

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

**DETERMINANTS OF OBESITY AMONG BASIC SCHOOL PUPILS  
IN THE GA-EAST MUNICIPALITY**



**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA,  
LEGON IN FULFILMENT OF THE REQUIREMENT FOR THE  
AWARD OF PhD PUBLIC HEALTH DEGREE**

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## DECLARATION

I hereby declare that this thesis is the product of my original independent research conducted in the Ga-East Municipality under the supervision of Professor Richard M.K. Adanu, Dr. Richmond Aryeetey and Dr. Amos K. Laar. I affirm that this work has neither been published in whole or in part to any institution for any academic award. All references made to other researchers' work have been duly acknowledged.

-----  
Deda Ogum Alangea

PhD candidate

-----  
Date

-----  
Professor Richard M.K. Adanu

Principal Supervisor

-----  
Date

-----  
Dr. Richmond Aryeetey

Supervisor

-----  
Date

-----  
Dr. Amos K. Laar

Supervisor

-----  
Date

## ABSTRACT

**Background:** Overweight and obesity among children is a major public health concern globally. Childhood obesity is likely to persist into adulthood. Little is known about the prevalence and determinants of overweight and obesity among school-age children in Ghana. Knowing the determinants of overweight/obesity among basic school pupils is important for obesity intervention design.

**Objective:** To determine overweight and obesity prevalence and its risk factors among basic school pupils in the Ga-East Municipality of Ghana.

**Methods:** A cross-sectional study involving 24 private and public basic schools in the Ga-East Municipality; 487 pupils aged 9 - 15 years and 340 parents. Data collection involved interviews with pupils, parents and head teachers, a school environmental scan and an audit of school feeding and physical activity facilities. Dietary data was collected using a one-time 24 – hour meal recall and a 7–day Food Frequency assessment. Body weight and height of pupils and their parents were measured. Physical activity level of pupils was determined using the physical activity questionnaire for children. Associations between home and school food environments and child BMI and overweight status were tested using linear and logistic regressions respectively.

**Results:** Total overweight prevalence among basic school pupils in the Ga-East Municipality was 17.7%; 8% were obese. Overweight prevalence among parents was 59.2%. Frequency of beverage consumption ( $p<0.01$ ), least physical activity level ( $p<0.01$ ) and being in the middle household wealth tertile ( $p=0.03$ ) significantly predicted higher child BMI after controlling for parental BMI, age, sex, and calories consumed.

None of the schools assessed had a written policy on eating at school and physical activity of pupils. Over 77% of all pupil purchases made during break time were from within the school compound. Foods associated with obesity formed 46.6% of all purchases. Schools which highly promoted healthier food options had over 5 times increased odds of child overweight [AOR=5.55; 95% CI = 1.430 – 21.511, p=0.013] than schools that least promoted. Schools' exerting moderate control over the food options available to pupils compared to those who had least control had 84.3% reduced odds of having overweight pupils. Parental use of snacks and sweetened drinks as reward from the least to the moderate category was associated with reduced odds of child overweight (AOR = 0.282, 95% CI = 0.105 – 0.759, p<0.05). High provision of a supporting environment for physical activity (open spaces, sports field) in a school was associated with an 80.2% reduced likelihood of pupils being overweight compared to the least provision.

**Conclusions:** The school and home environments have significant influences on child weight status beyond the individual child behavioural and background factors. The school environment offers an opportunity to reach a large child population and changes made to improve physical activity and access to healthy food can have positive impacts on child weight status.

## DEDICATION

I dedicate this work to our father in heaven for His unending love and sustenance; and to my husband, Duncan Alangea, and daughter, Danielle Wewura Alangea for their patience and endurance.



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## **LIST OF ABBREVIATIONS**

BMA - Body Mass Index for age- and –sex z-score

BMI – Body Mass Index

CDC – Center for Disease Control and Prevention

CERSGIS - Center for Remote Sensing and Geographic Information Systems

DD – Dietary Diversity

DHS – Demographic and Health Survey

UNICEF – United Nations International Children's Emergency Fund

UNESCO - United Nations Educational, Scientific and Cultural Organization

GHS – Ghana Health Services

HRFE – Healthy Retail Food Environment

IOTF – International Obesity Task Force

LMICs – Low and Middle Income Countries

MICS - Multiple Indicator Cluster Survey

MVPA – Moderate-to-Vigorous- Physical Activity

NCD – Non-communicable Disease

PAQ-C – Physical Activity Questionnaire for children

PE – Physical Education

SES – Socio-economic status

SHEP – School Health Education Programme

SSB - Sugar-sweetened Beverage

USDA – United States Department of Agriculture

WHO – World Health Organisation

## DEFINITION OF TERMS

For the purposes of this research, the following operational definitions were used.

