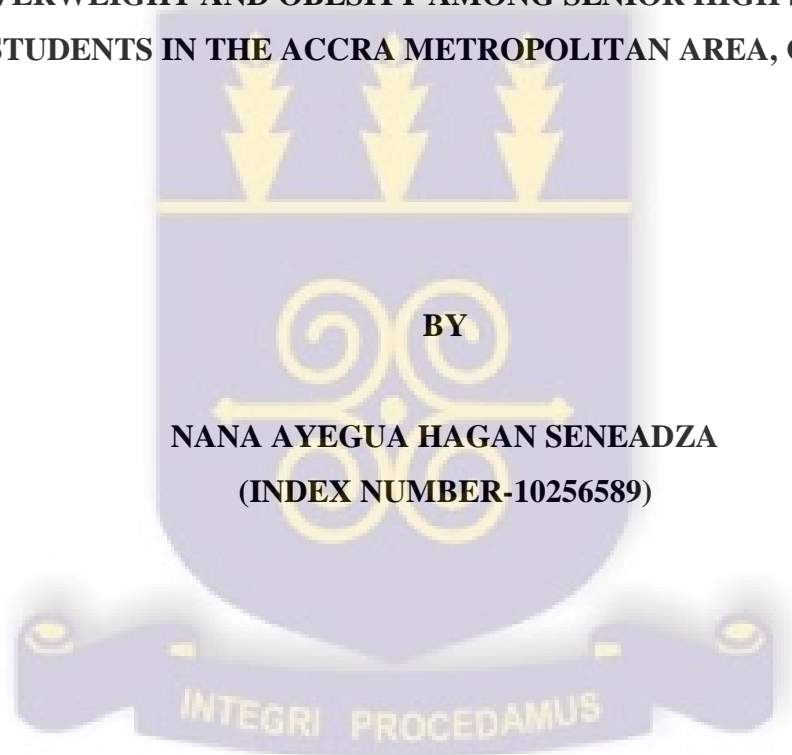


**SCHOOL OF PUBLIC HEALTH,
COLLEGE OF HEALTH SCIENCES UNIVERSITY OF GHANA,
LEGON.**

**OVERWEIGHT AND OBESITY AMONG SENIOR HIGH SCHOOL
STUDENTS IN THE ACCRA METROPOLITAN AREA, GHANA**



**A DISSERTATION SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH IN
PARTIAL FULFILLMENT FOR THE AWARD OF THE MASTER OF PUBLIC
HEALTH (MPH) DEGREE.**

AUGUST 2008

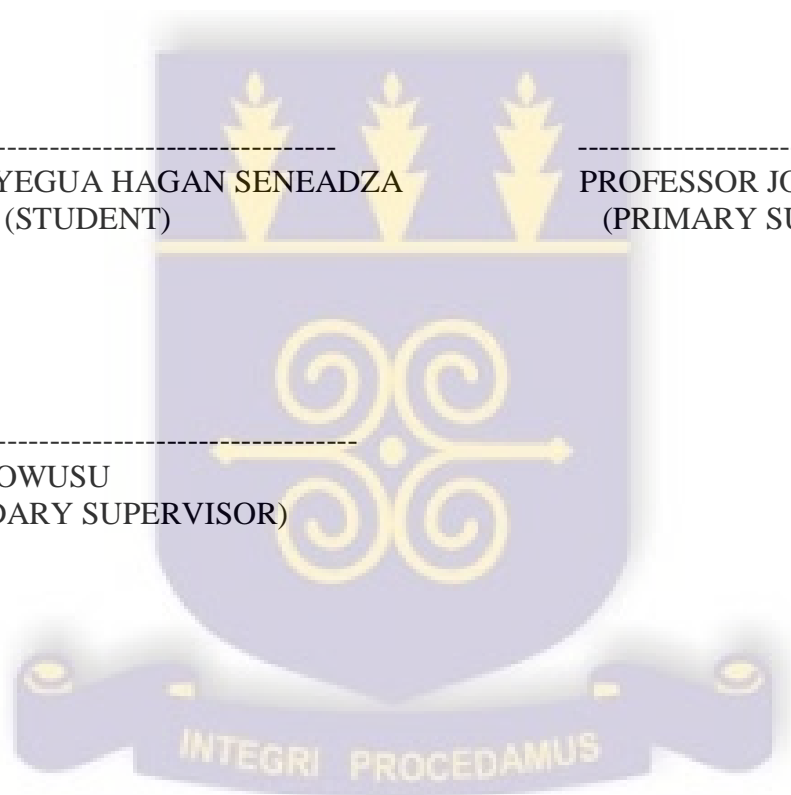
DECLARATION

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

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DEDICATION

I dedicate this dissertation to Kudzo, Seyram and Auntie Peace. I could not have made it this far without your love and support. Thank you.



ACKNOWLEDGEMENT

To God be the glory. Thank you God for all the strength you gave me to go through the past year.

Kudzo, Seyram and Auntie Peace, I cannot thank you enough. God bless you. Your sacrifice will not be in vain.

I am also very grateful to my supervisors, Professor John Gyapong and Dr. W.B Owusu for their continuous support and direction. I have learnt a lot from you.

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To the head teachers of Christian Methodist High School, Accra and Presbyterian Senior High School, Osu, I would like to say thank you for allowing and assisting me to carry out this research.

To the students of the above mentioned schools, I would like to say thank you and ‘Ayekooo’! You are the stars of this research. Thank you for your co-operation and for taking time off to be a part of this research.

I also wish to thank my research assistants for their hard work. You were a great team to work with.

My sincerest gratitude goes to my parents for their love and support throughout the years. You have done well.

To all my classmates in School of Public Health, I would want to thank you for the many good times and even for the few bad times. You will always be a part of my life.

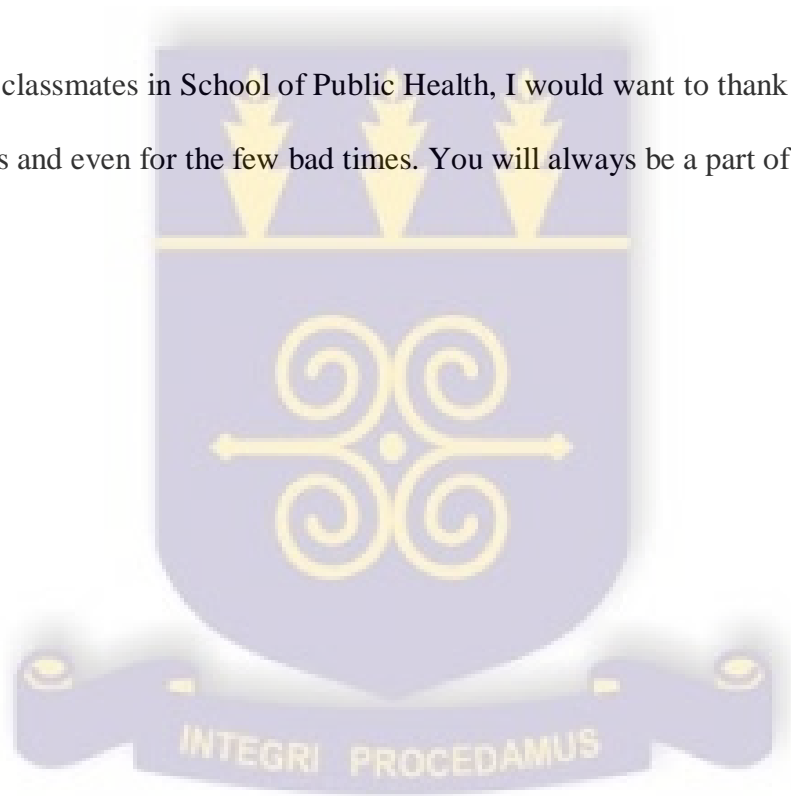
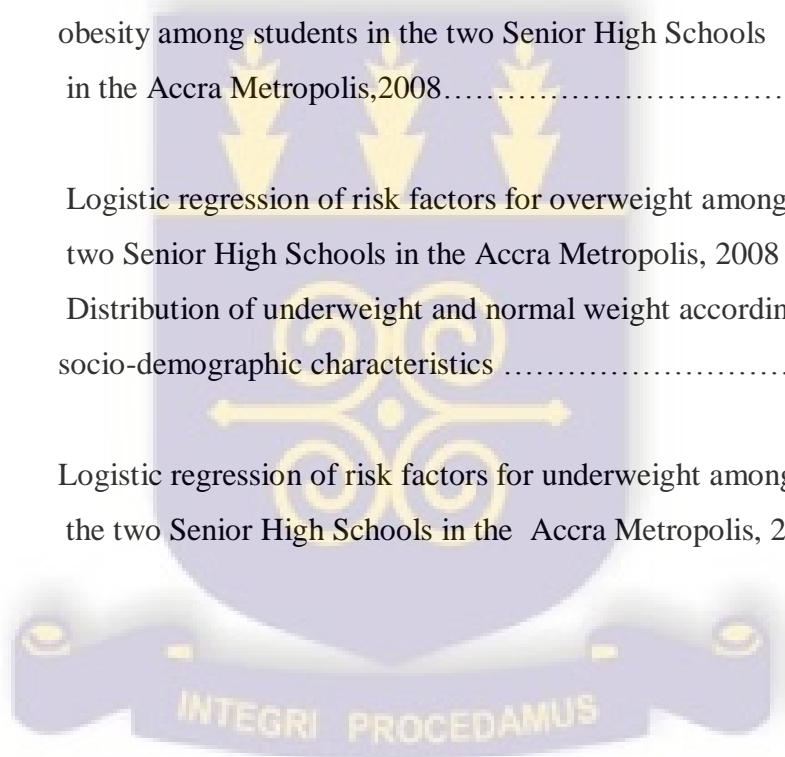


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LIST OF ABBREVIATIONS

BMI	-	BODY MASS INDEX
DALYS	-	DISABILITY-ADJUSTED LIFE YEARS
GDP	-	GROSS DOMESTIC PRODUCT
IASO	-	INTERNATIONAL ASSOCIATION FOR THE STUDY OF OBESITY
METROPOLIS	-	METROPOLITAN AREA
OR	-	ODDS RATIO
SES	-	SOCIOECONOMIC STATUS
SHS	-	SENIOR HIGH SCHOOL
UNDP	-	UNITED NATIONS DEVELOPMENT PROGRAMME
WHO	-	WORLD HEALTH ORGANIZATION



SUMMARY

Overweight and obesity have reached unprecedented levels worldwide and the WHO has described obesity as an ‘epidemic’. Of great concern are the data pointing to the recent increase in the prevalence of obesity regardless of age group and country. Childhood and adolescence obesity are on the rise worldwide.

