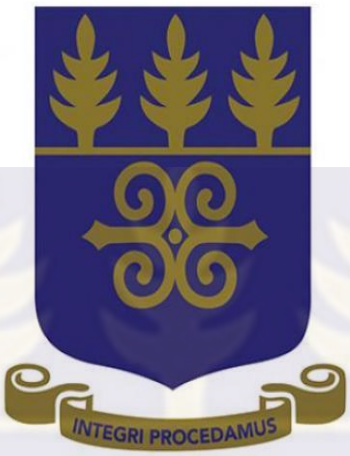

FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG ADOLESCENTS IN SENIOR HIGH SCHOOLS IN THE GA CENTRAL MUNICIPALITY

BY

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DECLARATION

I, Prince Osei hereby declare that apart from references to other people's works, which have been duly acknowledged, this dissertation is as a result of my own independent work and has not been submitted for the award of any degree in any institution.

……. ……..

Date …….. Date……..

OSEI PRINCE DR. ERNEST KENU

(STUDENT) (SUPERVISOR)

Dedication

I dedicate this work to my mother, Hellina Darkoaa– I couldn't have done this without your love.

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To the Almighty God, my light, my strength, my shepherd. To my supervisor, Dr Ernest Kenu, your advice, comments, input, suggestions and encouragements are invaluable. To the Lecturers in the Department of Epidemiology and Disease Control, thank you for imparting knowledge. To Headmistress and Staff of Ordogono Senior High especially, Mrs. Benedicta Gyamfua and the headmaster on of Apostle Safo Senior High School Dr. Micheal Huges. Your enthusiasm and help cannot go unnoticed. To my research team, Belinda Kesima, Charlotte Okae and Terrence I, I'm thankful that I could rely on you. I know you were an angel sent by God to provide directions for me. I appreciate all your input. To all the students (and their guardians) who participated in this study, thank you for trusting me with your information. This has only been possible because of your willingness to participate. Finally, to all my family. Your support during this period cannot go unnoticed. God bless you all.

ABSTRACT

Introduction: Obesity has been described as an epidemic with more than one-third of children aged of 2 to 19, said to be overweight or obese. Adult obesity has been strongly linked to obesity in childhood and adolescence. It is therefore imperative to tackle this problem in the adolescent stage, to prevent entering adulthood with one of the major risk factors for Non-Communicable Diseases. Known immediate consequences of obesity include self-esteem, reduced cognitive capabilities, and memory functions. The aim of this study was to investigate the prevalence of overweight/obesity and factors associated with it.

Methods: A descriptive cross-sectional study was done. A mixed public and private school in the Ga Central Municipality, Accra with students belonging to families to the high and low socio-economic class was selected. A multi-stage sampling design was used to select the form (based on years spent in school) and classes (based on courses offered). A simple random sampling was then used to select a representative sample of 219 adolescents (aged 10 to 19) in the school. Pre-coded structured questionnaires were administered to obtain information on socio-demographics, genetic, dietary and general lifestyle factors. Using a standardized protocol, height (to the nearest meters) and weight (to the nearest kilogram) were measured. Overweight was defined as BMI for Age Z-Scores ($BAZ) > +1\ SD \leq BAZ +2$, while obesity as $BAZ > +2\ SD$ using the World Health Organization Anthro plus growth Chart (WHOanthro plus). Data were assessed for association using Pearson's chi-squared test and binary/multivariate logistic regression analysis after adjusting for covariates.

Results: The prevalence of underweight, overweight and obesity was 15%, 9.59% and 11.42% respectively. The overall overweight/obesity is 21.01% The risk factors associated with overweight and obesity in this study were gender, having a slim/slender father or relative, engaging in less or no vigorous physical activity, the number of meals taken in a day,. These were statistically significant (P<0.005). However, there was no significant association between overweight/obesity and lifestyle factors.

Conclusion: There was an association between overweight/obesity and number of meals taken per day, physical activities and gender among adolescents in Senior High Schools the in GA Central Municipality.

Keywords: Obesity, overweight, adolescents, senior high schools, Body Mass Index

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LIST OF ACRONYMS

AOR	ADJUSTED ODDS RATIO
BAZ	BMI FOR AGE Z-SCORES
BMI	BODY MASS INDEX
CDC	CENTERS FOR DISEASE CONTROL
CI	CONFIDENCE INTERVAL
COR	CRUDE ODDS RATIO
GCMA	GA CENTRAL MUNICIPAL ASSEMBLY
NCD	NONCOMMUNICABLE DISEASE
SD	STANDARD DEVIATION
SHEP	SCHOOL HEALTH EDUCATION PROGRAM
SHS	SENIOR HIGH SCHOOL
WHO	WORLD HEALTH ORGANISATION

CHAPTER ONE

INTRODUCTION

1.1 Background

Obesity is defined as a condition in which there is an abnormal or accumulation or excessive body fat that impairs or presents a risk to health(WHO, 2010a). The causes of obesity are complex and multiple leading to an imbalance between energy intake and output often termed as an energy imbalance between calories consumed and calories expended.

WHO defines obesity as the Body Mass Index as equal to or greater than 30 kg/m2 or (BMI) > 2 standard deviations above the World Health Organization (WHO) growth standard median for 5 to 19 year olds (WHO, 2006) while the CDC uses the BMI for age growth charts which takes into account the sex and categorizes obese as >95th percentile (Kuczmarski, Ogden, Grummer, Flegal, Guo, Wei & Johnson 2000).

Obesity is a disease and a known risk factor associated with many conditions such as high blood pressure, heart disease, stroke, diabetes, joint problems such as osteoarthritis, sleep apnea and respiratory problems, gallstones, kidney stones, infertility (Bogers, Bemelmans, Hoogenveen, Boshuizen, Woodward, Knekt, &Shipley, 2007); cancers of the esophagus, pancreas, breast, colon and rectum, gallbladder, ovary, endometrium and prostate (Wiseman, 2008); and Psychosocial effects like depression from bias and discrimination (Abubakari & Bhopal, 2008).

There are different ways of measuring obesity but it is difficult to develop one simple index for the measurement of obesity in children and adolescents because their bodies undergo a number of physiological changes as they grow. It is however often measured as an excessive weight for a given height which is the Body Mass Index (BMI). It is defined as a person's weight in kilograms divided by the square of the height in meters (kg/m2) (Swamy, 2011; WHO, 2006).

Studying obesity in adolescence is of importance because the adolescents are known to carry the obesity into adulthood and hence develop Non-Communicable Diseases (NCDs) early in their early years of adulthood. For most obesity-related NCDs, the risks are associated with the age of onset and on the duration of obesity. It is important to note that obese adolescents tend to suffer from both short-term and long-term health consequences of obesity (WHO, 2008).

Unfortunately, children and adolescents do not usually make the decisions on the environment in which they live or the food they eat. The long-term consequence of their behavior is probably not immediately clear to them hence their irresponsible dieting and physical inactivity.

Westernization has led to new eating patterns, which affect dietary habits and even pattern of consumption (Lobstein, Baur, & Uauy, 2004). Changes in diets and lifestyles that have occurred with industrialization, urbanization and the world food economy have had a significant impact on the health and nutritional status of populations, especially in developing countries. This has reflected in the shifting dietary patterns of increased consumption of energy-dense diets that are high in fat, particularly polysaturated fatty acids

and high in refined carbohydrates. This has led to protection from some nutritional deficiencies but not nutritional imbalance(Mendoza, Drewnowski, & Christakis, 2007; Mozaffarian, Hao, Rimm, Willett, & Hu, 2011; WHO, 2006).

These changing dietary patterns combined with a decline in energy expenditure associated with motorized transport, labor-saving devices in the home, the decline in physical demanding manual tasks in the workplace, and the leisure time that is devoted to physically undemanding activities lead to obesity(Chatterjee & DeVol, 2012; Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpelä, 2005; WHO, 2010) .

Adolescents are exposed to foods that are high in fat, high in sugar, high in salt, energy dense, and poor in micronutrients(Cole, Bellizzi, Flegal, & Dietz, 2009). These foods are lower in cost and have little nutrient quality. This pattern of diet together with increased levels of physical inactivity from the increasingly sedentary nature of many forms of leisure or recreational time, changing modes of transportation, and increasing urbanization, results in sharp increases in adolescent obesity (Chatterjee & DeVol, 2012; Mendoza et al., 2007). Until recently obesity was thought to be rare in developing or low and middle-income countries. It is now being reported in Africa.

1.2 Problem Statement

Epidemiological evidence in several studies has documented the dramatic rise in overweight and obesity in both adults and children (Ogden, Carroll, Kit, & Flegal, 2012; Stamatakis, Wardle, & Cole, 2009; Wang Y, 2006). Recent statistics show that among children and adolescents in developed nations, 23.8% boys and 22.6% girls were overweight or obese in 2013. In developing nations, the figure stood at 8.1% to 12.9% in

2013 for boys and from 8.4% to 13.4% in girls (Ng M1, Fleming T1, 2014). But a realization of this problem has seen a slow and clumsy pivot to develop efforts that will address it (Agyei- Mensah & de-Graft Aikins, 2010)

2007 WHO report showed that Ghana had the highest prevalence of overweight and obesity in West Africa (World, 2007). Among children, prevalence studies that used similar measures in Ghana shows that there are 12.20%, and 0.80% of overweight and obesity respectively among high school students in Kumasi metropolis, 17.4% among school-going children in Tamale aged 5-14 years, 10.9% in primary school students aged 5-15 years in Greater Accra and 11.7% among high school students aged 15-19 years in Greater Accra (Kumah et al., 2015; Mogre, Gaa, Nagumsi, & Abukari, 2013; Mohammed & Vuvor, 2012; V. Nyawornota, Aryeetey, Bosomprah, & Aikins, 2011). These clearly indicate that childhood obesity is a public health problem that may be affecting more than one in ten children in Ghana. However, beyond its prevalence, there are clearly documented immediate and chronic consequences of excess body fat (WHO 2010)

Factors contributing to obesity and overweight have been established in many types of research. Factors such as dietary habit, physical activity, socioeconomic status, lifestyle behaviours (such as smoking and intake of alcohol) and environmental factors have been associated with overweight and obesity(Addo, Nyarko, Sackey, Akweongo, & Sarfo, 2015; Alangea, 2014; Moayeri et al., 2006; Mohammed & Vuvor, 2012; Salifu, 2014; Webber et al., 2012) . Most of these studies have been done in other parts of the country in adults and few on adolescents. Therefore, there is a need to assess the risk factors of obesity and overweight of adolescent in the municipality. The outcome of this research is expected to

provide data to fill in the data gap and to reinforce existing studies on obesity in adolescents in Senior High Schools.

1.3 Justification

This study seeks to investigate factors of overweight and obesity in adolescents in Senior High school in Ga Central Municipality Moreover Modern Ghana (2007) alleges that overweight and obesity is more prevalent in the urban south, therefore finding a relationship between BMI and factors would have both epidemiological and national significance. Considering the objectives of this study, this research seeks to fill a gap by providing a baseline prevalence of overweight and obesity in the senior high school setting. This can serve as a basis for a bigger, nationally representative research. Also it would be useful in identifying risk factors and it effects of obesity and overweight, thus allowing proper planning of how to manage the effects by affected students, to assure the economic future of the nation. Therefore, this study, when completed will provide prevalence evidence, determine if there is any significant relationship between overweight/obesity and factors that influence such relationships.

Conceptual Framework

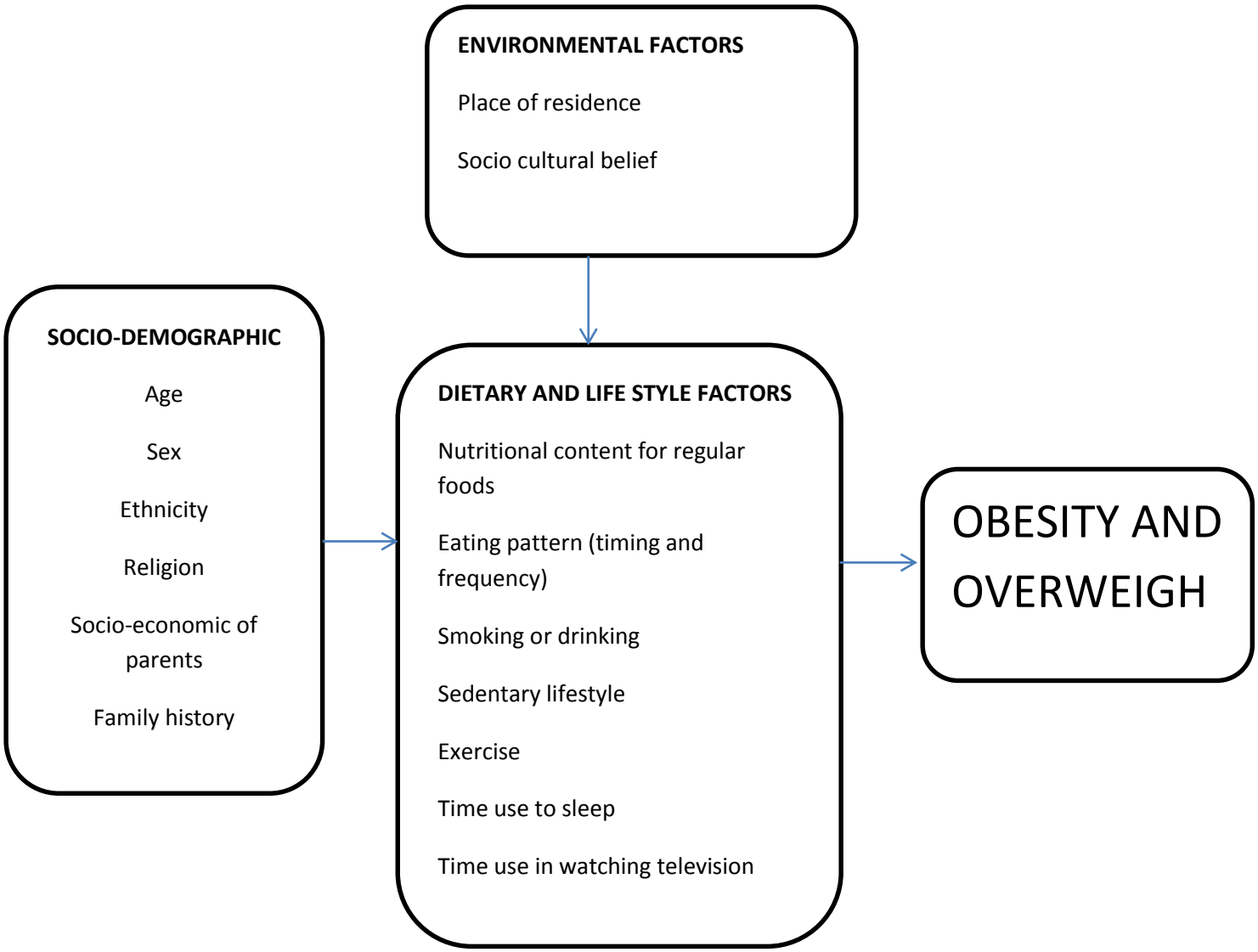

Figure 1: Conceptual framework of factors associated with obesity and overweight among adolescents

1.4 Conceptual framework

This study was based on a conceptual framework developed by the researcher based on several reviewed literature (Himathongkam, 2011; Sobal, 1991; Thanh, 2008; Verstraeten et al., 2014).