**Sugar-sweetened beverages:** drinks with added sugar including: non-diet soft drinks/sodas, flavored juice drinks, sports drinks, sweetened tea, coffee drinks, energy drinks, locally made malted and spicy drinks.

**Soft drinks:** refer to carbonated sugar-sweetened flavoured drinks.

**Snacks:** refer to foods that are flour or dough-based, cookies, cakes and pastries, crackers/ biscuits, chips or crisps.

**School physical activity environment:** refers to the summation of the policies, practices and facilities related to physical activity and education in school.

**School food environment:** refers to the summation of food-related policies, practices and facilities in schools.

**Home food environment:** refers to food-related practices in the home such as frequency of family eating out; child-feeding behaviour of parents including pressure on child to eat, the storage, provision, and availability snacks and drinks in home, as well as parental modeling drinks and snacks consumption to children.

**Mother:** an adult female serving as a parent to the child; may be biologically or non-biologically related.

**Father:** an adult male serving as a parent to the child; may be biologically or non-biologically related.

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## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

Overweight and obesity among children is a major public health concern globally. In 2010, the WHO estimated that over 42 million children under 5 years worldwide were overweight and close to 35 million of these lived in developing countries (de Onis et al., 2010). Also, about 10% of the world's school-age children were overweight with about 2 – 3% of them obese. North America and some European countries have the highest prevalence with a global average greater than 20% whereas Africa and Asia regions have less than a 10% average estimate (Wang and Lobstein, 2006). Although there is limited data on weight status of school-age children in the sub-Saharan Africa region, a prevalence of 8.5% estimated for pre-schoolers in 2010 is expected to rise to 12.7 by 2020 (de Onis et al., 2010).

Nationally representative data on early childhood overweight and obesity in Ghana have been collected by the demographic and health surveys which reported overweight prevalence increases from 0.7% in 1987 to 5% in 2008 (GSS et al., 2009). Among school age children, pilot studies in Accra reported overweight and obesity prevalence of over 12% and 5% respectively among private school children (Goh, 2006, Aduama, 2004). Also, a more recent survey of school-age children sampled from schools in the two largest cities of Ghana (Accra and Kumasi) estimated a total overweight and obesity prevalence of 15% (Ghana School Survey, 2012).

Overweight and obesity among children is a public concern because it is likely to persist into adulthood (Hauner, 2004, Johnson-Taylor and Everhart, 2006, Wang and Lobstein, 2006, Olshansky et al., 2005).

Childhood obesity affects physical health and well-being conferring both short and long-term health consequences including: increased risk for cardiovascular disease (such as high cholesterol, hypertension, dyslipidaemia); impaired glucose tolerance, insulin resistance and type 2 diabetes and the metabolic syndrome (Stephen R. Daniels et al., 2005; J. J. Reilly & Kelly, 2010; Whitlock, Williams, Gold, Smith, & Shipman, 2005); increasing the risk of orthopaedic problems (Taylor et al., 2006); and adverse effects on mental health (Carter and Swinburn, 2004, Reilly et al., 2003). In particular, childhood obesity has been linked to lower self-reported quality of life and social marginalisation from peers (Schwimmer et al., 2003, Strauss and Pollack, 2003). There is evidence of a long term increase in morbidity and mortality among adults who were obese during adolescence (Biro and Wien, 2010, Adams et al., 2006, Reilly and Kelly, 2010).

Overweight is the result of excessive accumulation of fat or adipose tissue to an extent that it impairs health (World Health Organization, 2013). It is generally agreed that overweight results when there is positive caloric intake over expenditure (Schoeller, 2009). Energy balance is influenced by genetic, physiologic and environmental factors. Although genetic factors affect individual disposition to being overweight, rising prevalence rates among genetically stable populations suggests that a combination of behavioural, environmental, social and perinatal factors underlie the contemporary obesity epidemic (Ebbeling et al., 2002). Risk factors associated with childhood overweight/obesity are parent obesity status, prenatal over-nutrition, rapid weight gain,

inadequate physical activity, sedentary lifestyle, and inappropriate dietary choices (including diets high in simple sugars and fat) and habits (Kubik et al., 2009, Kubik et al., 2005a, Neumark-Sztainer, 2005, Lillico et al., 2014).

The rapid rise in obesity prevalence worldwide has also been linked with the so-called nutrition transition characterized by modifications in dietary practices resulting from environmental and social shifts encompassing economic changes, urbanization and globalization (Hill et al., 2003, Popkin, 2004). These environmental changes are associated with limited opportunities for physical activity, occurring simultaneously with increased availability and access to energy-dense foods which are marketed at cheaper prices, obtained at convenient locations and served in larger portions (Schmitz and Jeffery, 2002, Johnson-Taylor and Everhart, 2006, Binkley et al., 2000, Ello-Martin et al., 2005). The resultant dietary transitions have been distinguished from the pre-historic era during which plant-based higher fibre diets were more commonly consumed. At the peak of the transition, populations typically are exposed to the so-called 'Western diet' characterized by energy-dense, high fat, high sodium and low fibre foods (Food and Agriculture Organisation, 2013, Popkin and Nielsen, 2003).