Several factors have been associated with overweight and obesity, some of which are; diet, physical inactivity, age, sex, familial, socioeconomic status, childhood obesity.

The objectives of the study were to determine the proportion of students who were overweight and obese using their body mass indices and to assess the risk factors associated with overweight and obesity among students in Senior High Schools in the Accra Metropolis.

All students from two selected schools in the Accra Metropolitan Area were examined and their BMI-for-age determined. The students were interviewed for information regarding risk factors such as socioeconomic status, having fat relatives, physical activity, self perception before the age of 10 years and dietary habits.

A case-control study was conducted using 97 cases (overweight students with BMI-for-age > 85th percentile) and 821 controls (with BMI-for-age between the 15th and 85th percentiles) to determine the risk factors which were significantly associated with overweight and obesity.

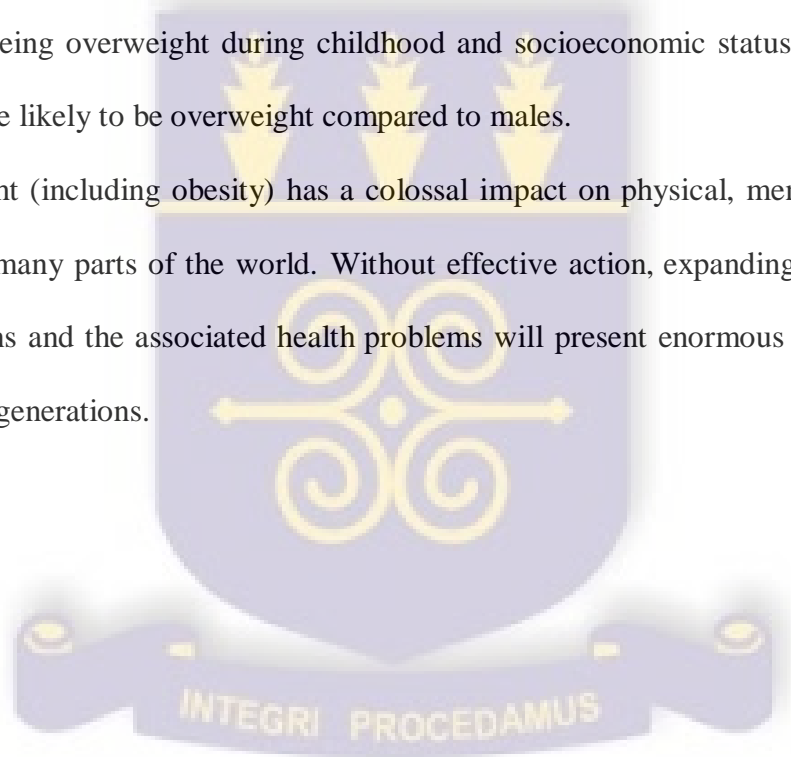
Out of the total of 1133 students, 545 males and 588 females were examined, 97 (8.6%) were overweight with 14 (1.2%) being obese, 821 (72.5%) were normal weight and 215 (19%) were underweight.

Multiple logistic regression showed that overweight and obesity were associated with sex males odds ratio(OR) 0.14, 95% confidence interval(CI) of (0.69-0.26), having a fat relative (OR) 2.34 (CI, 0.12-44.85), watching TV<4 hours (OR) 0.67 (CI, 0.42-1.06), eating at most 3 meals a day (OR) 0.66 (CI, 0.42-1.04).

The prevalence of underweight, normal weight, overweight and obesity was 19%, 72.5%, 8.6%, 1.2% respectively.

The risk factors associated with the group in this study were sex, age, having a fat relative, being overweight during childhood and socioeconomic status. Females were 7 times more likely to be overweight compared to males.

Overweight (including obesity) has a colossal impact on physical, mental, and social ill health in many parts of the world. Without effective action, expanding waists in ageing populations and the associated health problems will present enormous financial burdens for future generations.



CHAPTER ONE

1.0 INTRODUCTION

Overweight and obesity are well known problems worldwide and important risk factors for many diseases. An overweight person is one who has more body fat than is optimal.

The World Health Organization (WHO) defines "overweight" as a BMI equal to or more than 25, and "obesity" as a BMI equal to or more than 30 (WHO, 2006). In the last 10 years, the number of overweight people in industrialized countries has increased to the extent that WHO has labeled obesity an 'epidemic'. Epidemiological data by the International Obesity Task Force show that prevalence rates are increasing not only in industrialized countries, but also in developing countries, especially as far as the adolescent population is concerned (Turconi et al, 2006).

Globally obesity in children and adolescents has reached alarming levels, and the prevalence of obesity is continuing to rise. In the developed world obesity is now the most common disease of childhood and adolescence. Current rates of obesity among this group are between 6% and 30% (Devito et al.,1999) .

In a study to describe obesity among students of public schools in Sao Paulo, the prevalence of obesity in the surveyed population was 10.5% (da Costa Ribeiro et al., 2003).

Among Brazilian adolescents of low-income families, a case-control study of obese and non-obese adolescents was conducted using 83 overweight (body mass index (BMI) > 85th percentile) and 89 non-overweight (aged 14-19 years). The prevalence of overweight was 15.2%. (Silveira et al., 2006).

In Australia approximately 50% of men and 33% of women were overweight or obese, and about 16% of adolescents were obese. It has been found that approximately 80% of obese adolescents became obese adults (Joseph et al, 1996).

Similar to developing countries, those of North Africa are moving along epidemiologic, demographic and nutrition transitions (Martorell et al., 1998 ; Drewnowski, Popkin 1997). Changes in lifestyle, the increase of food availability and dietary diversification certainly have protected many groups from nutritional deficiencies but not from nutrition imbalance (WHO 1990.). “Westernization” has led to new consumption patterns, which affect dietary habits and even the rhythm of consumption. These new dietary habits have created conditions for chronic diseases like obesity and diabetes to take hold. Obesity is a growing problem in these countries, especially since female fatness is viewed as a sign of social status and is a cultural symbol of beauty, fertility and prosperity.

In Morocco, results from the 1984 national household consumption and expenditure survey (Government of Morocco Ministry of Socio-Economic Affairs, 1984/1985) already showed high levels of overweight and obesity among women in urban areas [20% of women with body mass index (BMI) >28].

In Tunisia, the National Nutrition Institute completed a national survey in 1997, showing female obesity to be a serious public health problem in that country. The prevalence of overweight and obesity (BMI>25) increased from 28.3% in 1980 to 51% in 1997. Obesity has tripled in 17 years. At present, one out of every two women becomes overweight or obese.

In a study to determine the distribution of and trends in obesity in adult West African populations, urban residents and women were particularly at a higher risk of overweight/obesity (Abubakari et al., 2008)

In Ghana, according to the Demographic and Health Survey report, 6.9% of women 15-19 years were obese 1.1% were overweight. Among the 20-24 year group, the prevalence of overweight and obesity were 14.7% and 2.2% respectively. (Demographic and Health Survey, 2003).

Risk factors associated with overweight and obesity were changing lifestyles (ie westernization, increased food consumption, reduced physical activity), genetic factors such as an obese parent, age, sex, socio-economic characteristics and the black race.(Wang et al., 1998, Al-Isa., 1998, Musaiger., 1993).

Overweight and obesity have been found to be associated with diseases such as Type II diabetes, hypertension, heart diseases, hyperlipidemia, hypercholesterolemia and

osteoarthritis.(Freedman et al., 1995 ; 1999, Biritwum et al., 2005 ; Solomon and Manson 1997).

1.1 PROBLEM STATEMENT

Obesity is excessive body fat to the point where it impairs the health of the individual and is a leading cause of preventable illnesses and deaths worldwide. Research conducted in seven African countries including Nigeria, Congo Brazzaville, Liberia, Senegal, Sierra Leone, Niger, and Ghana showed that three million out of the 20 million population of Ghana were overweight (The Point, 2007)

In Ghana, the work by Amoah et al.(2003), in urban and rural Accra showed that the overall crude prevalence of overweight and obesity was 23.4% and 14.1% respectively among adults aged 25 years and above.

In a WHO nationwide survey of health status and health system responsiveness from a random sample of 5000 Ghanaian adults aged 18 years and older, anthropometric measurements were included. The results showed a prevalence of obesity to be 5.5% and higher among females.

It was highest in the Greater Accra region with 16.1% prevalence and virtually absent in Upper West and Upper East Regions. The situation was more common in females than in males with 7.9% and 2.8% respectively (Biritwum et al., 2005).

The mean prevalence of overweight and obesity in Ghana over the period from 1989-2004 was 22.6% in females and 23.1% in males.(WHO Global Info Base)

These data show that the prevalence of obesity in Ghana is considerable.

