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SCHOOL OF PUBLIC HEALTH

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UNIVERSITY OF GHANA

THE RELATIONSHIP BETWEEN OVERWEIGHT, OBESITY AND ACADEMIC PERFORMANCE OF ADOLESCENTS IN A SENIOR HIGH SCHOOL IN ACCRA

BY

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INTEGRI PROCEDAMUS

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

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Declaration

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

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Dedication

I dedicate this work to my parents, Late Nana Adom Frempong and Amma Amoakowaa. And also to my family, Sedina, Maame Yaa and Nana Kwasi – I couldn't have done this without your love.

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To the Almighty God, my light, my strength, my shepherd

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To all the students (and their guardians) who participated in this study, thank you for trusting me with your information. This has only been possible because of your willingness to participate.

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Abstract

Introduction: Obesity has been described as an epidemic with more than one-third of children aged of 2 to 19, said to be overweight or obese, as at 2013 (CDC). Adult obesity has been strongly linked with obesity in childhood and adolescence. It is therefore imperative to tackle this problem in the adolescent stage, to prevent entering adulthood with one of the major risk factors for Non-Communicable diseases. Known immediate consequences of obesity include self-esteem, reduced cognitive capabilities and memory functions. Academic performance has also been found to be related to cognitive and memory functions. The aim of this study therefore was to investigate the association between overweight/obesity and students academic performance in a senior high school setting.

Methods: A descriptive cross sectional study was done. A mixed public school in Accra, with students belonging to families to the high and low socio-economic class, which consented to giving access to students' end-of-term marks, was selected. A multi-stage sampling design was used to select the form (based on years spent in school) and classes (based on courses offered). A simple random sampling was then used to select a representative sample of 390 adolescents (aged 10 to 19) in the school. Pre-coded structured questionnaires were administered to obtain information on socio-demographics, genetic, dietary and general lifestyle factors. Using a standardized protocol, height (to the nearest centimetre) and weight (to the nearest kilogram) were measured. Overweight was defined as BMI more than or equal to 85th percentile but less than the 95th percentile, while obesity as more than or equal to 95th BMI percentile, using the Centre for Disease Control and Prevention Growth Charts (2000).

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Data on academic performance for each participant were extracted from school records and classified into Good (40%+) and Poor (<40%) grades. Data were assessed for association using Pearson's chi-squared test and binary/multivariate logistic regression analysis after adjusting for covariates.

Results: The prevalence of underweight, overweight and obesity was 9.2% (95% CI: 6.6–12.6%), 10.3% (95% CI: 7.5–13.9%) and 5.0% (95% CI: 3.2–7.8%) respectively. The risk factors associated with overweight and obesity were female gender, offering home economics, having a slim/slender best friend, eating after 8pm, engaging in less or no vigorous physical activity, friends perception of being big/very big and perceiving ones self as big/very big. These were statistically significant (P<0.001). However there was no significant association between overweight/obesity and academic performance after controlling for socio-demographic, genetic and lifestyle factors. Absenteeism was the most important predictor for poor academic performance in this study (P<0.001).

Conclusion: There is no association between overweight/obesity and academic performance in the classroom setting among adolescents in Accra. Based on this finding, good academic performance cannot be used to justify measurement of success in obesity prevention initiatives. However, students can be encouraged to ignore their weight status as part of reason for their non-performance or otherwise in the senior high schools.

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List Of Abbreviations

BMI	-	Body Mass Index
CDC	-	Centre for Disease Control and Prevention
GDHS	-	Ghana Demographic and Health Survey
GHS	-	Ghana Health Service
GSS	-	Ghana Statistical Services
SD	-	Standard Deviation
SHS	-	Senior High School
SSA	-	Sub Saharan Africa
TV	-	Television
WASSCE	-	West Africa Senior Secondary Certificate Examination
WHO	-	World Health Organization

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Definitions of terms

Academic Performance

It is the total mark in a subject received at the end of the term by a student using both class assessment scores and end-of-term examination scores. An average of four core subjects taken by a student was used as academic performance in this study.

Adolescent

An adolescent is a child from age 10 to 19 completed years. Age here was defined as exact age 10 to exact age 19.

Globesity

The global epidemic of overweight and obesity

Obesity

Obesity is defined as BMI of more than or equal to the 95th percentile for age and sex, in children and adolescents.

Overweight

Overweight is where BMI is more than or equal to the 85th percentile but less than the 95th percentile for age and sex.

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CHAPTER ONE

1. 0 INTRODUCTION

1.1 Background

According to the World Health Organisation, overweight implies having a Body Mass Index (BMI) measure which is equal to or greater than 25kg/m^2, but less than 30.0kg/m^2 (World Health Organization - WHO, 2015). Obesity is described as a medical condition in which a person has a BMI equal to or greater than 30kg/m^2. This condition is characterised by having excess body fat, which can lead to adverse health effects and reduced life expectancy (Haslam & James, 2005).

Overweight and obesity have become an increasing health concern as the world transits through the epidemiological transition as postulated by Omran, which has led to an epidemic of obesity and what is now being termed as the third component of a triple burden in the developing world (Frenk, Gómez-Dantés, & Moon, 2014; Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; Omran, 2005). It has been explained that obesity and overweight are simply from an imbalance in energy intake/consumption and output/use, with more consumption relative to output (Hill, Wyatt, & Peters, 2012). In addition to high caloric intake with inactive lifestyles, genetic factors also contribute to overweight/obese (Herrera, Keildson, & Lindgren, 2011). In children, obesity has been linked with the rise in consumption of energy-dense foods that are high in fat, sedentary activities and long period spent watching TV (Popkin & Gordon-Larsen, 2004).

In 2005, it was estimated that there were 937 million overweight and 396 million obese persons aged 18 and over around the world, and that by 2030, these would increase to 1.35 billion overweight and 573 million obese people (Kelly, Yang, Chen, Reynolds, &

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He, 2008). However, the latest statistics from the WHO reveals these 2030 projections were optimistic, because in 2014, 1.9 billion adults were already thought to be overweight and 600 million were obese (World Health Organization - WHO, 2015).

Tellingly, much of this burden is found in the developing countries, as rapid shifts in diet and activity level due to global trade liberalization, economic growth, rapid urbanization and modernization has ensured that under-nutrition co-exists with overweight and obesity in these nations (Amuna & Zotor, 2008; Malik, Willett, & Hu, 2013; Popkin, Adair, & Ng, 2013; Prentice, 2006).

While the estimates outlined above are for adults, obesity in childhood and adolescence is also a clear and present danger. The US Centre for Disease Control and Prevention (CDC) states that by their measure, childhood obesity has become increasingly rampant in the US with more than one third of American children aged 2 through 19 years being overweight or obese as at 2013 (Centre for Disease Control and Prevention [CDC], 2013).

Sub-Saharan Africa (SSA) is especially affected by this epidemic in adults but little work has been done concerning adolescents. One of the latest study to assess region-wide obesity found that the prevalence ranged from 0.4 to 43% (Dalal et al., 2011).

In Ghana, a study by Kumah et al among 500 junior high students showed that the prevalence of overweight and obesity was 12.2% and 0.8% respectively.(Kumah, Akuffo, Abaka-Cann, Affram, & Osae, 2015)

These increasing overweight and obesity situation is resulting in different health, social, psychological, and economic consequences for both the affected people and the society at large. The co-morbidities such as diabetes mellitus, cardiovascular disorders, colorectal

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polyps and even cancers are well documented (Field et al; 2001)(Calle & Kaaks, 2004; Malik et al., 2013; Popkin et al., 2013).

In children and adolescents, vital organs, such as the heart and lungs, have been known to be affected by excess adiposity, and recent research has shown that adolescents, who are overweight and obese, have lower cognitive performance. This further indicates that the cognitive abilities may also be affected (Yau, Castro, Tagani, Tsui, & Convit, 2012). Obesity in childhood is also associated with later heart disease, breathing difficulties, increased risk of fractures, hyperlipidaemia, hyper-insulinaemia, hypertension, and early atherosclerosis (Cole, Bellizzi, Flegal, & Dietz, 2000).

Other studies have established that academic performance is related to cognitive and memory function. Obese children and adolescents are said to suffer from stigmatisation, discrimination and ridicule which resolves as depression, and poor educational attainment (Aguirre-Perez et al., 2007; Puhl & Heuer, 2009). A link between overweight and obesity and school academic performance could help both the Ministries of Education and Health and other stakeholders, to improve the students performance while ensuring good health.

Despite the silent challenge obesity in children and adolescents poses to the future of the nation, little work has been done to comprehensively collect data on the prevalence across Ghana. Instead, a few community-based and even fewer school-based studies have been conducted to map out these phenomena. However, it is important to realise the necessity of such studies as health in childhood and adolescence is the foundation for adult health, and considering the peculiar epidemiology and social context of childhood/adolescent health, data that can be used to develop sound policies targeted at meeting the unique needs of children/adolescents is needed.

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This work will be contributing to that effort by assessing the prevalence of overweight and obesity among adolescents in Senior high school, and relate it to their academic performance.

1.2 Problem Statement

Statistical evidence in several studies has documented the dramatic rise in overweight and obesity in both adults and children (Ogden, Carroll, Kit, & Flegal, 2012; Stamatakis, Wardle, & Cole, 2009; Wang Y, 2006). Recent statistics show that among children and adolescents in developed nations, 23.8% boys and 22.6% girls were overweight or obese in 2013. In developing nations, the figure stood at 8.1% to 12.9% in 2013 for boys and from 8.4% to 13.4% in girls (Ng M1, Fleming T1, 2014). But a realisation of this problem has seen a slow and clumsy pivot to develop efforts that will address it (Agyei-Mensah & de-Graft Aikins, 2010)

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

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However, beyond its prevalence, there are clearly documented immediate and chronic consequences of excess body fat. In clearly understanding of the consequences of such weight problems on children and adolescents, researchers have examined the relationship between children's health and nutrition and a vital part of modern childhood –school performance (Gurley-Calvez & Higginbotham, 2010; Naticchioni, 2013; Taras & Potts-Datema, 2005; Florence, Asbridge, & Veugelers, 2008; Foltz et al., 2012; Hollar et al., 2010; Kantomaa et al., 2013; Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). The bulk of these studies that have established a link seem between the types of foods that students eat, their weight, and their performance in school. They all show that obesity strongly correlates with poor academic performance. The implications of these are immense, as it shows clearly how obesity threatens the quality of adults our society develops, and would also have serious impact on their economic prospects in life and even push them into criminality (Cawley, 2010; Crowle & Turner, 2010; Trzesniewski et al., 2006; Yach, Stuckler, & Brownell, 2006).

However, such researches were mostly done in the developed world, where overweight and obesity is currently more prevalent but is at steady levels. There is a need to assess if in Ghana, such a relationship exists. It is also pertinent to note that although school-based studies on overweight and obesity have been done in Ghana, such studies have not assessed the relationship of the observed prevalence to academic performance.

As such, this study seeks to fill that gap by investigating how overweight and obesity affects the academic performance of students in a senior high school in Accra.

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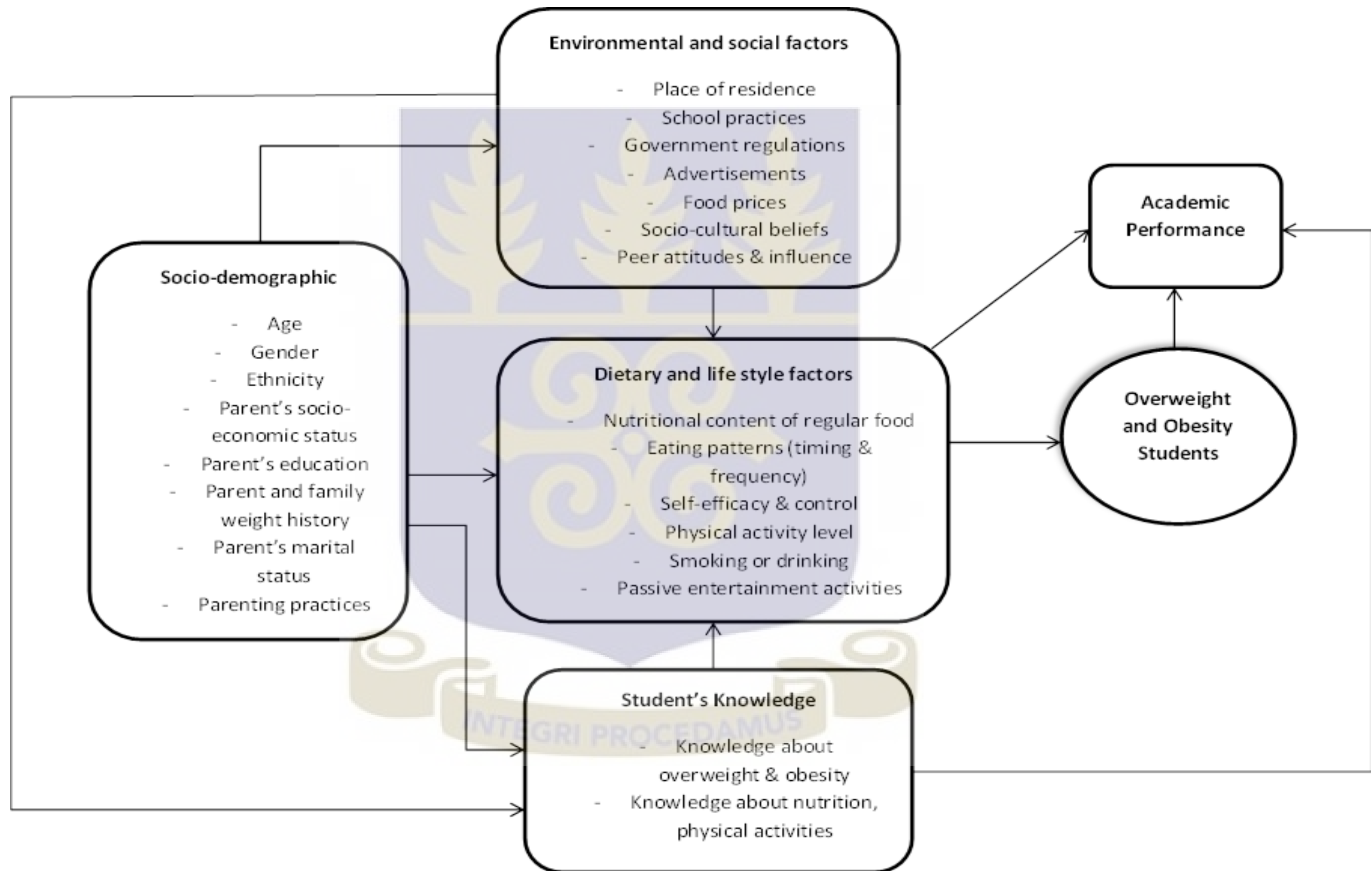
1.3 Conceptual Framework



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1.3 Conceptual framework

This study will be based on a conceptual framework developed by the researcher based on several reviewed literature (Himathongkam, 2011; Sobal, 1991; Thanh, 2008; Verstraeten et al., 2014). This conceptual framework is also loosely based on Bronfenbrenner's human ecology theory in which adolescent health outcomes are governed by an ecological framework (Bronfenbrenner, 1977).