The concept of the food environment has been used to characterise the changes in food systems at community and regional levels. The food environment involves sources of food energy and nutrients and the circumstances surrounding their procurement and consumption (Holsten, 2009). Thus, a characterisation of the food environment has been used to demonstrate effects of the environment on weight status and health outcomes of populations. The food environment of children has been of great concern to researchers because children exercise much less control over their environment (compared to adults),

and what they eat is strongly influenced particularly by their home and school environments (Edwards, 2010).

The school food environments is also subject to global changes in the food supply and nutrition situation. Similar factors driving the obesity epidemic in developed countries have been associated with overweight and obesity among school children and adolescents including: clustering of fast food outlets at locations close to schools, vending machines selling sugar-sweetened beverages and other energy-dense foods (Day and Pearce, 2011, Arcan et al., 2009); school food practices such as using food as rewards and classroom fundraising, allowing food in school hallways (Kubik et al., 2009, Kubik et al., 2005a, Neumark-Sztainer, 2005) and limited opportunities for physical activity in school. Environments having the above-mentioned characteristics have been described as ‘obesogenic’. An obesogenic environment has been defined as, ‘the sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals or populations’(Swinburn et al., 1999). Since obesity is an outcome of the interaction between environmental influences and genetics, many authors have strongly advocated that successful interventions to control obesity should address factors in the wider obesogenic environment for success (Egger and Swinburn, 1997, Lobstein, 2005, Carter and Swinburn, 2004, Dianna et al., 2013, Johnson-Taylor and Everhart, 2006). For this reason, schools have been identified as one of the most important settings for promoting child health (Story et al., 2009). Healthy eating and regular physical activity in the school system are considered essential components of an environmentally friendly school setting. Evidence on the physical activity environments in Ghanaian basic schools

is lacking; Amo-Addae (2004) reports that the majority of basic school pupils (90%) make food purchases within the school compound.

This study therefore seeks to provide data on the prevalence of overweight and obesity among basic school pupils and its determinants at the individual, home and school levels.

## **1. 2 Problem statement**

School-age children in Ghana spend most of their day in school for nearly 12 years of their childhood, and consume up to about 50% of total daily calories in school (Gleason and Sutor, 2001). However, little is known about how the school environment influences children's diets and risk of overweight in Ghana. Also little is known of the types and levels of 'obesogenic' exposures within the school environment regarding types of food offered by school or by vendors in and around schools, as well as opportunities for physical activity.

Meanwhile, obesity rates in children in Ghana are increasing based on demographic and health survey data. Pilot studies in Accra reported about 12% prevalence of overweight among basic school pupils attending private schools (Aduama, 2004, Goh, 2006). More recently, the Ghana School Survey (2012) also reported 15% prevalence of overweight among school-age children from selected schools in Accra and Kumasi. Existing evidence on ecological determinants of childhood obesity have been conducted in developed countries (van der Horst et al., 2007, Kumanyika and K., 2008). While these are useful in predicting general outcomes related to policy and physical facilities within schools and communities in low income settings, they are inadequate in explaining the unique experiences of LMICs<sup>1</sup>. The relationship between populations' behaviour and

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<sup>1</sup> LMICs – Low and Medium Income Countries

developmentally-linked environmental attributes present in LMICs may have intermediary factors dictated by the different socio-cultural contexts that may be alien to developed or high income countries. For example, fast foods are accessible outside of ‘registered multi—chain fast-food joints or restaurants’ in Ghana. Hence, data on location and density of fast-food establishments will be inadequate in explaining consumptions. Furthermore, nutritional status of school-age children in Ghana is less well known as compared to children under five years old.