The accumulation of fat begins from childhood through adolescence to adulthood. Along with urbanization and westernization, has come a form of malnutrition- obesity with its dire consequences. Without effective action, expanding frames in young and elderly populations and the associated health problems will present huge economic burdens for future generations

1.2 JUSTIFICATION

Obesity in adolescence is not a cosmetic issue, but has important impacts on short and long term health. Obesity increases the risk of several conditions including Diabetes Mellitus, Hypertension and Heart diseases.

Though some studies have been carried out among adults, data on the situation among adolescents is limited.

School health services, though required in Senior High Schools by the Ghana Health Service and Ghana Education Service, are almost non existent in these schools, therefore, these schools do not have data on the health status of their students including their anthropometric profiles (Personal communication with SHS students).

Adolescents in the Accra metropolis have a profile of risk factors similar to those listed previously and therefore are at risk of overweight and obesity.

This study sought to find out the situation among senior high school students and to provide data to fill in some of the existing knowledge gap.

Results of the data could be used to inform the Ghana Health Service and policy makers on the prevalence and some of the potential risk factors of overweight and obesity so that appropriate measures can be put in place to reduce the trend among adolescents. This way, the nation can be rescued from having to spend a lot of money taking care of ‘fat’ adults with multiple, chronic, complicated and costly to manage diseases, if preventive programmes are instituted early.

The objectives of the study were as follows;

General Objective

To determine risk factors associated with overweight and obesity among Senior High School students in the Accra Metropolis.

Specific Objectives

- To determine the proportion of students who were overweight and obese using their body mass indices
- To determine the risk factors (e.g. familial, age, sex, socioeconomic status, dietary habits etc.) associated with overweight and obesity among the study group
- To determine the most important risk factor associated with overweight and obesity among the study group

CHAPTER TWO

2.0 LITERATURE REVIEW

Overweight and obesity have become global pandemics and whilst the world concentrates on infectious diseases like Tuberculosis, Malaria and HIV/AIDS, these two states are quietly seeping into society (Maire et al., 2002)

Overweight/Obesity should be regarded as today's principal neglected public health problem associated with diseases such as Type II diabetes, hypertension, heart diseases, hyperlipidemia, hypercholesterolemia and osteoarthritis (Freedman et al., 1995; 1999, Biritwum et al., 2005; Solomon and Manson 1997).

Overweight is defined as abnormal or excessive fat accumulation that may impair health. Body mass index (BMI) is a simple index of weight-for-height that is commonly used in classifying overweight and obesity in adult populations and individuals. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2)(WHO, 2006)

The prevalence of obesity is rising at an alarming rate worldwide, in most high income countries, in developing countries undergoing nutrition transition, and even in poor countries with current food insecurity and under-nutrition problems. Once considered a

problem only in high-income countries, overweight and obesity are now dramatically on the rise in low and middle-income countries, particularly in urban settings.

Though the prevalence of obesity and secular trends in adults has been well documented, data are limited for children and adolescents.

According to a report published on behalf of the International Association for the Study of Obesity (IASO), one in ten children worldwide is overweight, a total of 155 million.

Around 30-45 million within that figure are classified as obese (IASO report, 2004).

Research forecasts published in the International Journal of Pediatric Obesity, a new scientific journal launched by the International Association for the Study of Obesity and published by Taylor & Francis, suggest the proportion of obese children in Europe will reach 10% by 2010-almost double the level reported in earlier surveys. In the Middle East the figure is even higher and will also double to 11.5%. In the WHO European Region, excess body weight is responsible for more than 1 million deaths and loss of 12 million disability-adjusted life years (DALYS) (European Environment and Health Information Systems, 2007)

In a study done in central Italy among 1357 secondary school students aged 11-19 years, 8.4% were considered obese, with a higher prevalence in male population (9.8%) as compared to female population (6.5%). Of these responders, 21.4% were considered at risk of overweight with no statistical difference due to gender. Statistically significant correlations of teenagers' risk of overweight and obesity with nutritional conditions of parents, mother's educational level and amount of weekly physical activity were observed (De Vito et al., 1999).

The increase in the prevalence of obesity has been reported in several Arab countries, with rates reaching as high as 40% in some countries (WHO, 2001).

In a study carried out in Tehran to determine the prevalence of overweight and obesity and associated factors among students aged 11-17 years, the prevalence were 17.9% and 7.1% respectively (Moayeri et al, 2005).

In Bahrain, 16% of boys and 17% of girls in secondary schools were overweight (Musaiger et al., 1993).

Twenty thousand and eighty-four students from urban schools (first to fourth-grade) in Pelotas, Rio Grande do Sul State, Brazil, assessed for their nutritional status were classified according to the World Health Organization (height deficit) and International Obesity Task Force (overweight and obesity) criteria. Prevalence rates for overweight and obesity were 29.8% and 9.1%, respectively (Vieira et al., 2008).

Recent data published in the South African Youth Risk Assessment Survey 2002 by the South African Medical Research Council show the prevalence of overweight (including obesity) among young people aged 13-19 years to be 17% overall affecting more girls (25%) than boys (7%). Prevalence was highest (over 20% for boys and girls combined) in white and Indian population groups. (International Association for the study of Obesity Report,2004).

In general, research and existing data show an increase in childhood and adolescent obesity globally. The prevalence of overweight in 11-15-year-old Sicilian children was very high, nearly 40% at age 11 and, although progressively decreasing with age increase, still over 25% at age 15. This prevalence is one of the highest ever reported (Baratta et al., 2006).

The Health Survey for England predicts that more than 12 million adults and 1 million children will be obese by 2010 if no action is taken (BBC., 2006).

The United States has the highest rates of obesity in the developed world. From 1980 to 2002, obesity has doubled in adults and overweight prevalence has tripled in children and adolescents. In 2003-2004 17.1% of children and adolescents were overweight and 32.2% of adults were obese (Ogden et al., 2006).

2.1 THE DYNAMICS OF OBESITY

An imbalance between energy intake and energy expenditure will lead to a change in body weight (mass) and body composition (fat and lean masses). In simple terms, an obese person has eaten more than he/she requires. Commonly the number of adipocytes in the body does not increase but merely swell up as they become filled with triacylglycerols. However, if obesity develops before puberty, an increase in the number of fat cells can occur (Devlin, 1997).

Obesity can develop gradually as a consequence of minor energy imbalance. Once the obese state sets in, the body mounts up physiological processes to maintain this state. Though the body may exert a defense mechanism against malnutrition, the defense against under-nutrition is thought to be stronger than against over nutrition (Blundell, 1996). An excess of 500k cal a day leads to weight gain at a rate of about 0.5kg a week (Whitney et al.,1990).

The role of genetics cannot be undermined in the dynamics of obesity. Though the lifestyle of the individual may promote obesity, there are some individuals who are predisposed to becoming overweight /obese. It has been suggested that the problem of obese individuals might be decreased sensitivity to leptin (Devlin, 1997). Leptin is produced by adipose tissue to signal fat storage reserves in the body, and mediates long-term appetitive controls (i.e. to eat more when fat storages are low and less when fat storages are high). This control mechanism is lost when there is decreased sensitivity to leptin.

On a population level, the thrifty gene hypothesis postulates that certain ethnic groups may be more prone to obesity when exposed to an equivalent environment. Their ability to take advantage of rare periods of abundance by storing energy as fat would be advantageous during times of varying food availability. This is the presumed reason why Pima Indians, who evolved in a desert ecosystem, developed some of the highest rates of obesity when exposed to a Western lifestyle (Pool, 2001).

Obesity is a major feature in a number of rare genetic conditions: Prader-Willi syndrome, Bardet-Biedl syndrome, MOMO syndrome, leptin receptor mutations, and melanocortin receptor mutations.

2.2 MEASUREMENT OF OBESITY

Anthropometric measurements

There are different methods of diagnosing overweight and obesity. The ideal method, however should accurately calculate the fat mass, be independent of other covariates of body mass such as height, be acceptable and reproducible, and be inexpensive and have appropriate values of normality (Power et al., 1997).

It is not possible to measure directly the body fat in vivo, therefore several indirect methods have been developed. (e.g. underwater weighing) (Reilley et al., 1995 ; Pietrobelli et al. , 1998). However, these methods are expensive, sometimes invasive and require special equipments and skills.

Although anthropometric measures are less accurate for measuring the excess body fat, they are less expensive, non-invasive and easy to use. The commonly used measurements are skin-fold thickness, weight and height.

The triceps, biceps, sub-scapular, and supra-iliac skin-fold thickness measure directly the subcutaneous fat and indirectly the total fat mass.

Body mass index (BMI, in kg/m^2), which is the weight /height² ratio, is frequently used to categorize adolescents into underweight, normal weight, overweight and obese. However this ratio provides only a crude measure of body fatness and does not distinguish between weight associated with muscle and weight associated with fat. (WHO, 2000)

BMI is also affected by physiological fluctuations in weight and height during growth at different age points in childhood and adolescence (Rolland-Cachera et al. 1994). In 1995, the WHO recommended the use of percentile BMI-for-age for adolescents 10-19 years to differentiate underweight (<5th percentile), normal (5th-85th percentile), overweight (85th -<95th percentile and obese(\geq 95th percentile) (WHO , 1995 ; Must et al 1991).

2.3 RISK FACTORS FOR OBESITY

Obesity is associated with a myriad of factors and often there is an inter-play of these factors in an obese individual.

2.3.1 Familial

The risk of childhood and adolescent obesity has been found to be associated with the individual having one or both parents being obese and this risk is increased when both parents are obese. Childhood obesity is associated with a high parental body mass. (da Costa Ribeiro et al., 2003).

