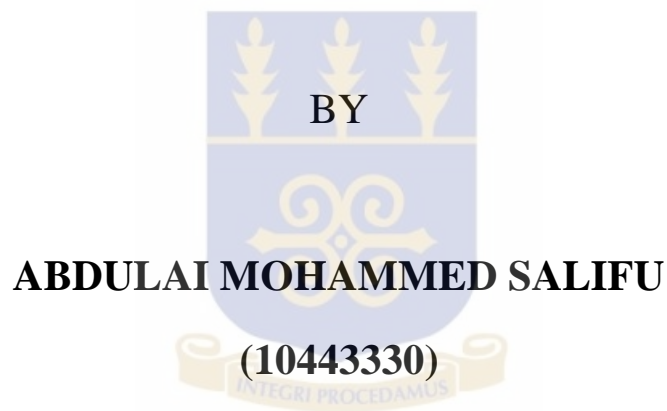


SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

**RISK FACTORS FOR OBESITY AMONG ADOLESCENTS
IN SENIOR HIGH SCHOOLS IN THE TEMA METROPOLIS**



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

JULY, 2014

DECLARATION

I declare that this thesis is the result of my own research. References from other people's work have been duly acknowledged.

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Date :



DEDICATION

I would like to dedicate this dissertation to my mother, Ms Mariama Yayah, for her immense contribution to my life. She has been my constant source of inspiration.



ACKNOWLEDGEMENT

My first gratitude goes to the Almighty for His favour upon my life and giving me the strength, wisdom and knowledge to complete this work.

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I want to thank the headmasters of Methodists and Datus SHS for their help and understanding. I also appreciate the support of the teachers of Methodist Day and Datus SHS.

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ABSTRACT

Introduction: Obesity in adolescents has reached alarming levels and its prevalence is continuing to rise to the extent that WHO has labeled it as an epidemic. Obesity in adolescence is of importance because the adolescents are known to carry the obesity into adulthood and develop Non Communicable Diseases (NCDs) in their early years of adulthood.

Objective: The aim of the study was to determine the prevalence and risk factors for obesity among adolescents in senior high schools in the Tema Metropolis.

Methods: A cross-sectional school based study was conducted on 423 adolescents in Methodist Day SHS and Datus SHS in the Tema Metropolis. A multistage stratified random sampling was used to select the participants for the study. The students were asked to complete questionnaires that included risk factors of obesity such as dietary habits, physical inactivity, familial or genetic factors and socioeconomic status. Their weight and height were measured and used to compute their BMI. They were then categorized as obese, overweight, normal weight or underweight based on their BMI for age taking into account their sex using the CDC BMI for age growth chart.

Results: Out of the 423 participants aged between 13 – 19 years, 159(37.6%) were males and 264(62.4%) were females. The overall prevalence of obesity was 15.4%. The prevalence of obesity in males and females was 6.3 % and 20.8% respectively. Seventy (16.5 %) were overweight while 3(0.7%) were underweight. The risk factors that showed significant association with obesity after adjusting for other variables were sex (AOR= 21.8, p=0.000), socioeconomic status (AOR=2.56, p=0.036), snacks consumption per week (AOR=1.88, p=0.046), not having a fat father (AOR=0.06, p=0.000), not having a fat mother (AOR=0.21, p=0.000), not having a fat

relative (AOR=0.29, p=0.007), not being fat before age 10years (AOR=0.17, p=0.001) and duration of watching TV of > 4hours (AOR= 2.31, p=0.006)

Conclusion: Sex was the most significant risk factor associated with obesity, with females being 21.8 times more likely to be obese compared to males. There is the need for increased awareness for obesity. Health education programs should be conducted for obese children but should target overweight children too. These health education programs must include diet, exercise and family based behavior approach. Further research is needed on obesity.

Key words: Obesity, adolescents, senior high schools, Tema metropolis

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LIST OF ACRONYMS

AOR	ADJUSTED ODDS RATIO
BMI	BODY MASS INDEX
CDC	CENTERS FOR DISEASE CONTROL
CI	CONFIDENCE INTERVAL
NCD	NONCOMMUNICABLE DISEASE
OR	ODDS RATIO
WC	WAIST CIRCUMFERENCE
WHO	WORLD HEALTH ORGANISATION
WHR	WAIST TO HIP RATIO

CHAPTER ONE

INTRODUCTION

1.1 Background

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 et al., 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 (Pan et al., 2011).

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, 2010). The causes of obesity are complex and multiple leading to an imbalance between energy intake and output often termed as energy imbalance between calories consumed and calories expended.

WHO defines obesity as the BMI as equal to or greater than 30 kg/m² or Body Mass Index (BMI) > 2 standard deviations above the 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 et al., 2000).

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 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).

Data available shows that the prevalence of obesity is increasing rapidly in developing countries (De Onis & Blössner, 2000) and this is placing significant financial burdens on health system to the extent that WHO has labeled it as an epidemic. At least 2.8 million people each year die as a result of being overweight or obese. According to WHO, obesity is the leading cause of preventable illnesses and death worldwide (WHO, 2010).

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 has occurred with industrialization, urbanization and the world food economy has 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 are 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 leads to obesity (Chatterjee & DeVol, 2012; S. Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpelä, 2005; WHO, 2010).

The developing economies or countries are undergoing epidemiological transition (Ezzati et al., 2005), and are now facing a double or dual burden of disease (Boutayeb, 2006). Even though they continue to deal with the problems of infectious diseases and under-nutrition, they are experiencing a sudden increase in Non Communicable Diseases risk factors such as obesity, especially in urban settings (Yach & Beaglehole, 2004).

Adolescents are exposed to foods that are high in fat, high in sugar, high in salt, energy dense, and poor in micronutrients. 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. In a study to determine the distribution and trends of obesity in West Africa populations, urban residents and women were particularly at higher risk of obesity (Abubakari & Bhopal, 2008).

Some African cultures consider weight gain and fat storage as signs of health and prosperity. Some Africans therefore make frantic efforts to put on weight (Arojo & Osungbade, 2013)..

In Ghana, studies conducted on obesity in 2005 have indicated a prevalence of 5.5% among the general population, with prevalence higher in females than in males. The prevalence was 7.4% among females and 2.8% among males (Biritwum, Gyapong, & Mensah, 2005).

The Ghana Demographic and Health Survey report for 2008 showed that 1.6% of female adolescents between the ages of 15 to 19 were obese with 14% of them in the urban areas and just 4.6% in the rural areas. The Greater Accra region alone had a prevalence of 19.4% for obese females, the least was 2.4% and that was recorded in both the Northern and Upper West Regions (Ghana Demographic and Health Survey Report, 2008).

1.2 Statement of problem

Obesity is the leading cause of preventable illnesses and death worldwide. It is believed that obesity is associated with more deaths worldwide than underweight and 65% of the world's population are at risk (WHO, 2010).

Obesity in adolescents is increasing and placing significant financial burdens on health system to the extent that WHO has labeled it as an epidemic (Reddy et al., 2012; WHO, 2010). About half of the diabetes burden, a quarter of the heart disease burden and between 7% and 41% of certain cancer burdens are attributable to obesity and overweight (WHO, 2008).

Obesity in adolescence is of importance because the adolescents are known to carry the obesity into adulthood and develop non communicable diseases (NCDs) early in their early years of adulthood (WHO, 2010). The sad aspect for these obese adolescents is that they tend to suffer

from both short-term and long-term health consequences of obesity (WHO, 2008). Childhood obesity is associated with a higher chance of obesity, premature death and disability in adulthood (Kalra, De Sousa, Sonavane, & Shah, 2012).

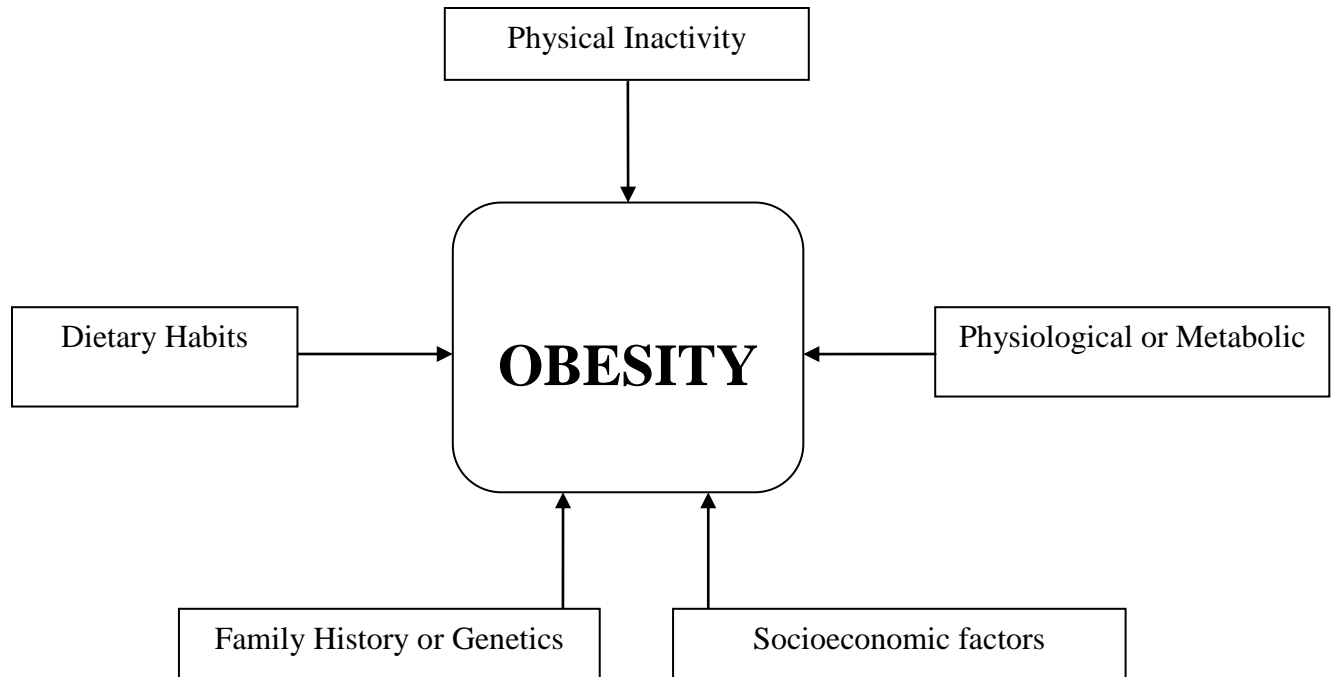
Most students especially those in the urban areas like Tema Metropolis do very little or no physical activity. Many of these students vehicles as transport to school due to either long distance or their inability to go school by foot or cycling due to the unsafe nature of our roads and time constraints. As a result of technology, labor saving devices and equipment are widely used in homes for cooking, washing, cleaning and even controlling the air condition, radio and television. Children and adolescents are now using video and computer games that require sitting or lying down to participate. These limit the expenditure of energy in adolescents which results in excessive weight gain leading to obesity (Chatterjee & DeVol, 2012; Mendoza et al., 2007; Siervo, Grey, Nyan, & Prentice, 2005; WHO, 2006).