### **1.3 Conceptual framework**

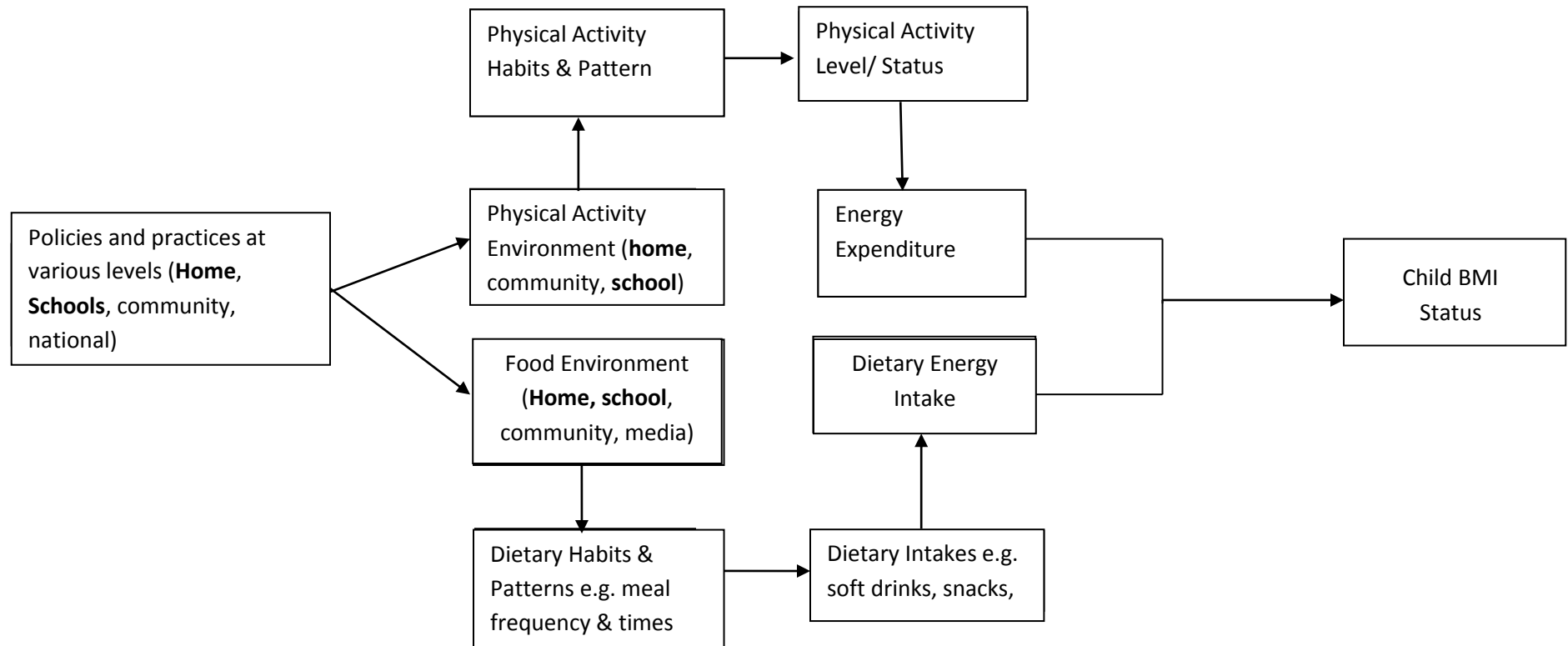
The conceptual framework for this study is an adaptation of the framework used by the United States Department of Agriculture (USDA) Food and Nutrition Service in ‘selecting Policy Indicators and Developing Simulation Models for the National School Lunch and Breakfast Programs, June, 2010’.

#### **1.3.1 Context of conceptual framework for the study**

School policies and practices have direct influence over the physical activity and food environments in the school. Physical activity and food environments also influence the physical activity patterns and habits, as well as the dietary patterns and habits of pupils in the school. Physical activity patterns and habits translate into the physical activity levels or status which impacts the total energy expenditure of pupils (Reilly et al., 2004). Dietary habits and patterns also reflect in the actual intakes of foods which contribute to the total dietary energy intakes of pupils. The resulting BMI status of pupils will be dependent on the balance between energy intakes and energy expenditure of individuals via metabolism. A positive energy balance increases BMI, a perfect energy balance maintains BMI, and a negative energy balance decreases BMI over time.

Home food environment characteristics such as: parental pressure-to-eat, provision of snacks and sweetened drinks for pupils, and parental consumption (modelling) of snack and soft drink consumption are likely to influence intakes of pupils and BMI status in effect.

Figure 1.1 Conceptual framework



Adapted from: U.S. Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis

Reference: Lisa Dragoset, Anne Gordon and Joseph F. Robare. (2010). *Selecting Policy Indicators and Developing Simulation Models For the National School Lunch and Breakfast Programs* VA: June 2010.

### 1.3.2 Description of framework components

Components of the framework shown in Figure 1.1 are:

1. Policies and practices at home and school (school: policies at school regarding feeding and physical activity of pupils- kinds of food allowed or prohibited for sale to pupils, guidelines governing physical activity and physical education (PE) in the school. Home: attitudes and practices related to access to snacks and sweetened drinks by children).
2. Physical activity environment in the School (a combination of policies and facilities for physical activity: physical education practice, duration of PE lessons, availability of sports facility and open spaces for play).
3. Food environment in the school and Home (a combination of policies and facilities that affect the circumstances under which food is procured or eaten during school hours: Types of foods offered for sale, density and type of food vendors, canteen services, facility for eating and hand washing) and home (feeding style, availability of snacks and sweetened drinks and parental modeling of soft drink and snack consumption).
4. Physical activity Habits and Pattern of pupil (physical activity level during school hours, after school hours, evenings, and weekends, participation in sporting activities, doing household chores, time spent on sedentary leisure activities).
5. Dietary Habits and Patterns of pupil (consumption of breakfast, lunch, supper, snacks, meal frequency and amount, choices of foods from various food groups- dietary diversity).
6. Physical activity status of pupil (physically inactive, low physical activity, moderate and high physical activity- which translates into actual energy expenditure of pupil).