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

A child who has knowledge on nutrition and obesity issues is more likely to take some individual action to prevent it by adopting a healthy lifestyle, than one who doesn't. This knowledge is influenced by socio-demographic as well as environmental factors, as children from higher-income and well-educated homes, who are taught in school about nutrition as well as who live in areas where avenues of living healthy abound are more likely to know about obesity. This knowledge can also directly impact academic achievement, as knowledgeable children would be more likely to be pro-active, self-efficacious and refuse to let their weight affect their academic performance. Environmental and social issues can directly influence dietary and lifestyle of a child as the influence of peers, school policies on feeding, and their exposure to advertisements

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on energy-dense food may impact their lifestyle. Ultimately, dietary and lifestyle factors are the most important influence on the child being over-weight and obese, these weight states will then affect the academic performance of the child, a link that is the central research question of this study.

1.4 Significance Of Study

This study seeks to investigate how overweight and obesity affects the academic performance of students in a Senior High school in Accra. Most schools in Accra have played pivotal roles and still play important roles in the academic development of much of Ghana's leaders, elites and public health shapers (Coe, 2002; Yamada, 2009). Moreover Modern Ghana (2007) alleges that overweight and obesity is more prevalent in the urban south, therefore finding a relationship between BMI and academic performance would have both epidemiological and national significance.

Considering the objectives of this study, this research seeks to fill a gap by providing a baseline prevalence of overweight and obesity in the senior high school setting. This can serve as a basis for a bigger, nationally representative research. Also it would be useful in identifying risk factors and educational effects of obesity and overweight, thus allowing proper planning of how to manage the effects of dismal school performance by affected students, to assure the economic future of the nation.

Therefore, this study, when completed will provide prevalence evidence, determine if there is any significant relationship between academic achievement and overweight/obesity, as well as identify factors that influence such relationships.

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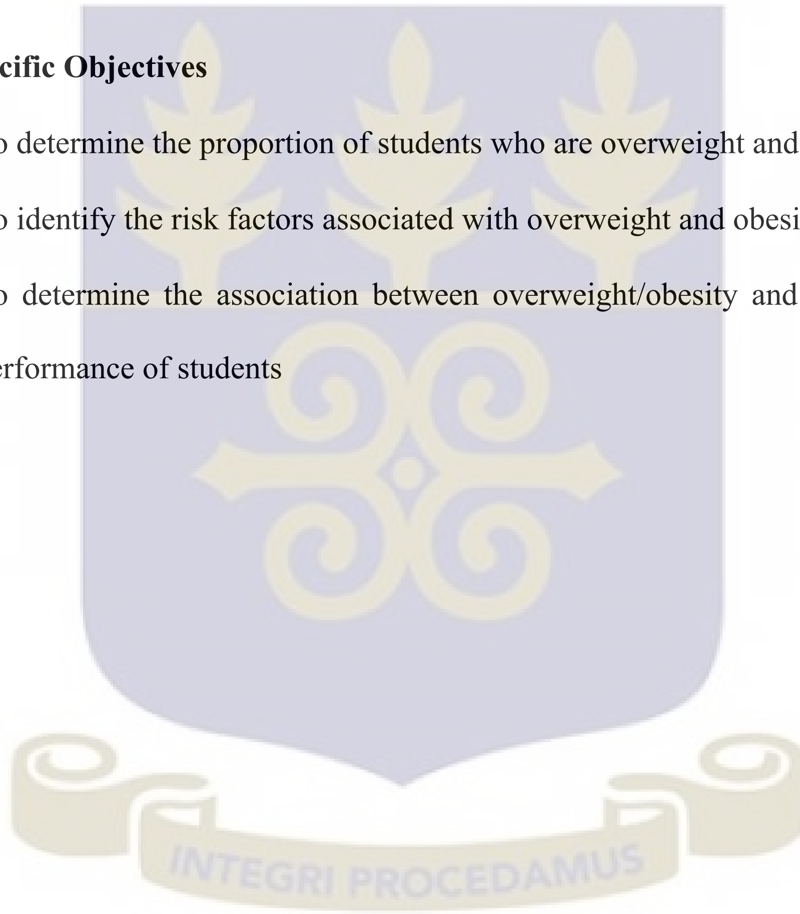
1.5 Aim/Objectives

1.5.1 General Objectives

To determine the relationship between overweight/obesity and academic performance of adolescents in a Senior High School in Accra

1.5.2 Specific Objectives

- To determine the proportion of students who are overweight and obese
- To identify the risk factors associated with overweight and obesity
- To determine the association between overweight/obesity and school academic performance of students



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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview Of Overweight And Obesity In Adolescents: Concept And Cause

2.1.1 Adolescence and nutrition

Adolescence is a critical stage of human development between the ages of 10-19 years marked by the developmental transition between childhood and adulthood, involving physical, intellectual/cognitive, emotional, and social developmental changes (McClure, 2005). It is at this stage that the most important life-markers occur- sexual maturation and initiation, cognitive maturity, increased autonomy from parents, strong social, sexual & peer-relations and self-concept/identity (Blakemore, 2008; Roenneberg et al., 2004; Roisman, Masten, Coatsworth, & Tellegen, 2004; Sebastian, Burnett, & Blakemore, 2008; Spear & Kulbok, 2004; Yurgelun-Todd, 2007). It is also the stage at which health events that span the life-course occurs; events that when wrongly managed leads to chronic illnesses that spans an individual's lifetime (Crowley, Wolfe, Lock, & McKee, 2011).

Socio-culturally, adolescents (i.e. individuals in the stage of adolescence) are expected to be in school, become socially and physically engaged with their peers and grow optimally (Kohl & Cook, 2013). As they grow, they experience a growth acceleration that is second only to that observed in the first year of life. It is at this point they go through puberty (and its attendant menarche, genital growth, and sexual maturation), they achieve their peak bone mass, full body size and fat deposition (Christie & Viner, 2005). As such, the nutritional requirements of this stage are immense. It is this facet of their lives that

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interests this study – the relationship of their nutritional outcomes to a measure of their cognitive performance.

According to Story & Stang (2005), the nutritional needs of adolescents parallels the rate of their growth, and at the peak velocity of growth (weight and height), the nutrient demands is said to occur – a period that although varies among individuals but is held to occur at a mean of 13.5 years in boys and 12 years in girls (Story & Stang, 2005). This period occurs later in puberty among males than among females, and is seen approximately 6 to 12 months prior to menarche in females (Jenkins, 2005). At the end of this growth phase, female adolescents gain a mean weight of 17.5kg and gain 120% body fat while males gain 23.7kg and lose 12% of body fat creating a gender-based disparity in body mass index between the sexes (Story & Stang, 2005). This fat gain, called the adiposity rebound, can be a pre-disposing factor for overweight as those who experience it early are at higher risk for overweight (Malina, 1999). Importantly, many adolescents are in the secondary school at this age, and by the time most, even those with delayed growth, are completing this spurt and have achieved , they are in the senior secondary school, making this study focus on students in that class range (Busscher et al., 2012).

According to dietary recommendations for children and adolescents proposed by the American Heart Association, the normal growth expected from adolescents is said to be optimally fuelled by nutrition that primarily relies on fruits and vegetables, whole grains, low-fat and non-fat dairy products, beans, fish, and lean meat, as well as low intakes of saturated and trans fat, cholesterol, and added sugar and salt (Gidding et al., 2005). They further advocate that children aged 9-18 years need 1600-1800kcal daily for females and 1800-2200kcal for males all alongside 60 Minutes of moderate to vigorous play or

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physical activity daily. In addition, they advocate that daily calorie intake is dependent on the activity level of the child. For sedentary adolescents they specify a daily calorie intake of 1600kcal-1750kcal, for moderately active ones they recommend 2000kcal, and for active adolescents 2200-2400kcal (Gidding et al., 2005). This is not too different to the recommendations by Story & Stang (2015) (based on UNICEF standards) who outlined a 2071-2368kcal energy intake by female adolescents, and 2279-3152kcal for male adolescents.

This however is not adhered to. Adolescents' diet is characterized by

"*a reduction in regular breakfast consumption, an increase in consumption of foods prepared away from the home, an increase in the percentage of total calories from snacks, an increase in consumption of fried and nutrient-poor foods, a significant increase in portion size at each meal, and an increase in consumption of sweetened beverages, whereas dairy product consumption has decreased, and a shift away from high-fiber fruits and vegetables as well as a general decline in fruit and vegetable consumption…[also there is] sugar consumption has increased… the shift in dietary patterns has resulted in median intakes below recommended values of many important nutrients during adolescence… Sodium intake is far in excess of recommended levels, whereas calcium and potassium intakes are below recommended levels*" (Gidding et al., 2005). Alongside this, they also have poor physical exercise practice/habits (Hallal, Victora, Azevedo, & Wells, 2006).

A study in the Ga-East district of Ghana that assessed the diet intake and physical activity behaviours and status of nutrition of overweight/obese school-going children aged 8-18 years verifies the poor nutritional and lifestyle habits associated with overweight/obesity.

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They found that about three in five of the students reported consuming no fruits or vegetables, whiles almost four in five of them preferred fried foods over other forms of cooked food. Majority (60.9%) also engaged in less than 60 mins of physical activity a day (Steiner-Asiedu, Addo, Bediako-Amoa, Fiadjoe, & Anderson, 2012).

This presents a major problem, as it means that adolescents are not developing healthy eating and lifestyle habits early in life, and this would place them at higher risk of suffering from chronic diseases such as obesity, cardiovascular diseases, cancers, diabetes and osteoporosis (Buxton, 2014). Overweight and obesity in adolescents are of primary interest among the consequences of such unhealthy lifestyle because they are reversible, are often precursors of the other consequences and have psychosocial and economic effects on adolescents that would affect them for life (Ebbeling, Pawlak, & Ludwig, 2002). Also, there is some evidence propounding the fact that 80% of obese adolescents would grow into obese adults (Daniels et al., 2005).

2.1.2 Causes of adolescent overweight and obesity

This ballooning weight problem cannot be simply attributed to genetic changes occurring worldwide; rather, lifestyle, hormonal and environmental reasons can be proposed as cause (Troiano, Briefel, Carroll, & Bialostosky, 2000). In extremely rare cases, overweight and obesity can be caused by adrenal conditions such as hypothyroidism, hypercortisolism and hyperpituitarism, as well as and testicular and ovarian hypofunction (Anderson & Butcher, 2006; Wyatt, Winters, & Dubbert, 2006). This kind of obesity due to endocrinal and metabolism problems is called the endogenous obesity. But obesity is commonly exogenous - an imbalance between food eaten and energy expended (Krebs et al., 2007). Further, their currently is increased availability of unhealthy energy-dense,

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high-calorie foods and drinks and limited access to healthy and affordable food as well as poor eating habits and increased sedentary lifestyle of adolescents (Anderson & Butcher, 2006). This stated reason has a host of genetic, environmental, factors that define their presentation.

Studies have shown that factors such as birth weight, watching too much TV, playing video games & using the computer for long hours, having overweight parents or family history of CVD, changes towards the built environment, sleep disorders and having overweight or obese friends increases the risk that an adolescent will be overweight or obese (Daniels et al., 2005; Guo et al., 2013; Krebs et al., 2007; Valente, Fujimoto, Chou, & Spruijt-Metz, 2009). Other factors associated with overweight and obesity includes age, gender, socio-economic status, and diet (calorie and fat intake) (Ahmad, Ahmad, & Ahmad, 2010). In addition, genetic influences have been estimated to explain up to 70% of individual differences in BMI (Krebs et al., 2007).