Westernization has led to new eating patterns, which affect dietary habits and even pattern of consumption. Adolescents are exposed to foods that are high in fat, high in sugar, high in salt, energy dense and poor in micronutrients (Chatterjee & DeVol, 2012; Susanna Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpelä, 2005; Mendoza et al., 2007).

In the face of increasing trends in obesity and overweight reliable data baseline on obesity in adolescents would be useful. There is available data on obesity as a whole but data on adolescent obesity is scanty and limited. 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.

1.3 Conceptual frame work

Figure 1 Conceptual framework



The conceptual framework shows the risk factors that lead to obesity. The main risk factors which are dietary habits, physical inactivity, physiological or metabolic, socioeconomic factors and family history or genetics are responsible for obesity. Any one of these risk factors can lead to obesity but it does not mean that someone with all these will be obese.

1.4 Justification

Obesity is on the increase among adolescents and these adolescents tend to carry the obesity into adulthood. Obesity is associated with many conditions such as High blood pressure, Heart disease, Stroke and Diabetes (WHO, 2010).

Even though studies have been done on obesity, most of these studies on obesity have been carried out on adults making data available on children and adolescents scanty and scarce.

There is the need to focus on prevention of obesity especially among adolescents because they tend carry their obesity into adulthood. Obesity is also the leading cause of preventable illness and death globally (WHO, 2010).

This study aims to determine the prevalence and the assess risk factors for obesity among adolescents in senior high school in the Tema metropolis to add to the pool of data currently available.

The data will go a long way to help in the prevention of obesity through planning and education.

The research data will also serve as a baseline data upon which further research could be done.

1.5 OBJECTIVES

1.5.1 General Objective

To determine the prevalence and risk factors for obesity among adolescents in senior high school in the Tema Metropolis.

1.5.2 Specific Objectives

1. To determine the prevalence of obesity among adolescents in Senior High School of Tema Metropolis.
2. To assess risk factors for obesity among adolescents in Senior High School of Tema Metropolis.

1.5.3 Research Questions

1. What is the prevalence of obesity in adolescents in Senior High Schools in the Tema Metropolis?
2. What are the risk factors for obesity in adolescents in Senior High Schools in the Tema Metropolis?

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

A cross-sectional study using a multistage stratified random sampling technique was conducted in Kuwaiti 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 from their study was 30.7% and 14.6%, respectively. The prevalence of obesity among females and males was 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 prevalence of obesity in children and adolescents. The prevalence of obesity was 10.3% and 9.1% in males and females respectively, using the NHANES I definition (Savva et al., 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 that all ages, the

prevalence of childhood and adolescent obesity for both males and females was higher in the 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 developed and developing countries (WHO, 2010).

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 (S. 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 et al., 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, 2010).

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 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 reason why it is assumed that 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 lifestyles (Schulz et al., 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 equipments 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 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 ($\geq 5^{\text{th}}$ 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 (Rothman, 2008; Wickramasinghe et al., 2005).

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 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, 2000).

2.4 Risk factors for 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 unlimited capacity for storage of fat. However, 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 WHO/FAO Expert Consultation Report, 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 sugars-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 et al., 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, 2008).

The shift from traditional staples to processed foods in these developing (especially urban areas) is strongly enhanced by borrowed western culture (Neutzling et al., 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, 2010).

2.4.2 Familial or Genetic factors

Some conducted studies have shown a strong predisposition 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. The prevalence of obesity in the study in males was 10.3% and in females 9.1% (Savva et al., 2002). Similarly, a study conducted earlier in Italy showed that parental obesity was the main risk factor for obesity in children (Maffeis et al., 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 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, Taddei, Colugnatti, & others, 2003).

A study has also shown an association between BMI of friends, siblings and spouses (Christakis & 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 were greater than 30 were two times more likely to be overweight or obese than those whose parents had BMI less than 30 (Neutzling et al., 2003).

2.4.3 Metabolic or Physiological factors

Overweight and obesity tends to be associated with the sex of individuals, being more prevalent in girls than in boys, a study done in Kuwait showed that obesity was prevalent in 14.9% of females and 14.2% of males. The BMI in females was also higher than in males. This denotes that the level of fatness among adolescent girls was found to be higher than among boys (El-Bayoumy et al., 2009).

During adolescence, and especially during puberty, both girls and boys undergo fat storage, and because the spurt of height in boys is higher than in girls, the BMI of girls appears to be higher than boys (Poskit, 1988).

In addition, boys lose their body fat during puberty faster than girls, and the fat deposition among girls still continues through puberty (Meredith & Dwyer, 1991). The difference in obesity between males and females can be further explained by the differences in the level of physical activity between them, that is, boys tend to be more physically active than girls (Sallis, 1993).

However, some studies have showed higher prevalence of obesity in males than females, a study conducted showed the prevalence of obesity was 3.8% for boys and 3.3% for girls (Georgiadis & Nassis, 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. Childhood overweight showed a direct relationship to overweight and obesity during adolescence. Adolescents who reported being overweight before they were 10 years old were 2.5 times more likely to be overweight or obese during their adolescence (Neutzling et al., 2003).

2.4.4 Physical inactivity

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2010). Literature available have reported that children and adolescents are more active than adults (Pratt, Macera, & Blanton, 1999).

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 et al., 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 noticed sedentary behaviour was higher in overweight children in the intervention group than the control group (Sahota et al., 2001).

The association between overweight and obesity and factors related to physical activity showed that adolescents using 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 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 et al., 2002) .

The American Academy of Pediatrics states that children and adolescents need 1-2hours 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 Academy of Pediatrics, 2013).

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 (S. Kautiainen et al., 2005).

Studies were reviewed to assess the role of television as 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; the prevalence of obesity and the number of hours that TV networks dedicate 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 et al., 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).

In a cross sectional study conducted to compare the physical activity pattern of children, 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 (Troost, Sirard, Dowda, Pfeiffer, & Pate, 2003).

2.4.5 Socioeconomic status

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 higher risk of paediatric obesity (WHO, 2010).

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 et al., 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 socio-demographic 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, 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. 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 status (Grøholt et al., 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 for 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 et al., 2003).

CHAPTER THREE

METHODOLOGY

3.1 Study design

A cross sectional study was conducted among adolescent students (aged 10 to 19 years) from Methodist Day and DATUS Senior High Schools in the Tema Metropolis using quantitative and qualitative data. The study took place from June to July 2014.

3.2 Study location or area

Tema is the administrative capital of the Tema Metropolitan District in the Greater Accra Region of Ghana with a population of about 402,637 people.

It is a coastal city situated 25 kilometres east of the national capital, Accra.

The Greenwich Meridian (0° Longitude) passes through the city of Tema. It has a deep seaport that was developed in 1952 and became a Metropolitan in 1990.

The Metropolitan shares boundaries with Ashaiman Municipal, Adentan Municipal, and Ledzokuku-Krowor Municipal to the west, to the east with Kpone Katamanso District, to the North with Dangme West District and to the South with the Gulf of Guinea.

Towns in This Metropolis: Tema Community One to Eleven, Tema Newtown, Lashibi and Bethlehem.

Tema has 13 Senior High Schools, Six (6) are public and Seven (7) are private.

3.3 Variables

3.3.1 Independent variables

Age

Sex

Ethnicity

Level of education (class)

Residential area

Residential status in school

Socioeconomic status of Parents or Guardians

Dietary intake and habits

Family history

Physical activity level

Weight

Height.

3.3.2 Dependent variable

BMI(Body Mass Index)- Obesity

Table 3.1: Study Variables

Study Variable	Operational Definition	Measurement Scale	Data Collection Tool/ Technique
Age	Age at last birthday	Continuous	Questionnaire
Sex	Sex of student <ul style="list-style-type: none"> ▪ Male or Female 	Nominal <ol style="list-style-type: none"> 1. Male 2. Female 	Questionnaire
Ethnicity	Ethnic group of association by birth	Nominal <ol style="list-style-type: none"> 1. Ga 2. Fante 3. Ewe 4. Dagomba 5. Others 	Questionnaire
Level of education (class)	Current class of student <ul style="list-style-type: none"> ▪ SHS1, SHS 2 or SHS 3 	Nominal <ol style="list-style-type: none"> 1. SHS1 2. SHS 2 3. SHS 3 	Questionnaire
Residential area	Residential area of the student when not in school	Nominal <ol style="list-style-type: none"> 1. Tema 2. Ashaiman 3. Kpone 4. Others 	Questionnaire
Residential status in school	Whether student resides in school or comes to school from home daily <ul style="list-style-type: none"> ▪ Day or Boarding 	Nominal <ol style="list-style-type: none"> 1. Day 2. Boarding 	Questionnaire
Socioeconomic status of Parents or Guardians	Highest level of education, occupation and monthly income of the father and/or mother or guardian; Type of residence; Ownership and number of some named items. <ul style="list-style-type: none"> ▪ Low, Medium or High 	Ordinal <ol style="list-style-type: none"> 1. Low 2. Medium 3. High 	Questionnaire and Modified Kuppuswamy scale
Dietary Intake and Habits	What one ate for breakfast, lunch, supper and snacks How many times one eats breakfast, lunch, snacks, supper, fruits and vegetables in a week <ul style="list-style-type: none"> ▪ <3 days/week or >3days/week 	Nominal <ol style="list-style-type: none"> 1. Beverages(e.g. koko, tea) 2. Grains(e.g. rice, waakye) 3. Solid starchy foods(e.g. fufu, banku) 4. OTHER Binary <ol style="list-style-type: none"> 1. <3 days/week 2. >3days/week 	Questionnaire