7. Dietary intakes of Pupil (actual intakes of macro & micro nutrients from foods – which translates into energy and nutrient intakes).

#### **1.4 Study Justification**

Currently, NCDs account for 39% of all deaths in Ghana with a steady rise in all behavioural and metabolic risk factors such as overweight, obesity, raised cholesterol, raised blood glucose, raised blood pressure and physical inactivity (World Health Organization, 2011). This raises grave public health concerns as a rapid surge in NCDs will impose serious financial and healthcare challenges to the nation. Since physical inactivity and unhealthy diets are major risk factors for the development of NCDs, understanding the epidemiological distribution of these risk factors, as well as identifying their environmental determinants, will help improve preventive measures and in the design of public health interventions for reducing NCDs.

Presently in Ghana, children under 15 years form 38.3% of Ghana's population (Ghana Statistical Service, 2012). The rapid growth that characterizes this age group (9-15 years), the early onset of puberty (Opare-Addo et al., 2012) and the sharp decline in physical activity in young adolescents coupled with worsening nutritional habits put them at increased risk for overweight and obesity (Nader et al., 2008, Ilich and Brownbill, 2010). Childhood obesity is known to track into adulthood, and therefore is a major threat to the health of the nation. Identifying determinants of overweight among children is a key step towards prevention of a present and future epidemic among the nation's human resource. The National Policy for the Prevention and Control of NCDs in 2011 (M.O.H., 2012) targets school children as well as other categories of the Ghanaian population. However, there is presently no systematic data collected on nutritional status of school-age children

except that collected by the global school health survey for pupils 13 – 15years old. This study will therefore fill the gap related to absence of data on the prevalence and determinants of overweight among school-age children. Specifically, it will provide evidence on the present state of the school environment with respect to policies and facilities for feeding and physical activity of pupils. This should inform stakeholders and guide policy approaches to the implementation of health strategies at the basic school level.

Additionally, this work will provide evidence of environmental influences on childhood obesity in Ghanaian basic schools which should enable policy makers predict the impact (or otherwise) of the populations obesity following changes in these constructs (Edwards, 2010). The study will generate evidence on what basic school pupils eat or the types of food available to them in school. This information will guide stakeholders in the formulation of school policies related to eating and physical activity of pupils as part of the School Health Education Programme (SHEP).

The few studies that assessed overweight status of school-age children in Ghana have been conducted in the major cities since obesity is known to be common in urban areas (Ghana School Survey, 2012, Amidu et al., 2013, Goh, 2006, Abachingsa, 2001, Mohammed and Vuvor, 2012). The Ga-East Municipality was selected for this study because of its close proximity to the Accra Metropolis. This setting will provide data on less urbanised populations since it has both rural and peri-urban areas. The rapid urbanisation observed in Ghana since the mid-twentieth century (Yankson and Bertrand, 2012) in settlements surrounding the major cities nationwide, also predicts rapid lifestyle and nutrition transitions known to drive the obesity epidemic in developing countries

(Popkin et al., 2012). There is therefore the need to provide some district level data on overweight prevalence near the capital city to enable stakeholders make predictions at the national level when drafting future interventions for use outside of cities.

Generally, there is limited evidence on the prevalence of childhood overweight and its determinants in Sub-Saharan Africa and evidence from this work will add up to the body of knowledge.

## **1.5 Research Questions**

The following questions guided the study:

1. What is the prevalence of overweight and obesity among basic school pupils in the Ga-East municipal Area?
2. What are the school policies and practices that guide or influence what pupils eat at school? And if so, what actions do the policies suggest?
3. What are the types and energy density of foods frequently purchased by basic school pupils in the Ga-East Municipality?
4. Where do children purchase foods associated with obesity at school?
5. What are the individual and ecological risk factors for overweight and obesity among basic school pupils?