Parental/familial factors such as parental marital status, nutrition attitude, weight history affect the likelihood of an adolescent being overweight/obesity (Berge, 2009; Lawlor et al., 2008). Strauss & Knight found that over the period of their 6 year longitudinal study, children who lived with single mothers were significantly more likely to become obese, just as children with nonworking parents, children with nonprofessional parents, and children whose mothers did not complete high school were also likely to be more obese (Strauss & Knight, 1999). The influence of marital status in adolescent obesity was also found in a study in Norway, as overweight/obesity was more prevalent among children of divorced parents compared with children of married parents (Biehl et al., 2014). This effect was more pronounced among boys. The researchers found in another study that

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low-income mothers who did not worry about their child being obese had more obese children (Jain et al., 2001). Parental interest in nutrition and weight management, as well as parental body shape/weight were also cited as predictors of overweight/obesity in a study done in Korea (Noh, Kim, Park, Oh, & Kwon, 2014). Low family income, non-working parents, over-consumption of high-calorie foods, snacking while watching television or doing homework, and over-exposure to advertisement of high calorie foods were found as risk factors for adolescent obesity in a review of global studies (Huffman, Kanikireddy, & Patel, 2010). Also, as in other studies in South Africa, Iran, and China, living in the urban area was found to be more associated with adolescent obesity in Nigeria (Ani, Uvere, & Ene-Obong, 2013; Chen, Modin, Ji, & Hjern, 2011; Kelishadi et al., 2008; Reddy et al., 2012). However, studies in Canada, the United States and Italy found the opposite (Bertoncello, Cazzaro, Ferraresso, Mazzer, & Moretti, 2008; Bruner, Lawson, Pickett, Boyce, & Janssen, 2008; Liu, Bennett, Harun, & Probst, 2008). This shows a divide between developing countries and developed countries, as further corroborated by Gupta et al. (2010) who explained that fascination with western diets which was fattening and easily available in the urban areas of developing countries accounted for the urban-rural dynamics in the developing world (Gupta, Goel, Shah, & Misra, 2012). However such fattening foods are eaten by the rural and poor in the West, whereas the urban eat better healthier food (Ericson, 2010; Witkowski, 2007).

Other environmental factors also play some role. These include the school programs on nutrition and physical exercise, availability of recreational facilities in residential area the availability of cheap healthy food, government policies on adolescent nutrition and socio-cultural beliefs (Afrifa-Anane, Agyemang, Codjoe, Ogedegbe, & de-Graft Aikins, 2015;

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Buxton, 2014; Dietz, 2015; Kropski, Keckley, & Jensen, 2008; Larson, Wall, Story, & Neumark-Sztainer, 2013; Manyanga, El-Sayed, Doku, & Randall, 2014).

2.1.3 Perceptions of adolescent overweight and obesity

Importantly, perceptions of overweight/obesity defers across locations and cultures. In the West, the cultural elevation of the thin and lean female imagery and strong and lean male imagery into idealised body types forces adolescents to comply early with that stereotype, forcing many adolescents there into nutritional problems of bulimia nervosa and anorexia nervosa (Rosen, 2013; Wilson, Viswanathan, Rousson, & Bovet, 2013). . In developing nations, especially sub-Saharan Africa, body image ideals may have more complex social underpinnings. In Ghana, it has been found that while there is the societal perception that being overweight or obese is an indication of high socio-economic status and happiness, overweight and obese Ghanaian women were more dissatisfied with their weight than normal weight women (Benkeser, Biritwum, & Hill, 2012; Mogre, Mwinlenna, & Oladele, 2013). A study in Kumasi, Ghana among secondary school students which found a significant prevalence of overweight and obesity among them also found that obese females considered putting on weight as a sign of affluence, eating good and healthy food and happiness. They further showed that students believed that being obese afforded them the needed strength in their sport and accorded them the necessary respect (Kumah et al., 2015). This is further supported by a study comparing attitudes toward obesity and thinness among students in the US and Ghana. The study revealed that students in Ghana more often rated larger body sizes as ideal for both males and females and also assumed that these larger sizes were held as ideals in society, than did U.S. students (Cogan, Bhalla, Sefa-Dedeh, & Rothblum, 1996).

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2.1.4 Measuring adolescent overweight and obesity

It is interesting to note that despite the release of standardised measures by the CDC and the WHO, defining adolescent overweight and obesity remains challenging due to the fact that the BMI on which both measures are based on an is imperfect approximation of excess adiposity (Daniels et al., 2005; Onis et al., 2007; U.S. Centers for Disease Control and Prevention - CDC, 2015). Measurement of adiposity in children and adolescents can be done with a range of direct and indirect methods (Lobstein, Baur, & Uauy, 2004). Direct measures of body composition provide an estimation of total body fat mass and various components of fat-free mass. Such techniques include underwater weighing, magnetic resonance imaging (MRI), bioelectrical impedance analysis (BIA), computerized axial tomography (CT or CAT) and dual energy X-ray absorptiometry (DEXA) (Power, Lake, & Cole, 1997). These methods are used predominantly for research and in tertiary care settings, but may be used as a 'gold standard' to validate anthropometric measures of body fatness.

Among the anthropometric or more indirect measures of relative adiposity or fatness are waist, hip and other girth measurements, skin fold thickness and indices derived from measured height and weight such as Quetelet's index (BMI or WH^{-2}), and the ponderal index (WH^{-3}) (Sweeting, 2007). All anthropometric measurements rely to some extent on the skill of the measurer, and their relative accuracy as a measure of adiposity in adolescents must be validated against a 'gold standard' measure of adiposity such as a reference chart (Power et al., 1997; Sweeting, 2007).

However, the proportion of the children and adolescent population classified as overweight has increased dramatically over the past two decades globally, just as a

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similar increase has been noted among the adolescent population (Ahmad et al., 2010). In sub-Saharan Africa, a review by Muthuri et al. (2014) found that a trend towards increasing proportions of school-aged children and adolescents were overweight/obese evens as a persistent problem of underweight co-existed with it (Muthuri et al., 2014).

2.2 The relationship between body weight and academic achievement: Concept and determinants

From time immemorial, the link between nutrition and weight has been known; however the connection between weight and cognitive performance has just been recently alluded to. The first of such allusions focused on the psychosocial relationship – the fact that overweight and obesity caused poor academic performance by first affecting a child's self-esteem, which led to sadness, loneliness, non-participation in class and social life, and general withdrawal. Since then, a mechanistic link has been found between obesity-associated metabolic disease and lower academic and professional potential of adolescents (Yau, Castro, Tagani, Tsui, & Convit, 2012).

Generally, there has been a prevalence of studies finding a negative association between BMI and academic performance; that is increase in BMI in adolescents leads to worse academic performance. A study in India among adolescents aged 13 to 16 years showed that while adolescent boys and girls with normal weights showed better academic performance than their obese mates, obesity seemed to affect girls' academic performance than boys with obese girls performing worse than obese boys as compared to their normal weight peers in both genders respectively (Rashmi & Jaswal, 2012). A study in the United States however clarifies the relationship by showing that while there is a negative association between obesity and achievement, such associations were more

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pronounced in schools with higher levels of romantic activity and lower average body size among students (Crosnoe & Muller, 2004).

This brings to question whether there really is a causal relationship between body weight and academic performance or maybe there are confounders and effect modifiers that govern the relationship. An examination of more studies buttresses this point. Another study in the United States shows the role of race in this relationship, as they found that among white female adolescents aged 14-17 years, there is solid evidence of a significantly negative association between BMI and grade point average, whereas among minority girls of same age a far more weaker and inconsistent association was found (Sabia, 2007). A possible reason might be the stronger bias against obesity in white culture than other cultures (Hebl & Turchin, 2005; Huey, 2013). This does show a cultural linkage as mediating the relationship between body weight and academic performance.

The role of residence has also been pointed out in the relationship between overweight and obesity. A study by Nsiah & Joshi found that while overweight and obese adolescents generally had poorer GPA scores than their mates, urban children had worse scores than rural ones (Nsiah & Joshi, 2009).

As such it is imperative to see if such locational and cultural differences occurs in sub-Saharan Africa and Ghana specifically.

Another factor found to be a mediating one on body weight and academic performance among adolescents is weigh-based teasing. Krukowski et al. (2009) revealed that while overweight status significantly predicted poorer school performance, the addition of

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weight-based teasing to the regression model the study used showed such predictor relationship became insignificant highlighting a possible mediating effect of weight-based teasing on the relationship between body weight and academic performance (Krukowski et al., 2009). This link was somewhat bolstered by the finding by the same study that there was lower odds of strong school performance among weight-based teased.

A study by Rampersaud et al. (2005) found that while breakfast eaters generally consumed more daily calories yet were less likely to be overweight, even overweight and obese adolescents who ate breakfast had better cognitive function related to memory, test grades, and school attendance than those who don't.

A study in India which looked at the influence of body weight on academic achievement among medical students found that that academic achievement of overweight student is less than normal weight and significantly less than underweight students. This renders overweight and obesity as being predictors of worse academic outcomes than another class of malnourishment – underweight (Borse, Bansode, Modak, & Yadav, 2013).

A study in Nigeria by Oketayo et al. (2010) among predominantly young people in a tertiary institution had some interesting findings. They found that while a significant positive correlation was found between the body fat and weight in relation to academic performance among those classed as overweight, among the obese, a significantly negative relationship was found, showing that adolescent obesity may result in adverse academic outcomes (Oketayo et al., 2010). This finding is important in its pointing out the necessity of delineating the overweight from the obese in observing how body weight impacts academic performance.

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A review of literature on the association between obesity among school-aged children and academic outcomes by Taras & Potts-Datema (2005) again showed that there is an association between poor levels of academic performance and both overweight and obesity (Taras & Potts-Datema, 2005).

A study in the UK using a different measure of body size (genetic markers) from BMI which other studies reviewed in this work used still showed that leaner children perform better in school tests compared to their heavier counterparts (Scholder, Propper, Windmeijer, Smith, & Lawlor, 2009). Another study in the US found similar results (Ding, Lehrer, Rosenquist, & Audrain-McGovern, 2009). This lends credence to the position that the relationship between overweight & obesity and poor academic performance can still be observed across different measures.

Although overweight and obesity has been found more prevalent in female adolescents in spite of age, a systematic review stated that several studies have found that obese male adolescents were less likely to have poorer academic performance than their female counterparts (Cohen, Rai, Rehkopf, & Abrams, 2013). This association became more pronounced in countries with higher socioeconomic status. Han (2012) had found similar results that show that overweight/obese female adolescents had worse academic scores than their male counterparts (Han, 2012). However, contrasting research has shown that no difference exists in academic performance by gender among obsess adolescents (Rashmi & Jaswal, 2012).

A study in Korea asserts the role of a child's regularity of meals and socioeconomic status as well as physical status and parental education in modifying the relationship of overweight/obesity and academic performance (Kim et al., 2003). Socio-economic status

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and parental education actually ensured better academic performance as corroborated by another study (Rausch, 2013). Other parental factors, such as the provision of a stimulating home environment, play critical roles in the development of overweight, poor academic performance and cognitive outcomes (De Coulon, Meschi, & Vignoles, 2008; Vignoles & Meschi, 2010).

Li et al. (2012) found that although there was significant association between overweight/obesity and academic performance (which was age-gender sensitive), the relationship ceased to be significant after adjusting for parental/familial characteristics such as family income, parental attention and parental education (Li, Dai, Jackson, & Zhang, 2008; Sigfúsdóttir, Kristjánsson, & Allegrante, 2007). Dietary and lifestyle factors such as have been found to be associated with overweight/obesity and poor academic performance (Rausch, 2013). This includes physical activity, eating patterns, amount of screen-based sedentary activities, and nutritional content (Florence, Asbridge, & Veugelers, 2008b; Huffman et al., 2010).

In underlining the importance of assessing this relationship between adolescence body weight and academic performance, studies have proven that when overweight and obese adolescents grow into obese adults, they tend to have lower wages than their normal-weight mates, have worse economic outcomes and they face life-threatening implicit bias in utilisation of health services (Blair, Steiner, & Havranek, 2011; Puhl & Heuer, 2009; Sabia, 2007).

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2.3 Prevention, Management and Interventions

The prevention of overweight/obesity is not only possible but is the most realistic and cost effective approach for dealing with childhood obesity (Lobstein et al., 2004). The challenge is to create a multifaceted public health approach focused on health and not appearance, but which is capable of delivering long-term reductions in the prevalence of overweight and obesity (Gortmaker et al., 1999). This approach must also empower societies, reduce weight-bias, and address barriers in productive ways (Ebbeling et al., 2002). Generally, interventions targeted at preventing and treating overweight & obesity often are school or community programs, and they try to change individual behaviours, reduce environmental risk factors and change institutional policies (Fowler-Brown & Kahwati, 2004). Also, a study that reviewed research on the prevention and management of childhood obesity recommended that any intervention should include patient and family interventions focusing on nutrition, physical activity, reduced television viewing, and behaviour modification (Plourde, 2006).

The long-term efficaciousness of school-programs targeting body weight has been questioned (Fowler-Brown & Kahwati, 2004), but it still represents a viable option for use, as seen in the WHO backed programme - Health Promoting Schools (Stewart-Brown, 2004). Schools provide opportunities for nutrition education and promotion of physical activity both within the formal curriculum, and informally via the provision of appropriate facilities within the school environment such as healthy school meals, break-time snack provision and playground equipment (Lee, 2009; Stewart-Brown, 2004). Thus schools not only influence the knowledge and attitudes of children but also provide opportunities for experiential learning and the development of a sense of self-efficacy

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(Sylva, 2000). Furthermore, the school can also provide links with the family and the wider community.

A study by Gortmaker et al. (1999) found that interventions that reduced television hours among both girls and boys, and increased fruit and vegetable consumption resulted in a smaller increment in total energy intake among girls. It further showed that among girls, each hour of reduction in television viewing predicted reduced obesity prevalence (Gortmaker et al., 1999).

A meta-analysis by Peirson et al. (2015) of efficacious interventions to prevent overweight and obesity in children and youth found that of 16 successful programs across the globe that had time-ranges 12 weeks to 3 years, 14 programs were situated in educational settings, 15 involved group sessions, 4 incorporated family involvement and 6 specified that staff training was provided (Peirson et al., 2015). They also stated that the intervention focus varied from diet change only, exercise, diet and exercise and lifestyle modifications.