	<p>How many times one eats in a day</p> <ul style="list-style-type: none"> ▪ 3 or others <p>Patronizing fast foods and sugar sweetened drinks</p> <ul style="list-style-type: none"> ▪ Yes or No 	<p>Binary</p> <ol style="list-style-type: none"> 1. 3 2. Others <p>Binary</p> <ol style="list-style-type: none"> 1. Yes 2. No 	
Family History	<p>Perception of a fat father or mother or guardian or relative or being fat yourself before age 10 years?</p> <ul style="list-style-type: none"> ▪ Yes or No 	<p>Binary</p> <ol style="list-style-type: none"> 1. Yes 2. No 	Questionnaire
Physical Activity Level	<p>Engaging consciously in physical activity</p> <ul style="list-style-type: none"> ▪ Yes or No <p>How long one engages in physical activity</p> <ul style="list-style-type: none"> ▪ < 30minutes or > 30minutes <p>Number of hours spent watching TV OR Movies in a day</p> <ul style="list-style-type: none"> ▪ < 4HOURS or > 4 HOURS <p>Physical Education as part of the school curriculum</p> <ul style="list-style-type: none"> ▪ Yes or No 	<p>Binary</p> <ol style="list-style-type: none"> 1. Yes 2. No <p>Binary</p> <ol style="list-style-type: none"> 1. < 30minutes 2. > 30minutes <p>Binary</p> <ol style="list-style-type: none"> 3. < 4HOURS 4. > 4 HOURS <p>Binary</p> <ol style="list-style-type: none"> 1. Yes 2. No 	Questionnaire
Weight	<p>The weight to the nearest 0.1kg 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</p>	Continuous	Digital column weighing scales with height rod (with BMI calculation)
Height	<p>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</p>	Continuous	Digital column weighing scales with height rod (with BMI calculation).
BMI	<p>$BMI = \text{Weight(kg)} / \text{height(m)}^2$</p> <p>Obese: BMI for age $\geq 95^{\text{th}}$ percentile</p> <p>Overweight: BMI for age $\geq 85^{\text{th}}$ and $< 95^{\text{th}}$ percentile</p> <p>Normal: BMI for age $\geq 5^{\text{th}}$ and $< 85^{\text{th}}$ percentile</p> <p>Underweight: BMI for age $< 5^{\text{th}}$ percentile</p> <ul style="list-style-type: none"> ▪ Obese or Not Obese 	<p>Binary</p> <ol style="list-style-type: none"> 1. Obese 2. Not Obese 	Digital column weighing scales with height rod (with BMI calculation) and CDC BMI for age growth chart.

3.4 Study population

The study population were adolescent students (aged 10 to 19 years) from Methodist Day and DATUS Senior High Schools in the Tema Metropolis.

3.4.1 Inclusion criteria:

The following were included in the study;

Senior High School students aged 10 to 19 years from Methodist Day and DATUS Senior High Schools in the Tema Metropolis.

All students aged 18years and above who consented or all students aged 10 to 17 years whose parents consented

The age of 10 to 19 years old represent the age range for adolescents.

3.4.2 Exclusion criteria:

The following were excluded from the study;

All those below 10years

All those above 19years were excluded

Any student who does not attend Methodist Day or DATUS SHS in Tema Metropolis.

Any student aged 18years who declined to participate in the study or any students aged 10 to 17 years whose parents declined consent.

Any student who was seriously ill and could not take part in the study.

3.5 Sampling

3.5.1 Sampling method

Multistage stratified random sampling technique was used.

There are 13 Senior High Schools in the Metropolis made up of six (6) public and seven (7) private Senior High Schools.

The Senior High Schools were divided into two groups - Private and Public schools. Two Senior High Schools were selected by random sampling from each of the two groups:

One public and one private SHS were picked by the balloting technique. This idea was to enrich the data with students with different socioeconomic status backgrounds.

Systematic sampling was used for the selection of the students in each school. For each of the schools a master list was obtained and numbered. The first student for the study was chosen at random by balloting. After the first student had been chosen, the next students were chosen by a 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 on the list. This same pattern was used for any other student who refused to participate in the study.

3.5.2 Sample size

The sample size can be calculated using the Cochran's formula (Cochran, 1977) :

$$N = \frac{\text{deff} \cdot z^2 \cdot pq}{d^2}$$

N is the Sample size

deff is the design effect (the ratio between the variance of the cluster design to the variance that would be obtained from a simple random sampling)

z is the Confidence limits

p is the assumed prevalence of the dependent variable

q is given by 1-p

d is the acceptable deviation from the true value

For this study

deff= 2

z= 1.96 for CI at 95%

p= 15% =0.15 (an assumed prevalence of obesity among adolescents in Ghana of 15%)

q=1-0.15= 0.85

d= 5%= 0.05

Sample size, $N = \frac{2 \times 1.96^2 (0.15) \times (0.85)}{0.05^2}$

N= 392

A non response rate of 10% was then factored into the sample size:

$$\frac{392}{(1-0.1)} = 435.5$$

This was approximated to 436 (Four hundred and thirty six) but a total sample size of 440 (Four hundred and forty) was used.

Study participants per selected school

Proportionate sampling was used to determine the number of participants per each senior high school taking into account their respective total population. This was because the two schools had different populations. Methodist Day SHS has a total population of 736 students while DATUS SHS has a total population of 95 students making the total student population for the two schools 832.

Sample size for Methodist Day SHS; with a student population of 736 students

$$N \text{ for Methodist Day SHS} = \frac{736}{832} \times 440 = 389.7$$

This was approximated to 390.

Sample size for DATUS SHS; with a student population of 95 students

$$N \text{ for DATUS SHS} = \frac{95}{832} \times 440 = 50.3$$

This was approximated to 50.

390 students from Methodist Day SHS and 50 students from DATUS SHS were recruited for the study.

Out of the 440 questionnaires, 423 questionnaires were fully completed and analysed. The overall response rate was 96.1 % (423/440).

3.6 Data collection techniques or methods and tools

Interviews using self-administered questionnaires were conducted to obtain background information on students and to elicit the risk factors such as dietary habits, physical activity and family history.

Questionnaires were distributed to the students and the questions explained to them to make sure they did not leave questions unanswered. The students were also supervised to make sure that they answered the questionnaires independently. However, the question on the monthly income was added to the consent form for the parents or guardians to answer.

The socioeconomic status of the parents were 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 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 and monthly income.

However, the following were 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)

Height, weight and BMI were measured with digital column weighing scales with height rod (with BMI calculation).

The students were made to stand on the digital scale without shoes, with feet together and arms at the sides and in light clothing with emptied pockets. The students stood with heels, buttocks and upper back in a straight line in a complete upright position against the height rod of the machine.

The height and weight were then measured to the nearest 0.1cm and 0.1kg respectively. The BMI was then calculated with the same machine and then recorded. The height and weight were done twice by two different pairs of research assistants and the average was used. Before each reading the digital scale was checked to make sure it was on zero kg.

3.7 Quality control

The whole process of data collection was standardized to obtain uniform and of high quality data. The research assistants were trained to make sure they knew 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 researcher supervised the data collection process and ensured there were no protocol deviations.

The digital column weighing scales with height rod (with BMI calculation) were calibrated daily and before each measurement and placed on a flat floor before taking weights and height.

The height and weight for each student was measured two times by two different pairs of research assistants. The mean weight and height was then used to minimize intra-observer and inter-observer biases.

The student were supervised and told to answer the questionnaires independently. Questionnaires were checked for completeness before they were accepted.

Questionnaires were numbered during data entry to ensure that the questionnaires were not entered twice.

Data entry clerks were closely monitored; data was entered twice by two different data entry clerks to make sure data was correctly entered.

3.8 Data analysis and Statistical methods

Data entry, cleaning and analysis was done using EpiData 3.1, Microsoft Excel 2010 and Stata 11. The data were inspected and sorted. There were no missing values.

The data was described using descriptive statistics. BMI was determined as weight in kg divided by the height in metre-squared, this was calculated directly by the digital machine used for the measurements.

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 $\geq 95^{\text{th}}$ percentile were considered obese, those with BMI for age $\geq 85^{\text{th}}$ and $< 95^{\text{th}}$ percentile were considered overweight, those with BMI for age $\geq 5^{\text{th}}$ and $< 85^{\text{th}}$ percentile were considered normal and those with BMI for age $< 5^{\text{th}}$ percentile were considered underweight. The classification was done using the CDC BMI for age growth chart.

Univariate analysis was done using a Chi-square test to identify the association between the dependent and independent variables. A p-value of less than 0.05 was considered statistically significant throughout the data analysis. Bivariate analysis was carried out on variables that showed association in the univariate analysis. The variables that showed statistical significance in the bivariate analysis were incorporated into a multivariate logistic regression model for further analysis to determine the most significant risk factors for obesity.

The adjusted and unadjusted odds ratios at 95% confidence interval was determined using Stata 11.

3.9 Ethical considerations

The Ethical Review Committee of the Ghana Health Service approved the study. Permission was obtained from the Ghana Education Service, Tema Metropolitan 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.

Parents or Guardians were also asked to give consent before the data was taken from the adolescents or students.

An informed written consent was used for both parents or guardians and the study participants. All those who gave consent were assured of confidentiality and anonymity.

Participants were made to know that there were no incentives and they could withdraw at any time during the study.

The procedures that were used did not cause any physical, emotional or mental harm.

Participants were told their BMI status and those who were obese were educated on the health implications of obesity and how to reduce their weight through regular physical activity and healthy eating habits. Obese participants were also advised to see dieticians and experts in physical activity to help them maintain a healthy weight.

The data obtained was analyzed solely for the objective of the study and utmost discretion was exercised in the handling of the personal information provided.

The questionnaires were secured in a locked cupboard. Data from the study was password-protected and stored on an external storage device.

3.10 Pretest or pilot study

Pre testing of the questionnaires was carried out among 20 adolescents in Achimota 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 metropolis.

This process enabled me to clarify the adequacy 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 was also done to enable the data collectors practice the data collection technique.

3.11 Limitations of the study

SHS 3 students were on vacation so they did not participate in the study. Only SHS1 and SHS2 students participated in the study.

The consent forms which were given out to the parents or guardians resulted in some delayed response because some parents or guardians were not at home.

Some parents or guardians prevented their adolescents from taking part in the research even though those adolescents really wanted to take part.

The BMI of the parents or guardians were not checked.

3.12 Assumptions

It was assumed that participants gave accurate and honest information, and the non-availability of incentives from the principal investigator did not skew the responses to any direction.