## **1.6 Objectives of the study**

### **1.6.1 General Objective**

To determine overweight prevalence and its risk factors among basic school pupils in the Ga- East Municipality

### **1.6.2 Specific objectives**

The specific objectives were to:

1. Determine overweight prevalence among basic school pupils aged 9 -15 years in the Ga- East Municipality
2. Assess school policies and practices relating to eating and physical activity in basic schools within the Ga- East Municipality
3. Characterize the type of foods frequently purchased by basic school pupils
4. Identify individual level risk factors associated with child BMI among basic school pupils
5. Identify environmental level determinants of overweight and obesity among basic school pupils

### **1.7 Hypotheses**

The following underlying hypotheses stated in the alternate form were tested under a given specific objective:

#### **OBJECTIVE 1:**

1. Pupils in private schools are more likely to be overweight/ obese than those in public schools
2. Girls are more likely to be overweight/ obese than boys
3. Pupils in the highest SES group are more likely to be overweight/ obese

#### **OBJECTIVE 4:**

1. Pupils with lower physical activity levels are more likely to be overweight/ obese
2. Pupils who eat a diverse diet are less likely to be overweight/ obese

**OBJECTIVE 5:**

1. Pupils in schools with healthier school food environments (i.e. higher Healthy Retail Food Environment (HRFE) score) are less likely to be overweight/ obese
2. Pupils in schools with better Physical activity environment are less likely to be overweight/ obese
3. Pupils from homes with healthier food environments are less likely to be overweight/ obese
4. Pupils who have overweight/ obese parents are more likely to be overweight/ obese.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter presents the relevant literature in relation to the study objectives. The following themes are covered:

- Description of the problem: childhood overweight and obesity
- Overweight and obesity burden in children
- Determinants of childhood overweight and obesity
- Assessment of child weight status
- Assessment of diet and physical activity in children
- Assessment of food and physical activity environments
- Interventions to control or prevent childhood obesity

#### **2.1 Description of the problem: Childhood overweight and obesity**

Childhood overweight and obesity is defined as an excessive accumulation of fat or adipose tissue to an extent that it impairs health (World Health Organization, 2013). Generally, obesity results when there is net positive caloric intakes over expenditure (Schoeller, 2009). While daily variations in energy balance emanates from diet and physical activity patterns (Hill, 2006), the cause of childhood overweight/obesity is multi-faceted and not just simply attributable to excessive caloric consumption and extremely low expenditure (Chung and Romney, 2012). Energy balance is influenced by genetic, physiologic, behavioral and socio-ecological factors (Dong et al., 2003, Institute of Medicine, 2006, Faith and Kral, 2006).

Childhood overweight and obesity is crucial because it is likely to track into adulthood (Wardle et al., 2006, Serdula et al., 1993), and it imposes significant health, psychosocial and economic costs (Cawley, 2010). Childhood obesity and overweight has both short and long-term health consequences including: increased risk for cardiovascular disease (eg. high cholesterol, hypertension, dyslipidemia); impaired glucose tolerance, insulin resistance and type 2 diabetes and the metabolic syndrome (Daniels et al., 2005, Whitlock et al., 2005, Reilly and Kelly, 2010); greater risk for bone and joint problems (Taylor et al., 2006); breathing problems and sleep apnea (Han et al., 2010). There is evidence of long-term impact on morbidity and premature mortality in adulthood (Reilly and Kelly, 2010, Biro and Wien, 2010). Obese children are also at risk for social and psychological problems such as stigmatization and poor self-esteem (Wardle and Cooke, 2005).

## **2.2 Overweight and Obesity burden in children**

Using the International Obesity Task Force (IOTF) criteria, it was estimated that in 2004, one in 10 children worldwide was overweight or obese (Lobstein et al., 2004); a total of 155 million, and about 43 million of these are aged 5-17 years. In the same report, about 22 million children under 5 years were also affected. The World Health Organization estimated in 2010 that over 43 million children under five years are overweight (WHO, 2010), indicating about a 100% increase over a 5-year period. Various studies have reported an increase in overweight/ obesity prevalence across both developed (Bua et al., 2007) and developing nations (De Onis and Blössner, 2000). Although there is limited data collected from children as compared to adults, the evidence is compelling enough that childhood obesity has become a global epidemic (Wang and Lobstein, 2006).

Childhood overweight prevalence varies considerably across various regions of the world and even within countries (urban-rural differences). The highest prevalence of childhood overweight (20-30%) were recorded in North America, Europe and parts of Western Pacific, whilst South-East Asia and Sub-Saharan Africa recorded lowest (< 6%) (Wang and Lobstein, 2006). In the United States, prevalence rates from (1980 – 2006) more than doubled (6.5% to 17%) among children aged 6-11 years and tripled among adolescents aged 12-19 years (from 5% to 17% ;(Ogden et al., 2008). A similar trend was reported for children in other high income countries including East Germany, New Zealand, Canada, Netherlands, Australia (Booth et al., 2007),Greece and Iceland (Wang and Lobstein, 2006).