Overweight and obesity among Brazilian adolescents were found to be positively associated with obesity in their mothers and fathers (Neutzling et al., 2003).

Evidence from twin, adoption and family studies strongly suggests that biological relatives exhibit similarities in maintenance of body weight.(CDC, 2005)

A Four year longitudinal study in Italy, carried out to assess the relationships between diet, body composition, physical activity, parents' obesity and adiposity in children at the age of 8 years revealed that parents' obesity was the main risk factor for obesity in this group of children (Maffei C. et al., 2001).

A correlation in BMI changes over time has been found between friends, siblings, and spouses (Christakis and Fowler., 2007).

2.3.2 Physiological

Overweight/obesity tends to be associated with the sex of individuals, being more prevalent in girls than in boys. This association is sometimes explained using normal physiological processes such as menarche in the girls.

In England about 31% of men and 38% of women aged 16–24 were overweight or obese. The pattern was similar for Scottish men (31%) and women (39%) aged 16–24 (Health Survey for England 2004 (2005).

In a study to quantify the prevalence of overweight and obesity and their associated factors in adolescent children living in Tehran, Iran, 2900 students were selected using a multistage stratified cluster sampling. The prevalence of overweight and obesity were 17.9 and 7.1%, respectively. BMI increased with age, and it was higher in those who had lower levels of physical activity (Moayeri et al., 2008).

Being overweight before the age of 10 years has been found to be positively associated with overweight in adolescence (Neutzling et al., 2003).

To examine the prevalence and changes in the prevalence of overweight and obesity among school children in Jena (Germany) in the last twenty years and to identify factors associated with childhood overweight, cross-sectional surveys in 1975, 1985, 1995 and a household questionnaire in 1995 were carried out. Children from schools in Jena, aged 7-14 years, participated. The prevalence of overweight and obesity increased within the 20 year period. In boys the prevalence of overweight increased from 10.0 to 16.3% and in girls from 11.7 to 20.7% between 1975 and 1995. The prevalence of obesity increased from 5.3 to 8.2% in boys and from 4.7 to 9.9% in girls between 1975 and 1995. (Kromever-Hauschild K et al, 1999)

A Greek study to examine the prevalence of overweight and obesity in Greek school age children and adolescents between October 1990 and May 1991 using the 12-month-International Obesity Task Force cutoff values, revealed an overall prevalence of overweight of 17.3% (16.9% for boys, 17.6% for girls). The rate of obesity was 3.6% (3.8% for boys, 3.3% for girls). The prevalence of overweight and obesity was decreasing with age in girls (6-9 years: 23.2 and 6.7%, respectively, 10-17 years: 14.8 and 1.6%, respectively). In boys, the prevalence of overweight was higher in 10-17 years (19.3 and 2.7%, for the rate of overweight and obesity, respectively) than in 6-9 years (12.1 and 5.9%, respectively). (Georgiadis , Nassis , 2007)

One thousand eight hundred and four adolescents attending junior high schools in Xi'an, Shanxi province in China, were examined. Overall, 17.4% of adolescents were overweight or obese (overweight 11.2%; obesity 6.2%), but there was a marked gender difference in the prevalence with 20.2% of boys versus 14.4% of the girls being overweight or obese. (Li et al., 2006)

In a study on the cardiovascular risk factors in Italian adolescents attending junior high schools the prevalence of obesity was 24% in boys and 19% in girls and 39% of the remaining boys and 38% of the remaining girls were in the overweight range. (Rabbia et al., 1994). This higher prevalence in boys is at variance with results of most studies.

2.3.3 Socio-economic factors

The correlation between social class and BMI varies globally. In the developed world, prevalence of paediatric obesity is generally as common in boys as girls. The picture with respect to sex differences in prevalence in the developing world is more complex and difficult to predict. In the developed world paediatric obesity is generally more common in children and adolescents from families of lower socioeconomic status, but the magnitude of these socioeconomic differences in prevalence is quite limited. In the developing world the picture is again more complex. Higher socioeconomic status has usually been associated with higher risk of paediatric obesity, although as the epidemic progresses in the developing world lower socioeconomic status may become more of a risk for obesity. A review in 1989 found that in developed countries women of a high social class were less likely to be obese. No significant differences were seen among men

of different social classes. In the developing world, women, men, and children from high social classes had greater rates of obesity. (Sobal and Stunkard, 1989).

In the Minnesota Adolescent Health Survey (Neumark-Sztainer et al, 1998), there was a strong inverse relationship between socio-economic status and weight status in girls but not boys. In a study to investigate the nutritional status of Black South African teenagers by sex and compare it with nutritional profiles of teenagers from other countries, significant sex differences were observed for under and over nutrition. Boys (18.4%) had a higher prevalence of underweight than girls (2.6%) ($P < 0.005$), who were more at risk of overweight than boys (20.9% vs. 4.2%) ($P < 0.005$). Boys (21.9%) were more stunted than girls (9.4%) ($P < 0.05$), but stunted girls were at greater risk of overweight than boys across all levels of stunting. The prevalence of overweight among boys (4.2%) was lower than in other countries while for girls (20.9%), it was similar to several upper middle and high income countries.

In the study to assess the magnitude of overweight and obesity and its associated socio-demographic factors in adolescents attending junior high schools in Xi'an, Shanxi province in China, 1804 adolescents were examined. Overweight and obesity was more prevalent in younger boys from richer families living in urban districts and those whose parents were either overweight or obese (Li et al., 2006).

A higher rate of obesity in poorer individuals is also seen in developed countries. An example is among the Amerindians (The first nations of North America). Here obesity has become a serious epidemic (Broussard 1995; Bernard et al, 1995).

2.3.4 Dietary Habits

Dietary patterns influence energy imbalance, thus influencing an individual's weight.

The macronutrient content of a diet determines the extent to which excess is stored and about 80% of the excess energy may be stored after carbohydrate overfeeding. The capacity for storage of carbohydrates is smaller compared to the unlimited capacity for storage of fat (Horton et al., 1995). Dietary fat induces one's appetite thus encouraging an individual to overeat (Blundell and King, 1996).

In England it was estimated that the per person consumption of fat and refined carbohydrates has increased 5 to 10 fold over the past two centuries, whilst the consumption of fiber-rich grains has declined.

In the U.S dietary trends have changed with reliance on energy-dense fast-food meals tripling between 1977 and 1995, and calorie intake from fast food quadrupling over the same period.(Lin et al., 1999).

In China, there was an increase from 22.8 to 66.6% in the proportion of adults consuming a higher-fat diet between 1989 and 1993 as well as rapid shifts in the structure of diet as income changes. There appears to reflect a basic shift in dietary patterns, induced mainly by shifts in income, prices and food availability, but also by the modern food industry and the mass media. One consequence of the nutrition transition has been a decline in

under-nutrition accompanied by a rapid increase in obesity. There are marked differences between urban and rural eating patterns, particularly regarding the consumption of food prepared away from home. (Popkin, 2001).

This nutrition transition, in the developed countries, took 100-200 years, however in the developing countries, this is occurring within a few decades.

The shift from traditional staples to processed foods in these developing (especially urban areas) is strongly enhanced by western culture.

Eating “junk” food has become widely accepted. Almost every corner of the major streets in Accra (Ghana) has several fast food joints competing for space and patrons. Adolescents form part of this group of patrons. As long as parents continue to leave the decision concerning what to eat to their wards either as a sign of affluence or not, their children are bound to patronize foods that may be unbalanced and unhealthy.

2.3.5 Physical inactivity

The majority of the literature available has reported that children and adolescents are more active than adults. In spite of this, concerns have been raised as to whether they are exercising enough to confer current as well as future health benefits. Modern lifestyle has seen a reduction in both voluntary and incidental activities. This is an important influence on weight gain and the increase in obesity in the last decade (Caterson, 1997). A study of children and television viewing in the United States by Gortmaker et al.

(1996), estimated that more than 60% of overweight incidences in the population can be linked to excessive television viewing time (sedentary lifestyle).

In a study to investigate the determinants of overweight and obesity among 10- to 15-year-old schoolchildren in a population in the transitional phase in the North West Province of South Africa, smaller households, inactivity and increasing age for girls were found to be determinants that influence the development of overweight/obesity. (Kruger et al., 2006) In a cross-sectional national survey to assess the national prevalence of different grades of nutritional status (underweight, normal weight, overweight and obesity) among Iranian school-students, a sample of 21 111 school students including 10 253 boys (48.6%) and 10 858 girls (51.4%) aged 6-18 years were included. The prevalence of underweight was 5% (2.6% for boys and 2.4% for girls). The prevalence of overweight was 11.3% and the prevalence of obesity was 2.9%. The prevalence of overweight was highest (10.98%) in the 12-year-old group and that of obesity (7.81%) in the 6-year-old group (Janghorbani et al., 2007).

The amount of time spent in front of the television during adolescence has been found to be significantly associated with adiposity even after correction for obesity history (Dietz and Gortmaker, 1985)

2.4 EFFECTS OF OVERWEIGHT/OBESITY

Overweight and obesity are associated with several health risks. Overweight/Obesity is more likely to persist into adulthood when it begins in childhood or adolescence (Abraham et al.,1971).

Liver pathologies (such as hepatic steatosis) characterized by high serum transaminase have also been associated with overweight (Noguchi et al., 1995).

Overweight and obesity have been found to be associated with diseases such as Type II diabetes, hypertension, heart diseases, hyperlipidemia, hypercholesterolemia and osteoarthritis (Freedman et al., 1995; 1999, Biritwum et al., 2005; Solomon and Manson 1997).