CHAPTER FOUR

4 RESULTS

4.1 Prevalence of Obesity and Characteristics of the Study Population

Four hundred and twenty (423) three Senior High School students aged between 13 – 19years participated in the study. Three hundred and eighty one (90.1%) students were from Methodist Day Senior High School and 42(9.9%) were from Datus Senior High School.

This was made up of 159(37.6%) males and 264(62.4%) females. For Methodist Day SHS, there were 135 males and 246 females while Datus SHS had 24 male and 18 female participants. Majority of the participants were in SHS 1(69.3%) and day students (92.7%). All the boarding students 31(7.3%) came from Datus SHS.

The overall prevalence of obesity was 15.4%. The prevalence of obesity in Methodist Day Senior High School and Datus Senior High School was 15.0% and 19.1% respectively. The overall prevalence of obesity amongst males and females was 10(6.3%) and 55(20.8%) respectively.

The mean age was 16.8 ± 1.12 years for all the participants with majority 147(34.8%) being 17years of age. The mean age was 16.64 ± 1.12 years in males and 16.84 ± 1.12 years in females.

The average height was 1.6 ± 0.07 metres with males having an average height of 1.65 ± 0.08 metres and females 1.59 ± 0.06 metres.

The average weight was 61.2 ± 11.8 kilograms in both sexes but it was 61.24 ± 10.6 kilograms in males and 62.20 ± 12.5 kilograms in females.

The average BMI was 23.6 ± 4.53 kg/m². The mean BMI for females and males was 24.26 ± 4.90 kg/m² and 22.39 ± 3.56 kg/m² respectively.

Table 4.1 shows the distribution of BMI status by background characteristics. The BMI was categorized as obese, overweight, normal and underweight according to guidelines given by the CDC BMI for age growth chart.

Majority of the participants 285(67.4%) were normal while 65(15.4%) were obese, 70(16.5 %) were overweight and 3(0.7%) were underweight. The normal category had the most number of participants with respect to the demographic characteristics. All the underweight participants, 3(100%) were females. There were more obese females 55 (20.8%) than overweight females 53(20.1%). There were 3(100.0%) participants who were 17years old. The underweight participants were all in Methodist Day SHS.

Table 4.1 : Distribution of BMI status by background characteristics

Variable	Obese (n=65)	Overweight(n=70)	Normal(n=285)	Underweight(n=3)
	No. (%)	No. (%)	No. (%)	No. (%)
Sex				
Male	10 (6.3)	17 (10.7)	132(83.0)	0(0.0)
Female	55(20.8)	53 (20.1)	153(58.0)	3(100)
Age				
13	2 (100)	0(0.0)	0(0.0)	0(0.0)
14	0(0.0)	0(0.0)	6(100)	0(0.0)
15	5(12.2)	8(19.5)	28(68.3)	0(0.0)
16	26(21.1)	8(6.5)	89(72.3)	0(0.0)
17	17(11.6)	18(12.2)	109(74.2)	3(2.0)
18	9 (11.5)	24(30.8)	45(57.7)	0(0.0)
19	6(23.1)	12(46.2)	8(30.8)	0(0.0)
School				
Methodist Day SHS	57(15)	60(15.8)	261(68.5)	3(0.8)
DATUS SHS	8(19)	10(28.3)	24(57.1)	0(0.0)
Educational level				
SHS 1	50(17.1)	40(13.7)	200(68.3)	3(1.0)
SHS 2	15(11.5)	30(23.1)	85(65.4)	0(0.0)
Ethnicity				
Ga	26 (22.41)	17(14.7)	73(62.9)	0(0.0)
Ewe	22(20.4)	19(17.6)	67(62.0)	0(0.0)
Akan	6(7.8)	12(15.6)	59(76.6)	0(0.0)
Fante	11(15.3)	11(15.3)	47(65.3)	3(4.2)
Others	0(0.0)	11(22.0)	39(78.0)	0(0.0)
Residential Area				
Tema	40 (22.0)	34 (18.7)	108(59.3)	0(0.0)
Ashaiman	19 (13.3)	18 (13.3)	103(72.0)	3(0.0)
Others	6(6.1)	18(18.4)	74(75.5)	0(0.0)
Residential status in school				
Day	57 (14.5)	64 (16.3)	268(68.4)	3(0.8)
Boarding	8(25.8)	6(19.4)	17(54.8)	0(0.0)
Socioeconomic Status (SES)				
Low SES	9 (15.8)	6 (10.5)	42(73.7)	0(0.0)
Middle SES	21(10.3)	35(17.2)	144(71.0)	3(1.5)
High SES	35 (21.5)	29 (17.8)	99(60.7)	0(0.0)

N=423

Table 4.2 shows the distribution of obesity by background characteristics. There were 264(62.4%) females and 159(37.6%) males. There were 55(20.8%) obese females and 10(6.3%) males with a strong evidence of association ($p= 0.000$).

Majority of the participants 147 (34.8%) were aged 17 years but majority of the obese participants 26(21.1%) were 16years old. None 0(0.0%) of the 14year olds were obese. Age showed a strong association with obesity ($p= 0.000$). Datus SHS had a high prevalence of obesity of 19.1 % compared to 15.0% for Methodist Day SHS. The school of a participant was insignificant ($p= 0.399$).

There were 293(69.3%) SHS1 students and 190(30.7 %) SHS2 students. There were 50(17.1%) obese SHS1 students as against 15(11.5%) obese SHS2 students. The level of education showed no association with obesity ($p= 0.055$).

There were 116(27.4%) Gas forming the majority and this same ethnic group had the most obese participants 26(22.41%). Ethnicity showed a strong association with obesity ($p= 0.000$).

Majority of the participants 182(43.0%) were resident in Tema. Those resident in Tema had the most obese participants 40(22.0%), while those resident in Others had 6(9.52%) obese participants.

Residential area showed a significant association with obesity ($p= 0.008$). Residential status in school was made of 392(92.7%) day and 31(7.3%) boarding participants. 57 of the day students and 8 of the boarding students were obese respectively, however the boarding students had a higher prevalence of obesity of 25.8% compared to the day students. The residential status in school was nonetheless insignificant with obesity ($p= 0.314$).

Majority of the participants 203(48.0%) were of middle socioeconomic status, 163(38.5%) were of high socioeconomic status and 57(13.5%) were of low socioeconomic status. However, majority of the obese participants 35(21.5%) were of high socioeconomic status and the least number of obese participants 9(15.8%) were of low socioeconomic status. The socioeconomic status showed significance with obesity ($p=0.032$).

Table 4.2 : Distribution of obesity by background characteristics

Variable	Participants No. (%)	Obese No. (%)	Pearson (χ^2) (p-value)
Sex			$\chi^2= 30.000$
Male	159 (37.6)	10 (6.3)	p= 0.000
Female	264(62.4)	55 (20.8)	
Age			$\chi^2= 65.944$
13	2 (0.5)	2(100.0)	p= 0.000
14	6(1.4)	0(0.0)	
15	41(9.7)	5(12.2)	
16	123(29.1)	26(21.1)	
17	147(34.8)	17(11.6)	
18	78 (18.4)	9(11.5)	
19	26(6.2)	6(23.1)	
School			$\chi^2= 2.952$
Methodist Day SHS	381(90.1)	57(15.0)	p= 0.399
DATUS SHS	42(9.9)	8(19.1)	
Educational level			$\chi^2= 8.065$
SHS 1	293 (69.3)	50(17.1)	p= 0.055
SHS 2	130 (30.7)	15(11.5)	
Ethnicity			$\chi^2= 57.976$
Ga	116(27.4)	26 (22.41)	p= 0.000
Ewe	108(25.5)	22(20.4)	
Akan	77 (18.2)	6(7.8)	
Fante	72(17.0)	11(15.3)	
Others	50(11.9)	0(0.0)	
Residential Area			$\chi^2= 27.116$
Tema	182 (43.0)	40 (22.0)	p= 0.008
Ashaiman	143 (33.8)	19 (13.3)	
Others	98(23.2)	6(9.52)	
Residential status in school			$\chi^2= 3.550$
Day	392 (92.7)	57 (14.5)	p= 0.314
Boarding	31 (7.3)	8(25.8)	
Socioeconomic Status(SES)			$\chi^2= 13.789$
Low SES	57 (13.5)	9 (15.8)	p= 0.032
Middle SES	203 (48.0)	21(10.3)	
High SES	163(38.5)	35 (21.5)	

Table 4.3 shows the distribution of obesity by dietary habits on number of meals per day, breakfast, lunch and supper. Most of the participants 343(81.1%) ate 3meals a day, 51(12.0%) ate 4 times in a day and 29(6.9%) ate 2 times in a day. No participant ate once a day or more than 4 times a day. Fifty one of the obese participants ate 3 times a day and the rest of the obese participants ate 4 times a day. No obese participant ate 2 times a day. The number of meals per day showed strong statistical significance with obesity ($p=0.001$).

Majority of the participants 220(52%) had breakfast daily while 57(13.5%) had breakfast 1-3 days/week. Thirty four (15.5%) of those who ate breakfast daily were obese and 9(15.8%) of those who ate breakfast 1-3 days/week were obese. Eating breakfast was not associated with obesity ($p=0.150$).

For food for breakfast, those who ate beverages (e.g. koko, tea) were 374(88.4%) and those who ate solid starchy foods (e.g. fufu, banku) were 3(0.7%). None of those who ate solid starchy foods for breakfast were obese. Fifty four of the participants who ate beverages for breakfast were obese. Food for breakfast per week showed a strong statistical significance with obesity ($p=0.000$).

Lunch consumption per week had 219 (51.8%) participants eating lunch daily and 38(9.0%) participants eating lunch 1-3 days/week. Thirty nine (17.8%) of those who ate lunch daily were obese while 6(15.8%) obese participants ate lunch 1-3 days/week. Lunch consumption per week was not associated with obesity ($p=0.200$).

For food for lunch, those who ate grains (e.g. rice, waakye) were 340(80.4%) and those who ate solid starchy foods (e.g. fufu, banku) were 45(10.6%). Fifty two of the participants who ate

grains (e.g. rice, waakye) were obese. Six of those who ate solid starchy foods for breakfast were obese. Food for lunch showed association with obesity ($p=0.001$).

For Supper consumption per week, majority 300(70.9%) of the participants ate supper daily. Those who ate supper 1-3 days/week were 14(3.3%). None of those who ate supper 1-3 days/week was obese while majority of the obese participants 43(14.3%) ate supper daily. Supper consumption per week was not associated with obesity ($p=0.103$).