The dramatic increase in obesity prevalence has been associated with industrialized countries and societies that are undergoing rapid socio-economic transitions. However, annualized change in prevalence for Ghana from 1987 – 1994 was the same as that reported for the USA (0.2 % point), and about a 3.8% increase in prevalence from 1988 (0.5) to 1994 (1.9) (Wang and Lobstein, 2006, Ebbeling et al., 2002). Although childhood obesity has not reached epidemic proportions in Ghana as is seen in developed countries such as the USA, the annual percent point increment in 2006 is comparable with the USA. This increases the need for more obesity epidemiological studies among Ghanaian school-age children (6 to 15 years) especially when there is no nationally representative data tracking prevalence.

Recent published data report a plateauing or decline of childhood obesity (after the year 2000) in the US as a whole(Ogden et al., 2008), France (Péneau et al., 2009, Salanave et al., 2009), Australia (O'Dea, 2008, Booth et al., 2007), New Zealand (New Zealand

Ministry of Health, 2008) and Sweden (Sjöberg et al., 2008), although other studies indicate a steady rise in other parts of the same country as is reported for Louisiana in the US (Broyles et al., 2010).

The somewhat plateauing of obesity prevalence in most of the industrialized countries that had previously recorded dramatic increases, may be due to the various interventions that were put in place in response to the ‘obesity scare’. These interventions, such as, “the get moving campaign” in Australia (Bauman, 2008) and USA (Obama, 2010), development of national, district and even school level legislations to regulate nutritional content of foods provided to schools, the WHO’s Global Strategy on Diet, Physical Activity and Health, bans on sale of unhealthy foods in schools ( e.g. Mauritius), may have played a role in the reversing trends observed in obesity prevalence.

Although data suggest a stability in obesity prevalence in post industrialized societies, prevalence in developing countries is still increasing (Kelishadi, 2007, Popkin, 2006). The increasing prevalence observed in developing countries may be linked to the economic transformation they are undergoing. Obesity has been found to be more prevalent among households in the upper socio-economic status (SES) strata of developing nations probably due to the adoption of western lifestyles with increasing household wealth (Ebbeling et al., 2002). Countries like Brazil, Chile, Mexico and Egypt have reported high obesity prevalence comparable to those reported for industrialized countries due to the economic growth they have witnessed (Wang and Lobstein, 2006).

A recent review by Muthuri et al. (2014b) on the evidence of overweight and obesity transition among school-age children in sub-Saharan Africa revealed a clear transition of

increasing overweight / obesity similar to observed trends in high income countries. The weighted average of overweight and obesity for the total population of children was 10.6% and 2.5% respectively. Weighted average of overweight/ obesity prevalence in boys and girls was 7.6% and 15.4% respectively, of which 2.0% and 3.9% of boys and girls respectively were classified as obese. Evidence also suggested (29 out of 33 studies) that overweight/ obesity prevalence was higher among children in urban areas compared to rural dwellers. Evidence on association of body composition measures with age was not conclusive, with studies finding both largely negative and largely positive results.

The only nationally representative data on child overweight status in Ghana are those from the Demographic and Health Survey (DHSs) for children under-five years old, the Multiple Indicator Cluster Survey (MICS) also for children under-five years old and the Global School Health Survey of adolescents (13-15 years). Data on school-age children in Ghana between 6 and 13 years old is scanty. The Ghana schools survey was conducted with the goal of providing data on childhood overweight and obesity in urban Ghana (Ghana School Survey, 2012). The study sampled 3000 pupils from 121 schools (both public and private) in the two largest cities of Ghana. The authors reported an overall prevalence of overweight and obesity of 15% (girls 20%, boys 9%).

Other studies have also reported overweight and obesity prevalence among school-age children as a main objective or as a variable associated with the studied outcome. The majority of the studies have been conducted in Accra, the nation's capital. These include studies by: Abachingsa (2001)- reported 19.3% obesity prevalence; Goh (2006) – reported 12% overweight prevalence ; Amo-Addae (2004) – reported 5% obesity prevalence ; Mohammed and Vuvor (2012) – reported 10% obesity prevalence. Outside

Accra, evidence from the Northern regional capital, Tamale indicates overweight and obesity prevalence of 9.8% and 7.5% respectively (Amidu et al., 2013). From the central region of Ghana, Kwaw et al. (2013) reported an almost 50% prevalence of overweight/obesity with 23.9% obesity prevalence among children enrolled in all basic schools (both public and private) within the Mfantseman Municipality. With the exception of the Ghana school survey, these studies mainly examined associations between child weight status and gender, household socioeconomic status (SES), school administration type or active commuting to school.