As such, most fundamental to a child's nutritional and weight outcome are individual or socio-demographic factors, such as the child's age, gender as well as parental/family factors including the parent's socio-economic status, education and weight history. These demographic factors may act directly to influence lifestyle and dietary behaviour which results in the weight outcome observed or they can then act through environmental and social factors to influence the lifestyle and dietary behaviour.

1.5 Objectives

1.5.1 General Objective

- To determine the prevalence and risk factors associated with obesity and overweight among adolescents in Senior High School in the Ga Central municipality

1.5.2 Specific Objectives

2. To determine the prevalence of obesity and overweight among adolescents in Senior High School in the Ga Central municipality

3. To determine the factors that are associated with obesity and overweight among adolescents in Senior High School in the Ga Central municipality.

1.6 Research Questions

1. What is the prevalence of obesity and overweight among adolescents in Senior High Schools in the Ga Central municipality?

2. What are the risk factors of obesity and overweight among adolescents in Senior High Schools in the Ga Central municipality?

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CHAPTER TWO

LITERATURE REVIEW

2.1 Prevalence of obesity

The prevalence of obesity is rising at a fast rate worldwide especially in developing countries(Martorell, Stein, & Schroeder, 2001). Once considered a problem of only high-income countries, overweight and obesity are now rising rapidly in low and middle-income countries, particularly in urban settings(Abubakari & Bhopal, 2008; Amoah, 2003).

While the part world is concentrated on infectious diseases like malaria and tuberculosis, overweight and obesity have become global pandemics leading to the dual or double burden of disease. The frightening issue with the obesity pandemic is that it affects both children and adults (Boutayeb, 2006; WHO, 2010b).

A cross-sectional study using a multistage stratified random sampling technique was conducted in Kuwait among 5402 intermediate school adolescents aged 10 to 14 years to find out the prevalence of obesity and overweight. The overall prevalence of overweight and obesity in their study was 30.7% and 14.6%, respectively, the prevalence of obesity among females and males were 14.2% and 14.9% respectively (El-Bayoumy, Shady, & Lotfy, 2009). In another cross-sectional study conducted among children 6 to 17 years to determine the prevalence of obesity in children and adolescents. The prevalence of obesity was 10.3% and 9.1% in males and females respectively, using the National Health and Nutrition Examination Survey NHANES I definition (Savva, Kourides, Tornaritis, Epiphaniou-Savva, M Chadjigeorgiou, & Kafatos, 2002). In a study of weight-for-height reference and the prevalence of obesity for school children and adolescents in Taiwan and

Fuchien areas, the prevalence of childhood and adolescent obesity was 18.5% in boys and 15.0% in girls. By comparing data, they concluded ages, the prevalence of childhood and adolescent obesity for both males and females were higher in 2002 compared to 1997. This evidence strongly indicates an increasing prevalence of obesity during childhood and adolescence in recent years, irrespective of sex (Huang, Wu, & Yang, 2003). Obesity has also increased throughout the developed and developing countries (WHO, 2010b).

A study that was done in Accra metropolis among children between 5-15 years indicated that 15.8% were overweight whiles 10.9% were obese. (Mohammed & Vuvor, 2012).

Another study that was done by Amoah and Bempong at Adansi North District in the Ashanti region on the prevalence of obesity among adolescent in senior high school reported prevalence of obesity to be 47.6%.(Amoh & Appiah-brempong, 2017).

A study in 1989 to describe the prevalence of overweight and obesity among Brazilian adolescents was done through a nationwide home-based survey involving 13,715 adolescents from 10 to 19 years of age. The prevalence of obesity and overweight was 7.7%, with 10.6% in the females and 4.8% in the males (Neutzling, Taddei, & Gigante, 2003).

In a study on secular trends in overweight and obesity among Finish adolescents from 1977 to 1999, they had a sample size of 64, 147 with a response rate of 78.9%. Their study concluded that obesity and overweight increased linearly in all sex and age groups from 1977 to 1999 (Kautiainen, Rimpelä, Vikat, & Virtanen, 2002). A study conducted in 2005 to determine the prevalence of overweight and obesity and associated factors among

students aged 11 to 17 years in Tehran, resulted in a prevalence of 17.9% and 7.1% respectively(Moayeri, Bidad, Aghamohammadi, Rabbani, Anari, Nazemi, & Hatmi 2006).

In Bahraini, a study was conducted to determine the prevalence of overweight and obesity among of 506 students (249 males and 257 females) between the ages of 12 and 17 years. The overall prevalence of obesity among Bahraini boys and girls was higher than was previously reported. Obesity was higher in females, 35% than in males 21% (Al-Sendi, Shetty, & Musaiger, 2003).

In general, research and existing data show a global increase in childhood and adolescent obesity(WHO, 2010b).

2.2 Causes of obesity

The causes of obesity are complex and multiple leading to an imbalance between energy intake and output often termed as an energy imbalance between calories consumed and calories expended.

The thrifty gene hypothesis postulates that there are certain ethnic groups which have a higher chance of being obese when exposed to the same environment as others. This could be the reason why it is the assumption that those who evolved in a desert ecosystem like the Pima Indians tend to develop some of the highest rates of obesity when they are exposed to a Western lifestyle (Schulz, Bennett, Ravussin, Kidd, Kidd, Esparza & Valencia, 2006). Some rare genetic conditions such as Prader-Willi syndrome, Bardet-Biedl syndrome, MOMO syndrome and Congenital leptin deficiency have obesity as the main feature (Ahmad, Ahmad, & Ahmad, 2010; Elena, Bruna, Benedetta, Stefania, & Giuseppe, 2012).

2.3 Measurement of Obesity

There are several ways in which obesity or body fat can be measured. The ideal method of checking body fat should accurately calculate the fat mass, be independent of other covariates of body mass such as height, be acceptable and reproducible, be inexpensive and have appropriate values of normality(Power, Lake, & Cole, 1997).

It is however impossible to measure directly the body fat in vivo (RAO, 2011). The direct methods and indirect methods have therefore been developed. The direct methods consists of Bioelectric Impedance (BIA), Underwater Weighing (Densitometry), Air-Displacement Plethysmography, Dilution Method (Hydrometry), Dual Energy X-ray Absorptiometry (DEXA), Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) while the indirect methods consist of Body Mass Index (BMI), Waist Circumference, Waist-to-Hip Ratio and Skinfold Thickness (Hu & Hu, 2008).

The direct methods are expensive, sometimes invasive and often require special equipment and skills. Although anthropometric measures are less accurate for measuring the excess body fat, they are less expensive, non-invasive and easy to use. The commonly used measurements are skin-fold thickness, weight, and height. Anthropometry allows measurement of variations in physical dimensions and gross composition of the human body. At different ages, anthropometric measurements serve as an indicator of nutritional status (WHO, 1986).

Body Mass Index is frequently used to categorize adolescents and adults into underweight, normal weight, overweight and obese. However, this ratio provides only a crude measure of body fatness and does not distinguish between weight associated with muscles and

weight associated with fat (WHO, 2006). BMI is also affected by physiological fluctuations in weight and height during growth at different age points in childhood and adolescence (Rolland-Cachera, 1995).

In 1995, the WHO recommended the use of percentile BMI-for-age for adolescents 10-19 years to differentiate underweight (<5th percentile), normal (>=5th to <85th percentile), overweight (>85th-<=95th percentile) and obese (>95th percentile) (WHO, 1995).

An expert committee declared BMI to be the principal measure of obesity in childhood because it is reproducible, valid and an easy measure of body fat (Bellizzi & Dietz, 1999). However, most studies have shown that BMI does not readily distinguish between body fat and muscle because it fails to take into account fat distribution making it a poor indicator of body fat.

A cross-sectional analysis was conducted using 474 healthy 17year old adolescents to evaluate the diagnostic accuracy of body mass index (BMI, kg/m2), waist circumference (WC) and waist-hip-ratio (WHR) as diagnostic tests for detecting fatness in adolescents using the measurements performed by air-displacement plethysmography as the reference. From the results, BMI and WC showed a strong positive correlation in both sexes than WHR leading to a conclusion that BMI and WC performed well as diagnostic tests for fatness than WHR (Neovius, Linne, & Rossner, 2004). There are also various proposed reference values for obesity for BMI but there are not enough references for WC and WHR (Cole, Bellizzi, Flegal, & Dietz, 2009).

2.4 Factors associated with obesity

The main risk factors for obesity are dietary habits, physical inactivity, physiological or metabolic, socioeconomic factors and family history or genetics.

2.4.1 Dietary Habits

You are what you eat. What we eat and how we eat influences energy balance and therefore influence our weight.

The macronutrient content of a diet determines the extent to which excess is stored and about 80% of the excess energy may be stored after carbohydrate overfeeding. The capacity for storage of carbohydrates is smaller compared to the almost unlimited capacity for storage of fat. Therefore, when excess carbohydrate in the body is not used it is converted to body fat (Joosen & Westerterp, 2006). Dietary fat tends to induce appetite and therefore encourages one to eat more than is needed (Drewnowski & Almiron-Roig, 2010).

From the (World Health Organization, 2003), there is convincing evidence that the factors that increase the risk of obesity include sedentary lifestyle, high intake of energy-dense and micronutrient – poor foods, increased number of fast-food outlets and marketing of energy-dense foods, high intake of sugar-sweetened carbonated drinks and fruit juices as well as low consumption of fruits and vegetables(Nishida, Uauy, Kumanyika, & Shetty, 2004).

In a randomised controlled trial of a primary school based intervention to reduce risk factors for obesity in Leeds, it was noticed that consumption of vegetable by 24-hour recall was lower in children in the control group than the intervention group. In the same study,

consumption of fruit was lower in obese children in the intervention group compared to those in the control group.

Similarly, in that study, a three-day recall diary showed a low consumption of highly sugary foods among overweight children in the control group than the intervention group. The study involved 634 primary school children aged 7 to 11 years (Sahota , Rudolf, Dixey, Hill, Barth, & Cade, 2001).

There appears to be a basic shift in dietary patterns, induced mainly by shifts in income, prices and food availability, and also by the modern food industry and the mass media. There are marked differences between urban and rural eating patterns, particularly regarding the consumption of food prepared away from home (Popkin, 2006).

Breakfast and lunch habits are associated with both overweight and obesity, eating breakfast was positively associated with not being overweight and obese (Grøholt, Stigum, & Nordhagen, 2008). Skipping and or infrequent intake of breakfast at home, frequent consumption of fast foods, low servings of fruits and vegetables per day, and frequent consumption of sweets, candy, and carbonated drinks were all predictors of obesity and overweight among the school children in Saudi Arabia (Amin, Al-Sultan, & Ali, 2007).The shift from traditional staples to processed foods in these developing (especially urban areas) is strongly enhanced by borrowed western culture (Neutzling, , Taddei, & Gigante 2003). Eating western food has become widely accepted in developing countries. Adolescents form part of this group of patrons. And as long as parents continue to leave the decision concerning what to eat to their wards, their wards are bound to patronize foods that may be unbalanced and unhealthy (WHO, 2010b).

2.4.2 Family History or genetics

Some conducted studies have shown an evidence that obesity can be inherited. Researchers have identified several genes that appear to be associated with obesity but most believe that one gene alone is not responsible for the entire obesity epidemic. From the results of study conducted on obesity in children and adolescents in Cyprus, the most significant associated factor for obesity was parental obesity status. Similarly, a study conducted earlier in Italy showed that parental obesity was the main risk factor for obesity in children (Maffei Maffeis, Consolaro, Cavarzere, Chini, Banzato, Grezzani, &Tatò, 2006).

The risk of childhood and adolescent obesity has been found to be associated with high parental body mass in another study conducted in Sao Paulo, Brazil. The study showed that the risk of childhood obesity was associated with having one or both parents obese, the risk increased when both parents were found to be obese (Da Costa Ribeiro, Taddei, Colugnatti, & Others, 2003).