In outlining specific ways to prevent and manage overweight among adolescents, the Society for Adolescent Medicine (Kohn et al., 2006) proposed these educational and environmental strategies: regular monitoring of adolescent growth and development, families learning to eat and exercise healthfully together, and implementation of environmental strategies by schools, institutions, restaurants and other businesses, through encouraging intake of healthy foods, limiting access to unneeded food and encouraging healthy physical activity.

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CHAPTER THREE

3.0 METHODS

3.1 Study Design

A descriptive cross-sectional study involving the use of quantitative methods in data collection was conducted.

3.2 Study Area

The research was done in Accra. Accra is being chosen because it is cosmopolitan in nature and as such has a mix of individuals falling in the high, middle and low-income brackets. Thus, it is the researchers believe that this target population will give the true reflective picture of how weight status affects performance taking into account different socioeconomic background. Based on the pivotal roles played by most schools in Accra in the academic development of much of Ghana's leaders, elites and public opinion shapers (Coe, 2002; Yamada, 2009), a study in this region will have an epidemiological and national significance.

Fig 1. A map of the city of Accra (Credit: Google Maps)

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The study was conducted in a Senior High School, located in the Greater Accra region. In other to prevent stigmatization and certain associations being made with the selected school, certain characteristics of the school will be omitted. The school was founded in 1964 as one of the premier co-educational senior high school in Ghana. It is located on several acres of land at Adentan, and operates a day system. Its student population stands at about 1907, with most aged between 14-18 years, 51% of which are boys. Lessons there are taught in English by about 82 teachers, with 137 other non-academic staff in the school's employ. It is a publicly funded school with its financial needs met through 80% government revenue, maintenance and other tuition fees, with 20% coming from other income, endowments, grants and donations. Although most of its student population is Ghanaian, there are a few foreign nationals who are students.

This school was selected because it is a mixed public senior high school in Accra and most importantly because the school authorities agreed to give the researcher access to the end-of-term grades and academic records of participants, though limited.

3.3 Study Population

The study population for this work were all adolescent students in the selected Senior High School who were Form 1 and Form 2 students. The Form 3 students were not part of the study because they had written their final WASSCE exams and had therefore completed SHS.

3.3.1 Inclusion Criteria

Students who were included in this study were

- All students aged 10-19 years (adolescents)

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- Students who were in Form 1 and 2 of the selected senior high school, with relevant academic records
- Students who fulfill the previous criteria, and whose parents agreed for them to participate in the study
- Students who assent or consent to take part in the study

3.3.2 Exclusion Criteria

To be excluded from this study are

- Students who are below the age of 10 years or above 19 years.
- Students whose parents refused to consent to them participating in the study
- Students who decided not to assent/consent to taking part in the study
- Ill students or students who recently recovered from a major illness drastically affecting body weight;
- Students who are on certain medications for more than 3 weeks prior to the data collection duration.

3.4 Variables

3.4.1 Dependent Variable

The dependent variable in this study was academic performance. This was measured by assessing the performance of study participants over the course of at least one school term.

3.4.2 Independent Variable

The main independent variable was Body Mass Index for age and sex, calculated as weight in kilogram over height in metres squared.

Other Independent variables for this study include

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- Socio-demographic characteristics of the participant
  - Sex, age, ethnicity
  - Family weight, parental practices, occupation, educational level and parental marital status
- Knowledge of participant on obesity & overweight
  - Knowledge on what obesity and overweight are
  - Knowledge on causes of obesity
  - Knowledge on consequences of obesity
- Environmental and social factors
  - Place of residence
  - Personal perception of body-weight
  - Participants' perception of social beliefs on weight
  - Friends attitude and beliefs towards weight
  - Exposure to food advertisement
  - School nutritional education and practices
- Lifestyle and dietary factors
  - Food habits (frequency, contents, timing)
  - Food preference
  - Recreation time and activities
  - Passive entertainment times
  - Physical activity

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3.5 Sampling

3.5.1. Sample Size Estimation

The sample size was calculated based on the Cochran (1977) single proportion population formula (Cochran, 1977). The sample size was estimated based on the assumption of a 12% prevalence of overweight and obesity among school-going adolescents in Greater Accra region with a confidence interval of 95% and a significance level of 5% (V. K. Nyawornota, Aryeetey, Bosomprah, & Aikins, 2013); (Kumah et al., 2015)

$$n = \frac{{z_{\alpha/2}}^2 pq}{d^2}$$

Where n= sample size

`p= probability of the event occurring, in this study the expected prevalence for overweight and obesity is 0.12 (12%)

q= 1-p= probability of the event not occurring, in this case 1-0.12= 0.88

d= Precision/margin of error (0.05)

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

The sample size was estimated as follows

$$n = \frac{(1.96)^2(0.12 * 0.88)}{0.05^2}$$

$$n = \frac{3.8416 * 0.1056}{0.05^2}$$

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$$n = \frac{0.40567296}{0.025}$$

$n = 162.3$

Therefore, a sample size of 163 was to be used for the study. However, adjusting for a finite population correction factor given by the formula

$$s = \frac{n}{\{1 + (n/N)\}}$$

Where s =adjusted sample size

n= estimated sample size (163)

N= estimated population (1639)

$$s = \frac{163}{\{1 + (\frac{163}{1907})\}}$$

$$s = \frac{163}{(1 + 0.085475)}$$

$s = 150.162 \approx 151$

The adjusted sample size was then further adjusted for an anticipated non-response; a 10% oversampling (15 more students included) was done, yielding a total of 166 study participants. However, because there was a possibility of omitting the underweight group from the analysis leading to a reduction in the calculated sample size during analysis, 390 students were sampled for the study with 13 students from each of the 30 classes. Therefore 180 students from each of Form 1 and 2 were selected.

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3.5.2 Sampling Procedure

The study area was chosen on account of certain peculiar characteristics. It is a mixed school with both boys and girls. It is also a public, government-funded school with a population that has adolescents from all socio-economic classes. However, the most important criterion was the school authorities' great interest in the study and their willingness to consent to release the end-of-term grades for the participants.

A multi-stage sampling technique was used to select the form and classes used in this study. As the final year students had completed their WASSCE examination, there were two main forms, depending on the number of years spent and a student passing the appropriate end-of-year examination. This was the first stage. The second stage involved a stratification of the various classes based on the courses offered. There were five different strata as a result. Depending on the course offered, there were 2, 3, 4 or 5 classes offering a course. All classes were selected as part of the study.

In the each class, a list of all the students was obtained. A random list of all the students in each class was generated using Microsoft Excel. All the list of student numbers was entered into a column in an EXCEL spread sheet. Thus, in the column right next to it the function =RAND( ) which is EXCEL's way of putting a random number between 0 and 1 in the cells was pasted. This was then dragged down the rows to the last student number. Both the columns with the list of students and the random numbers were sorted. This rearranged the list in random order from the lowest to the highest random number. Then, the number of students (13) needed in each class was taken from this sorted list starting from the first student with the lowest random number. These students were then

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identified in the class with their numbers with the help of the two teachers who were assigned to us by the school.

The students whose names are assigned to the generated number, as listed on the class register, were enrolled in the study. Permission was then sought from the school regarding the use of the selected students' grades from at least one previous term.

3.6 Data Collection

3.6.1 Questionnaire

For the data collection, a structured pre-coded questionnaire was used. This questionnaire was prepared in English, and was administered by the researcher and trained research assistants. The questionnaire contained 8 sections that assess the variables the study considers. These sections include

A. Demographic Characteristics
B. Socio-economic factors
C. Familial/Genetic factors
D. Dietary factors
E. Physical activity
F. Knowledge on Obesity and Overweight
G. General/Lifestyle
H. Anthropometric factors
I. Academic performance

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3.6.2 Anthropometric Measure

All measurements were taken with participants wearing light clothing. However, those with heavy clothing such as jackets and sweaters were asked to remove them. Participating students were also required to remove shoes or sandals, watches, phones or other jewellery on their wrists and also emptied their pockets prior to measurements. Weight was measured in kilograms (kg) with a calibrated Health Care® weighing scale. A stadiometer that comes with the weighting scale was used to measure the height of the students in centimetres (cm). An average of two different measurements, taken before and after answering the questionnaire, were used.

Classification of overweight and obesity was based on the CDC growth reference standards for children and adolescents (Onis et al., 2007). The measures of height and weight for each individual's age and sex were entered into the Medscape® BMI Calculator to yield z-scores and percentiles.

Students were classified as Underweight when the BMI was less than 5th percentile. Overweight was considered if their BMI $\geq 85^{th}$ percentile but less than the 95th percentile, which is equivalent to or greater than $25.0kg/m^2$ but less than 30.0kg/m2. Obesity was described as BMI $\geq 95^{th}$ percentile corresponding to BMI equal to or greater than 30.0kg/m2. The percentiles were used to estimate the prevalence of overweight and obesity in the study.

3.6.3 Academic performance

The dependent variable in this study was academic performance. This was measured by assessing the performance of study participants over the course of at least one school term. The four major core subjects being taken by students were used for the evaluation.

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This includes English Language, Core Mathematics, Integrated Science and Social Studies. Class grades were then transformed into Good (40 marks and above) and Poor (less than 40) as WASSCE grades marks less than 40 as a fail (F9).

3.6.4 Pre-Testing

The pre-test of questionnaire was done in Madina Senior High School within the same district. The school has similar socio-demographic characteristics as that of the study area. However, responses from this phase were not included in the study. Questionnaires were pre-tested to help the researcher modify questions, which do not help in answering the research questions and for easy administration of the questionnaire in the study area.

3.6.5 Data Collection Training

Five (5) research assistants with a minimum of completed senior high school education were used in the study. The research assistants were trained for three days, a first day of familiarisation and introduction to the study as well as ethical principles involved in a study on adolescents. A second day involved introducing them to the measures that would be used in the study, and a final day in which there was mock test of their ability to properly administer the questionnaire and take the anthropometric measurements.

3.6.6 Data Collection Procedure

Data was collected over three weeks. The participants were introduced to the study, first measurements taken, asked the questions from the questionnaire, after which the second measurements were then taken. An abstraction form was used to collect their raw scores from the school, after which it is entered into an Excel spread sheet, and then further transformed in Excel into the five (and two) point grading system, both of which the study used in analysis.

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3.7 Data Analysis

3.7.1 Data Processing And Entry

Questionnaires were given a unique identification (ID) number and responses were pre-coded. The researcher has securely kept these questionnaires in a room after being filled, with minimal public access to it. For the duration of data collection, data collected daily was immediately entered within 24 hours of collection into a Microsoft Excel 2013 spread sheet and imported into STATA version 13.0 where it was first cleaned before analysis was done. A digital copy of the dataset has been stored on an external hard drive.

3.7.2 Data Analysis Procedure

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

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

In finding an association between overweight/obesity and the socio-demographic, familial/genetic, dietary, physical activity and general lifestyle factors, logistic regression

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analysis was performed for each individual variable with the weight status comparing the overweight/obese group to the not-overweight group. This also helped to determine the strength of the association with reported Odds Ratio. Age was modelled as a continuous variable with the other variable as categorical.

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

3.8 Ethical Considerations

Ghana Health Service Ethical Approval

Before data collection, ethical approval was sought from the Ghana Health Service Ethical Review Committee of the Research and Development Division of the Ghana Health Services.

Consent was obtained from the school authorities. Permission was also sought from the parents and students (accent signed) before the individuals were enrolled. The study was explained to the students in English language, which is the language by which they are taught.

A written informed consent was also sought from the participants. Those who agreed to participate were administered the questionnaire if they satisfied the inclusion criteria. All responses obtained were kept confidential. Forms for each individual were kept under lock and key. The electronic data was stored and secured with a password known only to the principal investigator, to prevent access to unauthorized people.

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Approval from study area

Research clearance was gotten from the management of the selected Senior High School.

Potential risks/benefits

Both the target population and the society would stand to benefit from the study. The target population would be able to gain appreciable knowledge about overweight and obesity. Also, identification of cognitive effects of weight conditions would be used as a platform to address dietary and lifestyle issues among students. Findings of this study will aid school health authorities and policy makers in planning and implementation of policies. The research posed no risks to the target population or society.

Privacy/confidentiality

All interviews were conducted in an enclosed place to ensure privacy. Data was reported in a way that reduced the possibility of tracing the information gathered back to respondents. This was done to ensure the confidentiality and anonymity of respondents. To ensure this, the data collection instruments were coded.

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Compensation

Respondents were given no compensation during the data collection. Their inputs however were recognized and appreciated verbally at the time of data collection.