Sleep disorders have also been closely linked to overweight (especially in obese individuals) and in some cases this has led to hypoventilation and death (Riley et al., 1976).

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN AND STUDY AREA

A case control study was conducted using overweight and normal weight students in the Presbyterian and Christian Methodist Senior High Schools in the Accra Metropolitan Area at Osu and Adabraka respectively.

3.1.1 Profile of study area

The Southern boundary of the Metropolis of Accra is the Gulf of Guinea from Gbegbeyese to the Mokwei Lagoon near Regional Maritime Academy. The boundary continues along the Maritime road to join the Accra-Tema road to Nungua Barrier. It turns right to the Ashiaman road till the Railway Overhead Bridge on the Motorway and continues to Mile Post 9.5.

Politically there are 13 administrative sub-metros but the District Health Administration currently uses the initial 6 sub-metros that existed. These are Ablekuma, Ashiedu Keteke, Kpeshie, Okaikwei, Ayawaso, Osu-Klottey sub-metros (Appendix 5).

The Metropolis has a population of 2,147,993 (with a daily influx of about 1,500,000 visitors). Forty-four percent of the population is < 15 years and about 50% are between 15-44 years.

Generally there are several levels and categories of health facilities. The categories are government, quasi-government, mission and private. The levels include Hospitals, Polyclinics, Health Centres /Health post and others. There are over 200 health facilities in the Metropolis. According to the 2006 annual report, hypertension was the third most prevalent disease.

There are 52 senior high schools with over 27000 students in the metropolis.

3.2 STUDY POPULATION

Senior High School Students from Christian Methodist and Presbyterian Senior High Schools the Accra Metropolitan Area were used in the study.

3.3 SAMPLING

3.3.1 Sample size determination

The estimated sample size of 53 cases and 212 controls was calculated allowing for the detection of an Odds ratio of 2.50, given the prevalence of television viewing for more than 4 hours among the normal weight students of 30%, a power of 80% and 95% confidence level (using EPI INFO version 3.4.3).

3.3.2 Sampling method

Two schools, (out of a total of 52) Senior High Schools in the Accra Metropolitan Area were selected (by simple random sampling using SPSS version 12.0.1) for the study. Only students in SHS1 and 2 were screened for their anthropometric profile because SHS 3 students were on vacation after their final examinations.

Overweight students with BMI-for-age \geq 85th percentile were considered as “cases”, whereas students with BMI-for-age between the 15th and 85th percentiles (normal weight) were considered as “controls” (using the WHO 2007 Reference tables- Appendix 3).

Case definition –Overweight = students with BMI-for-age \geq 85th percentile.

BMI (body mass index is calculated as follows; BMI= weight (in kg)/Height² (in squared metres).

3.4 DATA COLLECTION

3.4.1 Method

Interviews, using self administered structured questionnaires (Appendix 1), were conducted to obtain background information on students and to elicit information on the risk factors for overweight and obesity.

The weights and heights of the students were measured to assess body mass and linear dimensions respectively.

3.4.1.1 Questionnaires

Pre-coded questionnaires were distributed to students and the questions were explained one after the other to guide the students to fill them as well as ensuring that students did not leave questions unanswered.

3.4.1.2 Height

The heights of the students were measured using the Microtoise. The students were made to stand barefooted and upright with the back of their heads, scapulars, calf and buttocks touching the wall before their heights were taken using the Microtoise. The Microtoise is calibrated in centimeters (cm) and measures heights to the nearest 0.1cm. The Microtoise was hung at a height of 200 meters from the ground and drawn down to touch the vertex of the student while the Frankfurt horizontal plane (the lower eye socket line to the ear carnal being perpendicular to the vertical board) was observed.

3.4.1.3 Weights

The weights were measured with Seca scales. The scale is calibrated in kilograms and gives weights to the nearest 0.1kg.

Students were weighed bare-footed, in minimum clothing and with their pockets emptied of heavy objects such as keys, mobile phones etc.

3.4.2 Training of Interviewers/Assistants

Four research assistants (who had just graduated from the universities) were trained in taking accurate measurements (weight and height) by ensuring that the students were in the right positions as previously described, barefooted, with their pockets emptied and with minimal clothing.

3.4.3 Quality Control

The quality of the data collected was ensured by calibrating the scales daily. The height and weight for each student was measured by one pair of assistants consisting of a measurer with his assistant and then repeated by another pair. This was to minimize intra-

observer and inter-observer biases. Mean measurements were determined and these were used to compute the body mass indices of the students.

Questionnaires were checked for completeness before they were accepted. Questionnaires were numbered during data entry to ensure that details of each questionnaire were not entered twice. Double entry of the data collected was done to make sure that the data was correctly entered.

3.4.4 Ethical Issues

Ethical clearance was obtained from the Ghana Health Service, Ghana Education Service, and permission was obtained from the Accra Metropolitan Health Management Team, and School authorities. The students gave their consent before the research was carried out.

3.4.5 Pre-testing

Pre-testing of the questionnaires was carried out in West Africa High School. The school is not in the area of study but has similar characteristics as the schools in the study area.

This process enabled me know the clarity and adequacy of the questions, estimate the approximate time for each questionnaire and helped me make the necessary corrections to improve on the questionnaire for the actual study. Pre-testing also enabled me to plan the analysis of the data.

3.5 DATA PROCESSING AND ANALYSIS

The SPSS software (version 12.0.1) was used to process and analyze the data.

Socioeconomic status was assessed using mainly the level of education of their parents and guardians (where applicable), ownership of selected items and ownership, or otherwise of the place of residence. The information on ownership of the items was obtained from the questionnaires and specific grade points were given for each of the variables. The sum of the grade points was computed. A minimum of 11 points and a maximum of 59 points were obtained. Subjects who had points below the 25th percentile were categorized as being of low SES, between 25th and 50th percentile as middle SES and above 75th percentile as high SES (Appendix 3).

A univariate analysis was carried out on all the risk factors collected, calculating the proportions for the categorical variables.

Bivariate analyses were done, looking at the prevalence of exposures (risk factors) for both cases and controls, Chi-square test of association and Odd's ratios with their respective 95% confidence intervals.

Multivariate analysis was carried out using logistic regression models to find out the effect of the various variables in the model, thereby determining the most significant risk factors for overweight and obesity.

CHAPTER FOUR

4.0 RESULTS

Out of the total of 1133 students, 545 males and 588 females were examined, 97 (8.6%) were overweight with 14 (1.2%) of those overweight being obese, 821 (72.5%) were normal weight and 215 (19%) were underweight. Over 87% of the cases (overweight and obese students) were females. Cases and controls were all from SHS 1 and 2 and more than 50% of the overweight students were from Christian Methodist Senior High School. Students who participated in the study were between the ages of 14 years, 6 months and 22 years, 1 month, with >90% below the age of 20 years.

Table 1 describes the demographic and socio-economic characteristics of the cases and controls.

Table 2 shows the risk factor distributions for cases and controls with their crude odds ratios and respective confidence intervals and p-values.

The sex (male/female) was significantly associated with being overweight with the odds of being male among the overweight group being 0.4.

With the high socio-economic status as the reference, the odds of being from the low socio-economic class among the cases was twice the odds among the controls whilst the odds for middle socio-economic status was 1.5 times.

There was a significant difference between the study groups with respect to their being related to someone they perceived as being overweight, with the odds among the

overweight students being twice as much as that among the normal weight students.

Among those who had overweight relatives, parental obesity was associated though not significantly with overweight in the students.

Though only 12 (12.4%) of the overweight students perceived themselves as being “fat” before the age of 10 years, being thin or normal weight before the age of ten appeared to be relatively protective with odds ratios less than for those who were overweight before 10 years.

Table 4.1 Distribution of cases (overweight) and controls (normal weight) according to some socio-demographic characteristics.

Variable	Cases (BMI>85 th Percentile)		Controls (15 th <BMI<85 th Percentile)		p-value
	N	%	N	%	
Sex					
Male	12	12.4	409	49.8	0.00
Female	85	87.6	412	50.2	
Age, months					
168-203	52	53.6	339	41.3	0.00
204-239	44	45.4	417	50.8	
≥240	1	1.0	65	7.9	
School					
Christian Methodist SHS	57	58.8	439	58.8	
Presbyterian SHS	40	41.2	382	58.8	
Level of education					
1 st year	54	55.7	408	49.7	0.26
2 nd year	43	44.3	413	50.3	
Socioeconomic status					
Low SES	59	60.8	411	50.1	0.02
Middle SES	33	34.0	333	40.6	
High SES	5	5.2	77	9.4	

There was no significant difference between cases and controls with respect to exercising consciously outside school, the results indicate that, those who exercised for ≥ 30 minutes had an increased odds of 1.6(though not statistically significant). Though Physical Education (PE) was part of the curriculum of both schools, 50 (51.5%) of the cases and 479 (58.4%) of the controls admitted to not participating in any physical

activity during the period. The odds of participating in physical activity during PE periods among the overweight students was 1.3 times higher than in the normal weight students.

Spending less than 4 hours/day watching television was found to be protective (OR=0.79), though the finding was not statistically significant.

Having at most 3 main meals a day and not more than 2 snacks a day were associated with a decreased likelihood of being overweight, though the associations were not statistically significant.

All students in the study admitted to patronizing one or more of the selected “junk” foods (fried rice, fried chicken, burgers, potato chips, pizza, fried turkey tail). However, the frequent patronage of one or more of these foods was not significantly associated with overweight/obesity, being three times more likely in the overweight group.