For food for supper, those who ate solid starchy foods (e.g. fufu, banku) were 304(71.9%) and no participants ate beverages (e.g. koko, tea). Fifty of the participants who ate solid starchy foods (e.g. fufu, banku) were obese and the rest of the 15 obese participants ate grains (e.g. rice, waakye). Food for supper showed no association with obesity ($p=0.356$).

Table 4.3 Distribution of obesity by Dietary Habits on Number of meals per day, Breakfast, Lunch and Supper

Variable	Participants No. (%)	Obese No. (%)	Pearson (χ^2) (p-value)
Number of meals per day			$\chi^2= 21.499$
2 times	29(6.9)	0(0.0)	p= 0.001
3 times	343(81.1)	51(14.9)	
4 times	51(12.0)	14(27.5)	
Breakfast consumption per week			$\chi^2= 9.447$
Daily	220(52.0)	34(15.5)	p= 0.150
1-3 days/week	57(13.5)	9(15.8)	
4-6 days/week	146(34.5)	22(15.1)	
None	0(0.0)	0(0.0)	
Lunch consumption per week			$\chi^2= 5.243$
Daily	219(51.8)	39(17.8)	p= 0.200
1-3 days/week	38(9.0)	6(15.8)	
4-6 days/week	166(39.2)	20(12.1)	
None	0(0.0)	0(0.0)	
Supper consumption per week			$\chi^2= 10.552$
Daily	300(70.9)	43(14.3)	p= 0.103
1-3 days/week	14(3.3)	0(0.0)	
4-6 days/week	109(25.8)	22(20.2)	
None	0(0.00)	0(0.0)	
Food for breakfast			$\chi^2=8.045$
Beverages(e.g. koko, tea)	374 (88.4)	54 (14.4)	p=0.060
Grains(e.g. rice, waakye)	38 (9.0)	11 (29.0)	
Solid starchy foods(e.g. fufu, banku)	3 (0.7)	0 (0.0)	
None	8(1.9)	0(0.0)	
Food for lunch			$\chi^2= 33.823$
Beverages(e.g. koko, tea)	19(4.5)	7(36.8)	p= 0.001
Grains (e.g. rice, waakye)	340 (80.4)	52 (15.3)	
Solid starchy foods(e.g. fufu, banku)	45 (10.6)	6 (13.3)	
None	19(4.5)	0(0.0)	
Food for supper			$\chi^2=6.638$
Beverages(e.g. koko, tea)	0 (0.0)	0(0.0)	p=0.356
Grains(e.g. rice, waakye)	116 (27.4)	15 (12.9)	
Solid starchy foods(e.g. fufu, banku)	304 (71.9)	50 (16.5)	
None	3(0.7)	0(0.0)	

Table 4.4a shows distribution of obesity by Dietary Habits on snacks, fruits and vegetables consumption. For snacks consumption per week, majority 175(41.4%) of the participants ate snacks 4-6days/week. Those who did not eat snacks were 17(4.0%). Most of the obese participants 27 ate snacks 4-6days/week while 8 of the obese participants did not eat snacks. Snacks consumption per week showed statistical significance with obesity ($p=0.001$)

With fruits consumption per week, majority 233(55.1%) of the participants ate fruits 1-3 days/week. Those who did not eat fruits were 30(7.1%). Most of the obese participants (32) ate fruits 1-3days/week while 15 of the obese participants did not eat fruits. Fruits consumption per week showed some statistical significance with obesity ($p=0.045$)

Vegetable consumption per week, most of the respondents 208(49.2%) ate vegetables 1-3days/week. Those who did not eat vegetables were 21(5.0%). Most of the obese participants (38) ate vegetables 1-3days/week while 9 of the obese participants did not eat vegetables. Vegetable consumption per week showed a strong statistically significance with obesity ($p=0.000$).

Table 4.4a Distribution of obesity by Dietary Habits on snacks, fruits and vegetables consumption.

Variable	Participants No. (%)	Obese No. (%)	Pearson (χ^2) (p-value)
Snacks consumption per week			$\chi^2= 28.150$
Daily	57(13.5)	13(22.8)	p= 0.001
1-3 days/week	174(41.1)	17(9.8)	
4-6 days/week	175(41.4)	27(15.4)	
None	17(4.0)	8(47.1)	
Fruits consumption per week			$\chi^2= 8.065$
Daily	22(5.2)	0(0.0)	p= 0.045
1-3 days/week	233(55.1)	32(13.7)	
4-6 days/week	138(32.6)	18(13.0)	
None	30(7.1)	15(50.0)	
Vegetable consumption per week			$\chi^2=71.912$
Daily	55 (13.0)	0 (0.0)	p=0.000
1-3 days/week	208 (49.2)	38(18.3)	
4-6 days/week	139 (32.9)	18 (13.0)	
None	21 (5.0)	9 (42.9)	

Table 4.4b shows the distribution of obesity by Dietary Habits on types and frequency of fast food and sweetened beverages consumed.

Majority of the respondents 400(94.6%) consumed fast food while 23(5.4%) did not. Sixty three of the obese participants consumed fast food and 2 did not consume fast food. Fast food consumption showed a strong association with obesity ($p=0.000$).

The types of fast food listed were fried rice, fried chicken, pizza, potato chips and burgers. 356(84.2%) of the participants consumed fried rice. Out of the 65 obese participants, 58 consumed fried rice. Fried Chicken was consumed by 380(89.8%) participants and 60(15.8%) obese participants. Ninety eight (23.2%) participants consumed potato chips while 20(20.4%) obese participants consumed potato chips.

Pizza was also consumed by 98(23.2%) participants with 33(33.7%) of the obese participants consuming pizza. The least consumed fast food was the burger, only 58(13.7%) participants consumed burgers. Nine (15.5%) obese participants consumed burgers.

With the frequency of fast food consumption, majority of the participants 233(55.1%) ate fast food 1-3days/week, 108(32.6%) ate fast food 4-6days/week and 26(5.2%) ate fast foods daily. Majority of the obese participants 22 ate fast food 1-3days/week. 18 of the obese participants ate fast food 4-6 days/week while 15 obese participants ate fast food daily.

Sugar-sweetened beverages consumption had most of the participants 414(97.9%). Those who did not consume sugar-sweetened beverages were 9(2.1%). All the 65 obese participants were those who consumed sugar-sweetened beverages. Sugar-sweetened beverages consumption was statistically significant ($p=0.000$).

The types of sweetened beverages listed were coke, fanta, sprite and other soft drinks or “minerals”. Majority of the participants 336(79.42%) patronized coke. Those who patronized fanta were 339(80.1%). Those who patronized sprite and other soft drinks were 306(72.3%) and 317(74.9%) respectively.

Out of the 65 obese participants, 56 consumed both coke, fanta and other soft drinks while sprite was patronized by 50 obese participants.

With the frequency of sweetened beverages consumption, majority of the participants 227(53.7%) took sweetened beverages 1-3days/week, 94(22.2%) took sweetened beverages 4-6days/week and 63(14.9%) took sweetened beverages daily. Majority of the obese participants 22 took sweetened beverages 1-3days/week. Twenty of the obese participants took sweetened beverages 4-6 days/week while 17 obese participants took sweetened beverages daily.

Table 4.4b Distribution of obesity by Dietary Habits on types and frequency of fast food and sweetened beverages consumed.

Variable	Participants No. (%)	Obese No. (%)	Pearson (χ^2) (p-value)
Fast food consumption			$\chi^2=49.423$
Yes	400(94.6)	63(15.8)	p=0.000
No	23(5.4)	2(8.7)	
Type of fast food			
Fried Rice	356(84.2)	58(16.3)	
Fried Chicken	380(89.8)	60(15.8)	
Potato chips	98(23.2)	20(20.4)	
Pizza	98(23.2)	33(33.7)	
Burger	58(13.7)	9(15.5)	
Fast food consumption			
Daily	26(5.2)	15(57.7)	
1-3 days/week	233(55.1)	22(9.4)	
4-6 days/week	108(32.6)	18(16.7)	
Other	33(7.8)	8(4.2)	
None	23(5.4)	2(8.7)	
Sugar-sweetened beverages consumption			$\chi^2=46.498$
Yes	414(97.9)	65(15.7)	p=0.000
No	9 (2.1)	0 (0.0)	
Type of sweetened beverage			
Coke	336(79.4)	56(16.7)	
Fanta	339(80.1)	56(16.5)	
Sprite	306(72.3)	50(16.3)	
Others	317(74.9)	56(17.7)	
Sweetened beverages consumption			
Daily	63 (14.9)	17(27.0)	
1-3 days/week	227(53.7)	22(9.7)	
4-6 days/week	94(22.2)	20(20.3)	
Other	32(7.6)	6 (18.8)	
None	9(2.1)	0(0.0)	

Table 4.5 shows the distribution of obesity by familial or genetic factors and physical activity. Those who had a fat father were 54(14.0%) and those without a fat father were 364(86.0%). Thirty four of the obese respondents had a fat father. Having a fat father was strongly associated with obesity ($p=0.000$)

Those who had a fat mother were 142(33.6%) and those without a fat mother were 281(66.4%). Forty four of the obese respondents had a fat mother. Having a fat mother was statistically significant with obesity ($p=0.000$)

Those who had a fat relative other than a father or mother were 184(43.5%) and those without a fat relative were 239(56.5%). Forty eight of the obese respondents had a fat relative. Having a fat relative was strongly associated with obesity ($p=0.000$).

Those who had a fat sibling were 69(16.3%) and those without a fat sibling were 354(83.7%). Thirty four of the obese respondents had a fat sibling. Having a fat sibling was statistically significant with obesity ($p=0.000$)

Those who were fat before age 10years were 66(15.6%) and those who were not fat before 10years were 357(84.4%). Thirty two of the obese respondents were fat before age 10years. Being fat before age 10years was statistically significant with obesity ($p=0.000$).

Majority of the participants 316(74.7%) engaged in conscious Physical Activity. Most of the obese participants (37) did not engage in conscious physical activity. Engaging in conscious physical activity was statistically significant ($p=0.000$)

For duration of Physical Activity, most of the respondents 166(39.2%) had a duration of Physical Activity of <30 minutes. 107(25.3%) of the respondents did not engage in Physical Activity.

Majority of the obese respondents (37) did not engage in physical activity. No participant with duration of Physical Activity between 61-120 minutes was obese. Duration of Physical Activity was strongly associated with obesity ($p=0.000$).