Voluntary consent

Consent was sought from the parents of all respondents below the age of 18 years before data was collected from them. All students below the age of 18 who were involved in the

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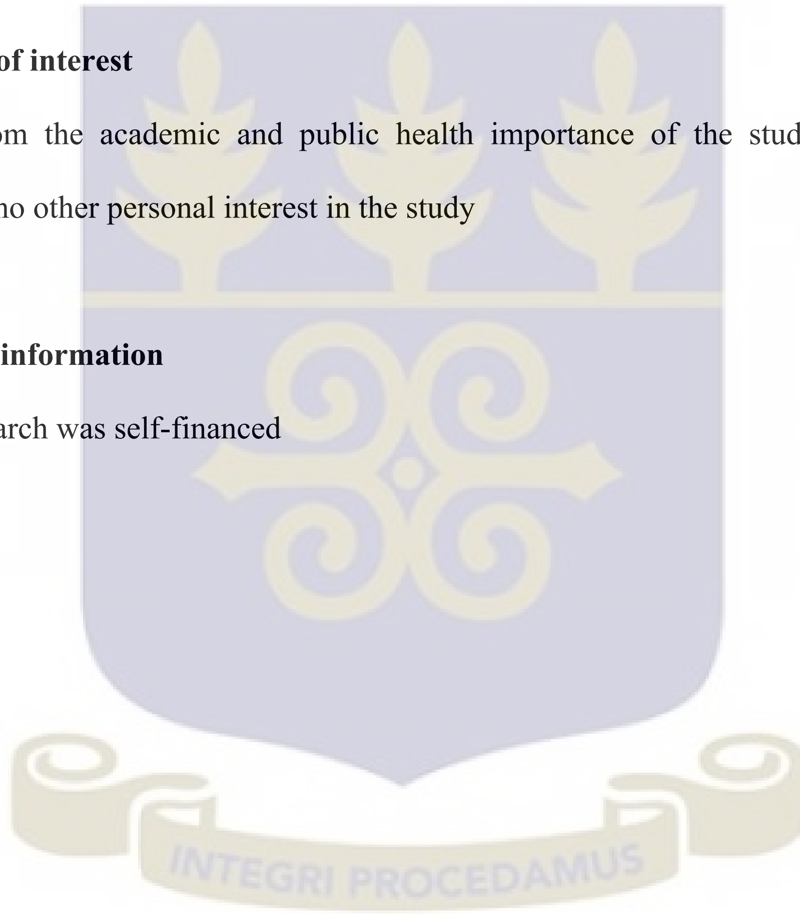
study were made to sign an assent form in order to partake. Students, who were 19 were given the informed consent form to read, understand and then allowed to decide if they would participate. Participation was fully voluntary. Respondents could refuse answering any question they deem uncomfortable, end the interview any time they wanted to or opt out of the study.



Conflict of interest

Apart from the academic and public health importance of the study, the researcher declared no other personal interest in the study

Funding information

This research was self-financed

CHAPTER FOUR

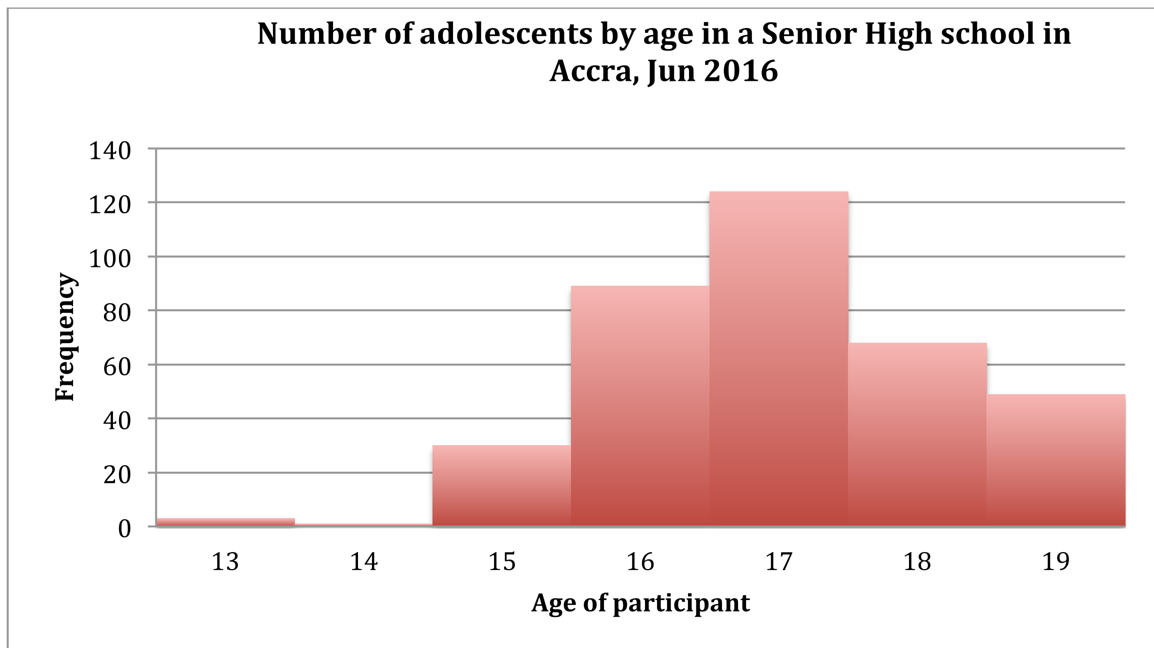
4.0 RESULTS

4.1 Demographic Characteristics

Three hundred and ninety (390) participants were eligible to be recruited into the study out of the student population of 1907. Out of the 390 questionnaires administered, 384 were completed and returned. Of the 384 participants enrolled, 20 of the participants who were older than 19yrs were deemed not eligible hence were excluded. Therefore, the analysis was based on 364 participants.

Data were analysed for 364 adolescent participants for whom questionnaires were administered and anthropometric measurements were taken. The age range was from 13 to 19 years with a mean age of 17.01 ± 1.21 years. Modal age was 17 years as shown in Fig 2. The mean age was 17.01 ± 1.26 years in males and 17.00 ± 1.17 years in females.

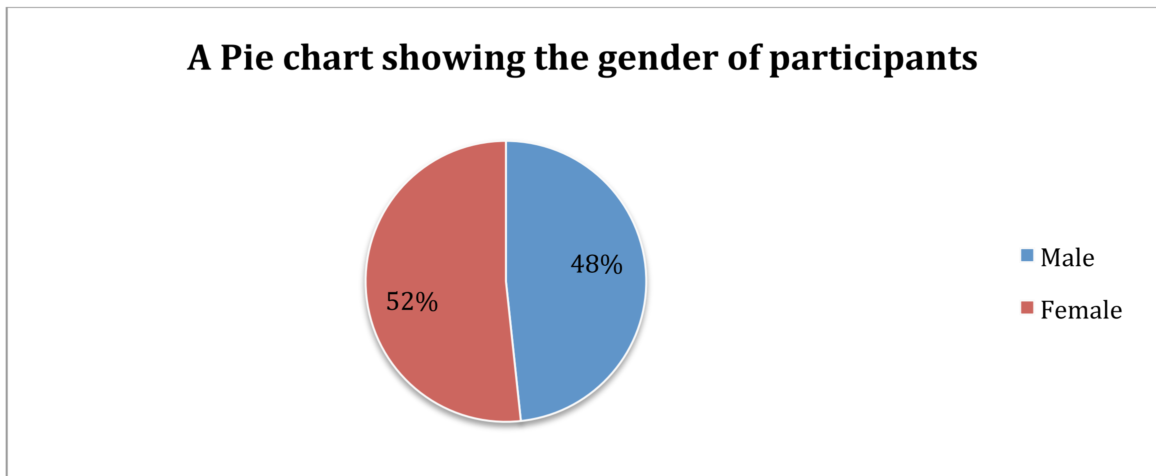
Fig 2. A graph showing number of adolescents by age in a Senior High school in Accra



0ne hundred and ninety eight (198) adolescents were in SHS form 1 forming the majority (54.4%) of the participants, with the rest being SHS form 2s. There was no SHS form 3 participants as the batch had graduated.

Six courses are being offered in the selected school. These courses include General Science, Business, General Arts, Visual Arts, Agricultural Science and Home Economics. One hundred and thirty (35.7%) of the participants were in the General Arts class with the lowest (5.2%) being Agric participants. Majority of the females were from the General Arts (82) whereas the bulk of the males were in the Business (52) class. There was a statistically significant association with a Pearsons chi-squared value of 56.45 and p value <0.001, comparing courses with gender.

Fig 3. A pie chart showing the gender of participants



Majority (188) of the participants were females accounting for 51.7% of the participants. Akans form 41.6% of the various ethnic groups represented in the sample. The other ethnic groups form the least (10.7%), made up of mainly Guans, Krobos, Ningos and

Igbos. With regards to religion, majority (84.1%) of the participants are Christians with 58 (15.9%) being Muslims.

About 122 of the participants, either did not report their place of residence or the places of residence were not known. Among the remaining 242, 65.3% live in the urban areas with the rest (34.7%) living in the Semi-urban areas in Greater Accra region.

Residential status was not necessary as the study area is a Day school.

4.2 Prevalence Of Overweight And Obesity

A descriptive statistic of the weight, height and BMI status of participants has been shown in Table 1

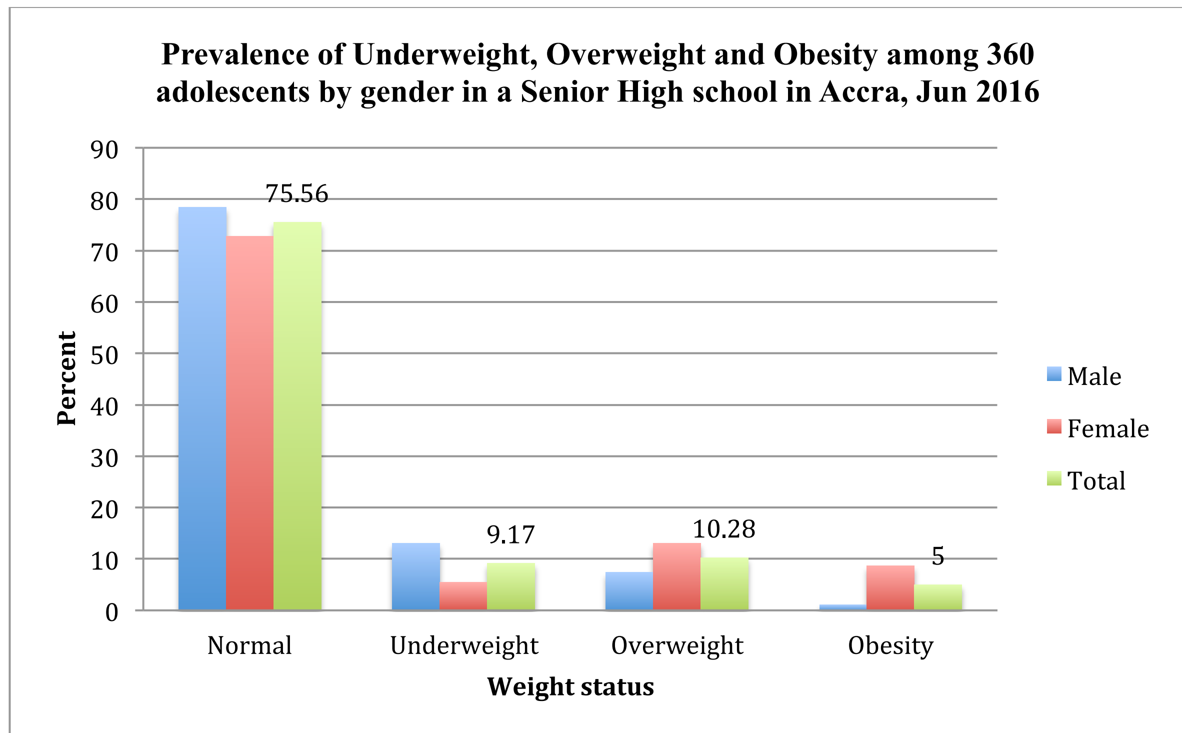
Table 1 Anthropometric measurement of the 364 respondents

		WEIGHT (kg)	HEIGHT (m)	BMI (kg/m^2)
ALL				
	Mean (SD)	59.14 (10.37)	1.66 (0.08)	21.57 (3.63)
Male				
	Min	33	1.46	14.36
	Max	95	1.87	35.76
	Mean (SD)	60.03 (9.61)	1.71 (0.07)	20.47 (2.87)
Female				
	Min	40	1.47	14.36
	Max	94	1.83	36.39
	Mean (SD)	58.31 (11.00)	1.61 (0.08)	22.60 (3.96)

The BMI was categorized as underweight, normal, overweight and obese according to guidelines given by the CDC BMI for age growth chart using Medscape BMI percentile calculator. The overall prevalence of overweight and obesity was 15.3%.

The prevalence of overweight/obesity amongst males and females was 15 (8.5%) and 40 (21.7%) respectively as shown by Figure 3. This was statistically significant at a p value less than 0.001 comparing the prevalence with gender.

Fig 4. Prevalence of Underweight, Overweight and Obesity by gender



Majority [75.6% (95% CI=70.8-79.7)] of the participants had normal weight while 5.0% (95% CI=3.2-7.8) were obese, 10.3% (95% CI=7.5-13.9) were overweight and 9.2 (95% CI=6.6-12.6) were underweight. There were more (23) males (13.1%) who were underweight, compared with 10 (5.4%) who were females. In contrast, there were more overweight (13%) and obese (8.7%) females than overweight (7.4%) and obese (1.1%) males. This was statistically significant at a p value less than 0.001.

4.3 Risk Factors Of Overweight And Obesity

4.3.1 Demographic factors

Age was modeled as a continuous variable, yielding an Odds Ratio of 0.94 but this was not statistically significant. [COR=0.94 (95% CI= 0.73-1.18), p>0.05]. For gender, females have an odds of 2.98 of becoming overweight or obese compared to males [COR= 2.98 (95% CI= 1.58-5.62), p=0.001). The course a student offered was significantly associated with being overweight/obese [COR=1.26 (95% CI= 1.03-1.54), p=0.019). Among the courses being offered, respondents who offered Home Economics were 2.4 times more likely to be overweight/obese than if they offered General Science.

Table 2. Binary Logistic regression on demographic characteristics for Overweight/Obesity group

Parameter	N	OR	Confidence Interval	P Value
Age°	360	0.94	0.74 – 1.19	0.589
Form				0.117
SHS 1	194	1		
SHS 2	166	0.62	0.34 – 1.13	
Course				0.019*
General Science	45	1		
Business	90	0.39	0.13 – 1.16	
General Arts	130	0.84	0.34 – 2.07	
Visual Arts	42	0.77	0.24 – 2.44	
Agric Science	18	0.58	0.11 – 3.03	
Home Economics	35	2.41	0.86 – 6.79	
Gender				0.001*
Male	176	1		
Female	184	2.98	1.58 – 5.62	
Ethnicity				0.888
Akan	151	1		
Ewe	84	0.93	0.44 – 1.97	
Ga/Adangbe	41	0.77	0.27 – 2.18	
Northern	46	1.75	0.78 – 3.93	
Other	38	0.65	0.21 – 2.02	
Religion				0.19
Christian	303	1		
Islam	57	1.61	0.79 – 3.30	
Residence✚				0.820
Urban	186	1		
Semi-Urban	93	0.93	0.48 – 1.80	

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

4.3.2 Socio-Economic factors

Most of the participants (30.0%) had fathers who had Senior High school education. Sixty-three (17.3%) had fathers who had some form of tertiary education with 16 (4.4%) who had never been to school. For mothers of the participants, 117 (32.1%) had Junior High/Middle school education, 31 (8.5%) had Tertiary education and 37 (10.2%) had no formal education.