A study has also shown an association between BMI of friends, siblings and spouses (Christakis, N. A., & Fowler, 2007). In a case control study to determine the risk factors associated with overweight and obesity among adolescents enrolled in private high schools in the city of Pelotas, southern Brazil, the results showed that overweight and obesity were positively associated with mother and father's BMI being greater than 30. Parental nutritional status was directly and significantly associated with overweight and obesity in adolescents. Adolescents whose parents' BMI was greater than 30 were two times more likely to be overweight or obese than those whose parents had BMI less than 30 (Neutzling, Taddei, & Gigante 2003). One study found that 80% of the offspring of two obese parents were obese in contrast to less than 10% of the offspring of two parents who were of normal

weight (Kopelman, 2005). The percentage of obesity that can be attributed to genetics varies from 6% to 85% depending on the population examined (Yang Huang & Wu, 2007). A child born into a family of overweight people may be predisposed to the condition, especially if there is high-calorie food consumption and decreased physical activity (Yang Huang & Wu, 2007).

Genes may predispose one to weight gain, but this weight can be lost by extra physical activity. Patterns of the prevalence of obesity are normally identified in certain families even if the family members do not live together or share the same patterns of exercise and food intake (Lyon & Hirschhornm, 2005).

According to Lyon and Hirschhornm (2005), estimates of heritability range from 30 to 70% with more specific estimates at 50% meaning about half of the variation in body mass within a population is a result of inherited factors. The predictable pattern of common forms of obesity doesn't follow the patterns seen in cases of cystic fibrosis and Huntington's disease rather it shows a 'complex pattern of segregation' which may indicate that multiple factors are involved (Lyon & Hirschhornm, 2005). Each of the obesity genes is likely to make a small contribution to body weight and by extension obesity. However, these obesity genes together with inherited variations play a large role in determining how an individual responds to the environmental factors of diet and physical activity. Veerman (2011) explains that genes may co-determine who becomes obese, but the environment determines how many become obese.

2.4.3 Physical Activities

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure.

In a study conducted from 2000 to 2004, physical inactivity was positively associated with being overweight and obese. There were more overweight and obese adolescents who were physically inactive compared to those who were physically active (Grøholt, Stigum, & Nordhagen, 2008).

In a randomised controlled trial of 634 primary school children aged 7 to 11 years in Leeds to reduce risk factors for obesity, it was found that sedentary lifestyle was higher in overweight children in the intervention group than the control group (Sahota, Rudolf, Dixey, Hill, Barth, & Cade, 2001).

The association between overweight and obesity and factors related to physical activity showed that adolescents using the bus or car transport to school were about 30% more likely to be obese compared with adolescents who cycled or walked. Furthermore, whereas overweight increased moderately with declining physical activity outside of school, the association with obesity was much stronger, with a doubling from the high to the low activity group. There was also an independent association between overweight and obesity and TV/PC use. Adolescents watching television/video 3 hours or more per day were about 60% more likely to be obese compared with adolescents watching television/video 0 to 2 hours per day (Savva, Kourides, Tornaritis, Epiphaniou-Savva,Chadjigeorgiou & Kafatos, 2002).

The American Academy of Pediatrics states that children and adolescents need 1-2 hours a day on screens but it has however estimated that the average child spends over 7 hours a day on internet usage, TV viewing and video games (American Acamedy of Pediatrics., 2013).

A sedentary lifestyle is positively associated with obesity, the amount of time spent in front of the television during adolescence has been found to be significantly associated with adiposity even after correction for obesity history (Kautiainen, Rimpelä, Vikat, & Virtanen, 2005).

Studies were reviewed to assess the role of television as a tool for childhood obesity prevention, results showed that television watching or viewing replaced more vigorous activities; there was an association between time spent watching or viewing television and being overweight or obese (Li, M., Dibley & Yan, 2011); the prevalence of obesity and the number of hours that TV networks dedicated to children have also increase increased; finally for the last 30 years, the rate at which children watch television for more than 4 hours per day has also increased (Caroli, Argentieri, Cardone, & Masi, 2004).

Physical activity and self-perceived physical fitness assessed in adolescents aged 16 to 18 years of age were used to predict the development of obesity in a study. The results showed that physical inactivity in adolescence strongly predicted the risk for obesity. The study also showed that poor physical fitness in adolescence also increased the risk for overall obesity. They concluded that physical inactivity in adolescence strongly and independently predicts total (and especially) abdominal obesity in young adulthood and therefore physical activity should be seriously recommended for obesity prevention in the young (Pietiläinen, Kaprio, Borg, Plasqui, Yki-Järvinen, Kujala, & Rissanen 2008).

According to the Ghana Health Service in 2007, physical inactivity contributed to the increasing prevalence of overweight and obesity and its associated diseases in Ghana (Ghana Health Service., 2007).

2.4.4 Socioeconomic Factors

The relationship between social class and BMI varies globally. In the developed world obesity is generally more common in children and adolescents from families of lower socioeconomic status whereas in the developing world, higher socioeconomic status has usually been associated with higher risk of pediatric obesity (WHO, 2010b).

In a study carried out in Kuwait, 89.2% of the obese children belonged to families with high socioeconomic status (earning ≥1000 Kuwaiti Dinars), while 6.7% of them belonged to middle social class families (families earning 500 to <1000 Kuwaiti Dinars), and 4.1% of them belonged to families with low socioeconomic status (earning <500 Kuwaiti Dinars) (El-Bayoumy, Shady, & Lotfy, 2009).

In the developed countries women of a high social class are less likely to be obese while in the developing world, women, men, and children from high social classes have higher rates of obesity (McLaren, 2007)

There appears to be a link between obesity and income levels of the families. Some studies have shown that obesity is prevalent among low socioeconomic class in developed countries but more prevalent among high socioeconomic class in developing countries (Burns, 2004).

In the study to assess the magnitude of overweight and obesity and its associated sociodemographic factors in adolescents attending junior high schools in Xi'an, Shanxi province in China, 1804 adolescents were examined. Overweight and obesity were more prevalent in younger boys from richer families living in urban districts and those whose parents were either overweight or obese (Li, M., Dibley & Yan, 2011)

In a study conducted among 15 and 16-year-olds in Norway, those with lower educational plans and poor family socioeconomic status were both significantly associated with overweight and obesity(Savva, Kourides, Tornaritis, Epiphaniou-Savva,Chadjigeorgiou & Kafatos, 2002). In the same study, when compared with adolescents living in families with high socioeconomic status, the odds of one becoming overweight and obese was about 1.5 times higher among adolescents living in families with low socioeconomic (Grøholt, Stigum, & Nordhagen, 2008).

A direct relation was established between the socioeconomic level and overweight and obesity. For adolescents in the most industrialized region of the country, they had a higher risk of overweight and obesity than those in the least industrialized region. They also found that male adolescents who lived in the urban areas were at a higher risk of being overweight and obese than those in the rural areas (Neutzling, Taddei, & Gigante 2003). From the literature reviewed it is clear that the prevalence of obesity is rising at a fast rate worldwide especially in developing countries.

CHAPTER THREE

METHODS

3.1 Study Design

A descriptive cross-sectional study was conducted among adolescents in senior High schools (aged 10 to 19 years) in the Ga Central Municipal.

3.2 Study location

The Ga Central Assembly was carved from the Ga South Municipal Assembly and inaugurated on 28th June 2012. The Assembly was established by Legislative instrument 2135 (2012) with the capital at Sowutuom.

The Ga Central Municipal Assembly (GCMA) lies within latitudes 5º 48´ North and within Longitudes 0º 8´ East and 0º 3´ west. It is one of the sixteen (16) Metropolitan/Municipal/District Assemblies in the Greater Accra Region and covers a Land Area of 103.44 sq Km. It shares boundaries with Accra Metropolitan Assembly to the South, Ga West to the East and North, and Ga South Assembly to the west. The Municipal Assembly has one (1) public Senior High School (SHS), namely, the Odorgonno Senior High School, Awoshie. There are eleven (11) public Junior High Schools and fourteen (14) Primary Schools. Again, there are twelve (12) public kindergartens which enrolled about Six Hundred and Ten (610) children at that level. There are therefore Fifteen (15) public schools in the municipality. Most of the schools lack libraries; ICT resource centers and recreational grounds. Moreover, there are about eleven (11) private Senior High/ Technical/ Vocational Schools which include PANK Senior High/ Business school, Apostle Safo School of Art and Science, New Star Educational Institute, Caicoo Vocational

and Dasein Practical School among the others. There are about One Hundred and Forty-Seven (147) private Junior High Schools, Two Hundred (200) Primary Schools and Two Hundred (200) public Kindergartens. There are therefore Two Hundred (200) private schools in the municipality. There are however a number of privately owned Early Childhood Development Centers (ECDC).

3.3 Variables

3.3.1 Independent Variables

Age

Sex

Ethnicity

Level of education (class)

Socioeconomic status of Parents or Guardians

Dietary intake and habits

Family history

Physical activity level

Smoking

Alcohol intake

3.3.2 Dependent Variable BMI

(Body Mass Index) - Obesity and overweight

Table 1: Variables of the study

Study Variable Operational	Operational Definition	Measurement Scale	Data Collection Tool Technique
Age	Age at last birthday	Continuous	Questionnaire
Sex	Sex of student • Male or Female	Nominal 1. Male 2. Female	Questionnaire
Ethnicity	Ethnic group of association by birth	Nominal 1. Ga 2. Fante 3. Ewe 4. Dagomba 5. Others	Questionnaire
Level education (class)	Current class of student SHS1, SHS 2 or SHS 3	Nominal 1. SHS1 2. SHS 2 3. SHS 3	Questionnaire
Residential area	The residential area of the student when not in school • Residential	Nominal 1.Awoshie 2. Ablekuma 3. Sowutoum 4. Others	Questionnaire
Residential status in school	Whether a student resides in school or comes to school from home daily • Day or Boarding	Nominal 1. Day 2. Boarding	Questionnaire
Socioeconomic status of	The highest level of education, occupation and monthly income of the father and/or mother or	Ordinal 1. Low	Questionnaire and Modified Kuppuswamy scale

Parents or Guardians	guardian; Type of residence; Ownership and number of some named items. • Low, Medium or High	2. Medium 3. High	
Dietary Intake and Habits	Food Eaten How many times one eats breakfast, lunch, snacks, supper, fruits and vegetables in a week <3 days/week or >3days/week How many times one eats in a day • 3 or others Patronizing fast foods and sugar sweetened drinks • Yes or No	Nominal 1. Beverages(e. g. Koko, tea) 2. Grains(e.g. rice, waakye) 3. Solid starchy foods(e.g. fufu, banku) 4. OTHER Binary 1. <3 days/week 2. >3days/week Binary 1. 3 2. Others Binary 1. Yes, 2. No	24-hour recall Questionnaire
Physical Activity Level	Engaging consciously in physical activity Yes or No How long one engages in physical activity • < 30minutes or	Binary 1. Yes 2. No Binary 1. < 30minutes	Questionnaire

	• >30minutes Number of hours spent watching TV OR Movies in a day • < 4HOURS or • > 4 HOURS Physical Education as part of the school curriculum • Yes or No	2. > 30minutes Binary 3. < 4HOURS 4. > 4 HOURS Binary 1. Yes 2. No	
Smoking	Smoking or Not smoking	Binary 1.Yes 2. No	Questionnaire
Alcohol intake	Alcohol intake Yes or No	Binary 1. Yes 2. No	
Family History	Perception of a fat father or mother or guardian or relative or being fat yourself before age 10 years • Yes or No	Binary 1. Yes 2. No	Questionnaire

Weight	The weight to the nearest 0.1kg with students standing with heels, buttocks and upper back in a straight line in a completely upright position against the height rod of the machine on the digital scale without shoes, with feet together and arms at the sides and in light clothing with emptied pockets	Continuous	Digital column weighing scales with height rod (with BMI calculation) Digital
Height	The height to the nearest 0.1cm with students standing with heels, buttocks and upper back in a straight line in a complete upright position against the height rod of the machine on the digital scale without shoes, with feet together and arms at the sides and in light clothing with emptied pockets	Continuous	Digital column weighing scales with height rod (with BMI calculation)
BMI-AGE	*Underweight=BAZ<-2SD, Normal weight = BAZ ≥-2SD ≤ +1 SD, Overweight =BAZ >+1 SD ≤ +2SD, Obese = BAZ > +2 SD,* Obese or Not Obese	Binary 1. Obese 2. Not Obese	Digital column weighing scales with height rod (with BMI calculation) and WHOathro plus BMI for age growth chart.

3.4 Sampling

3.4.1 Study Population

The study population was done among adolescents in Senior High School (aged 10 to 19 years) in the Ga Central Municipality.

3.4.2 Sample Size Estimation

The sample size was calculated based on the Cochran single proportion population formula. The sample size was estimated based on the 17.1% prevalence of overweight and obesity among basic school pupils in the Ga East Municipality in Greater Accra region with a confidence interval of 95% and a significance level of 5% (Alangea, 2014)

$n= (z^2pq)/d^2$

Where n= sample size

p= probability of the event occurring, in this study the expected prevalence for overweight and obesity is 0.171 (17.1%)

q= 1-p= probability of the event not occurring, in this case 1-0.171= 0.829

d= Precision/margin of error (0.05)

Z= 1.96 (95% confidence interval for a two-tailed test)

The sample size was estimated as follows

$= (1.96^2*0.171*0.829)/0.05^2$

$= (3.8416*0.171*0.829)/0.0025$

$= 217.83$

$= 218$

Non response- 10%= 21.8=22

218+22=240

=240

3.4.3 Sampling Method

Multistage random sampling technique was used.

There were 12 Senior High Schools in the Municipality made up of one (1) public and eleven (11) private Senior High Schools.

The Senior High Schools were divided into two groups - Private and Public schools. The private Senior High School were selected by random sampling. Convenient sampling was used to select the public Senior High School: This was so because there was only one public Senior High School in the municipal.

This idea was done to enrich the data with students of different socioeconomic status backgrounds. A sample proportional to the size of each school was selected to make up the total sample size of 240. Proportionate sampling was used to determine the number of participants per each senior high school taking into account their respective total population. The population of the public and private Senior High School was 2310 and 2210 respectively adding up to be 4520.