All the participants 423(100.0%) had Physical Education as part of school curriculum. All the 65 obese participants had Physical Education as part of school curriculum.

For duration of watching TV, majority of the respondents 235(55.6%) had a duration of watching TV < 1 hour. Sixty nine (16.3%) of the participants had a duration of watching TV of > 4 hours. Most of the obese respondents (25) had a duration of watching TV of 1-4 hours while 19 of the obese participants had a duration of watching TV of > 4hours. Duration of watching TV was strongly associated with obesity ($p=0.000$).

Table 4.5: Distribution of obesity by Familial or Genetic factors and Physical Activity

Variable	Participants No. (%)	Obese No. (%)	Pearson (χ^2) (p-value)
Fat Father			$\chi^2= 103.935$
Yes	59(14.0)	34(57.6)	p= 0.000
No	364(86.0)	31(8.5)	
Fat Mother			$\chi^2= 80.033$
Yes	142(33.6)	44(31.0)	p= 0.000
No	281(66.4)	21(7.5)	
Fat Relative			$\chi^2= 41.918$
Yes	184(43.5)	48(26.1)	p= 0.000
No	239(56.5)	17(7.1)	
Fat Sibling			$\chi^2= 48.508$
Yes	69(16.3)	34(15.5)	p= 0.000
No	354(83.7)	31(15.8)	
Fat before age 10years			$\chi^2= 66.388$
Yes	66(15.6)	32(48.5)	p= 0.000
No	357(84.4)	33(9.2)	
Conscious Physical Activity			$\chi^2= 47.594$
Yes	316(74.7)	28(8.9)	p= 0.000
No	107(25.3)	37(34.6)	
Duration of Physical Activity			$\chi^2= 90.899$
<30 minutes	166(39.2)	14(8.4)	p= 0.000
30-60 minutes	91(21.5)	11(12.1)	
61-120 minutes	56(13.2)	0(0.0)	
>120 minutes	3(0.7)	3(100.0)	
None	107(25.3)	37(34.6)	
Physical Education as part of school curriculum			
Yes	423(100.0)	65(15.4)	
No	0(0.0)	0(0.0)	
Duration of watching TV			$\chi^2= 62.150$
< 1 hour	235(55.6)	21(8.9)	p= 0.000
1-4 hours	119(28.1)	25(21.0)	
> 4 hours	69(16.3)	19(27.5)	

4.2. Risk factor for obesity

The variables that showed statistical significance with obesity using the chi square test (p-value <0.05) in the univariate model were sex, age, ethnicity, residential area, socioeconomic status, number of meals per day, fruits consumption per week, snacks consumption per week, vegetable consumption frequency, food for lunch, fast food consumption, sugar-sweetened beverages consumption, fat father, fat mother, fat sibling, fat before age 10years, conscious physical activity, duration of physical activity and duration of watching TV. A bivariate logistic regression was then performed to see the strength of association between each of these risk factors and obesity.

Table 4.6 shows a bivariate logistic regression socio demographic factors and dietary habits for obesity. For sex, females were 3.92 times likely to become obese compared to males (OR= 3.92, p=0.000). Socioeconomic status was still significantly associated with being obese, those from a high SES background were 1.56 times more likely to become obese compared to those from low SES background (OR=1.56, p=0.036).

Those whose ate other than 3times a day are 2.73 times likely to become obese compared to those who ate 3 times in a day (OR= 2.73, p=0.001).

For snacks consumption per week, those who consumed snacks >3days/week had a 63% reduced risk of becoming obese compared to those who consumed snacks <3days/week (OR=0.37, p=0.013).

Eating grains as food for lunch reduces the risk of being obese by 69% compared to those who ate beverages as food for lunch (OR=0.31, 95% CI 0.12-0.82)

Table 4.6: Bivariate logistic regression on socio demographic factors and dietary habits for obesity

Variable	Obese Crude OR(95% CI)	p-value
Sex		
Male	1	p= 0.000
Female	3.92 (1.94-7.94)	
Age	0.90(0.71-1.14)	p= 0.368
Ethnicity		
Ga	1	p= 0.710
Others	0.90(0.47-1.68)	
Residential Area		
Tema	1	p= 0.054
Others	0.37(0.15-1.93)	
Socioeconomic Status(SES)		
Low SES	1	p= 0.048
High SES	1.56(1.02-2.36)	
Number of meals per day		
3 times	1	p= 0.001
Others	2.73(1.50-4.96)	
Fruits consumption per week		
>3 days/week	1	p= 0.089
<3 days/week	1.42(0.78-1.84)	
Snacks consumption per week		
>3 days/week	1	p= 0.013
<3 days/week	0.37(0.17-0.81)	
Vegetable consumption frequency		
>3 days/week	1	p=0.146
<3 days/week	1.29(0.90 -1.65)	
Food for lunch		
Beverages(e.g. koko, tea)	1	p= 0.019
Grains (e.g. rice, waakye)	0.31 (0.12-0.82)	
Fast food consumption		
Yes	1	p=0.817
No	1.02(0.88-1.17)	
Sugar-sweetened beverages consumption		
Yes	1	p=0.719
No	1.04(0.85-1.28)	

Table 4.7 shows bivariate logistic regression on familial or genetic factors and physical activity for obesity. Not having a fat father reduces the risk of being obese by 93% compared to having a fat father (OR=0.07, p=0.000). For those without a fat mother, it reduces the risk of being obese by 82% compared to having a fat mother (OR=0.18, p=0.000).

Not having a fat relative reduces the risk of being obese by 78% compared to having a fat relative (OR=0.22, p=0.000). Not being fat before age 10years reduces the risk of being obese by 89% compared to being fat before age 10years (OR=0.11, 95% CI 0.06-0.20).

Those who did not engage in conscious physical activity were 5.44 times more likely to be obese compared to those who engage in conscious physical activity (OR= 5.44, p=0.000).

Those who engage in physical activity for < 30 minutes were 5.74 times more likely to be obese compared to those who engage in physical activity for > 30 minutes (OR= 5.74, p=0.000).

Those with duration of watching TV of > 4hours were 3.87 times more likely to be obese compared to those with duration of watching TV < 4hours (OR= 3.87, p=0.000)

Table 4.7: Bivariate logistic regression on Familial or genetic factors and Physical Activity for obesity

Variable	Obese Crude OR(95% CI)	p-value
Fat Father		
Yes	1	p= 0.000
No	0.07(0.04-0.13)	
Fat Mother		
Yes	1	p= 0.000
No	0.18(0.10-0.32)	
Fat Relative		
Yes	1	p= 0.000
No	0.22(0.12-0.39)	
Fat Sibling		
Yes	1	p= 0.200
No	1.64(0.77-3.49)	
Fat before age 10years		
Yes	1	p= 0.000
No	0.11(0.06-0.20)	
Conscious Physical Activity		
Yes	1	p= 0.000
No	5.44(3.12-9.48)	
Duration of Physical Activity		
<30 minutes	1	
>30 minutes	5.74(2.92-11.29)	p= 0.000
Duration of watching TV		
< 4 hours	1	
> 4 hours	3.87(1.94-7.74)	p= 0.000

4.2.1 Significant risk factors for obesity

For the bivariate logistic regression, the variables sex, socioeconomic status, snacks consumption per week, food for lunch, having a fat father, having a fat mother, having a fat relative, fat before age 10years, conscious physical activity, duration of physical activity and duration of watching TV showed statistical significance with obesity.

A multivariate logistic regression was carried out for the statistically significant in the bivariate logistic regression model. The variables sex, socioeconomic status, number of meals per day, snacks consumption per week, food for lunch, fat father, fat mother, fat relative, fat before age 10years and duration of watching TV were statistically significant with obesity in the multivariate logistic regression model.

Table 4.8 shows the significant of risk factors for obesity. For sex, females were 21.8 times likely to become obese compared to males after adjusting for other variables (AOR= 21.8, $p=0.000$).

Socioeconomic status was still significantly associated with being obese after adjusting for other variables those from a high SES background were 2.56 times more likely to become obese compared to those from low SES background (AOR=2.56, $p=0.036$).

For snacks consumption per week, those who consumed snacks <3 days/week were 1.88 times more likely to be obese compared to those who consumed snacks >3 days/week after controlling for other variables (AOR=1.88, $p=0.046$).

After adjusting for other variables, not having a fat father reduces the risk of being obese by 94% compared to having a fat father (AOR=0.06, p=0.000). For those without a fat mother, it reduces the risk of being obese by 79% compared to having a fat mother after controlling for other variables (AOR=0.21, p=0.000).

After controlling for other variables, not having a fat relative reduces the risk of being obese by 71% compared to having a fat relative (AOR=0.29, 95%CI 0.12-0.71). Not being fat before age 10years reduces the risk of being obese by 83% compared to being fat before age 10years after adjusting for other variables (AOR=0.17, 95% CI 0.06-0.46).

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 after controlling for other parameters (AOR= 2.31, p=0.006)

Table 4.8: Significant risk factors for obesity

Variable	Obese Adjusted OR(95% CI)	p-value
Sex		
Male	1	p= 0.000
Female	21.8 (5.57-85.60)	
Socioeconomic Status(SES)		
Low SES	1	p= 0.036
High SES	2.56(1.10-5.98)	
Number of meals per day		
3 times	1	p= 0.069
Others	2.60(0.93-7.25)	
Snacks consumption per week		
>3 days/week	1	p= 0.016
<3 days/week	2.7(0.17-0.81)	
Food for lunch		
Grains (e.g. rice, waakye)	1	p= 0.040
Solid starchy foods(e.g. fufu, banku)	0.30 (0.89-0.94)	
Fat Father		
Yes	1	p= 0.000
No	0.04(0.01-0.11)	
Fat Mother		
Yes	1	p= 0.000
No	0.21(0.09-0.50)	
Fat Relative		
Yes	1	p= 0.007
No	0.29(0.12-0.71)	
Fat before age 10years		
Yes	1	p= 0.001
No	0.17(0.06-0.46)	
Conscious Physical Activity		
Yes	1	p= 0.135
No	0.02(0.00-3.53)	
Duration of Physical Activity		
>30 minutes	1	p= 0.072
<30 minutes	1.90(0.94-3.84)	
Duration of watching TV		
<4hours	1	p= 0.006
>4hours	2.31(1.27-4.20)	

CHAPTER FIVE

5 DISCUSSION

5.1 Prevalence of Obesity

The overall prevalence of obesity was 15.4%. The prevalence of overweight was 16.5%. The combined prevalence of obesity and overweight was 31.9%. The prevalence of obesity in Methodist Day Senior High School and Datus Senior High School was 15.0% and 19.1% respectively. The overall prevalence of obesity amongst males and females was 6.3% and 20.8% respectively. This is similar to a study which showed that females had a higher prevalence of obesity of 14.9% compared to 14.2% for males (El-Bayoumy et al., 2009).