Among other guardians, 110 (96.5%) had formal education. Majority (28.9%) of these have had a Senior High school education, with 9 (7.9%) having a primary education.

Of the 364 participants, 185 (51.1%) live with both parents during vacation. For the remaining 179 participants, 19.6% live with their grandparents.

Of the participants, those who belonged to the low and high socio-economic class were 77 (21.4%) and 75 (20.8%) respectively. Majority (57.8%) belonged to the Middle social class.

Table 3. Logistic regression on socio-economic status of respondents on Overweight/Obesity group compared to the Not-Overweight group

Parameter	N	OR	Confidence Interval	P Value
Fathers Educational Level				0.113
None	16	1		
Primary/JHS	106	1.53	0.32 – 7.29	
SHS	107	1.81	0.38 – 8.57	
Tertiary	131	0.71	0.14 – 3.48	
Mothers Educational Level				0.193
None	37	1		
Primary/JHS	152	1.17	0.44 – 3.06	
SHS	101	0.76	0.27 – 2.18	
Tertiary	70	0.67	0.21 – 2.09	
Guardian				0.09*
Both Parents	199	1		
One parent	73	0.62	0.28 – 1.34	
Aunt/Uncle/Grandparent	68	0.42	0.17 – 1.05	
Sibling	20	0.77	0.22 – 2.77	
Who You Live During Vacation				0.128
Both Parents	184	1		
One parent	72	0.46	0.19 – 1.09	
Aunt/Uncle/Grandparent	81	0.60	0.28 – 1.28	
Sibling	23	0.64	0.18 – 2.27	
Socio-economic status				0.291
Low	77	1		
Middle	208	1.34	0.65 – 2.78	
High	75	0.52	0.18 – 1.49	

* Significant at 95% Confidence Interval

In Table 3, socio-economic status of participants in the Overweight/Obese group was compared with the Not-Overweight group. None of the variables was significant at 95% confidence interval. However, at a significance level of 0.1, the odds of becoming overweight depending on the type of guardian an adolescent has, is 0.75. [OR=0.75 (95% CI: 0.68-1.03), p=0.09]

4.3.3. Familial Or Genetic Factors

Two hundred and thirty nine (65.7%) participants had parents who are married. Among the other groups, 17.3% had parents who are either divorced or separated.

The commonest description of the body type for both parents of participants was Athletic/Average; 226 (62.1%) of fathers and 220 (60.4%) of mothers. Only 7.1% and 10.1% have fathers who are big and very big respectively. Among the mothers, 17.6% and 7.7% have big and very big mothers.

One hundred and five (28.9%) participants reported that they had someone else in the family who was big or very big person, with 31.4% of these being an aunt.

Self-perception of weight was assessed by the question "How would you describe your weight now?" 30.5% said they were slim or slender, 62.9% athletic or average, 6.3% big and 0.3% very big.

Majority (57.4%) of the participants reported they would not like to change their weight. Out of the 42.6% that would want to change their weight, 60% want to lose weight. The main reason given for opting to change the weight was 'Personal reasons'. Among the other reasons, 102 made the decision based on health reasons, 18 for parents/guardians advice and 21 on account of criticism from friends.

Two hundred and eighteen (218) of the participants reported that their friends thought that they are athletic/average, forming the majority (59.9%). The others include slim/slender (32.7%), big (6.0%) and very big (1.4%).

Table 4. Logistic regression on familial/genetic factors of adolescents comparing Overweight/Obesity to Not-Overweight

Parameter	N	OR	Confidence Interval	P Value
Number Of Siblings				0.130
Less Than Or Equal To 2	81	1		
More Than 2	279	1.85	0.84 – 4.09	
Birth Order				0.882
1st/2nd	184	1.00		
3rd/4th	118	0.90	0.47 – 1.72	
5th Or More	58	0.98	0.44 – 2.22	
Parents Marital Status				0.791
Single/Divorced/Separated	72	1		
Married	236	1.39	0.64 – 3.02	
One Or Both Parents Dead	52	1.09	0.38 – 3.14	
Fathers Body Type +				0.097
Slim/Slender	74	1		
Athletic/Average	223	0.61	0.31 – 1.18	
Big/Very Big	29	0.47	0.13 – 1.78	
Mothers Body Type +				0.076
Slim/Slender	51	1		
Athletic/Average	218	3.38	1.00 – 11.42	
Big/Very Big	69	3.71	1.00 – 13.81	
Having Another Big Relative				0.528
No	255	1		
Yes	105	1.22	0.66 – 2.26	
Self Perception Of Weight Status +				<0.001*
Athletic/Average	228	1		
Big/Very Big	24	15.49	5.76 – 41.63	
Friends Perception Of Weight +				<0.001*
Athletic/Average	217	1		
Big/Very Big	41	13.02	6.10 – 27.77	
Best Friends Body Type				0.005*
Slim/Slender	117	1		
Athletic/Average	217	0.52	0.29 – 0.93	
Big/Very Big	26	0.14	0.02 – 1.08	

\+ Missing data

* Significant at 95% Confidence Interval

Based on the familial factors, the most important risk factors for being overweight or obese are self-perception of weight status [OR=20.6 (95% CI= 0 – 0), p<0.001), friend's perception of weight status [OR=15.1 95% CI= 0 – 0), p<0.001] and the body type of best friend [COR= 0.48 (95% CI=0.29-0.80)]. The odds of becoming overweight in those with big/very big friends is 0.14 times the odds of those who had slim/slender best friends. This was statistically significant with p of 0.005 as seen in Table 4. Mother's body type was statistically significant at 90% Confidence interval. Compared to those who have slim/slender mothers, the odds of becoming overweight/obese when one has a big/very big mother is 3.71.

4.3.4 Dietary Factors

One hundred and ninety-six participants (53.9%) skip meals during the day with 53.1% of them skipping breakfast mainly. One hundred and twenty-five (34.3%) however said they always have breakfast with 53% reporting that they miss breakfast only one or two times in a week. The remaining 12.7% miss breakfast more than 3 times in a week.

Majority of the participants (59.9%) did not take snacks in between meals

Common fast foods, like pizza, chips, spicy chicken, shawarma, burger and ice cream were taken by 34.6% of the adolescents. 76.2% of them take these once a week (few times) with the minority (23.8%) taking them more than twice a week. (many times)

The usual time of having last meal was between 6pm and 8pm (61% of participants) while 1.9% have their last meal after 10pm. Out of those who eat after 8pm, 23% were found to be overweight or obese with a p value of 0.096.

Table 5. Binary logistic regression on dietary habits on Overweight/Obesity

Parameter	N	OR	Confidence Interval	P Value
Main Meals ✦				0.533
2	94	1		
3	222	1.17	0.59 – 2.32	
4	39	1.36	0.50 – 3.73	
Missing meals				0.128
No	165	1		
Yes	195	1.59	0.88 – 2.87	
Meal Missed				0.123
Breakfast	104	1		
Lunch	56	1.05	0.43 – 2.56	
Supper	35	2.20	0.89 – 5.45	
Breakfast				0.398
Always	123	1		
Sometimes	191	0.82	0.43 – 1.57	
Never	46	1.72	0.75 – 3.97	
Snack				0.800
No	215	1		
Yes	145	1.08	0.60 – 1.93	
Fast Food				0.781
No	235	1		
Yes	125	1.09	0.60 – 1.98	
Fast Food Frequency ✦				0.214
Few Times	95	1		
Many Times	30	1.92	0.69 – 5.37	
Time Of Last Meal				0.024*
8pm Or Before	273	1		
After 8pm	87	2.03	1.10 – 3.75	

✦ Missing data
* Significant at 95% Confidence Interval

Table 5 shows a binary logistic regression on dietary habits for overweight/obesity compared with the not-overweight group. When the number of main meals taken in a day was run as a continuous variable, there was no statistically significant relationship with becoming overweight or obese. [COR= 1.24 (95% CI= 0 – 0), p=0.359].

Compared to those who take their last meal at 8pm or before, those who take their last meal after 8pm have odds of 2.03 of becoming overweight or obese. [COR= 2.03 (95% CI=1.10-3.75), p=0.024].

4.3.5 Physical activity

Concerning transportation, 74.7% use a vehicular means of transport with the rest walking or using a bicycle.

Among the participants, 47 (12.9%) met the CDC recommended criteria for vigorous physical activity which involved digging, aerobics, heavy lifting, fast bicycling, playing basketball, soccer, running, swimming laps, and fast dancing for more than 5 days in a week and for more than or equal to 20 minutes per day. Forty-three (11%) met the CDC criteria for moderate physical activity.

About 2% never watch Television. However, the majority (65.4%) watch TV once a while in the week, mainly less than an hour per time. One hundred and twenty-two (33.5%) never play video game with only 8% playing video game daily.

Table 6 shows binary logistic regression on physical activity for overweight/obesity. Under the CDC criteria for vigorous physical activity, the odds of becoming overweight in the group that never engage in this activity was 5.7 times the odds of those who often engage in vigorous physical activity [COR=5.7 (95%CI=1.32-24.45), p=0.001). Similarly, those who never engage in little physical activity have a 77% reduced odds of developing overweight compared to those who often engage in little physical activity [COR= 0.23 (95% CI=0.03-1.73) p=0.05].

Table 6. Logistic regression of the physical activity on Overweight/Obesity vs Not-Overweight

Parameter	N	OR	Confidence Interval	P Value
Means Of Transport				0.307
Vehicular	268	1		
Walk/Bicycle	92	0.69	0.34 – 1.40	
Vigorous Physical Activity				0.001*
Often	46	1		
Few times	105	2.32	0.49 – 11.02	
Never	209	5.70	1.32 – 24.45	
Moderate Physical Activity				0.05*
Often	42	1		
Few times	186	1.54	0.60 – 3.92	
Never	132	0.55	0.19 – 1.58	
Little Physical Activity				0.05*
Often	271	1		
Few times	67	0.56	0.24 – 1.29	
Never	22	0.23	0.03 – 1.73	
TV✦				0.315
Once a while	236	1		
Everyday	117	0.72	0.38 – 1.37	
Hours Watching TV				0.134
1 hour or less	79	1		
More than 1hr	274	1.84	0.83 – 4.07	
Video Game				0.223
Never	121	1		
Once a while	210	0.57	0.31 – 1.05	
Everyday	29	0.84	0.29 – 2.44	
Video Game Duration✦				0.651
1 hour or less	122	1		
More than 1hr	117	0.84	0.39 – 1.79	

✦ Missing data
* Significant at 95% Confidence Interval

4.3.6 Knowledge on Obesity and General/Lifestyle Factors

On the knowledge of participants on Obesity, 87.1% knew the correct definition, 84.9% identified some of the causes and 53.8% correctly chose any of the consequences of obesity

Concerning the general factors, thirty-six (9.9%) had a chronic disease. These conditions include Eye problem (22.2%), Asthma (19.4%), Sickle Cell disease (6%), Peptic Ulcer disease (8%) and Rheumatism (8%).

Among the participants, 45% of participants feel stressed in relation to their academic work.

Majority (70.4%) of the participants sleep less than 8 hours. Three hundred and fifty-five (97.5%) of the participants had never smoked and 92% have never drunk alcohol.

Concerning absenteeism, 42.3% never absent themselves from school with only about 3.8% missing school a lot of times.

Table 7. Logistic regression on the general lifestyle factors on Overweight/Obesity compared to Not-Overweight

Parameter	N	OR	Confidence Interval	P Value
Chronic Disease				0.747
No	325	1		
Yes	35	1.17	0.46 – 2.95	
Stress				0.445
Never	199	1		
Some stress	161	0.80	0.44 – 1.43	
Sleep Duration				0.597
Less than 8 hours	253	1		
8 hours or more	107	1.18	0.64 – 2.18	
Alcohol				0.227
Never	332	1		
Drank before	28	0.40	0.09 – 1.76	
Absenteeism				0.947
Never	152	1		
Sometimes	208	1.02	0.57 – 1.82	

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

4.3.7 Significant risk factors for Overweight/Obesity

After analysis involving individual associated risk factors for Overweight and Obesity, a multivariate logistic regression analysis was performed for statistical significance ensuring a parsimonious model is obtained.

The variables vigorous physical activity, time of taking last meal, friend's perception of weight status and self-perception of weight were statistically significant with overweight/obesity in the multivariate logistic regression model.

Table 8 shows a multivariate logistic regression of risk factors for obesity. For gender, females had 2.03 times the odds to become overweight compared to males in the crude analysis but after adjusting for other variables, the odds reduced to 0.90 [AOR=0.90 (95% CI=0.60-1.35), $p>0.05$). Gender was therefore not significantly associated with being overweight/obese after adjusting for other variables, though the Crude Odds Ratio was statistically significant.

After adjusting for other variables, both fathers and mothers body types were not statistically significant as shown in Table 10 [AOR=0.48 (95% CI=0.19-1.24), $p=0.13$] and [AOR=1.54 (95% CI=0.68-3.51), $p=0.30$] respectively.