Table 4.2 Odds ratio (OR) and respective 95% confidence interval (CI) for characteristics related to overweight/obesity among students in the two Senior High Schools in the Accra Metropolis, 2008

Variable	Cases yes		Controls yes		Crude OR (95%CI)	P-value
	n	%	n	%		
Sex						
Male	12	12.4	409	49.8	0.14 (0.07-0.26)	0.00
Female	85	87.6	412	50.2		
Socioeconomic Status (SES)						
Low SES	59	60.8	411	50.1	2.21 (0.86-5.69)	0.10
Middle SES	33	34.0	333	40.6	1.53 (0.58-4.04)	0.39
High SES	5	5.2	77	9.4	1.00	
Familial						
Fat relative	69	77.1	420	51.2	2.35(1.94-4.88)	0.00
Type of relation						
Parent	30	43.5	135	32.3	1.36(0.78-2.35)	0.25
Self perception before age 10 years.						
Thin	22	22.7	260	31.7	0.51 (0.24-1.09)	0.08
Normal	62	64.9	488	59.4	0.78 (0.40-1.52)	0.48
Fat	12	12.4	73	8.9	1.00	
Physical Activity (PA)						
Exercise outside school						
PA \geq 30 min/day	56	57.7	453	55.2	1.11 (0.73-1.69)	0.63
Participation in PE	36	64.3	245	52.6	1.62 (0.88-3.01)	0.10
Watching TV	50	51.5	479	58.4	0.76 (0.50-1.16)	0.20
<4 hours	59	60.8	545	66.4	0.79 (0.51-1.21)	0.28
Dietary habits						
\leq 3 main meals/day	48	57.8	562	68.5	0.66(0.43-1.01)	0.06
\leq 2snacks/day	74	76.3	654	79.7	0.82 (0.50-1.35)	0.44
Eating selected junk foods often	72	74.2	555	68.0	1.35 (0.84-2.19)	0.21

The results of the logistic regression are shown in table 3.

Table 4.3 logistic regression of risk factors for overweight among the two Senior High Schools in the Accra Metropolis, 2008.

Variable	Adjusted OR (95% CI)	P-value
Sex		
male	0.14(0.69-0.26)	0.00
female		
Socioeconomic Status (SES)		
Low SES	1.81 (0.68-4.81)	0.23
Middle SES	1.42 (0.52-3.89)	0.49
High SES	1.00	
Familial		
Fat relative	2.34 (0.12-44.85)	0.57
Type of relation		
Parent	1.36 (0.71-26.09)	0.84
Other relatives	0.88 (0.05-17.19)	0.93
Self perception before age 10 years.		
Thin	0.55 (0.25-1.22)	0.14
Normal	0.85 (0.42-1.72)	0.65
Fat	1.00	
Physical Activity (PA)		
Watching TV <4 hours	0.67 (0.42-1.06)	0.09
Dietary patterns		
≤3 main meals/day	0.66 (0.42-1.04)	0.07
≤2snacks/day	0.91 (0.54-1.53)	0.71
Eating selected “junk” foods often	1.44 (0.87-2.37)	0.15

The adjusted odds for low socioeconomic status among the overweight students decreased as well as that for the middle socioeconomic status though there was still no significant association.

Having a “fat” relative though still associated with overweight (OR=2.34) was no longer significant after adjusting for other variables.

Being thin or normal weight before the age of 10 years was still protective compared to those who perceived themselves as being fat.

Watching television for less than 4 hours a day was still protective but the association was not statistically significant even after adjusting for other variables.

Frequent patronage of selected “junk” foods remained insignificantly associated with overweight.

An individual’s sex was the most significant (and important) variable associated with overweight in the model using the Wald estimates (Chan, 2004).

Though the study was not designed to determine the risk factors associated with underweight, it was observed that the proportion of the students examined and found to be underweight was 19%, and there were significant associations with some of the variables investigated.

Tables 4.4 and 4.5 give summaries of some of the findings.

Table 4.4 Distribution of underweight and normal weight according to socio-demographic characteristics.

Variable	underweight		normal weight		p-value
	(BMI<15th Percentile)		(15th<BMI<85thPercentile)		
	N	%	N	%	
Sex					
Male	124	57.7	409	49.8	0.00
Female	91	42.3	412	50.2	
Age, months					
168-203	50	23.3	339	41.3	0.00
204-239	149	69.3	417	50.8	
≥240	16	7.4	65	7.9	
Socioeconomic status					
Low SES	92	42.8	411	50.1	0.02
Middle SES	93	43.3	333	40.6	
High SES	30	14.0	77	9.4	
Familial					
Fat relative	96	44.7	420	51.2	0.00
Self perception before age 10 years.					
Thin	113	52.6	260	31.7	0.00
Normal	84	39.1	488	59.4	
Fat	18	8.1	73	8.9	

Table 4.5 logistic regression of risk factors for underweight among the two Senior High Schools in the Accra Metropolis, 2008.

Variable	Adjusted OR (95%CI)	P-value
Sex		
male	0.13 (0.95-1.78)	0.11
female		
Socioeconomic Status (SES)		
Low SES	0.54 (0.33-0.89)	0.02
Middle SES	0.74 (0.45-1.21)	0.23
High SES	1.00	
Familial		
Fat relative	0.56 (0.12-44.85)	0.68
Type of relation		
Parent	1.45 (0.10-21.54)	0.79
Other relatives	0.88 (0.09-19.46)	0.85
Self perception before age 10 years.		
Thin	1.88 (1.04-3.42)	0.04
Normal	0.71 (0.39-1.29)	0.26
Fat	1.00	
Physical Activity (PA)		
Watching TV <4 hours	0.75 (0.54-1.04)	0.08
Dietary patterns		
≤3 main meals/day	1.21 (0.85-1.72)	0.30
≤2snacks/day	0.59 (0.41-0.83)	0.00
Eating selected “junk” foods often	0.90 (0.65-1.26)	0.54

The prevalence of underweight was higher among the males (57.7%) compared to females. Socio-economic status was significantly associated with underweight with 42.8% and 43.3% of the underweight individuals being from the low and middle social classes respectively.

Only 44.7% of the underweight individuals admitted to having a relative who was fat.

A significant 52.6% of those who were underweight perceived themselves as thin before they reached the age of 10 years.

After adjusting for the other variables, low SES, being thin before the age of 10 years and having ≤ 2 snacks per day were significantly associated with underweight.

CHAPTER FIVE

DISCUSSION

This study demonstrated that the prevalence of underweight was 19%, normal weight 72.5%, overweight 8.6% and obesity 1.2%. This is comparable to the findings of a study on adolescents in Osun State, Nigeria where the prevalence of underweight was 20.1% in the study area, and the prevalence of overweight was 3.2% (Funke, 2008)

The prevalence of underweight among the females in this study was 15.5% and that of overweight among them was 14.5%. Among the males, the prevalence of underweight was 22.8% and overweight was 2.2%. These findings are comparable to trends seen in studies done in adolescents in South Africa, Tunisia and Turkey where the ranges of prevalence of underweight and overweight among females were 1%-11% and 11%-21% respectively (Oner et al., 2004, Aounallah-Skhiri et al., 2008, Reddy et al., 2008). However the ranges of the prevalence among the males were 8%-15% and 10%-15% respectively. Comparatively the males in this study seem to be more underweight and less overweight compared to the other countries.

The co-existence of underweight and overweight seems to be the trend in developing and even developed countries (Darton-Hill and Coyne, 1998).

Sex was significantly associated with overweight with females at a higher risk of becoming overweight. The odds of being female among the overweight group was 7 times the odds among the normal weight group. This is in line with several studies done which showed females being at a higher risk of overweight (Al-Sendi et al., 2008). Leibowitz (1992) suggested that there was a rise in appetite for fat in both sexes after puberty, however the increase is greater in females and this could be part of the reason why the females were at a higher risk of being overweight.

Results of the 2002 National Youth Risk Behaviour Survey in South Africa showed that higher rates of underweight were observed for males than females and higher percentages of females than males were overweight and obese, overall and among black students (Reddy et al., 2008).

In this study, socioeconomic status was associated (though not significantly) with overweight with middle SES being associated with an increased odds among the overweight group followed by the low SES group, compared to high SES. The correlation between social class and BMI varies globally with the variation being more complex and difficult to predict in the developing world, the finding in this study (a higher OR for those in the low and middle socioeconomic status compared to those in the higher social class), agrees with what usually pertains in the developed countries where overweight individuals tend to be of lower SES (Broussard 1995; Bernard et al, 1995). Individuals of low social class tend to consume a lot of carbohydrate meals because they are associated with higher satiety and are relatively inexpensive. These foods contain a lot of calories and therefore contribute greatly to one becoming overweight. This contrasts with what happens in most developing countries where the rich can afford to buy more food coupled with the cultural belief of affluence being associated with overweight (Mclaren, 2007).

The significant association between overweight and having a relative who is overweight agrees with a study done in Brazil among adolescents where overweight was found to be positively associated with parental obesity (Neutzling et al., 2003). Maffei et al.,(2001)

and da Costa et al., also reported similar associations. According to Whitaker et al., (1997), the risk of overweight increases considerably if one or both parents were overweight. Having a parent who was perceived to be fat was associated with a higher odds ratio (1.36) compared to other fat relatives even though this was not statistically significant. However in this study, after adjusting for the other variables, the association was no longer significant.

Childhood overweight is associated with overweight in adolescence and adulthood. Devlin (1997) explains that once obesity develops before puberty, fat cells may increase in number during adolescence or merely swell up as they become filled with fats (triacylglycerols). This means that once an individual is overweight during childhood, there is an increased risk of him/her becoming overweight as he grows up. Being thin or normal weight before age 10 years were found to be protective against overweight in this study, however these associations were not significant.