This study is also similar to a study conducted in 1989 to describe the prevalence of overweight and obesity among Brazilian adolescents aged 10 to 19 years, in which the prevalence of obesity and overweight was of 7.7%, with 10.6% in the females and 4.8% in the males (Neutzling et al., 2003).

However, our study is in contrast to a cross-sectional study conducted among children 6 to 17 years to determine prevalence of obesity in children and adolescents in which the prevalence of obesity was 10.3% and 9.1% in males and females respectively, using the NHANES I definition (Savva et al., 2002). Another study with a higher prevalence of obesity in males compared to females was 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 (Huang et al., 2003)

5.2 Risk factors for obesity

5.2.1 Dietary habits

In this study when it comes to snacks consumption per week, those who consumed snacks 1-3days/week were 1.88 times more likely to be obese compared to those who consumed snacks daily after controlling for other variables (AOR=1.88, p=0.046).

For this study 96.9% of the obese participants consumed fast food such as fried rice, fried chicken, potato chips and pizza. Fast food consumption showed a strong association with obesity in the univariate model (p=0.000). Sugar-sweetened beverages consumption was seen in 97.9% of the participants. All the obese participants (100.0%) consumed sugar-sweetened beverages. Sugar sweetened beverages consumption was statistically significant with obesity in the univariate model (p=0.000). This agrees with the WHO report in 2010, which indicates that eating western food has become widely accepted in developing countries with adolescents forming 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, 2010).

However, fast food consumption and sugar-sweetened beverages consumption did not show a significant association with obesity in the bivariate model (p=0.817 and p=0.719 respectively)

In this study none of those who consumed fruits and 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 et al., 2008).

In this study, 52.3% obese participants ate breakfast daily. Eating breakfast was not associated with obesity ($p=0.150$) and this is in contrast to a study conducted in Norway that showed that eating breakfast was positively associated with not being overweight and obese (Grøholt et al., 2008).

This study therefore coincides with another study that showed that factors that increase the risk of obesity include high intake of energy-dense and micronutrient – poor foods, increased number of fast-food outlets and marketing of energy-dense foods, high intake of sugars-sweetened carbonated drinks and fruit juices as well as low consumption of fruits and vegetables (Nishida et al., 2004).

Another study that agrees with this study is a randomized controlled trial of primary school based intervention to reduce risk factors for obesity in Leeds, which showed that consumption of fruits was lower in obese children in the intervention group compared to those in the control group and a three day recall diary showed a low consumption of highly sugary foods among overweight children in the control group than the intervention group (Sahota et al., 2001)

5.2.2 Familial or Genetic factors

Studies have shown a strong predisposition towards the fact that obesity can be inherited. In this study, after adjusting for other variables, not having a fat father reduces the risk of being obese by 94% compared to having a fat father (AOR=0.06, $p=0.000$). For those without a fat mother, it reduces the risk of being obese by 79% compared to having a fat mother after controlling for other variables (AOR=0.21, $p=0.000$). 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 et al., 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 had BMI less than 30 (Neutzling et al., 2003).

From the results of a study conducted on obesity in children and adolescents in Cyprus, the most significant associated factor for obesity was parental obesity status (Savva et al., 2002). Another study carried out in Italy showed that parental obesity was the main risk factor for obesity in children (Maffeis et al., 2006).

5.2.3 Metabolic or Physiological factors

The males had an average height of 1.65 ± 0.08 metres and females had an average height 1.59 ± 0.06 metres. The males were taller than the females. The average weight was 61.24 ± 10.6 kilograms in males and 62.20 ± 12.5 kilograms in females. The mean BMI for females and males was 24.26 ± 4.90 kg/m² and 22.39 ± 3.56 kg/m² respectively. This indicates that the females had a higher BMI and weight than the males. This corresponds to a study done in Kuwait in which females had higher BMI than males (El-Bayoumy et al., 2009). During adolescence, and especially during puberty, both girls and boys undergo fat storage, and because the spurt of height in boys is higher than in girls, the BMI of girls appears to be higher than boys (Poskit, 1988).

In this study the overall prevalence of obesity amongst females and males was 20.8% and 6.3% respectively. The most significant risk factor after adjusting for other variables was sex (AOR=21.8, $p=0.000$). This is similar to a study which showed females had a higher prevalence of obesity of 14.9% compared to 14.2% for males (El-Bayoumy et al., 2009).

In this study not being fat by the age of 10 years is protective, those who were not fat before age 10 years had a reduced risk of being obese by 89% compared to those who were fat before age 10 years after controlling for the effects of other variables (AOR=0.11, 95% CI 0.06-0.20). This agrees with 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 which demonstrated that childhood overweight showed a direct relationship to overweight and obesity during adolescence. Adolescents who reported being overweight before they were 10 years old were 2.5 times more likely to be overweight or obese during their adolescence (Neutzling et al., 2003).

5.2.4 Physical inactivity

In this study 58.6% of the obese participants did not engage in conscious physical activity, engaging in conscious physical activity was statistically significant with obesity ($p=0.000$). This is similar to 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 et al., 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 after controlling for other

variables (AOR= 2.31, $p=0.006$) 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 et al., 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 et al., 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 (Troost et al., 2003).

This study also agrees with a study conducted in which 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 (S. Kautiainen et al., 2005).

5.2.5 Socioeconomic status

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 higher risk of pediatric obesity (WHO, 2010).

In this study majority of the obese participants 35(55.6%) were of high socioeconomic status, 19(30.1%) were of middle socioeconomic status and 9(14.3%) of the obese participants were of low socioeconomic status. The socioeconomic status showed significance with obesity ($p=0.032$). 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 et al., 2009).

For this study the socioeconomic status was still significantly associated with being obese after adjusting for other variables (AOR=2.56, $p=0.036$) and it agrees with a study in which adolescents living in families with high socioeconomic status were 1.3–1.5 times more likely of becoming overweight and obese compared to adolescents living in families with low socioeconomic status (Grøholt et al., 2008).

This study is also similar to study that has shown that obesity is more prevalent among high socioeconomic class in developing countries (Burns, 2004).

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

6.1 CONCLUSION

The overall prevalence of obesity was 15.4%. There were 70 (16.5%) overweight students and these must be targeted to prevent them from becoming overweight. The combined prevalence of obesity and overweight was 31.9%. This combined prevalence of obesity and overweight is very high. The incidental finding of underweight of 0.7% means that under nutrition is an issue in adolescents but to a lesser extent. Under nutrition must therefore not be overlooked.

The study showed that there were associations between obesity and sex, socioeconomic status, snacks consumption per week, food for lunch, having a fat father, having a fat mother, having a fat relative, being fat before age 10 years and duration of watching TV.

Sex was the most significantly associated with obesity, with females being 21.8 times more likely to be obese compared to males.

Watching TV > 4hours increases the risk of being obese by 131%.

Not having a fat parent or relative, consuming snacks daily and eating of grains for lunch are protective.

This study provides useful baseline information for future studies on obesity in Senior High Schools.

6.2 RECOMMENDATION

Even though schools are the main institutions able to reach a large number of children and adolescents, the fight against obesity should be multidisciplinary. It should involve the schools, parents or guardians, policy makers, health professionals or institutions and everybody.

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 healthy.

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.

6.2.3 Policy 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.
- There is the need for systematic surveillance and screening of growth indices to identify overweight and obese adolescents for prompt action.

6.2.4 Research

- Further research into determinants of obesity in adolescents should be undertaken. The research can include the measuring of parental BMI.

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APPENDIX

APPENDIX 1A: CONSENT FORM FOR STUDY PARTICIPANTS

Project Title: Risk factors for obesity among adolescents in Senior High Schools in the Tema Metropolis

Institution of affiliation: School of Public Health, University of Ghana, Legon.

Background of interviewer: My name is from (I am a student who is here) or (I am helping a student) to collect data purely for academic work for a degree in Masters in Public Health

Procedure: Information required from you for this study includes background characteristics and risk factors for obesity among adolescents. Data collection is through the administration of a structured questionnaire, taking of weight and height.

Risks and benefits: There are minimum or no risks if you take part in this study. There are also no incentives but the information you provide will help you improve on your health and that of your loved ones.

Right to refuse: Your consent to participate in this study is voluntary and you can withdraw from this study at any time.

Anonymity and Confidentiality: You are assured of strict anonymity and confidentiality on any information you give.

If you have any further information or questions about the study, you may contact the principal investigator, **Abdulai Mohammed Salifu**, on phone number: **020 8077 230** or email:

doctorcalculus@yahoo.com

Your rights as a Participant: This research has been reviewed and approved by the Ethical Review Committee of the Ghana Health Service. If you have any questions about your rights as a research participant you can contact the ERB Office between the hours of 9am – 4pm on Monday to Friday through **0507041223 (Miss Hannah Frimpong)**.

I have read the information above, or it has been read to me. I consent voluntarily to be a participant in this study

Name of Participant :

Signature or Thumb print of Participant :

Date :

Thank you for agreeing to participate

Name of witness :

Signature or Thumb print of witness :

Date :

I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher or Principal investigator :

Signature of Researcher :

Date :

APPENDIX 1B: CONSENT FORM FOR PARENT OR GUARDIAN

Project Title: Risk factors for obesity among adolescents in Senior High Schools in the Tema Metropolis

Institution of affiliation: School of Public Health, University of Ghana, Legon.

Procedure: Information required from you for this study includes background characteristics and risk factors for obesity among adolescents. Data collection is through the administration of a structured questionnaire, taking of weight and height.

Risks and benefits: There are minimum or no risks if you take part in this study. There are also no incentives but the information you provide will help you improve on the health of your child and loved ones.

Right to refuse: You have a right to refuse your child to participate

Anonymity and Confidentiality: You are assured of strict anonymity and confidentiality on any information that is given.

If you have any further information or questions about the study, you may contact the principal investigator, **Dr Abdulai Mohammed Salifu**, on phone number: **020 8077 230** or email: doctorcalculus@yahoo.com

Your rights as a Parent or Guardian: This research has been reviewed and approved by the Ethical Review Committee of the Ghana Health Service. If you have any questions about your rights as a research participant you can contact the ERB Office between the hours of 9am – 4pm on Monday to Friday through **0507041223 (Miss Hannah Frimpong)**.