After controlling for other variables, friend's perception of body weight was the most statistically significant risk factor associated with being overweight/obese in this model. [AOR=5.89 (95%CI = 1.56-22.21), $p<0.01$). Self-perception of weight status is also statistically significant with the development of overweight or obese. [AOR=7.28 (95% CI= 1.01-52.22), $p<0.05$]

Socio-economic status was not significantly associated with being overweight/obese [COR=0.79 (95% CI=0.50 – 1.22), P=0.291]. Similarly it was not statistically significant in the model after adjusting for other [AOR = 0.29 (95% CI = 0.08 – 1.01, p=0.051].

The time of taking last meal was significantly associated with being overweight/obese both in the crude analysis and after controlling for other factors in the model. [AOR = 3.33 (95% CI = 1.07 – 10.38, p=0.038].

The same can be said of the variable 'vigorous physical activity'. This was statistically significant both in the crude and adjusted analysis. [AOR = 2.66 (95% CI = 1.09 – 6.49, p=0.032].

Table 8. Multiple Logistic regression of risk factors for Overweight/Obesity

	CRUDE			ADJUSTED		
WEIGHT STATUS	**Odds Ratio**	**P value**	**Confidence Interval**	**Odds Ratio**	**P value**	**Confidence Interval**
Age	0.94	0.589	0.74 - 1.18	0.90	0.607	0.60 - 1.35
Form	0.62	0.117	0.34 - 1.13	0.91	0.852	0.33 - 2.52
Course	1.26	0.019*	1.04 - 1.54	1.22	0.265	0.86 - 1.73
Gender	2.98	0.001*	1.58 - 5.62	0.61	0.377	0.21 - 1.82
Residence	1.08	0.820	0.56 - 2.10	0.67	0.457	0.23 - 1.93
Father's educational level	0.83	0.103	0.67 - 1.04	1.14	0.587	0.71 - 1.85
Mother's educational level	0.87	0.214	0.70 - 1.08	1.20	0.464	0.74 - 1.94
Socio-economic status	0.79	0.291	0.50 - 1.22	0.29	0.051	0.08 - 1.01
Marital status	1.07	0.791	0.65 - 1.75	1.23	0.650	0.51 - 2.95
Father's body type	0.62	0.087	0.36 - 1.07	0.48	0.130	0.19 - 1.24
Mother's body type	1.57	0.076	0.95 - 2.58	1.54	0.300	0.68 - 3.51
Vigorous Physical activity	2.42	0.001*	1.40 – 4.18	2.66	0.032*	1.09 – 6.49
Form of Transport	0.69	0.307	0.34 – 1.40	0.43	0.220	0.11 – 1.66
Time of Last Meal	2.03	0.024*	1.10 – 3.75	3.33	0.038*	1.07 – 10.38
Chronic Disease presence	1.17	0.747	0.46 – 2.95	1.56	0.575	0.33 – 7.36
Self Perception	15.49	<0.001*	5.76 – 41.63	7.28	0.048*	1.02 - 52.22
Friend's Perception	13.01	<0.001*	6.10 - 27.77	5.89	0.009*	1.56 - 22.21
Best friends Body type	0.48	0.005*	0.28 - 0.80	0.77	0.568	0.31 - 1.92

4.4 Association Between Overweight/Obesity And Academic Performance

Data derived from the school records were analysed. Four (4) students did not have Academic records therefore the analysis of the academic performance is based on 360 subjects. Concerning the academic performance, the minimum mark obtained was 13% with a maximum of 81% with a mean of 55.6% as shown in Table 9 below.

Table 9. Descriptive statistics of academic performance of participants

	Mean (SD)	**Min**	**Max**
English	52.98 (14.99)	0	84
Core Maths	46.26 (15.08)	0	89
Integrated Science	57.99 (16.71)	0	95
Social Studies	65.31 (19.35)	0	93

The average of all the four core subjects was 55.63 +- 11.20 with the minimum of 13.0% and a maximum of 81.2%.

Table 10 shows a cross-tabulation of good and poor academic performance and being overweight/obese and not overweight. Respondents who were not overweight have similar academic performance compared to those who were overweight/obese. Thus, in this sample of 360 adolescents, 7.2% of respondents had poor academic performance. Similarly, 7.2% respondents who were not overweight had poor academic performance. There was however no statistically significant relationship between being overweight/obese and poor academic performance.

Table 10. Cross-tabulation of Academic performance and Weight status

	Good **N (%)**	**Poor** **N (%)**	**Total** **N**
Not-Overweight	283 (92.8)	22 (7.2)	305
Overweight/Obesity	51 (92.7)	4 (7.3)	26
Total	334 (97.8)	55 (7.2)	360

In further analysis using logistic regression, there was no statistically significant relationship between the academic performance (Good or Poor) and the weight status. [OR=0.97 (95% CI=0.60-1.55), p>0.05]

CHAPTER FIVE

5.0 DISCUSSION

5.1 Discussion

An important determinant of an adolescent's prospective university admissions, future job opportunities and earnings, is the academic achievement during senior high school. Considering the fact that the relationship between body weight and academic performance has consistently being inconclusive and with the majority of the past studies coming from the west, this study revisited this important subject matter by using the data available in Ghana. This study therefore aimed at establishing an association between overweight/obesity and academic performance.

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

Comparing the 5% prevalence of adolescent obesity and 10.3% overweight of this study, the results seem to be consistent with the previous studies done in Ghana and other developing nations, among the similar population on childhood obesity of 15% in the age group 10– 14 years and 16% in the 14-18 year group. (Kumah et al, Steiner-Asiedu). Similar trends in the gender distribution were seen in this study, as the female prevalence of 21.7% was higher than that of their male counterparts (8.5%).

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

In determining the risk factors associated with weight status, previous studies have identified several of the associated risk factors. Among the notable risks factors include age, gender, socio-economic status, diet (calorie and fat intake), birth weight, watching too much TV, playing video games and using computer for long hours, having overweight parents, changes towards the built environment, sleep disorders and having overweight or obese friends. (Daniels et al., 2005; Guo et al., 2013; Krebs et al., 2007; Valente, Fujimoto, Chou, & Spruijt-Metz, 2009; Q. I. Ahmad, Ahmad, & Ahmad, 2010))

Similarly, in this study population, the relevant factors associated with Overweight and Obesity are female gender, form, offering home economics, having a slim/slender friend, eating after 8pm,engaging in less or no vigorous physical activity, mother's body type, friends perception of being big/very big and perceiving ones self as big/very big were found to be significant at a p value of less than 0.05. The most important of these risk factors was friend's perception of body weight. It is therefore imperative that adolescents pay heed to their friends description of their weight status. One is therefore likely to be overweight or obese when a friend says so. When attention is paid to such comments, efforts can be made to ensure the proper weight management.

In this study, the findings were that there was no association between overweight/obesity and academic performance, measured by the average score in all the four core subjects. Similarly, there was also no significant association with the individual courses like

English language, Social Studies, Core Mathematics, Integrated Science and ICT. This confirms a similar study in Nigeria by Oketayo et al. (2010), which did not find an association between obesity and academic performance. This is however contrary to numerous studies done in Europe and Asia (Crosnoe & Muller, 2004, Rashmi & Jaswal, 2012)

However, it is possible that the lack of association in our study was due to the fact that the adolescents, who are overweight or obese, try to counterbalance their negative self-image by studying harder than their colleagues.

5.2 Limitations of the study

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

Also, it was noticed that some of the students, who looked overweight or did not want their academic performance to be analysed (probably because of either their weight status or poor performance), did not consent/accent to the study.

Another limitation is that students who were absent, had to be replaced. In a study by K et al, obese children are more likely to be absent in school. This, in addition to the other two reasons stated above may have resulted in an underestimation of overweight/obesity and also may conceal (or affect) the association between weight status and students' academic performance.

The findings from this study may not necessarily be generalized to students in private schools, as study participants were from a public (government) school.

In determining the weight status of participants, other measurements like waist-hip ratio and skin fold thickness test could have been added to the weight and height measured to better predict the adiposity of participants. This could not be done on account of constraints on resources and allocated time for study.

Another limitation is that this was a cross-sectional study hence causality cannot be inferred.

5.3 Strengths of the study

There were also some notable strengths of this study. Anthropometric parameters were measured instead of self-reported weights and heights used in previous studies. This was done accurately using standard protocol and classified according to CDC growth charts. Qualified dietary technicians, who helped in the data collection, took these measurements. Since all students took the same examination, it could be said that the test scores were standardized, hence an objective assessment. This study had a high participation rate of 98.5%

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

There was no significant relationship between weight status and academic performance in adolescents. Contrary to the mind-set that adolescents who are obese/overweight do not do well in school, there is no evidence to support such claim. These adolescent should therefore be encouraged that there is no known association between their weight status and how well or how poorly they will perform in school, to dispel any myths that big children usually perform badly in school. Academic performance therefore may not be used as a measure of success in prevention initiatives in Accra.

Causality is not being inferred here as this study only sort to find an association, and not a causal inference.

This study sought to find out whether overweight/obese students perform poorly in school. However there is the possibility that a different form of association might exist for some adolescents. That is, poor academic performance may increase the risk of children being overweight or obese. However, these findings need confirmation in a larger representative sample across Ghana

6.2 Recommendation

A multidisciplinary approach is needed to curtail the increasing prevalence of overweight and obesity. The researcher therefore makes the following recommendations to individual stakeholders who form part of this team.

1. Government through the Ministries of Education and Health – Provision of recreational facilities, will encourage physical activity. Community awareness should be raised on the increasing trend of obesity and its consequences. Re-introduction of Physical Education into the curriculum of SHS
2. Health care providers – BMI screening is essential and can be achieved by routine measurement of weight and height of adolescents and drawing the necessary attention to increasing BMI. School nurses should provide regular health education on topics like obesity
3. Schools – There is the need for more educational programmes targeted at ensuring good health. Teachers should encourage students who are overweight and obese to ignore their weight status as a cause of poor academic performance or otherwise.
4. Parents – Parents should be interested in the health of their wards by ensuring that they monitor their wards frequency and duration of watching TV and playing video games. Outdoor games that ensure good physical activity should be encouraged. These factors have been found to be significantly associated with becoming overweight or obese. Both parents should also serve as good role models in eating healthy foods and being physically active. Meals for adolescents should be served before 8pm as this is protective against being overweight or obese.
5. Students – Females should lead activities in their schools that promote eating healthy and being physically active, as they are at a higher risk.
6. Researchers - The researcher would want to recommend that a nation-wide survey, involving a larger representative sample, to be carried across Ghana.

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APPENDIX 1

PARENTAL CONSENT FORM FOR ADOLESCENT PARTICIPATION

Title: The relationship between overweight/obesity and school academic performance in adolescents in a senior high school in Accra

Principal Investigator: Frempong Asafu-Adjaye

Phone and e-mail address: 0244846711; aafrempong@gmail.com

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

Dear Parent,

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

General Information about Research

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

The study will address the three objectives:

1. To determine the proportion of students who are underweight, overweight and obese
2. To identify risk factors associated with overweight and obesity
3. To determine the association between overweight/obesity and academic performance

Your child will be required to participate in an interview, which will take 30 to 45 minutes and will be held at his or her classroom. Your daughter/son will be given a questionnaire to fill. The questions that will be asked will be based on his/her eating habits, physical activity, school and home environment and knowledge on nutrition. Afterward his/her weight and height will be measured. I will conduct this interview, with help from other research assistants. The responses your child gives and the measurements taken will be coded and then analysed only by myself. The findings will be discussed by comparing it to other related researches and conclusion drawn. The report will be shared with the University of Ghana, as well as the Ministries of Health & Education, Youth and Sports, who deal with adolescent's health issues.

Possible Risks and Discomforts

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

Possible Benefits

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

Confidentiality

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

Compensation

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

Voluntary Participation and Right to Leave the Research

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

Contacts for Additional Information

If you or your child has any questions now or at any point during the course of the study, please feel free to ask. For further information please contact the principal investigator, Dr Frempong Asafu-Adjaye, School of Public Health, University of Ghana, Legon. Telephone: 0244846711 or email aafrempong@gmail.com. Contact can also be made with the supervising lecturer, Dr Ernest Kenu. If you have any questions about your child's rights as a research participant you can contact the Ghana Ethical Review Board Office via Hannah Frimpong 0243235225 or 0507041223.

PARENTAL AGREEMENT

The above document describing the benefits, risks and procedures for the research titled "The relationship between overweight, obesity and school academic performance in a senior high school in Accra" has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction.

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

_______________ __________________________________

Date Signature or thumbprint of parent or guardian

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

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

_______________ __________________________________

Date Signature or thumbprint of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual

__________________________ ____

Date Name & Signature of Person Who Obtained Consent

APPENDIX 2

CHILD ASSENT FORM

My name is Dr Frempong Asafu-Adjaye and I am from the School of Public Health at the University of Ghana. I am conducting a research study titled “The relationship between overweight, obesity and school academic performance in a senior high school in Accra”. I am asking you to take part in this research because I am trying to learn more about how the body weight of adolescents, influences how well they perform at school. It will take you 30 to 45 minutes to participate.

If you agree to be in this study, you will be asked to fill a questionnaire about your eating habits, physical activity, school and home environment and knowledge on nutrition. Your responses will be coded and I will analyse it to draw some conclusions.

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

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

Your information will be kept confidential and apart from those who are in the discussion with you, your information will be known to the researcher alone. You may ask me any questions about this study. You can call me, Dr Frempong Asafu-Adjaye at any time on 0244846711 or talk to me the next time you see me.

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

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

This assent form that describes the benefits, risks and procedures for the research titled “the relationship between overweight/obesity and school academic performance in a senior high school” has been read and/or explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate.