For each of the schools, a master list was obtained and numbered. The first student for the study were chosen at random using excel command "= RAND ()" Press "Enter. After the first student had been chosen, the next students were chosen by sampling interval. The interval was calculated by dividing the sample size by the number of classrooms. The value obtained was then be divided by the number of students in each class to obtain the sampling interval.

Any student who refused was replaced with the next student who was randomly picked. This same pattern was used for any other student who refused to participate or parents refused to sign the consent form for the children to participate in the study.

3.4.4 Inclusion Criteria

Students who were included in this study were

- All students aged 10-19 years (adolescents Students was in Form 1or 2 of the selected senior high schools)

- Students who fulfilled the previous criteria, and whose parents agreed for them to participate in the study

- Students who assent or consent to take part in the study

3.4.5 Exclusion Criteria

Students who were excluded from this study were

- Students who were below the age of 10 years or above 19 years.

- Students whose parents refuse to consent to them participating in the study

- Students who did not assent/consent to taking part in the study

- Students who recently recovered from a major illness drastically affected body weight;

- Students who were on certain medications for more than 3 weeks prior to the data collection duration.

3.5 Data collection techniques or methods and tools

3.5.1 Questionnaire

For the data collection, a structured pre-coded questionnaire was used. This questionnaire was prepared in English, and was administered by the researcher and two trained research assistants. Questionnaires were distributed to the students and the questions were explained to them to make sure they do not leave questions unanswered. The students were supervised to make sure that they answered the questionnaires independently. The

questionnaire contained 6 sections that assess the variables the study considers. These sections were

A. Demographic Characteristics

B. Socio-economic factors

C. Familial/Genetic factors

D. Dietary factors

E. Physical activity

F. General/Lifestyle

G. Anthropometric measurement

3.5.2 Anthropometric Measure

All measurements were taken with participants wearing light clothing. However, those with heavy clothing such as jackets and sweaters were asked to remove them.

Participating students were also required to remove shoes or sandals, watches, phones or other jewelry on their wrists and also emptied their pockets prior to measurements.

Weight was measured in kilograms (kg) with a calibrated Health Care® weighing scale.

A stadiometer that comes with the weighing scale was used to measure the height of the students in centimetres (cm). An average of two different measurements, taken before and after answering the questionnaire, was used.

Classification of overweight and obesity was based on the WHO growth reference standards for children and adolescents (WHO, 2007). Students were classified as Underweight when the BMI was less than 5th percentile. Overweight was considered if their BMI $\geq$ 85th percentile but less than the 95th percentile, which is equivalent to or greater than 25.0kg/m2 but less than 30.0kg/m2. Obesity was described as BMI $\geq$ 95th

percentile corresponding to BMI equal to or greater than 30.0kg/m2. The percentiles were used to estimate the prevalence of overweight and obesity in the study.

3.5.3 Socioeconomic

The socioeconomic status of the parents was assessed using both the modified Kuppuswamy scale (Kuppuswamy, 1981) and the modified version of the socioeconomic status questionnaire used by Balogun et al (1990). Based on the summative score, the participants were categorized into three levels- Low, Middle and High. The scoring of the questionnaire items was based on the head of the family's highest level of education, occupation. However, the following was also taken into consideration while assessing the socioeconomic status of the participants-Highest level of education, occupation and monthly income of the father and/or mother or guardian (If participant is not living with you parents); Location of residence; Type of residence(owned by parents, owned by guardian, family house or rented); Total number of rooms in your residence; Ownership and number of the following items (Television, DVD player, refrigerator, microwave, generator, car, personal computer or laptop, electric or gas stove, motorbike; Subscription to any TV NETWORK (DSTV, Multichoice).

3.5.4 Physical Activity Level

Level of Physical Activity was assessed using the Physical Activity Questionnaire for Adolescent (PAQ-A). It was developed to assess general levels of physical activities for senior high student age 10-19 years. The PAQ-A was administered in a classroom setting. The participant's physical activity information was entered into the excel version where the individual level of activity was generated. It provides a 4 – level Physical Activity Index (PAI), categorizing the individuals as; Vigorously Active, Moderately Active, Low

physical active. A physical activity index less than Active suggests the need for a brief intervention supporting behavioral change to increase physical activity (Child Mind Institute, 2007)

3.5.5 Quality Control

The whole process of data collection was supervised to obtain uniform and of high-quality data. The research assistants were trained to make sure they know the objectives and methodology of the study. They were trained to use consistent and correct techniques through demonstration and role-playing. They were trained with WHO recommended measurement protocols.

The digital column weighing scales with height rod (with BMI calculation) was calibrated daily and before each measurement and placed on a flat floor before taking weights and height. The height and weight for each student were measured two times by two different pairs of research assistants. The mean weight and height were then use to minimize intra-observer and inter-observer biases.

Data entry was closely monitored; data was entered twice by two different data entry clerks to make sure data is correctly entered. Also, the table in excel was validated to make sure that no invalid number was entered.

3.6 Data analysis

3.6.1 Data Entry and Processing

Questionnaires were given a unique identification (ID) number and responses were pre-coded.

The researcher securely kept these questionnaires in a safe after being filled, to prevent minimal public access to it. For the duration of data collection, data collected daily was immediately entered within 24 hours of collection into a Microsoft Excel 2010 spreadsheet and imported into STATA version 15.0 where it was first cleaned of multiple entering before analysis was done. A digital copy of the dataset was stored on an external hard drive to prevent loss of data.

3.6.2 Data Analysis Procedure

Descriptive statistics, such as frequencies, percentages and range were used to describe the distribution of variables such as socio-demographic factors, genetic/familial factors, dietary, physical activity, general lifestyle factors and anthropometric measures. The data was explored by running frequencies for the outcome variable of interest (overweight and obesity) and all the exposure (independent) variables.

P-value <0.05 was used to determine statistical significance of associations. Chi-square analysis was conducted to evaluate the relationship between all potential exposure variables and either weight status (BMI) or the outcome of interest (academic performance). This exploratory analysis served as the primary mechanism for determining which exposure variables seemed important, and was used to screen out insignificant exposure variables

Subjects were classified based on their BMI for age taking into account their sex, as obese, overweight, normal or underweight but with emphasis on the obese status. Those with BMI for age > =95th percentile were considered obese, those with BMI for age >= 85th and < 95th percentile were considered overweight, those with BMI for age >= 5th and <85th

percentile were considered normal and those with BMI for age <5th percentile were considered underweight. The classification was done using the WHO anthro BMI for age growth chart.

In finding an association between overweight/obesity and the socio-demographic, familial/genetic, dietary, physical activity and general lifestyle factors, logistic regression analysis was performed for each individual variable with the weight status comparing the overweight/obese group to the not-overweight group. This also helped to determine the strength of the association with reported Odds Ratio. Age was modelled as a continuous variable with the other variable as categorical.

Pearson's Chi-squared and Binary logistic regression analyses were computed for associations between weight status (Overweight/Obesity or Not-Overweight) and the independents variables.

3.6.3 Ethical Considerations

Approval was sought from the Ethical Review Committee of the Ghana Health Service (GHS) before the commencement of the study (see appendix IV).

Permission was obtained from the Ghana Education Service, Ga Central Health Management Team, and the School authorities before the research was started.

The students gave their consent before they were recruited into the research. No student was forced or coerced to take part in the study. They were made to know that participation was voluntary and there was no penalty for refusing to participate. Any student who refused to participate in the research was respected.

3.6.4 Pretest

Pre-testing of the questionnaires was carried out among 30 adolescents in St Magret Senior High School. This school is not in the area of study but has similar characteristics as the schools in the study area because it is also in a municipality. Testing the reliability of the questionnaire a chrombac alpha (Average interitem covariance: 3.92, scale reliability coefficient: 0.78)

This process enabled me to clarify the validity of the questions, reaction of the respondents to the research questions, estimate the approximate time for each measurement and help make the necessary corrections or adjustments for the questionnaire for the actual study. Pretesting also done to enable the data collectors to to practice the data collection technique.

CHAPTER FOUR

RESULTS

4.1 Prevalence of Obesity and Characteristics of the study

Three hundred and twelve (312) participants were eligible to be recruited into the study for both private and public school in the Ga central municipality and received parental consent to participate in the study. 247 were signed by parents to participate in the study. Out of the 247 questionnaires administered, 227 were completed and returned. Of the 227 participants enrolled, 8 of the participants who were older than 19yrs were deemed not eligible hence were excluded. Therefore, the analysis was based on 219 participants.

Data were analyzed for 219 adolescent participants for whom questionnaires were administered and anthropometric measurements were taken.

The age range was 11 to 19 years with the mean age of 16.9±1.2 years. Modal age is 17 years. The mean age was 17±1.1 years for males and 16.9±1.4 years in females. Age was statistically significant (p=0.015) with obesity and overweight

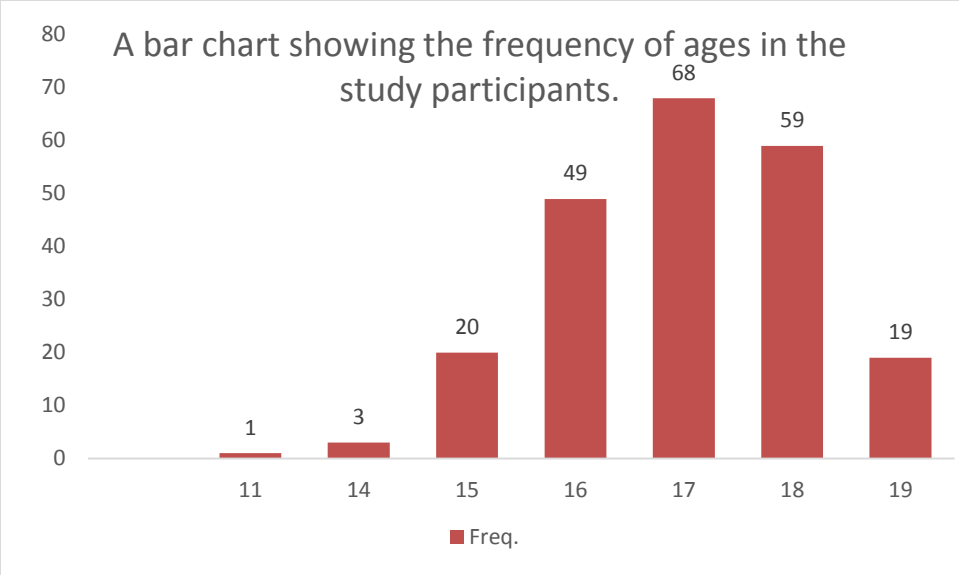

Figure 2 A graph showing the number of adolescents by age in Senior High Schools

One hundred and ten (110) adolescents were in SHS form 1 forming the majority (50.2%) (110/219) of the participants, with the rest (49.7%) (109/219) being SHS form 2s. There were no SHS form 3 participants as the batch had graduated at the time of the study. One hundred ten (110) adolescents participated at the public senior high school whiles one hundred and 109 participated at the private school. Six courses are being offered in the selected schools. These courses include General Science, Business, General Arts, Visual Arts, Agricultural Science and Home Economics. One hundred and three (47.03) (113/219) of the participants were in the General Arts class with the lowest (5.9%) (13/219) being agricultural participants. Majority of the males and females were from the General Arts (53.8%) (57/106) and (40.7) (46/113) respectively. There was a statistically significant association with a Pearson chi-squared value of 9.3017 and p-value <0.005, comparing obesity with and the courses offered.

The majority (113) of the participant were female accounting for (51.6%) (113/219). Akans form (64.8%) (142/219) of the various ethnic group represented in the sample. The other ethnic group

form at least (made up of mainly Ningos, krobos, igbos. With regards to religion, the majority (79.4%) (174/219) of the participants are Christians with (18.7%) (41/219) being Muslims.

Majority of the adolescents were day students (52.9%) (119/219). Among 219 adolescents, the majority of the students (34.7%) (76/219) live at the surroundings away from Ga Central Municipality.

Table 2 Bivariate analysis between Socio-Demographic characteristics and overweight/obesity

Characteristics	Overweight/Obese N (%)	Not-Overweight/Obese N (%)	(p value)
Agẻ			**0.015***
Mean Age(SD)			
11-12 years	0(0.00)	1(100.00)	
13-16 years	59(81.94)	13(18.06)	
17-19 years	114(78.08)	32(21.92)	
Class			0.951
SHS 1	87 (77.68)	25 (22.32)	
SHS 2			
Courses			**0.004***
Science	58(86.57)	9 (13.43)	
Business	14 (73.68)	5 (26.32)	
General Arts	77(74.76)	26 (25.24)	
Visual Art	11 (64.71)	6 (35.29)	
Agriculture	13 (100)	0(0)	
Sex			**0.015***
Male	83(78.30)	23 (21.70)	
Female	90 (79.65)	23(20.35)	
Ethnicity			0.788
Akan	113(79.58)	29 (20.42)	
Ewe	19 (76.00)	6(24.00)	
Ga	28(82.35)	6(17.65)	
Northern	5(62.50)	3 (37.50)	
Others	8 (80.00)	2 (20.00)	
Religion			
Christianity	137(78.74)	37 (21.26)	
Islam	33(80.49)	8 (19.51)	
Traditionalist	3(75.00)	1 (25.00)	
Residence status in School			0.147
Day	96(82.76)	20 (17.24)	
Boarder	77 (74.76)	26 (25.24)	
Residence status in Area			0.791
Urban	92(79.31)	24 (20.69)	
Semi-Urban	81(78.64)	22 (21.36)	

* Significant at 95% Confidence Interval

4.2 Anthropometric indices of Adolescents

Table 3 below provides the weight and height status of adolescents who participated in the study. Mean height of respondents was 1.7 ±0.13m and ranged from 1.01 m to 1.99 m. Mean weight of pupils was 60.15 ± 11.98 Kg and ranged from 100Kg to 39 Kg. The majority (63.01%) (138/219) of the adolescent had BMIs within the normal range, there were more obese adolescents in the private school (20.18%) (22/109) than the public school (2.7%) (3/110).