I have read the information above, or it has been read to me. I consent voluntarily for my child to be a participant in this study

Name of Parent or Guardian :

Signature or Thumb print of Participant :

Date :

Thank you for agreeing for your child to participate

Name of Researcher or Principal investigator :

Signature of Researcher :

Date :

APPENDIX 1C: QUESTIONNAIRE FOR RISK FACTORS FOR OBESITY AMONG SENIOR HIGH SCHOOLS IN THE TEMA METROPOLIS

INTRODUCTION

Greetings, my name is..... I am a member of a team from the University of Ghana conducting a research on the risk factors for obesity among Senior High Schools in the Tema Metropolis. If you agree to take part in this study, I will give you a questionnaire to fill and then measure you 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 obesity in adolescent.

Questionnaire number :.....

Name of interviewer :.....

Date :.....

SECTION A: SOCIODEMOGRAPHIC CHARACTERISTICS

1	Date of birth	
2	Age	
3	Sex	MALE <input type="checkbox"/>1 FEMALE <input type="checkbox"/>2
4	Level of Education	SHS 1 <input type="checkbox"/>1 SHS 2 <input type="checkbox"/>2 SHS 3 <input type="checkbox"/>3
5	Ethnicity	GA <input type="checkbox"/>1 EWE <input type="checkbox"/>2 AKAN <input type="checkbox"/>3 DAGOMBA <input type="checkbox"/>4 FANTE <input type="checkbox"/>5 OTHER <input type="checkbox"/>6
6	Residential area (where do you stay?)	TEMA <input type="checkbox"/> 1 ASHAIMAN <input type="checkbox"/> 2 KPONE <input type="checkbox"/>3 OTHERS <input type="checkbox"/> 4
7	Residential status in school	DAY <input type="checkbox"/>1 BOARDING <input type="checkbox"/>2

SECTION B: SOCIOECONOMIC STATUS OF PARENTS OR GUARDIANS

8	Father's highest level of education	NONE	<input type="checkbox"/>1
		PRIMARY	<input type="checkbox"/>2
		JHS/MIDDLE SCH	<input type="checkbox"/>3
		SHS	<input type="checkbox"/>4
		TERTIARY	<input type="checkbox"/>5
9	Father's occupation		
10	Mother's highest level of education	NONE	<input type="checkbox"/>1
		PRIMARY	<input type="checkbox"/>2
		JHS/MIDDLE SCH	<input type="checkbox"/>3
		SHS	<input type="checkbox"/>4
		TERTIARY	<input type="checkbox"/>5
11	Mother's occupation		
12	Guardian's highest level of education	NONE	<input type="checkbox"/>1
		PRIMARY	<input type="checkbox"/>2
		JHS/MIDDLE SCH	<input type="checkbox"/>3
		SHS	<input type="checkbox"/>4
		TERTIARY	<input type="checkbox"/>5
13	Guardian's occupation		
14	Relationship to guardian	AUNT	<input type="checkbox"/>1
		UNCLE	<input type="checkbox"/>2
		SISTER	<input type="checkbox"/>3
		BROTHER	<input type="checkbox"/>4

15	Type of residence	OWNED BY PARENTS OWNED BY GUARDIAN FAMILY HOUSE RENTED	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4
16	Do you own any of the following? YES-1 NO-2	TELEVISION DVD PLAYER REFRIGERATOR MICROWAVE GENERATOR CAR PERSONAL COMPUTER ELEC OR GAS COOKER MOTORBIKE	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
17	Do you subscribe to any TV NETWORK?	YES NO	<input type="checkbox"/>1 <input type="checkbox"/>2

SECTION C: DIETARY HABITS

18	How many times do you eat in a day?	ONE	<input type="checkbox"/>1
		TWO	<input type="checkbox"/>2
		THREE	<input type="checkbox"/>3
		FOUR	<input type="checkbox"/>4
		OTHER	<input type="checkbox"/>5
19	How many times do you eat breakfast in a week?	DAILY	<input type="checkbox"/>1
		1-3 DAYS/WEEK	<input type="checkbox"/>2
		4-6 DAYS/WEEK	<input type="checkbox"/>3
		NONE	<input type="checkbox"/>4
		OTHER	<input type="checkbox"/>5
20	How many times do you eat snacks in a day?	ONE	<input type="checkbox"/>1
		TWO	<input type="checkbox"/>2
		THREE	<input type="checkbox"/>3
		FOUR	<input type="checkbox"/>4
		OTHER	<input type="checkbox"/>5
21	How many times do you eat snacks in a week	DAILY	<input type="checkbox"/>1
		1-3 DAYS/WEEK	<input type="checkbox"/>2
		4-6 DAYS/WEEK	<input type="checkbox"/>3
		NONE	<input type="checkbox"/>4
		OTHER	<input type="checkbox"/>5

22	What do you eat for snacks?	
23	How many times do you eat lunch in a week?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 NONE <input type="checkbox"/>4 OTHER <input type="checkbox"/>5
24	How many times do you eat supper in a week?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 NONE <input type="checkbox"/>4 OTHER <input type="checkbox"/>5
25	How many times do you eat vegetables in a week?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 NONE <input type="checkbox"/>4 OTHER <input type="checkbox"/>5
26	How many times do you eat fruits in a week?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 NONE <input type="checkbox"/>4 OTHER <input type="checkbox"/>5

27.1	What did you eat for breakfast yesterday?	Beverages(e.g. koko, tea) Grains(e.g. rice, waakye) Solid starchy foods(e.g. fufu, banku) OTHER	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4
27.2	What did you eat for lunch yesterday?	Beverages(e.g. koko, tea) Grains(e.g. rice, waakye) Solid starchy foods(e.g. fufu, banku) OTHER	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4
27.3	What did you eat for supper yesterday?	Beverages(e.g. koko, tea) Grains(e.g. rice, waakye) Solid starchy foods(e.g. fufu, banku) OTHER	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4
27.4	What else did you eat yesterday?		
28.1	What did you eat for breakfast three days ago?	Beverages(e.g. koko, tea) Grains(e.g. rice, waakye) Solid starchy foods(e.g. fufu, banku) OTHER	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4
28.2	What did you eat for lunch three days ago?	Beverages(e.g. koko, tea) Grains(e.g. rice, waakye) Solid starchy foods(e.g. fufu, banku) OTHER	<input type="checkbox"/>1 <input type="checkbox"/>2 <input type="checkbox"/>3 <input type="checkbox"/>4

28.3	What did you eat for supper three days ago?	Beverages(e.g. koko, tea) <input type="checkbox"/>1 Grains(e.g. rice, waakye) <input type="checkbox"/>2 Solid starchy foods(e.g. fufu, banku) <input type="checkbox"/>3 OTHER <input type="checkbox"/>4
28.4	What else did you eat three days ago?	
29	Do you patronize any of the following foods? Fried Rice, Fried Chicken, Burger, Pizza, Potato chips	YES <input type="checkbox"/>1 NO <input type="checkbox"/>2
30	If YES, How often?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 OTHER <input type="checkbox"/>5 NA <input type="checkbox"/>9
31	Do you patronize any of the following drinks? Fanta, coke, sprite, other soft drinks and minerals	YES <input type="checkbox"/>1 NO <input type="checkbox"/>2
32	If YES, How often?	DAILY <input type="checkbox"/>1 1-3 DAYS/WEEK <input type="checkbox"/>2 4-6 DAYS/WEEK <input type="checkbox"/>3 OTHER <input type="checkbox"/>5 NA <input type="checkbox"/>9

SECTION D: FAMILIAL OR GENETIC HISTORY

33	Do you think your father is fat?	YES	<input type="checkbox"/>1
		NO	<input type="checkbox"/>2
34	Do you think your mother is fat?	YES	<input type="checkbox"/>1
		NO	<input type="checkbox"/>2
35	Do you think your guardian is fat?	YES	<input type="checkbox"/>1
		NO	<input type="checkbox"/>2
		NA	<input type="checkbox"/>9
36	Do you know of any relative you think is fat?	YES	<input type="checkbox"/>1
		NO	<input type="checkbox"/>2
37	If YES to 36, what is the relationship?	AUNT	<input type="checkbox"/>1
		UNCLE	<input type="checkbox"/>2
		SISTER	<input type="checkbox"/>3
		BROTHER	<input type="checkbox"/>4
		OTHER	<input type="checkbox"/>5
		NA	<input type="checkbox"/>9
38	Were you fat when you were a child under 10year old?	YES	<input type="checkbox"/>1
		NO	<input type="checkbox"/>2

SECTION E: PHYSICAL ACTIVITY

39	Do you consciously engage in physical activity?	YES <input type="checkbox"/>1 NO <input type="checkbox"/>2
40	If YES to 39, how long do you engage in physical activity?	<30 MINUTES <input type="checkbox"/>1 30-60 MINUTE <input type="checkbox"/>2 61-120 MINUTES <input type="checkbox"/>3 >120MINUTES <input type="checkbox"/>4 NA <input type="checkbox"/>9
41	If YES to 39, what type of physical activity do you engage in?	ACTIVITIES <input type="checkbox"/>1 NA <input type="checkbox"/>9
42	How many hours do you spend watching TV OR Movies in a day(when you are at home or vacation)?:	< 1HOUR <input type="checkbox"/>1 1-4 HOURS <input type="checkbox"/>2 > 4 HOURS <input type="checkbox"/>3
43	Is Physical Education part of your school curriculum?	YES <input type="checkbox"/>1 NO <input type="checkbox"/>2
44	If YES to 43, what type of physical education activity do you engage in?	ACTIVITIES <input type="checkbox"/>1 NA <input type="checkbox"/>9
45	Was Physical Education part of your JHS curriculum?	YES <input type="checkbox"/>1 NO <input type="checkbox"/>2

SECTION F: ANTHROPOMETRIC MEASUREMENTS

MEASUREMENT	FIRST MEASUREMENT	SECOND MEASUREMENT	AVERAGE
HEIGHT (m)			
WEIGHT (kg)			

BMI (kg/ m ²)	
BMI STATUS	OBESE <input type="checkbox"/>1 OVERWEIGHT <input type="checkbox"/>2 NORMAL <input type="checkbox"/>3 UNDERWIGHT <input type="checkbox"/>4