Researcher’s Signature: _________________ Date: ______________________________

Child’s Signature/ Thumbprint:______________ Date: _________________________

APPENDIX 3

RESEARCH QUESTIONNAIRE

QUESTIONNAIRE FOR A SURVEY ON THE RELATIONSHIP BETWEEEN WEIGHT STATUS AND ACADEMIC PERFORMANCE IN ADOLESCENTS IN A SENIOR HIGH SCHOOL IN ACCRA

INTRODUCTION

Greetings, I am a member of a team from the University of Ghana conducting a research on the relationship between weight status and academic performance on adolescents in a Senior High School in Accra. 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 weight status and academic performance in adolescents.

Questionnaire number:...

Name of Interviewer:...

Date:...

A. DEMOGRAPHIC CHARACTERISTICS

1	Date of Birth (MONTH/YEAR)	…………………../………………..………..
2	Age	………………………………………………
3	Class	SHS 1…………………………….…………………..1 SHS 2……………………....……………….………..2
4	Course	SCIENCE……………………….……..…….….……1 BUSINESS…………………………..…….………....2 GENERAL ARTS………………..………...………...3 VISUAL ARTS……………………..…….………….…4 AGRIC……………………………….……….…………....5 OTHER……………………….……………...............6
5	Gender/Sex	MALE……………………………………...………......1 FEMALE……………………………….…...........……2
6	Ethnicity	AKAN…………………….……………..……………..1 EWE……………………………………………………2 GA………………………..………….………………...3 FANTE……………………..……….…….……….…...4 NORTHERN……………..……….……...……….……5 OTHER…………………….……………….….………...6
7	Religion	CHRISTIANITY……….……..……………….……1 ISLAM……………………………………………….2 TRADITIONAL……….…………..……………….3 OTHER……………………….……...........……4
8	Place of Residence	

B. SOCIOECONOMIC STATUS OF PARENTS/GUARDIAN

9	Fathers Highest Educational level	NONE…………………………………………..1 PRIMARY……………………………………...2 JHS/MIDDLE SCH…………………………….3 SHS……………………………………….….4 TECHNICAL/DIPLOMA……………………...5 TERTIARY (BACHELORS/MASTERS/PHD) …………………………………………………...6
10	Fathers Occupation	

11	Mothers Highest Educational level	NONE……………………………………………..1 PRIMARY……………………………………....2 JHS/MIDDLE SCH…………………………..…3 SHS……………………………………….…….....4 TECHNICAL/DIPLOMA…………….…….……..5 TERTIARY (BACHELORS/MASTERS/PHD)…...6
12	Mothers Occupation	
13	With whom do you live? (Guardian) Relationship to Guardian	PARENTS……………………….…………….…1 MOTHER ONLY……………….…….…….....2 FATHER ONLY……………….……….....3 AUNT/UNCLE…………………...………....4 GRANDPARENT……………………..…..……5 SIBLINGS (SISTER OR BROTHER)………....6
14	If 1, 2 or 3, skip to Question16	
15	Guardians Highest Educational level	NONE……………………………………….…...1 PRIMARY………………………………..…..…2 JHS/MIDDLE SCHOOL………………...…….3 SHS……………………………………….....4 TECHNICAL/DIPLOMA……………………..5 TERTIARY (BACHELORS/MASTERS/PHD)…6
16	Guardians Occupation	
17	Who do you live with during vacation	PARENTS……………………..………...…….1 MOTHER ONLY……………..………..……..2 FATHER ONLY…………………..…………..3 AUNT…………………………………..………..4 UNCLE………………………………..…….…5 GRANDPARENT…………………..…………6 SIBLINGS (SISTER OR BROTHER)………...…7
18	Type of Residence (OWNED BY)	PARENTS…………………………….……........1 GUARDIAN…………………………….……....2 FAMILY HOUSE……………………………..3 RENTED…………………………………….…...4
19	Do you own any of the following in your house? (Tick as many as possible)	TV DVD PLAYER REFRIGERATOR MICROWAVE GENERATOR CAR MOTORBIKE COMPUTER/LAPTOP COOKER
20	Does your family subscribe to any TV Network? (Apart from the free-to-air channels)	NO……………………………………….……..0 If no, skip to Question 22 YES……………………………………….………1
21	If yes, which one?	

C. FAMILIAL OR GENETIC HISTORY

22	Number of Siblings:	0 1 2 3 4 5 or more
23	What is your birth order in your family?	1st 2nd 3rd 4th 5th or more
24	What is your parent's marital status?	SINGLE……………………..……….……….1 MARRIED……………………...……………..2 SEPARATED……………………………………3 DIVORCED…………………..….……………4 MOTHER DIED……………………….……...……5 FATHER DIED……………………..…………6 BOTH PARENTS DEAD………...……….…..…7

25	What body type will you class your father?	SLIM/SLENDER…………………….……..……1 ATHLETIC……………………….………...….2 AVERAGE……………………………..……..3 BIG……………………………………………4 VERY BIG……………………………..……...5 DON'T KNOW………………………………..6
26	What body type will you class your mother?	SLIM/SLENDER………………………………1 ATHLETIC……………………………….……2 AVERAGE……………………….……………3 BIG…………………………………….………4 VERY BIG…………………………...………..5 DON'T KNOW……………………….……….6
27	Is there anyone else in your family who is Big or Very Big?	NO…………………………………………………0 If no, skip to Question 29 YES…………………………………………..1
28	If yes, who is he or she?	
29	How do you describe your weight now?	SLIM/SLENDER………………………………1 ATHLETIC……………………………….……2 AVERAGE……………………….………….3 BIG…………………………………..…………4 VERY BIG……………………………………..5
30	Would you like to change your weight?	NO…………………………………….…………..0 If no, skip to Question 33 YES……………………………….…...……1
31	If yes, how?	LOSE WEIGHT…………………..……….……1 GAIN WEIGHT…………………………...……2
32	Why?	HEALTH REASONS……………….……….1 PERSONAL REASONS……………..………2 CRITICISM FROM FRIENDS……….……….3 PARENTS/GUARDIANS ADVICE……..……4 OTHER…………………..…….…………..…5 If other, specify…………………..……………..
33	What do your friends think about your weight?	SLIM/SLENDER……………………………..…1 ATHLETIC……………………………………..…2 AVERAGE………………………………..…3 BIG……………………………….…....…4 VERY BIG…………………………...…...5
34	Tell me about the body type of your Best friend	SLIM/SLENDER………………………………1 ATHLETIC……………………………….……2 AVERAGE……………………….……….……3 BIG…………………………………......…….4 VERY BIG………………………...…………...5

D. DIETARY HABITS

35	How many main meals do you eat in a day?	1 2 3 4+
36	Are there times you go without a meal in a day?	NO………………………………….……….……0 If no, skip to Question 38 YES…………………..…………………………1
37	If yes, which meal?	BREAKFAST……………………..………1 LUNCH………………………………………2 SUPPER……………………..……………3
38	Do you always have Breakfast?	ALWAYS…………………………………1 SOMETIMES (Miss only 1-2 times in a week) ……………………………………………2 NEVER (Miss more than 3 times in a week) ….……………………………...……3

39	Do you take snack in-between meals?	NO……………………………………………0 YES…………………………………………..1
40	24 Hour Dietary Recall (What did you eat yesterday?)	BREAKFAST…………………………………… LUNCH……………………………………..…… SUPPER...…………………………..…………… SNACKS...……………………..…………………
41	Do you usually have fast food like Pizza, Chips, Spicy chicken, Shawarma, Burger, Ice cream etc…	NO……………………………………………0 If no, skip to Question 43 YES……………………………………......1
42	If yes, how many times in a week?	
43	What time do you usually have your last meal?	BEFORE 6pm………………………………..…1 6.00pm - 8:00pm………………………….…2 8:01pm – 10:00pm…………………….….…3 AFTER 10pm……………….…………….……4

E. PHYSICAL ACTIVITY

44	What is the means of transport you frequently use?	PUBLIC TRANSPORT………….…………1 PRIVATE TRANSPORT……………..………2 SCHOOL BUS……………………………...3 MOTORBIKE…………………………………4 BICYCLE……………………………………5 WALKING……………………….………6
45	Do you do any of the following? (Choose as many as possible)	DIGGING, AEROBICS, HEAVY LIFTING, FAST BICYCLING, BASKETBALL, SOCCER, RUNNING, SWIMMING LAPS, FAST DANCING, NONE
46	How often?	NEVER……………………………………….……1 1-3 DAYS……………………………………2 4-5 DAYS……………………………………3 MORE THAN 5 DAYS IN A WEEK………….4
47	How long?	LESS THAN 20 MINS PER DAY MORE THAN 20 MINS PER DAY
48	Do you do any of the following? (Choose as many as possible)	SLOW BICYCLING/ AT REGULAR PACE, FAST WALKING, CARRYING LIGHT LOADS, PLAYING TT, SKATING, MOPPING FLOORS, PUSHING A LAWN MOWER, NONE
49	How often?	NEVER……………………………………….……1 1-3 DAYS………………………………….…2 4-5 DAYS………………………………….…3 MORE THAN 5 DAYS IN A WEEK………..…4
50	How long?	LESS THAN 20 MINS PER DAY MORE THAN OR EQUAL TO 20 MINS PER DAY
51	Do you do any of the following? (Choose as many as possible)	SURFING THE INTERNET, CHATTING ON YOUR PHONE, VISITING FACEBOOK, INSTAGRAM, SOCIAL MEDIA, PLAYING COMPUTER GAMES, READING A BOOK
52	How often?	NEVER……………………………………….…1 1-3 DAYS…………………………………..…2 4-5 DAYS…………………………………..…3 MORE THAN 5 DAYS IN A WEEK…………...4
53	For how long?	LESS THAN 20 MINS PER DAY MORE THAN 20 MINS PER DAY
54	How often do you watch TV?	NEVER…………………………………..….…1 ONCE A WHILE……………………………2 EVERYDAY………………………………..…3
55	For how long?	0, 30MINS, 1, 2, 3, 4, 5 HRS/DAY

56	How often do you play Video games?	NEVER……………………………………..….…1 ONCE A WHILE…………………………………2 EVERYDAY………………..…………………3
57	For how long?	0, 0.5, 1, 2, 3, 4, 5 HRS/DAY

F. KNOWLEDGE ON OBESITY

58	What is Obesity?	INFECTION……………………………………………1 UNDERWEIGHT…………………………………….2 EXCESS WEIGHT………………………………….……3 DON'T KNOW………………………………….…...……4
59	What may be the cause of Obesity?	BACTERIA/VIRUS/PARASITE……...…………….…1 POOR PHYSICAL ACTIVITY…..…..……………….…2 POVERTY……………………………….….……….…3 ILLITERACY…………………………….……...……4 EATING TOO MUCH FOOD……………………….……5 DON'T KNOW…………………..………..….……6
60	What are the consequences of Obesity?	HEART DISEASE……………………….....……….…1 BREATHING PROBLEMS……………………….…….2 CANNOT RUN……………………………..……..….3 POOR SLEEPING HABITS. ………..…….……….…4 POOR SCHOOL PERFORMANCE. …..……….....…5 DON'T KNOW………………………..….……...…6

G. GENERAL / LIFESTYLE

61	Do you have any of the following disease?	ASTHMA…………………………YES………NO……… SEIZURE DISORDER……………...YES………NO……… SICKLE CELL DISEASE..……....YES………NO……… OTHER pls specify. ……………………………………
62	Do you sometimes feel mentally stressed?	NEVER…………………………...……………..1 AVERAGE……………………..………………....2 HIGH…………………………………………..……..3 VERY HIGH……………….……………..…..…..4
63	On the average, how long do you sleep?	<=4HRS……………………………………….……..1 5 HOURS…………………………...…………..2 6 HOURS…………………………….…..……….3 7 HOURS……………………………….……….…..4 8 HOURS……………………………….……..……..5 > 8 HOURS……………………………….……………6
64	Do you Smoke?	NEVER SMOKED………………………………..1 SMOKE EVERYDAY……………………………2 SMOKED BEFORE…………………….........…3
65	Do you drink Alcohol?	NEVER…………………………………...……..1 ONCE IN A WHILE……………………………2 EVERYDAY…………………………..………..3 STOPPED……………………………..………..4
66	How often do you absent yourself from school?	NEVER…………………………………….…………..1 ONCE A WHILE……………………..………..2 AVERAGE…………………………….....……..3 A LOT……………………………………...……..4 ALMOST ALWAYS…………………………..…5

H. ANTHROPOMETRIC MEASUREMENTS

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

I. ACADEMIC PERFORMANCE

Subject	1st Term scores	2nd Term scores	AVERAGE	GOOD/POOR
Mathematics (Core)				
English Language				
Social Studies				
Integrated Science				
ICT				
ELECTIVES				
1.				
2.				
3.				
4.				
OVERALL				

APPENDIX 4

INFORMATION/CODING SHEET

CLASS/COURSE ______________________________________

CODE	NAME OF STUDENT	OTHER INFORMATION
001		
002		
003		
004		
005		
006		
007		
008		
009		
010		
011		
012		
013		
014		
015		

CLASS/COURSE ______________________________________

CODE	NAME OF STUDENT	OTHER INFORMATION
001		
002		
003		
004		
005		
006		
007		
008		
009		
010		
011		
012		
013		
014		
015		

APPENDIX 5

BODY MASS INDEX-FOR-AGE PERCENTILES (FOR GIRLS)

2 to 20 years: Girls
Body mass index-for-age percentiles

NAME ____________________

RECORD # ____________

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703

BMI

35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12

95
90
85
75
50
25
10
5

kg/m²

AGE (YEARS)

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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APPENDIX 6

BODY MASS INDEX-FOR-AGE PERCENTILES (FOR BOYS)

2 to 20 years: Boys
Body mass index-for-age percentiles

NAME ______________________

RECORD # ____________

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703

Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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