Table 3 Anthropometric indices of adolescents in Senior High Schools

		Weight	HEIGHT	BMI	BAZ
ALL	MEAN(SD)	60.15(11.98)	1.70(0.13)	21.13(5.77)	0.41(1.75)
MALE		61.32(12.4)	1.72(0.21)	21.33(1.87)	0.51(2.0)
FEMALE		59.06(12.4)	1.69(0.11)	20.94(4.95)	-0.31(1.48)

4.3 Prevalence of Overweight and Obesity

The BMI was categorized as underweight, normal, overweight and obese according to guidelines given by the WHO BMI for age growth chart using the WHO Anthro plus percentile calculator. The overall prevalence of overweight and obesity was (21.0%) (46/219). The prevalence of overweight/obesity amongst males and females was (22.5%) (23/106) and (20.35) (23/113) respectively. This was statistically significant at a p-value less than 0.05 comparing the prevalence with gender Table 4.

Table 4 Anthropometric measurement of the 219 participants

		SCHOOL STATUS	SEX ADOLESCENT		
BMI STATUS	ALL ADOLESCENTS **N=219** (%)	PUBLIC SCHOOL **N=110**(%)	PRIVATE SCHOOL **109** (%)	MALE **N=106** (%)	FEMALE **N=113** (%)
Underweight	35(15.0)	24(21.82)	11(10.09)	23(21.70)	12(10.62)
Normal weight	138(63.01)	79(71.82)	59(54.13)	60(56.60)	78(69.03)
Overweight	21(9.59)	4(3.64)	17(15.59)	7(6.60)	14(12.39)
Obese(grade 1-3)	25(11.42)	3(2.73)	22(20.18)	16(15.09)	9(7.96)
Total overweight	**46(21.01)**	**7(6.37)**	**39(35.77)**	**23(22.5)**	**23(20.35)**

Underweight =BAZ<-2SD, Normal weight = BAZ ≥-2SD ≤ +1 SD, Overweight =BAZ >+1 SD ≤ +2 SD, Obese = BAZ > +2 SD, Total Overweight

There were more males (21.7%) (23/106) who were underweight, compared with (10.6%) (12/113) who were females. And also, there were more overweight (12.3%) (14/113) in females than overweight (6.60%) (7/106) in males. Table 4

4.4 Risk Factors of Overweight and Obesity

Age was modeled as a continuous variable, yielding an Odds Ratio of 0.55 and this was statistically significant [AOR=0.58 (95% CI= 0.39-0.80), p=0.001] as indicated in table 5. For gender, females have an odds of 2.50 times of becoming overweight or obese compared to males [AOR= 2.50 (95% CI= 1.05-5.95), p=0.001). The course a student offered was not significantly associated with being overweight/obese [COR=4.3 (95% CI=0 .72-1.34), p=0.927).

Table 5 **Logistic regression on demographic characteristics for Overweight/Obesity group**

Characteristics	Overweight/Obese N (%)	Not-Overweight/Obese N (%)	COR	CI	P value	AOR	CI	P value
Age°								
11-12yrs	0(0.00)	1(100.00)	Ref					
14-16yrs	59(81.94)	13(18.06)	0.28	0.19 -0.42	**0.001**	0.7	0.38-1.60	**0.508**
17-19yrs	114(78.08)	32(21.92)	0.55	0.38-0.78	**0.001**	0.58	0.39-0.80	**0.001***
Gender								
Males	83(78.30)	23 (21.70)	Ref					
Females	90 (79.65)	23(20.35)	2.33	1.09-4.97	**0.024**	2.50	1.05-5.95	**0.038**

✚ *Missing data ° Age as a continuous variable * Significant at 95% Confidence Interval*

4.5 Socio-Economic Factors

Most of the participants (30.6%) (67/219) had fathers who had Tertiary school education. Only a few (3.7%) (8/219) had fathers who had no education for mothers of the participants, the majority had (33.8%) (74/219) had Junior High/Middle school education, and few (8.2%) (18/219) have no level of education. Father's education was statistically significant compared to overweight/Obesity (X^2 = 10.3 P= **0.001**). Other guardians, (50.0%) (4/219) had a tertiary education which was the majority. Among the participant mother's occupation, the majority (60.7%) (113/219) of them where traders and few of them where unemployed. Mother's occupation was statistically significant with obesity/overweight (X^2=14.9, P= 0.005). For the father's occupation, most of them involved in professional work such as doctors, lawyers, etc. Also, there is also high (31.1%) (68/219) numbers of traders among the participants of fathers, this was statistically significant with the p-value <**0.001.** Both mothers and fathers occupation there is few [2.7% (6/219) and 0.5% (1/219) respectively] who involve themselves in be in agriculture in the city. The majority (81.3%) (178/219) of the participants lived with their parents

during vacation, few (0.46%) (1/219) lived with either Uncle/Aunt or grandparent. Socio-Economic status of the participants where statistically significant (X^2 = 15.7132 P= 0.001) compare to overweight/obesity

Table 6 Bivariate analysis of socio-economic factors and overweight/obese and not overweight/obese.

Characteristics	Not-Overweight/Obese N (%)	Overweight/Obese N (%)	(p value)
Father's Education Level			**0.001**
None	7(87.50)	1(12.50)	
Primary	25(78.13)	7(21.88)	
JHS/Middle School	42 (85.71)	7(14.29)	
SHS	51(80.95)	12 (19.05)	
Tertiary	48(71.64)	19 (28.36)	
Mother's Educational Level			0.005
None	15(83.33)	3(16.67)	
Primary	26(86.67)	4(13.33)	
JHS/Middle School	58 (78.38)	16 (21.62)	
SHS	55(87.30)	8 (12.70)	
Tertiary	19(55.88)	15(44.12)	
Fathers Occupation			0.128
Unemployment	18 (94.74)	1 (5.26)	
Professional	47(71.21)	19(28.79)	
Trader	53(77.94)	15(22.06)	
Artisan	49(81.67)	11(18.33)	
Farmer	6(100)	0(0)	
Mother's Occupation			**0.015**
Unemployment	15 (93.75)	1 6.25	
Professional	28(71.79)	11 (28.21)	
Trader	102(76.69)	31 (23.31)	
Artisan	27(90.00)	3 (10.00)	
Farmer	1(100.00)	0 (0.00)	
Socio-Economic Status			0.001
Low	42(77.78)	12(22.22)	
Middle	83(79.81)	21(20.19)	
High	46(77.97)	13 (22.0)	
Guardian			
Both Parents	139 78.09	39 21.91	0.951
One Parent	28 84.85	5 15.15	
Aunt/Uncle/Grandparents	0(0.00)	1(100)	
Siblings(sisters/Brothers)	6 (85.71)	1 (14.29)	
Who you live During Vacation			0.791
Both Parents	134(79.29)	35(20.71)	
One Parent	20 (76.92)	6 (23.08)	
Aunt/Uncle/Grandparents	11 (78.57)	3 (21.43)	
Siblings(sisters/Brothers)	8(80.00)	2(20.00)	

* * Significant at 95% Confidence Interval

Figure 3, Economic level of the adolescents were grouped into three categories (high, middle and low). The majority (47.9%) (104/217) of the participants were in the middle-income class, about (27.49%) (59/217) are in the low-income class compared to (24.9%) (54/217) who have a high standard of living. Among schools, more participants in private school (26.17%) (26/217) has higher class than participants in public school (23.34%) (54/217).

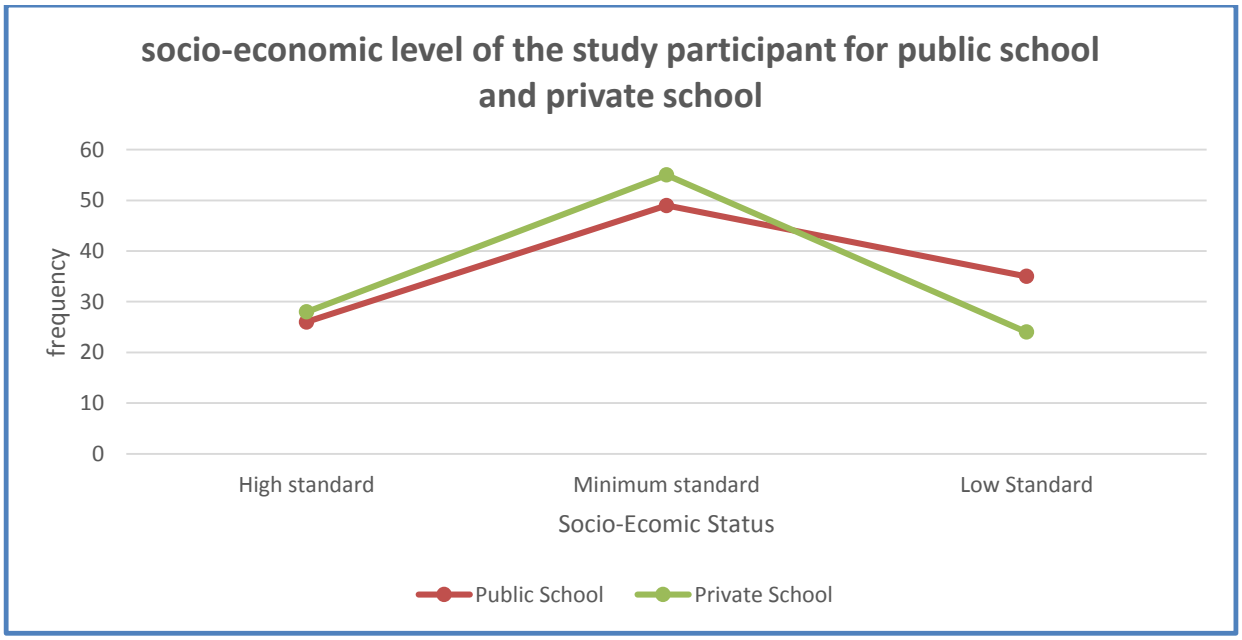

Figure 3 Socio-Economic level of adolescents in both schools

Table 7 shows the socio-economic status of participants in the Overweight/Obese group was compared with the Not-Overweight/Obese group. None of the variables was significant at 95% confidence interval. However, at a significance level of 0.001, the odds of becoming overweight/Obese when the mother has a tertiary education is 59% odds

reduced of becoming overweight/Obese compared to those who have none of the educational levels. [AOR=0.31 (95% CI: 0.31-0.67), p=0.002]. Those who had primary school had 4.95 increased odds of becoming obese compared to those who had none ducation [AOR=4.95 (95% CI: 2.33-10.52), p=0.001]

Table 7 Logistic regression on the socio-economic status of respondents on Overweight/Obesity group compared to the Not-Overweight group

Characteristics	Not-Overweight/Obese N (%)	Overweight /Obese N (%)	OR	Confidence interval	P Value	AOR	Confidence interval	P Value
Mother's Educational Level								
None	15(83.33)	3(16.67)	Ref			Ref		
Primary	26(86.67)	4(13.33)	2.41	(1.17-4.94)	**0.01**	4.95	2.33-10.52	**0.001**
JHS/Middle	58 (78.38)	16 (21.62)	1.38	0.35- 5.36	0.59	1.93	0.76-4.92	0.168
SHS	55(87.30)	8 (12.70)	0.73	0.17 -3.08	0.21	0.24	0.13-0.42	**0.002**
Tertiary	19(55.88)	15(44.12)	3.95	0.96-16.20	0.96	0.31	0.13-0.67	**0.002**
Farmer	1(100.00)	0 (0.00)	1					
Father's Education Level								
None	7(87.50)	1(12.50)	Ref			Ref		
Primary	25(78.13)	7(21.88)	1.96	0.21-18.72	0.55	4.95	1.33-11.52	0.001
JHS/Middle School	42 (85.71)	7(14.29)	1.16	0.12 -10.99	0.89	1.93	1.24-5.92	0.023
SHS	51(80.95)	12 (19.05)	1.65	0.18 14.68	0.65	2.45	1.82-4.57	0.001
Socio-Economic Status								
Low	42(77.78)	12(22.22)	Ref			Ref		
Middle	83(79.81)	21(20.19)	0.35	0.23-0.54	**0.001**	0.51	0.26-0.87	**0.046**
High	46(77.97)	13 (22.0)	0.11	0.02-0.05	**0.007**	0.45	0.00-0.79	**0.001**
Mother's Occupation								
Unemployment	15 (93.75)	1 (6.25)	Ref			Ref		
Professional	28(71.79)	11(28.21)	5.89	0.39-50.14	0.56	1.2	0.9-2.94	0.49
Trader	102(76.69)	31(23.31)	4.56	0.58 -35.90	0.76	3.4	1.33-11.52	**0.003**
Artisan	27(90.00)	3(10.00)	0.30	0.10-0.94	**0.039**	0.4	0.32-5.92	0.12
Farmer	1(100.00)	0 (0.00)				-	-	-

** Significant at 95% Confidence Interval*

4.6 Familial or Genetic Factors

Among the adolescents, Majority (58.5%) (128/219) reported of having sibling more than two or more and most (66.7%) (146/219) of the respondents are born either first or second according to the birth order. One hundred and thirty (63.0%) (138/219) participants had parents who are married. Among the other groups, (34.0%) (76/219) had parents who are either divorced or separated. The commonest description of the body type for both parents of participants was Athletic/Average; (62.1%) (139/219) of fathers and (64.8%) (142/219) of mothers. Only (13.7%) (30/219) had fathers who are big/very big. Among the participants, 25.1% (55/219) have big/very big mothers. One hundred and sixty-two (26.0%) (162/219) participants reported that they had someone else in the family who was a big or very big person, with 64.2% (40/62) of these being an Aunt/Uncle. Having relative that are fat and mother's body type were statically significant with p values **p = 0.030** and p= **0.037** respectively.