Sedentary lifestyle, either from lack of exercise or from physical inactivity from watching television or sitting behind the computer for long hours was associated with overweight. There was no significant association between the physical activity, duration of exercising, watching television for ≥ 4 hours and overweight, though viewing television for fewer hours and participating in physical activity in school (during PE) were found to be protective. The results of analysis of surveys by Dietz and Gortmaker, (1985) found that adiposity and the amount of time spent watching television were significantly associated in adolescents. However it is difficult to say what the sequence of events really is- long

hours watching television leading to physical inactivity and overweight or overweight leading to less physical activity, and more time watching television. Lack of physical activity has also been determined as a risk factor for overweight (Kruger et al.,2006)

The study showed a positive association between the number of meals taken in a day (as well as snacks consumed) and overweight. This is in contrast to several studies where meal frequency and body weight were inversely related (Taylor and Garrow, 2001 and Bellisle et al ,1997). The variation may be due to the actual composition of the food consumed as it was observed, from a 24 hour dietary recall during the interviews that, the diets were mostly unbalanced, high in carbohydrate and fat and deficient in vegetables.

All the students patronized at least one of the “junk” foods listed in the questionnaire (Appendix 2). Frequent intake (explained as > 3 times a week) was not significantly associated with overweight though the OR was 1.35. These foods are usually high in fat and have increased energy density. Physiological effects of energy dense, high fat foods, when combined with a heightened responsiveness to such foods or a given tendency for disinhibited eating, creates ideal nutritional conditions for excessive intake and poor weight control (Mela,1996). In the US, during the period 1971-2000, obesity rates increased from 14.5% to 30.9% and with this increase, were increase in the average consumption of calories. Most of these extra calories came from an increase in carbohydrate and fat diets (Flegal et al, 2002 and Wright et al, 2004). In this study, frequent consumption of “junk” foods was the most important factor associated with overweight.

Underweight was found to be associated (though not significantly) with sex with males being more likely to be underweight compared to females.

Other significant associations were; being thin before the age of 10 years, belonging to low SES and taking at most 2 snacks a day.

Limitations of the study are as follows;

- The two schools selected were both day schools hence the results may not be generalizable to all senior high school students.
- Though attempts were made to limit recall period as in the 24 hour dietary recall, students had to recall their size before the age of 10 years and this could have introduced some bias.
- Third year students were not included in the study because they had started their vacation after completing their final examination, hence the situation in that group of students could not be described.
- The sample size could have been increased, by screening more students, to improve the power of the study. However, because of limited resources, this could not be done.
- Like most case control studies, the study was unable to predict causality but only able to detect associations.

CHAPTER SIX

CONCLUSIONS

Out of the total of 1133 students, 545 males and 588 females were examined, 97 (8.6%) were overweight with 14 (1.2%) being obese, 821 (72.5%) were normal weight and 215 (19%) were underweight.

The study showed that there were associations between overweight and low and middle socioeconomic status, parental obesity, perception of overweight before the age of 10 years, and watching television for more than 4 hours a day and being related to an overweight person but sex was most significantly associated with overweight with females being 7 times more likely to become overweight.

Incidental findings included a prevalence of underweight of 19% and associations between underweight and low and middle socioeconomic status, parental obesity, perception of self before the age of 10 years. Further research is needed to be able to make conclusions on the risk factors for underweight in this age group. Research covering a wider age group (children and adults) is also needed

RECOMMENDATIONS

These results show that there is the need to encourage children to be more physically active. It is not enough for schools to include Physical Education in their curriculum without ensuring that students actually participate in these activities. Aside from the social clubs being formed on regular basis in schools, keep fit clubs should be instituted in these schools to encourage regular exercising.

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

School authorities need to regulate the foods being sold by vendors on their premises.

Health policies should be directed at ensuring that adolescents and young adults are healthy. This is a way of ensuring that the future workforce of the nation would be alive, healthy and not pose a financial burden on the nation.

School health programmes should be given the needed support and all schools must be mandated to provide school health services based on appropriate guidelines.

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APPENDICES

APPENDIX 1

CONSENT FORM FOR RESEARCH ON OVERWEIGHT AND OBESITY AMONG SENIOR HIGH SCHOOLS IN THE ACCRA METROPOLIS

I am NANA AYEGUA HAGAN SENEADZA, a student of the School of Public Health, University of Ghana. As part of the requirements for the award of the Master of Public Health, I am conducting a research on overweight and obesity among senior high school students. The objective is to study the risk factors for overweight and obesity among the senior high school students. If you agree to be a part of this study, I would ask you a few questions about yourself and your family and then measure your weight and height. These measurements will not be invasive. Any information given will be treated with the utmost confidentiality.

Your participation is voluntary and you are free to end the interview or measurement process at any time without any consequences.

I will be happy to answer any questions or concerns pertaining to the research.

Thank you.

I ----- after understanding the purpose of the study, agree to participate.

Signature / thumbprint of respondent: -----

Date of interview: -----

Signature of interviewer -----

APPENDIX 2

**QUESTIONNAIRE ON OVERWEIGHT AND OBESITY AMONG SENIOR
HIGH SCHOOL STUDENTS IN THE ACCRA METROPOLIS**

INTRODUCTION

Good morning! I am Nana Ayegua Hagan Seneadza, a student of the School of Public Health, University of Ghana. As part of the requirements for the award of the Master of Public Health, I am conducting a research on overweight and obesity among Senior High School students. If you agree to be a part of this study, I would ask you a few questions and then measure your weight and height

Your participation is voluntary and you are free to end the interview or measurement process at any time. However I would appreciate it if you participated in the study to contribute to existing knowledge on adolescent issues.

Questionnaire number:

Name of interviewer:

Date of interview:

SOCIO-DEMOGRAPHIC CHARACTERISTICS

NO.	QUESTION	RESPONSE	VARIABLE
Q1	Date of birth	____/____/____ Date/month/year	Q1age
Q2	Sex:	1- Male <input type="checkbox"/> 2- Female <input type="checkbox"/>	Q2sex
Q3	Level of Education:	1-SSS1 2-SSS2 3-SSS3 <input type="checkbox"/>	Q3ledu
Q4.	Ethnicity:	1- Ga 2- Ewe 3- Akan <input type="checkbox"/> 4- Others (Specify)	Q4ethnic
Q5.	Name of School:	Q5sch
Q6.	Residential status of student:	1- Boarding <input type="checkbox"/> 2- Day	Q6res
Q7.	How much school fees do your parents/guardians pay per term?	1-<200cedis/term 2-200-400cedis/term <input type="checkbox"/> 3->400cedis/term	Q7fees
Q8.	Where do you normally live during vacation?	Region _____ Suburb _____	Q8place

POTENTIAL RISK FACTOR ASSESSMENT			
NO.	QUESTION	CODE	VARIABLE
SOCIO-ECONOMIC STATUS OF PARENTS/GUARDIANS			
Q9.	Father's (highest) Level of Education	1-Primary 2-JSS/Middle School <input type="checkbox"/> 3-Secondary 4-Tertiary 5-none	Q9fledu
Q10.	Father's Occupation:	Main..... Subsidiary(if any).....	Q10focc
Q11.	Mother's (highest) Level of Education:	1-Primary 2-JSS/Middle School <input type="checkbox"/> 3-Secondary 4-Tertiary 5-none	Q11mledu
Q12.	Mother's Occupation	Main..... Subsidiary(if any).....	Q12mocc
Q13.	Guardian's (highest) Level of Education. (Fill Q13 and Q14 only if you are not living with your biological parents)	1-Primary 2-JSS/Middle School <input type="checkbox"/> 3-Secondary 4-Tertiary 5-none	Q13gledu
Q14.	Guardian's Occupation	Main..... Subsidiary(if any).....	Q14gocc
Q15.	Type of residence	1-owned by parents 2- family house <input type="checkbox"/> 3- rented 4-other(please specify)	Q15restyp
Q16.	Do your parents own any of the following? (select item only if it is functioning)	1- electric iron [] 2- refrigerator [] 3- television [] 4- DVD player/ video deck [] 5- personal computer[] 6- electric/gas stove [] 7- generator [] 8- vehicle [] Please specify number _	Q16items
FAMILIAL/GENETIC			
Q17.	Do you have a close relative (parent or sibling) whom you perceive as being 'fat'	1- Yes 2- No <input type="checkbox"/>	Q17rel

Q18.	If yes, to question 17, please state the relationship	Q18Trel
Q19.	How do you perceive yourself before the age of 10 years (compared to most children at that age)	1-thin 2-normal <input type="checkbox"/> 3-fat	Q19self
PHYSICAL ACTIVITY			
Q20.	Do you consciously engage in any physical activity	1-Yes 2-No <input type="checkbox"/>	Q20phys
Q21.	If yes to Q20, state what type of activity you engage in.	_____	Q21type
Q22.	If yes to Q20, how long do you engage in the physical activity above in a day?	1- <30minutes 2- 30-60 minutes <input type="checkbox"/> 3- >1-2 hours 4- >2 hours	Q22walk
Q23.	How many hours do you spend watching TV in a day (during vacation)?	1- <1hour 2- 1-4hours <input type="checkbox"/> 3- >4hours	Q23tv
Q24.	Is physical education part of your school's curriculum?	1-Yes 2-No <input type="checkbox"/>	Q24pe
Q25.	If yes to question 24, please specify the activities:	Q25PA
DIETARY HABITS			
Q26.	How many main meals do you eat in a day?	1-one 2-two 3-three <input type="checkbox"/> 4-more than 3 times	Q26times
Q27	How many times do you eat snacks in a day?	1-one 2-two 3-three <input type="checkbox"/> 4-more than 3 times	Q27snack
Q28.	What did you eat in the past 24 hours? (Please list including fruits and vegetables)	Breakfast..... Lunch..... Supper..... Snacks..... Others.....	Q28diet
Q29.	Do you patronise the any following foods? Please tick as appropriate	1- fried rice [] 2- fried chicken [] 3- burger [] 4- potato chips [] 5- pizza [] 6- fried turkey tail []	Q29junk
Q30.	How often do patronise these foods (in Q29)	1- rarely 2- often <input type="checkbox"/> 3- very often	Q30freq