Table 8 Bivariate analysis between familial/genetic factors and overweight/obese

Characteristics	**Not-Overweight/Obese N (%)**	**Overweight/Obese N (%)**	**P value**
Number of Siblings			0.085
Less than or equal to 2	77 (84.62)	14 (15.38)	
More than 2	96(75.00)	32(25.00)	
Birth Order			**>0.001**
1st/2nd	126 (86.30)	20 (13.70)	
3rd/4th	30 (62.50)	18 (37.50)	
5th /more	17(68.00)	8(32.00)	
Parents Marital Status			0.375
Single/Divoced/Seperated	63(82.89)	13 (17.11)	
Married	107(77.54)	31 (22.46)	
One or Both Parent Dead	3(60.00)	2(40.00)	
Father's Body type+			0.5871
Slim/Slender	29(76.32)	9 (23.68)	
Athletic/Average	112(80.58)	27 (19.42)	
Big/Very Big	23(76.67)	7(23.33)	
Mothers Body Type+			**0.037***
Slim/Slender	11(64.71)	6 (35.29)	
Athletic/Average	108 (76.06)	34(23.94)	
Big/Very Big	49(89.09)	6 (10.91)	

Table 9 Bivariate analysis between familial/genetic factors and overweight/obese

Characteristics	Not-Overweight/Obese N (%)	Overweight/Obese N (%)	P value
Having Big Relative			**0.030***
No	123(75.93)	39(24.07)	
Yes	50(87.72)	7(12.28)	
Relationship with Relatives who are big+			0.310
Uncle/Aunte	22(91.67)	2(8.33)	
Brother/sister	25(86.21)	4(13.79)	
Grandmother/Father	8(88.89)	1(11.11)	

95% confidence Interval

Based on the familial factors, the most important risk factors for being overweight or obese are mother's body type of weight status [AOR=1.23 (95% CI= 1.04– 3.83), p=0.029). This means having a big/very big mother have 23% increased odds of an adolescent becoming overweight/obese. The odds of becoming overweight in those who family members are big/very big is 54% reduced odds of those who had no family members who are not big [AOR=0.46 (95% CI= 0.01-0.79), p=0.002) Table 9.

Table 10 Logistic regression on familial/genetic factors of adolescents comparing Overweight/Obesity to Not-Overweight

Characteristics	Not-Overweight/ Obese N (%)	Overweight/ Obese N (%)	OR	CI	P Value	AOR	CI	P Value
Birth Order								
1st/2nd	126 (86.30)	20 (13.70)	Ref			Ref		
3rd/4th	30 (62.50)	18 (37.50)	3.78	1.78-8.01	**0.001**	2.78	1.13-7.77	**0.041**
5th or more	17(68)	8(32)	2.96	1.13-7.77	**0.027**	2.51	1.12-8.23	**0.021**
Mothers Body Type+								
Slim/Slender	11(64.71)	6 (35.29)	Ref			Ref		
Athletic/Average	**108 (76.06)**	34(23.94)	0.58	0.19-1.68	0.24	0.26	0.20-1.68	0.89
Big/Very Big	49(89.09)	6 (10.91)	0.22	0.06-0.83	**0.025**	1.23	1.04-3 .83	**0.029**
Having Big Relative								
No	123(75.93)	39(24.07)	Ref			Ref		
Yes	50(87.72)	7(12.28)	0.31	0.14-0.66	**0.003**	0.46	0.01-0.79	**0.002**

95% confidence Interval +Missing Data

4.7 Dietary factors

Table 10 shows that one hundred and thirty-six (62.4%) (136/218) skip meals during the day with (58.1%) (80/136) of them skipping breakfast mainly. One hundred and nineteen (54.59%) (119/218) however said they always have breakfast with (37.2%) (81/218) reporting that they miss breakfast only one or two times in a week.

Majority of the participants (61.9%) (134/219) take snacks in between meals. Also, the majority of the adolescents take vegetable every day with few (1.7%) (3/219) who do not eat vegetable at all. In terms of fruit, the majority takes fruit once a week as compared with adolescents who take fruits 3 times in a week. There was a significant association between taking fruit and overweight/obesity with p=0 .049.On 24 hour dietary recall, the majority (58.5%) (128/219) met the minimum dietary diversity which means a lot eat from the seven

food groups that were classified under the food the adolescents provided during the time of the study. The usual time for having the last meal was between 6 pm and 8 pm (49.8%) (109/219) while (3.2%) (7/219) have their last meal after 10 pm

Table 11 Bivariate analysis of dietary habits and overweight/obese and not overweight/obese

Characteristics	Not-Overweight/Obese N (%)	Overweight/Obese N (%)	P value
Main Meal			**0.263**
1-2 Times	38(76.00)	12 (24.00)	
3 Times	87(83.65)	17 (16.35)	
4 or more Times	48(73.85)	17(26.15)	
Missing Meals			0.051
No	59(71.95)	23 (28.05)	
Yes	113(83.09)	23(16.91)	
Meal Missed+			0.786
Breakfast	67(83.75)	13 (16.25)	
Lunch	31(81.58)	7(18.42)	
Supper	16 (88.89)	2 (11.11)	
Breakfast			0.704
Always	92(77.31)	27(22.69)	
Sometimes	66(81.48)	15(18.52)	
Never	15 (83.33)	3 (16.67)	
Snack			**0.036**
No	61 (71.76)	24 (28.24)	
Yes	112 (83.58)	2216.42)	
Frequent eating of vegetable			0.303
Everyday	71 (85.54)	12(14.46)	
Once a Week	57 (73.08)	21(26.92)	
2-3 Times a week	28(75.68)	9(24.32)	
More than 3 times in a week	14 (77.78)	4(22.22)	
Never	3(100)	0 (00)	
Frequent eating of fruit			0.130
Everyday	27(87.10)	4(12.90)	
Once a Week	76 (75.25)	25(24.75)	
2-3 Times a week	46(83.64)	9 (16.36)	
More than 3 times in a week	16(66.67)	8(33.33)	
Never	8(100)	0(0.00)	

* Significant at 95% Confidence Interval

Table 12 Bivariate analysis of dietary habits and overweight/obese and not overweight/obese

Characteristics		Not-Overweight/Obese N (%)	Overweight/Obese N (%)	P value
24-hour Recall	**dietary**			**0.025**
Low Diversity	Dietary	7(77.78)	2(22.22)	
Minimum Diversity	Dietary	109(85.16)	19(14.84)	
High Diversity	Dietary	57(69.51)	25(30.49)	
Sachet Water a day				**0.000**
Less than 3		75(88.24)	10 (11.76)	
3-5 sachet of water		67(83.75)	13(16.25)	
6 or More		31(57.41)	23 (42.59)	
Time of last meal				0.209
Before 6:00pm		42(72.41)	16 (27.59)	
6:00pm-8:00pm		90 (82.57)	19 (17.43)	
8:01-10:00pm		34(11)	75.56(24.44)	
After 10:00pm		7 (100)	0 (0.00)	

* Significant at 95% Confidence Interval

Table 11 shows a logistic regression on dietary habits for overweight/obesity compared with the not-overweight group. When the number of main meals taken in a day was run, there was an association becoming overweight or obese [AOR=0.23 (95% CI= 0.004-0.97), p=0.012] when the adolescent takes meal more than four times per day. There is also a significant relationship between drinking water and becoming obese, there is 76% reduced odds of becoming obese when an adolescent drink more than four sachets of water per day [AOR= 0.24 (95% CI= (0.008- 0.84), p>0.002] compared to those who drink less than one sachet of water per day.

Table 13 Logistic regression on dietary habits on Overweight/Obesity

Characteristics	Not-Overweight/Obese N (%)	Overweight/ Obese N (%)	OR	CI	P Value	AOR	CI	P Value
Main Meal								
1-2 Times	38(76.00)	12 (24.00)	Ref			Ref		
3 Times	87 (83.65)	17 (16.35)	0.80	0.34-1,87	0.68	0.18	0.03-0.81	**0.011**
4 or more Times	48(73.85)	17(26.15)	0.20	0.04-0.97	**0.010**	0.23	0.09-0.97	**0.012**
Missing Meals								
No	59(71.95)	23(28.05)	Ref			Ref		
Yes	113(83.09)	23(16.91)	0.42	0.04-2.01	1.72	0.52	0.27-0.86	**0.039**
Snack								
No	61(71.76)	24 (28.24)	Ref			Ref		
Yes	112(83.58)	22 (16.42)	0.50	0.26- 0.96	**0.038**	0.60	0.26- 0.963	**0.012**
Frequent eating of vegetable								
Everyday	71(85.54)	12 (14.46)	Ref			Ref		
Once a Week	57(73.08)	21 (26.92)	2.25	0.35-14.48	0.39	3.12	1.7-28.2	**0.012**
2-3 Times a week	28(75.68)	9 (24.32)	3.37	0.14-78.25	0.45	3.22	1.62- 35.93	**0.023**
More than 3 times in a week	14 (77.78)	4(22.22)	0.25	0.16-0.40	**0.001**	0.28	0.14-0.56	**0.001**
Never	3(100)	0 (00)	-			-	-	-
24 hour dietary Recall								
Low Dietary Diversity	7(77.78)	2(22.22)	Ref			Ref		
High Dietary Diversity	57(69.51)	25 (30.49)	1.67	0.28-7.50	3.22	0.21	0.31-8.98	**0.002**
Minimum Dietary Diversity	109(85.16)	19(14.84)	0.14	0.06-0.36	**0.001**	1.8	0.22-15.62	0.56
High Dietary Diversity	57(69.51)	25(30.49)	0.13	0.040-0.42	**0.001**	0.46	0.22-0.99	**0.046**
Sachet Water a day								
Less than 3	75(88.24)	10 (11.76)	Ref			Ref		
3-5 sachet of water	67(83.75)	13(16.25)	1.46	0.38-6.72	0.47	1.32	0.38	**0.032**
6 or More	31(57.41)	23 (42.59)	0.27	0.48-8.53	**0.001**	0.24	0.008-0.84	**0.02**

* Significant at 95% Confidence Interval *+Missing Data*

4.8 Physical activity

Concerning transportation, (76.1%) (168/219) use a vehicular means of transport with the rest (23.29) (51/219) walking or using a bicycle. Among the participants, (26.48%) (58/219) met the CDC recommended criteria for vigorous physical activity which involved digging, aerobics, heavy lifting, fast bicycling, playing basketball, soccer, running, swimming laps, and fast dancing for more than 5 days in a week and for more than or equal to 30 minutes per day. Fifty-one (31.96%) (51/219) met the CDC criteria for moderate physical activity. Physical activities were statistically significant with obesity (p=0.001). About (15%) (34/219) never watch Television. However, the majority (46.12%) (101/219) watch TV once a while in the week, mainly less than an hour per time and was significant associated with obesity (p=0.007) Table 12. One hundred and one (46.12%) (101/219) never play video game with only (5.2%) (11/219) playing video game daily. Most of the adolescent play video games less than an hour.

Table 14 Bivariate analysis between physical activities and overweight/obesity and not overweigh

Characteristics	Not-Overweight/ObeseN(%)	Overweight/ObeseN(%)	P value
Means Of Transport			0.355
Vehicular	135(80.36)	33 (19.64)	
Walk/Bicycle	38(74.51)	13 (25.49)	
Physical Activities			**0.001***
vigorous	44 (75.86)	14(24.14)	
Moderate	57(81.43)	13(18.57)	
Low	72(79.12)	19(20.88)	
TV✚			0.433
Never	30(88.24)	4 (11.76)	
Once a while	78(77.23)	23(22.77)	
Everyday	6 (77.38)	19 (22.62)	
Hours Watching TV			**0.007***
<1 hour	105(80.15)	26(19.85)	
>1 hour	62(75.61)	20(24.39)	
Video Game			0.433
Never	82(81.19)	19(18.81)	
Once a while	86(80.37)	21(19.63)	
Everyday	5 (45.45)	6 (54.55)	
Video Game			0.743
Duration✚			
<1 hour	137(78.29)	38(21.71)	
>1 hour	36(81.82)	8(18.18)	

* Significant at 95% Confidence Interval

Table 13 shows logistic regression on physical activity for overweight/obesity. Under the CDC criteria for vigorous physical activity, the odds of becoming overweight in the group that never engage in this activity was 2.65 times the odds of becoming overweight/obese than those who engage in vigorous physical activity [AOR=2.65 (95% CI=1.43-10.61), p=0.027). There were 0.24 chances of becoming overweight/obese if an adolescent watch television for more than an hour [AOR=0.24 (95%CI=0.006-0.91), p=0.002)

Table 15 Logistic regression of the physical activity on Overweight/Obesity vs Not Overweight

Characteristics	Not-Overweight/ Obese N (%)	Overweight/Obese N (%)	OR	CI	P Value	AOR	CI	P Value
Physical Activities								
vigorous	44(75.86)	14 (24.14)	Ref			Ref		
Moderate	57(81.43)	13(18.57)	1.08	0.39-3.02	0.241	1.08	0.13-3.08	**0.072**
Low	72(79.12)	19(20.88)	3.65	1.26-10.61	**0.021**	2.65	1.43- 10.61	**0.027**
Video Game Duration+								
<1 hour	137(78.29)	38(21.71)	Ref			Ref		
>1 hour	36(81.82)	8(18.18)	0.57	0.21-10.85	1.56	0.24	0.006-0.91	**0.002**

95% confidence Interval +Missing Data

4.9 General/Lifestyle Factor

Concerning the general factors, six (2.7%) (6/216) had a chronic disease. These conditions include, Asthma (0.9%) (2/216), Sickle Cell disease (1.9%) (3/216), epilepsy disease (0.5%) (1/216). Majority (78.5%) (172/219) of the participants sleep less than 8 hours. Accounting for alcohol and smoking, (17.4%) (38/219) adolescents take in alcohol whiles (7.3%) (16/219) smokes.

Among the participants, an assessment of certain general lifestyle factors like sleep duration, presence of a chronic disease, alcohol intake, cigarette and smoking and were not statistically significant with being overweight or obese, at 95% Confidence interval

Table 16 Bivariate analysis between lifestyle and overweight/obese and not overweight/obese

Characteristics	Not-Overweight/Obese N (%)	Overweight/Obese N (%)	P value
Chronic Disease+			0.196
No	164(78.10)	46(21.90)	
Yes	6(100)	0 (0.00)	
Sleep Duration			0.638
Less than 8 hours	139 (80.81)	3319.19)	
More than 8 hours	34 (72.34)	13(27.66)	
Alcohol			0.191
No	140(77.35)	41(22.65)	
Yes	33(86.84)	5 (13.16)	
Smoking	160(78.82)	43 (21.18)	0.818
No	13(81.25)	3(18.75)	
Yes	173(79.00)	46(21.00)	

CHAPTER FIVE

DISCUSSION

5.1 Discussion

The observed prevalence of overweight and obesity among Senior High Schools in Ga-Central municipality were (9.6%)(21/219) and (11.4%) (25/219) respectively. These are lower than the 15% and lower 4% reported by the Ghana Schools survey (2012) for adolescents sampled from the two largest cities of Ghana (Accra and Kumasi).

Finding overweight/obesity prevalence among adolescents is also higher than (9.8%) was reported by Amidu and Ali. (2013) among Ghanaian basic school children in the Tamale Metropolis of Ghana. Other researches that measured BMI of basic school children across the rural-urban divides of Accra and Ashanti regions reported much lower overweight prevalence compared to this study‘s finding (Agyemang,Yeboah & Osei., 2005, Larbi, Tenge & Mawusi 2011b). Peltzer et al. (2011) in their assessment of weight status among adolescents in basic school (13-15) collected as part of the 2007 global school health survey also reported much lower overweight prevalence (girls=10.4% and 3.2% boys). However, a study conducted in the Accra metropolis (Abachingsa, 2001), reported higher obesity prevalence (19.3%) which was close to our overall prevalence (21.01%). Outside of the major cities of Ghana, Kwaw ,(2013) reported an almost 50% prevalence of overweight/ obesity with 23.9% obesity prevalence among children enrolled in all Senior Higher schools (both public and private) within the Mfantseman Municipality of Ghana. A study that was done in Accra metropolis among children between 5-15 years indicated that 8.8% were overweight whiles 10.9% were obese. The study was done by pupils (Mohammed &

Vuvor, 2012), this study seems to be consistent with our results which indicate that 9.59% and 11.4% where overweight and obese respectively.

Another study that was done by Amoah and Bempong at Adansi North District in the Ashanti region had a prevalence among adolescent in senior high school had a prevalence of obesity to be 47.6%. (Amoh & Appiah-brempong, 2017), this prevalence is higher than what this study recorded.

In all these, there is documented evidence that there has been a dramatic rise in obesity and overweight in both adults and children (Ogden, Carroll, Kit, & Flegal, 2012; Stamatakis, Wardle, & Cole, 2010; Wang & Lobstein, 2006). In the developed nations, 23.8% (22.9– 24.7) boys and 22.6% (21.7–23.6) girls were overweight or obese in 2013 while in the developing nations, the figure stood at 8·1% (7.7–8.6) to 12·9% (12·3–13·5) in 2013 for boys and from 8·4% (8·1–8·8) to 13·4% (13·0–13·9) in girls (Ng et al., 2014).

Effort should be made to reduce the increasing prevalence of overweight and obesity among adolescent by using certain preventive interventions that have been said to be effective in ensuring a stable (or even reducing) prevalence in the developed countries. These interventions can be modified to suit our environment in order to be effective

The energy and nutrient demands for active growth in school-age children require that meals are eaten regularly and in adequate amounts to prevent malnutrition (both overnutrition and under-nutrition). In this study, 54.6% (119/218) obese participants ate breakfast daily. Eating breakfast was associated with obesity [AOR=0.23 (95% CI= 0.004-0.97), p=0.028] and this goes in line with to a study conducted in Norway that showed that eating breakfast was positively associated with not being overweight and obese (Grøholt,

Stigum, & Nordhagen, 2008). Drinking equal or more than six sachet of water a day have the chances of not becoming obese in this study, this association agrees a research conducted in the United States of America that water help reduce or maintain weight and does not let an individual become obese or overweight (Stookey, Constant, Popkin, & Gardner, 2008).

In this study few (14.5%) (12/83) of those who consumed vegetables daily were obese. This agrees with the study conducted in Saudi Arabia which showed that low servings of fruits and vegetables were all predictors of obesity and overweight among the school children (Amin,Al-Sultan, & Ali 2008).

Studies have shown a strong predisposition towards the fact that obesity can be inherited. In this study, after adjusting for other variables, having a big/very big mother the increases odds of being obese by 23% compared to those who are having slender mother body type. The risk of childhood and adolescent obesity has been found to be associated with high parental body mass index in another study in which the results showed that the risk of childhood obesity was associated with having one or both parents obese, the risk increased when both parents were found to be obese (da Costa Ribeiro, Yabo & Others 2003). Similarly, a case-control study conducted to determine the risk factors associated with overweight and obesity among adolescents enrolled in private high schools in the city of Pelotas, southern Brazil. Their results showed adolescents whose parents' BMI were greater than 30 were 2 times more likely to be overweight or obese than those whose parents or one of them had BMI less than 30 (Neutzling, Taddei, & Gigante, 2003).

From the results of a study conducted on obesity in children and adolescents in Cyprus, the most significant associated factor for obesity was a relative being obese obesity status (Savva, Kourides, Tornaritis, Epiphaniou-Savva, M Chadjigeorgiou, & Kafatos, 2002). Another study carried out in Italy showed that having relatives who are big or very big was associated with the adolescent being obese ((Maffei Maffeis, Consolaro, Cavarzere, Chini, Banzato, Grezzani, &Tatò, 2006) as this study confirms that.

In this study (20.88%) (91/219) of the obese participants did not engage in a conscious physical activity, engaging in conscious physical activity was statistically significant with obesity (AOR=2.65 CI=1.43-10.61 p=0.027). This is similar to a study from 2000 to 2004 in Norway, in which physical inactivity was positively associated with being overweight and obese. There were more overweight and obese adolescents who were physically inactive compared to those who were physically active (Grøholt, Stigum, & Nordhagen, 2008).

For this study, those with duration of watching TV of > 4hours were 2.31 times more likely to be obese compared to those with duration of watching TV<4hours (AOR= 0.24, p=0.002) and this agrees with a study that showed there is an independent association between overweight and obesity and TV/PC use. Adolescents watching television/video 3 hours or more per day were about 60% more likely to be obese compared with adolescents watching television/video 0 to 2 hours per day (Savva, Kourides, Tornaritis, Epiphaniou-Savva, M Chadjigeorgiou, & Kafatos, 2002).This study agrees with a randomised controlled trial of 634 primary school children aged 7 to 11 years in Leeds to reduce risk factors for obesity, which showed that sedentary behaviour was higher in overweight

children in the intervention group than the control group (Sahota , Rudolf, Dixey, Hill, Barth, & Cade, 2001).

This study coincides with a study by Pietiläinen et al., (2008) in which physical activity and self-perceived physical fitness assessed in adolescents aged 16 to 18 years of age were used to predict the development of obesity and the results showed that physical inactivity in adolescence strongly predicted the risk for obesity. This study is similar to a cross-sectional study conducted to compare the physical activity pattern of children, in which their results showed that obese children exhibited significantly lower daily accumulations of total counts, significantly lower levels of physical activity self-efficacy and were also involved in significantly fewer community organizations promoting physical activity (Trost et al., 2003).

This study also agrees with a study conducted in which the amount of time spent in playing video games during adolescence has been found to be significantly associated with adiposity even after correction for obesity history (S. Kautiainen et al., 2005).

The relationship between social class and BMI varies globally. In the developed world pediatric obesity is generally more common in children and adolescents from families of lower socioeconomic status whereas in the developing world, higher socioeconomic status has usually been associated with a higher risk of pediatric obesity (WHO, 2010). In this study participants (27.6%) (54/217) were of high socioeconomic status, (47.9%) (104/217) were of middle socioeconomic status and (24.9%) (54/217) of the obese participants were of low socioeconomic status. High socioeconomic status was show significance with obesity (AOR=1.45 p=0.0001). This means that those with high socioeconomic status have

45% of becoming overweight/obese. This agrees with findings from a study carried out in Kuwait of which 89.2% of the obese children belonged to families with high socioeconomic status (earning ≥1000 Kuwaiti Dinars), while 6.7% of them belonged to middle social class families (families earning 500 to <1000 Kuwaiti Dinars), and 4.1% of them belonged to families with low socioeconomic status (earning <500 Kuwaiti Dinars) (El-Bayoumy Shady, & Lotfy, 2009).

5.2 Limitations of the study

This study was limited by time and geographical location of the sampling area. Research of this kind should have been performed using sample population from at least one senior high school in each of the ten regions in Ghana; however, the study was limited by time and resources, thus employing two senior high schools in Accra as the target population.

5.3 Strengths of the study

There were also some notable strengths of this study. Anthropometric parameters were measured instead of self-reported weights and heights used in previous studies. This was done accurately using standard protocol and classified according to WHO growth charts. Qualified dietary technicians, who helped in the data collection, took these measurements.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

6.1 CONCLUSION

The overall prevalence of obesity was 11.20%. There were 9.59% overweight students and these must be targeted to prevent them from becoming obese. The combined prevalence of obesity and overweight was 21.01%. This combined prevalence of obesity and overweight is very high. The incidental finding of underweight of 15% means that undernutrition is an issue in adolescents but to a lesser extent. Undernutrition must therefore not be overlooked. The study showed that there were associations between obesity and sex, socioeconomic status, snacks consumption, food for breakfast, having a fat father, having a fat relative, number of sachet water taken in a day, duration of watching TV and playing game

6.2 RECOMMENDATION

6.2.1 Schools

▪ Educational programs aimed at adolescents should encourage physical activity and adequate dietary habits

.▪ Basic nutrition should be introduced into the curricula of schools to educate students on healthy eating habits and its benefits.

▪ School authorities need to regulate foods being sold by vendors in their premises. School authorities should also ensure that food served to boarding students are of good nutrients in addition to adequate vegetables and fruits.

▪ Adolescents should be encouraged to engage in physical activity outside schools. They must also be made to participate fully in the Physical Education activities in school.

▪ School health programs should be given all the needed support and must be mandated to provide school health services to ensure our future workforce are health

6.2.2 Parents or Guardians

▪ Parents or guardians should limit the duration of watching TV by their children at home.

▪ Parents or guardians should also provide their children with adequate snacks and fruits for school or encourage them to buy healthy snacks or meals in school.

6.2.3Policy Makers and Health Institutions

▪ Health policies should be directed at ensuring that the adolescent are healthy by developing effective public health education programs to increase the awareness and causes of obesity as well as its prevention.

▪ More recreational facilities should be built to support physical activity. These facilities should be made affordable if not free to use.

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APPENDICIES

Appendix I Research Consent and Assent Form

PARENTAL CONSENT FORM FOR ADOLESCENT PARTICIPATION

Title: Factors associated with overweight/obesity among adolescents in senior high school in the Ga Central municipality

Principal Investigator: Osei Prince

Phone and e-mail address: 0244098538; princeoseijnr@gmail.com

Address: The University of Ghana, School of Public Health, P.O. Box 43, Legon

Dear Parent,

Your child is invited to participate in a research title stated above. You are entreated to read the information below very carefully before you agree to allow your child to take part in the research.

General Information about Research

The purpose of the study is to assess the relationship between overweight/obesity and school academic performance in your ward's school.

The study will address the three objectives:

1. To determine the prevalence of students who are underweight, overweight and obese
2. To identify risk factors associated with overweight and obesity
3. To determine the association between diet, physical activity and overweight/obesity

Your child will be required to participate in an interview, which will take 30 to 45 minutes and will be held at his or her classroom. Your daughter/son will be given a questionnaire to fill. The questions that will be asked will be based on his/her eating habits, physical activity and the socio-economic status of his/her parents.

Afterward his/her weight and height will be measured. I will conduct this interview, with help from other research assistants. The responses your child gives and the measurements taken will be coded and then analysed only by myself. The findings will be discussed by comparing it to other related researches and conclusion drawn. The report will be shared with the University of Ghana, as well as the Ministries of Health & Education, Youth and Sports, who deal with adolescent's health issues.

Possible Risks and Discomforts

Your child will not be exposed to any risk or discomfort in this research.

Possible Benefits

Your child will not receive any direct benefit for participating but the findings of the study will be used to counsel adolescents and their parents on how to improve the nutritional, and physical health of the adolescent, as well as helping adolescents perform better in school. It will also inform health providers especially on designing effective interventions for healthier eating and lifestyle practices by adolescents.

Confidentiality

All the information that your child provides will be known exclusively to the researcher and his supervisors. Your child's name will not be included in any of the information your child will give me except the agreement form. The information your child provide was kept under lock for three to five years and if the need to use it again arises, permission was sought from you and your child.

Compensation

Your child will be given refreshments after the interview. Apart from this, no other compensation will be given to the child.

Voluntary Participation and Right to Leave the Research

Please be assured that your child's participation in this study is entirely voluntary. Your child has the right to participate or refuse to participate and this will not result in any penalty in the service your child is entitled to. Your child has the right to drop out of the research at any time he/she desires.