ANTHROPOMETRIC MEASUREMENTS

Question	Measurement	1	2	mean
Q31.	Weight/kg			
Q32.	Height/m			

BMI _____

APPENDIX 3

SOCIOECONOMIC STATUS ASSESSMENT

VARIABLE	GRADE POINTS
Parents/Guardian’s level of education	
None	0
Primary	1
JSS/Middle School	2
Secondary	3
Tertiary	4
Parents/Guardian’s occupation	
High income jobs (eg. Lecturer, Doctors, Bank Managers)	3
Middle income jobs (eg civil servants, traders)	2
Low income jobs (eg labourers)	1
Unemployed	0
Type of Residence	
Owned by parents	5
Family house	3
Rented	2
Others (owned by family friends)	1

Other evidence of wealth

Electric iron	1
DVD player/ video deck	1
Refrigerator	2
Television	2
Electric /gas cooker	2
Personal computer	4
Generator	4
Vehicle	6

For those who had more than one of the items, the grade point for the particular item was multiplied by the number. A minimum of 11 points and a maximum of 59 points were obtained.

Subjects who had points below the 25th percentile were categorized as being of low SES, between 25th and 50th percentile as middle SES and above 75th percentile as high SES

APPENDIX 4

2007 WHO reference table for BMI-for-age BOYS 10-19 years (percentiles)

BMI-for-age BOYS						
10 to 19 years (percentiles)						
Year: Month	Months	3rd	15th	Median	85th	97th
10: 1	121	13.9	14.9	16.5	18.6	21.1
10: 2	122	13.9	14.9	16.5	18.7	21.1
10: 3	123	13.9	15.0	16.6	18.7	21.2
10: 4	124	14.0	15.0	16.6	18.8	21.3
10: 5	125	14.0	15.0	16.6	18.8	21.4
10: 6	126	14.0	15.1	16.7	18.9	21.5
10: 7	127	14.0	15.1	16.7	19.0	21.6
10: 8	128	14.1	15.1	16.8	19.0	21.6
10: 9	129	14.1	15.2	16.8	19.1	21.7
10: 10	130	14.1	15.2	16.9	19.1	21.8
10: 11	131	14.2	15.2	16.9	19.2	21.9
11: 0	132	14.2	15.3	16.9	19.3	22.0
11: 1	133	14.2	15.3	17.0	19.3	22.1
11: 2	134	14.3	15.3	17.0	19.4	22.2
11: 3	135	14.3	15.4	17.1	19.4	22.2

11: 4	136	14.3	15.4	17.1	19.5	22.3
11: 5	137	14.4	15.4	17.2	19.6	22.4
11: 6	138	14.4	15.5	17.2	19.6	22.5
11: 7	139	14.4	15.5	17.3	19.7	22.6
11: 8	140	14.5	15.6	17.3	19.8	22.7
11: 9	141	14.5	15.6	17.4	19.8	22.8
11: 10	142	14.5	15.6	17.4	19.9	22.9
11: 11	143	14.6	15.7	17.5	20.0	23.0
12: 0	144	14.6	15.7	17.5	20.1	23.1
12: 1	145	14.6	15.8	17.6	20.1	23.1
12: 2	146	14.7	15.8	17.6	20.2	23.2
12: 3	147	14.7	15.9	17.7	20.3	23.3
12: 4	148	14.8	15.9	17.8	20.3	23.4
12: 5	149	14.8	16.0	17.8	20.4	23.5
12: 6	150	14.8	16.0	17.9	20.5	23.6

BMI-for-age BOYS						
10 to 19 years (percentiles)						
Year: Month	Months	3rd	15th	Median	85th	97th
12: 7	151	14.9	16.1	17.9	20.6	23.7
12: 8	152	14.9	16.1	18.0	20.6	23.8
12: 9	153	15.0	16.2	18.0	20.7	23.9
12: 10	154	15.0	16.2	18.1	20.8	24.0
12: 11	155	15.0	16.3	18.2	20.9	24.1
13: 0	156	15.1	16.3	18.2	20.9	24.2
13: 1	157	15.1	16.4	18.3	21.0	24.3
13: 2	158	15.2	16.4	18.4	21.1	24.4
13: 3	159	15.2	16.5	18.4	21.2	24.5
13: 4	160	15.3	16.5	18.5	21.3	24.6
13: 5	161	15.3	16.6	18.6	21.3	24.7
13: 6	162	15.4	16.6	18.6	21.4	24.8
13: 7	163	15.4	16.7	18.7	21.5	24.9
13: 8	164	15.5	16.7	18.7	21.6	24.9
13: 9	165	15.5	16.8	18.8	21.7	25.0
13: 10	166	15.5	16.8	18.9	21.7	25.1
13: 11	167	15.6	16.9	18.9	21.8	25.2
14: 0	168	15.6	16.9	19.0	21.9	25.3

14: 1	169	15.7	17.0	19.1	22.0	25.4
14: 2	170	15.7	17.0	19.1	22.0	25.5
14: 3	171	15.8	17.1	19.2	22.1	25.6
14: 4	172	15.8	17.2	19.3	22.2	25.7
14: 5	173	15.9	17.2	19.3	22.3	25.8
14: 6	174	15.9	17.3	19.4	22.4	25.8
14: 7	175	16.0	17.3	19.5	22.4	25.9
14: 8	176	16.0	17.4	19.5	22.5	26.0
14: 9	177	16.1	17.4	19.6	22.6	26.1
14: 10	178	16.1	17.5	19.6	22.7	26.2
14: 11	179	16.1	17.5	19.7	22.7	26.3
15: 0	180	16.2	17.6	19.8	22.8	26.4

BMI-for-age BOYS						
10 to 19 years (percentiles)						
Year: Month	Months	3rd	15th	Median	85th	97th
15: 1	181	16.2	17.6	19.8	22.9	26.4
15: 2	182	16.3	17.7	19.9	23.0	26.5
15: 3	183	16.3	17.7	20.0	23.0	26.6
15: 4	184	16.4	17.8	20.0	23.1	26.7
15: 5	185	16.4	17.8	20.1	23.2	26.7
15: 6	186	16.4	17.9	20.1	23.2	26.8
15: 7	187	16.5	17.9	20.2	23.3	26.9
15: 8	188	16.5	18.0	20.3	23.4	27.0
15: 9	189	16.6	18.0	20.3	23.5	27.0
15: 10	190	16.6	18.1	20.4	23.5	27.1
15: 11	191	16.7	18.1	20.4	23.6	27.2
16: 0	192	16.7	18.2	20.5	23.7	27.3
16: 1	193	16.7	18.2	20.6	23.7	27.3
16: 2	194	16.8	18.3	20.6	23.8	27.4
16: 3	195	16.8	18.3	20.7	23.9	27.5
16: 4	196	16.8	18.4	20.7	23.9	27.5
16: 5	197	16.9	18.4	20.8	24.0	27.6
16: 6	198	16.9	18.5	20.8	24.0	27.7

16: 7	199	17.0	18.5	20.9	24.1	27.7
16: 8	200	17.0	18.5	20.9	24.2	27.8
16: 9	201	17.0	18.6	21.0	24.2	27.8
16: 10	202	17.1	18.6	21.0	24.3	27.9
16: 11	203	17.1	18.7	21.1	24.3	28.0
17: 0	204	17.1	18.7	21.1	24.4	28.0
17: 1	205	17.2	18.7	21.2	24.5	28.1
17: 2	206	17.2	18.8	21.2	24.5	28.1
17: 3	207	17.2	18.8	21.3	24.6	28.2
17: 4	208	17.3	18.9	21.3	24.6	28.2
17: 5	209	17.3	18.9	21.4	24.7	28.3
17: 6	210	17.3	18.9	21.4	24.7	28.4

BMI-for-age BOYS						
10 to 19 years (percentiles)						
Year: Month	Months	3rd	15th	Median	85th	97th
17: 7	211	17.4	19.0	21.5	24.8	28.4
17: 8	212	17.4	19.0	21.5	24.8	28.5
17: 9	213	17.4	19.1	21.6	24.9	28.5
17: 10	214	17.4	19.1	21.6	24.9	28.6
17: 11	215	17.5	19.1	21.7	25.0	28.6
18: 0	216	17.5	19.2	21.7	25.0	28.6
18: 1	217	17.5	19.2	21.8	25.1	28.7
18: 2	218	17.5	19.2	21.8	25.1	28.7
18: 3	219	17.6	19.3	21.8	25.2	28.8
18: 4	220	17.6	19.3	21.9	25.2	28.8
18: 5	221	17.6	19.3	21.9	25.3	28.9
18: 6	222	17.6	19.4	22.0	25.3	28.9
18: 7	223	17.7	19.4	22.0	25.4	29.0
18: 8	224	17.7	19.4	22.0	25.4	29.0
18: 9	225	17.7	19.5	22.1	25.5	29.0
18: 10	226	17.7	19.5	22.1	25.5	29.1
18: 11	227	17.8	19.5	22.2	25.5	29.1
19: 0	228	17.8	19.5	22.2	25.6	29.1

Appendix 5

A map of the Accra Metropolitan Area showing the submetros