Contacts for Additional Information

If you or your child have any questions now or at any point during the course of the study, please feel free to ask. For further information please contact the principal investigator, Osei Prince, School of Public Health, University of Ghana, Legon.

Telephone: 0244098538 or email:princeoseijnr@gmail.com. Contact can also be made with the supervising lecturer, Dr. Ernest Kenu. If you have any questions about your child's rights as a research participant you can contact the Ghana Ethical Review Board Office via Hannah Frimpong 0243235225 or 0507041223.

The above document describing the benefits, risks, and procedures for the research titled "**Factors associated with overweight/obesity among adolescents in senior high school in the Ga Central municipality**" has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction.

By ticking this box, I agree that my child should participate in the research.

_____ _____ Date

Signature or thumbprint of parent or guardian

If parent or guardian cannot read the form himself or herself, a witness must sign here:

I was present while the benefits, risks and procedures were read to the child's parent or guardian. All questions were answered and the child's parent/guardian has agreed that his or her child should take part in the research.

_____ _____

Date Signature or thumbprint of witness

Please provide your monthly income in Ghana cedis …….

CHILD ASSENT FORM

My name is Osei Prince and I am from the School of Public Health at the University of Ghana. I am conducting a research study titled "Factors associated with overweight/obesity among adolescents in senior high school in the Ga Central municipality".

I am asking you to take part in this research because I am trying to learn more about how the body weight of adolescents and the factors associated with it. It will take you 30 to 45 minutes to participate.

If you agree to be in this study, you will be asked to fill out a questionnaire about your eating habits, physical activity and socio-economic status of your parents. Your responses will be coded and I will analyse it to draw some conclusions.

Your participation in this study will not result in a direct benefit to you but the findings will be used to improve adolescent health services. However, there are no risks associated with this research.

You can stop participating at any time if you feel uncomfortable. No one will be angry with you if you do not want to participate. There will also be no punishment or any negative consequence to you not participating.

Your information will be kept confidential and apart from those who are in the discussion with you, your information will be known to the researcher alone. You may ask me any questions about this study. You can call me, Prince Osei at any time on 0244098538 or talk to me the next time you see me.

Please talk about this study with your parents/guardians before you decide whether or not to participate. I will also ask permission from your parents before you are enrolled into the study. Even if your parents say "yes" you can still decide not to participate.

By signing below, it means that you understand and know the issues concerning this research study. If you do not want to participate in this study, please do not sign this assent form.

This assent form that describes the benefits, risks, and procedures for the research titled "Factors associated with overweight/obesity among adolescents in senior high school in the Ga Central municipality has been read and/or explained to me. I have been given an opportunity to have asked any questions about the research answered to my satisfaction. I agree to participate.

Researcher's Signature: …….. Date: ……..

Child's Signature/ Thumbprint: …….. Date: …….

Appendix II: Study Questionnaire

SURVEY ON FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG ADOLESCENTS IN SENIOR HIGH SCHOOLS IN THE GA CENTRAL MUNICIPALITYINTRODUCTION

Greetings, I am a member of a team from the University of Ghana conducting a research on factors associated with overweight and obesity among adolescents in senior high schools in the Ga central municipality

If you agree to take part in this study, I will give you a questionnaire to fill and then measure your height and weight. The questions and measurements will take about 25 to 30 minutes. Your responses to all questions will be confidential and will not be shared with anyone other than members of our study team. No answer is wrong. Your participation in the study is voluntary and you are free to end the interview or measurement process at any time. However, I will be happy if you participate in the study to contribute to existing knowledge on weight status and academic performance in adolescents.

Questionnaire number:.....

Name of Interviewer:.....

Date:.....

DEMOGRAPHIC CHARACTERISTICS

1	Date of Birth (MONTH/YEAR)	……../……..……..
2	Age	……
3	class	SHS 1……1 SHS2……..2

		SHS3…….3
4	Course	SCIENCE……..……..…….……1 BUSINESS……..…….…….....2 GENERAL ARTS……..……...……....3 VISUAL ARTS……...…….……..…4 AGRIC…….……..……....5 OTHER
5	Sex	Male …….1 Female ……2
6	Ethnicity	AKAN…….……..……..1 EWE……2 GA……..…….……....3 FANTE……..…….…….……...4 NORTHERN……..……...…….……5 OTHER…….……..…..……...6
7	Religion	CHRISTIANITY…….……..…….……1 ISLAM……2 TRADITIONAL…….……..…..……..3 OTHER…….…….....…….4
8	Place of Residence status in school	Day……..1 Boarder……2
9	Place of Residence area	Awoshie……1 Ablekuma…….. 2 Sowutoum……..3 Others……..4

SOCIOECONOMIC STATUS

10	Fathers Highest Educational level	NONE……..1 PRIMARY……...2 JHS/MIDDLE SCH…….3 SHS…….….4 TECHNICAL/DIPLOMA……...5 TERTIARY (BACHELORS/MASTERS/ Ph.D.) ……...6
11	Fathers Occupation	
12	Mothers Highest Educational level	NONE……..1 PRIMARY……...2 JHS/MIDDLE SCH…….3 SHS…….….4 TECHNICAL/DIPLOMA……...5 TERTIARY (BACHELORS/MASTERS/PHD) ……...6
13	Mothers Occupation	
	With whom do you live? (Guardian) Relationship to Guardian	PARENTS……..……..…1 MOTHER ONLY……..……..…….....2 FATHER ONLY……..……....3 AUNT/UNCLE……...…….....4 GRANDPARENT……..…..……5 SIBLINGS (SISTER OR BROTHER)…….....6

14	If 1, 2 or 3, skip to Question15	
15	Guardians Highest Educational level	NONE……..……....1 PRIMARY……..…...….2 JHS/MIDDLE SCHOOL……...…….3 SHS…….....4 TECHNICAL/DIPLOMA……..5 TERTIARY (BACHELORS/MASTERS/ Ph.D.)…6
16	Guardians Occupation	
17	Who do you live with during a vacation	PARENTS……..……...…….1 MOTHER ONLY……..……...……..2 FATHER ONLY……..……..3 AUNT……..……...4 UNCLE……...…….…5 GRANDPARENT……..……6 SIBLINGS (SISTER OR BROTHER)……...…7
18	Type of Residence (OWNED BY)	PARENTS…….…….....1 GUARDIAN…….…….....2 FAMILY HOUSE……..3 RENTED…….…...4
19	Do you own any of the following in your house? (Tick as many as possible)	TV DVD PLAYER REFRIGERATOR MICROWAVE GENERATOR

		CAR MOTORBIKE COMPUTER/LAPTOP COOKER
20	Does your family subscribe to any TV Network? (Apart from the free-to-air channels)	NO……..……..0 If no, skip to Question 22 YES…….……1

FAMILIAL OR GENETIC HISTORY

21	Number of Siblings:	0 1 2 3 4 5 or more
22	What is your birth order in your family?	1st 2nd 3rd 4th 5th or more
23	What is your parent's marital status?	SINGLE……..…….…….……1 MARRIED……...……..2 SEPARATED……3 DIVORCED……..…..……4 MOTHER DIED…….……...……5 FATHER DIED……..……6 BOTH PARENTS DEAD……...…….……...…7
24	What body type will you class your father?	SLIM/SLENDER…….……...……1 ATHLETIC……....….2 AVERAGE……...……..3 BIG……4 VERY BIG……...……...5 DON'T KNOW……..6

25	What body type will you class your Mother?	SLIM/SLENDER……1 ATHLETIC……..……2 AVERAGE……..……3 BIG…….……4 VERY BIG……...……..5 DON'T KNOW……..……6
26	Is there anyone else in your family who is Big or Very Big?	NO……0 If no, skip to Question 29 YES……..
27	If yes, who is he or she?	

DIETARY HABITS

28	How many meals do you eat in a day?	1 – 2 TIMES.....1 3 TIMES..... 2 4 TIMES.....3 5 TIME .....4 OTHERS.....6
29	When do you take your first meal of the day?	
30	What meal do you usually skip?	Breakfast .....1 Lunch .....2 Dinner.....3

31	How frequently do you skip meals?	Everyday Once in a week 2 – 3 times a week More than 3 times a week Others specify……
32	How many sachets of water do you drink in a day?	Less than three 3 – 8 8 or more

Please describe the foods (meals and snacks) that you eat or drank over the past 24 hours, whether at home or outside the home. Start with the first food or drink of the morning.

Eating moment	Name of dish	Ingredients
Breakfast		
Snack before lunch		
Lunch		
Snack before dinner		
Dinner		
Snacks after dinner		

GENERAL LIFESTYLE

37	How often do you watch TV?	NEVER……..…..…1 ONCE A WHILE……2 EVERYDAY……..….3
38	For how long?	
		0, 30MINS, 1, 2, 3, 4, 5 HRS/DAY
39	How often do you play Video games?	NEVER……..…..…1 ONCE A WHILE……2 EVERYDAY……..…….3
40	For how long?	0, 0.5, 1, 2, 3, 4, 5 HRS/DAY

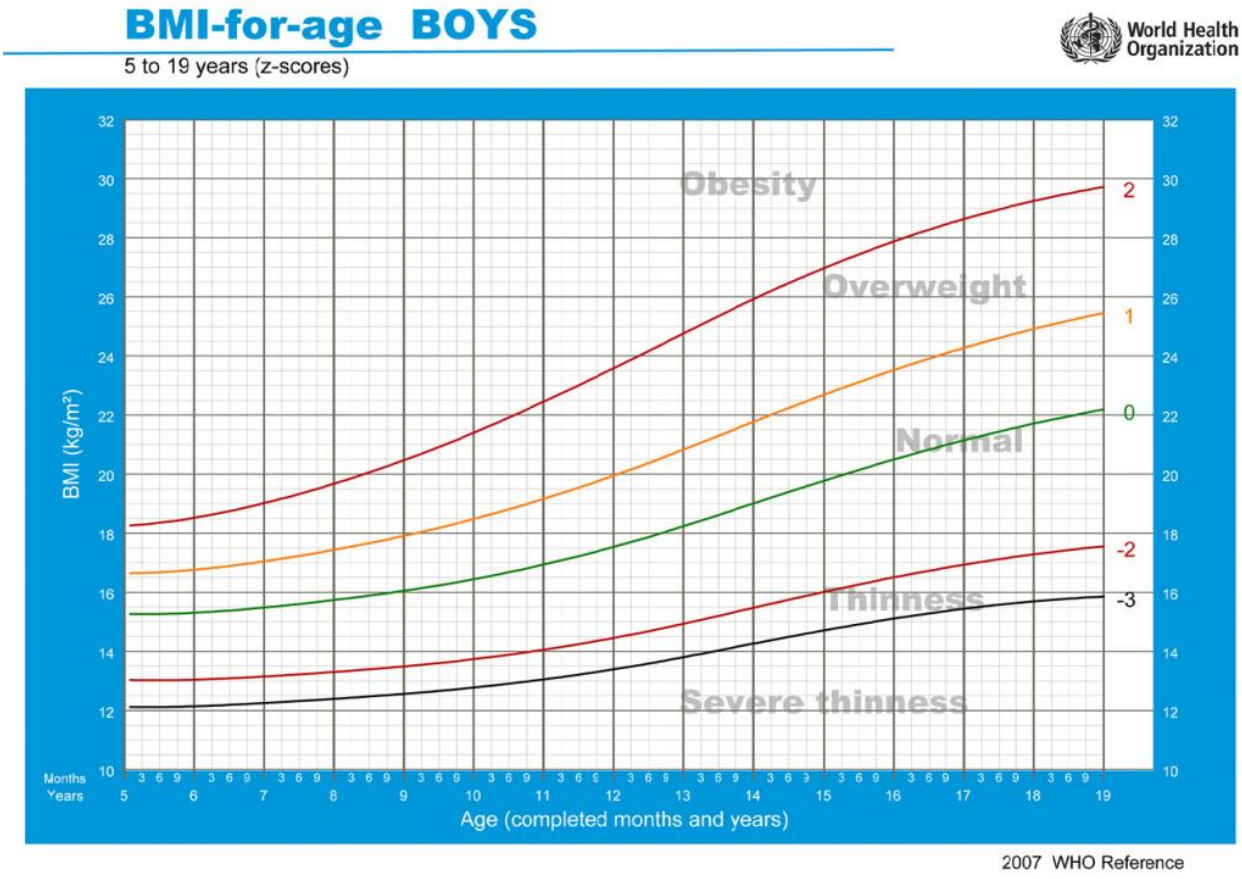
41	Do you have any of the following diseases?	ASTHMA……YES…….NO…… SEIZURE DISORDER……...YES……NO…… SICKLE CELL DISEASE..…….....YES……NO…… OTHER please specify. ……
42	Do you sometimes feel mentally stressed?	NEVER……...……..1 AVERAGE……..…..……....2 HIGH……..……..3 VERY HIGH……..……..…..…..4
43	On the average, how long do you sleep?	<=4HRS…….……..1 5 HOURS……...……..2 6 HOURS…….…...…….3 7 HOURS…….…….……...4

		8 HOURS……..……..……..5 > 8 HOURS…….……6
44	Do you Smoke?	NEVER SMOKED……..1 SMOKE EVERYDAY……2 SMOKED BEFORE…….....…3
45	Do you drink Alcohol?	NEVER……...……..1 ONCE IN A WHILE……2 EVERYDAY……..……..3 STOPPED……..……..4
46	How often do you absent yourself from school?	NEVER…….……..1 ONCE A WHILE……..……..2 AVERAGE……....……..3 A LOT……...……..4 ALMOST ALWAYS……..…5

ANTHROPOMETRIC MEASUREMENTS

Measurements	**1st Reading**	**2nd Reading**	**AVERAGE of both Readings**
Weight (kg)			
Height (cm)			
BMI			

Appendix III-A: BMI –age –Growth for Boys



Appendix III-B: BMI –age –Growth for Girls