Some evidence on overweight and obesity prevalence reported by studies designed to examine other outcomes are also available. Agyemang et al. (2005), as part of a study to report blood pressure patterns in children reported overweight prevalence of 3.1% among boys and 6.4% among girls. Also, another study examining the association between atopy and BMI among school children reported an overall overweight prevalence of 13.4% (16% rural and 10.8% urban) (Larbi et al., 2011a). Lastly, a study that sought to find the correlates of current pubertal age among school girls in Kumasi reported overweight and obesity prevalence of 10.4% and 8.9% respectively (Opare-Addo et al., 2012).

### **2.3 Determinants of childhood obesity**

The identification of risk factors is key to the prevention of childhood obesity (Dietz, 2000). The determinants of childhood obesity are engraved within the framework for understanding environmental influences on diet and physical activity based on the analysis grid for environments linked with Obesity (ANGELO) model (Swinburn et al., 1999). This model categorises the environment first into size (micro and macro levels) and then into type (physical, economic, political and socio-cultural). Thus, each size has

four dimensions. The micro level refers to individuals or groups or clearly defined settings such as homes, schools and neighbourhoods. The macro level covers broad sectors such as the food industry, government services or supporting infrastructure that may influence diet, physical activity or weight status. The physical dimension (what is available) is the most commonly studied (Kirk et al., 2010) and includes both tangible (e.g. recreational facilities and food outlets) and intangible (e.g. information) resources. Other usually measured physical attributes of the environment associated with obesity include: walkability; urbanization; location of facilities; transportation and traffic situation, etc. The economic dimension includes the costs of providing and obtaining food and physical activity, which includes motorized vehicle ownership and household income level (Edwards, 2010). The political dimensions includes formal and informal policies and rules and regulations regarding food and physical activity. The sociocultural dimension includes the beliefs, values and attitudes concerning food and physical activity. It also includes perception of safety within neighbourhoods; school or community pressures to lead healthy lifestyles, etc.

A wide range of potential risk factors have been identified in obesity studies. Most of the risk factors have not been confirmed due to the lack of compelling evidence and have thus been referred to as potential risk factors.

### **2.3.1 Biological determinants of childhood obesity**

Evidence from twin studies (Wardle et al., 2008) indicate strong genetic influences on BMI and abdominal adiposity with 40% of adiposity being attributable to independent genetic influences. Also, reports from the USA national survey of children's health (Li and Hooker, 2010) found child's age and sex to have significant effects on BMI.

A longitudinal study (Reilly et al., 2005) that sought to identify risk factors in early life for childhood obesity in the UK found only 8 out of the 25 potential risk factors to be associated with childhood obesity in the final model. Putative risk factors confirmed by the authors to be associated with increased risk of childhood obesity included parental obesity, adiposity rebound<sup>2</sup> by 43 months, catch up growth, standard deviation score for weight at 8 months and 18 months, weight gain in first year, birth weight, and short sleep duration at age 3 years. Risk factors for childhood obesity that were not supported by the authors included sex, parity, season of birth, gestational age, number of fetuses, and timing of introduction of complementary feeding, number of siblings, ethnicity, maternal age and time spent in the car. The authors' inability to confirm the protective effect of breastfeeding on BMI in their final model despite strong univariate associations was attributed to an observed interaction between breastfeeding and smoking in their population. Stratified analysis further indicated that breastfeeding in women who did not smoke during pregnancy was associated with a reduced risk of obesity at age 7. Many more publications have supported the finding that maternal smoking during pregnancy is associated with higher BMI in children (Li and Hooker, 2010, Stice et al., 2005, Von Kries, 2002), and exerts its' influence by programming appetite regulation in children (Jo et al., 2002). A systematic review by Oken et al. (2007) based on the results of 84,563 children reported by 14 observational studies, confirmed that maternal smoking during pregnancy is associated with elevated odds of child obesity at age 3 to 33 years.

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<sup>2</sup> Early adiposity rebound (a phenomenon in which BMI increases after reaching its minimum level during childhood) is also associated with higher adiposity in adolescence and adulthood BRISBOIS, T., FARMER, A. & MCCARGAR, L. 2012. Early markers of adult obesity: a review. *Obes Rev*, 13, 347 - 367..

Other reports (Bergmann et al., 2003, Arenz et al., 2004, Von Kries et al., 1999, Gillman et al., 2001, Armstrong and Reilly, 2002) suggest that exclusive breastfeeding has a protective effect on child BMI. A potential explanation to this observation given by Ebbeling et al. (2002) was that some intrinsic factor unique to human milk caused permanent physiologic changes in breastfed infants, or changed psychological factors such as locus of control over feeding rate (baby versus parent) or taste preference.

Maternal gestational diabetes irrespective of the type has been found to increase the risk of obesity in the offspring (Dabelea, 2007, Hillier et al., 2007). Many authors have also established a link between parental obesity and childhood obesity (Stettler, 2000, Salbe, 2002, Whitaker, 1997, Whitaker, 2004, Muthuri et al., 2014a).

### **2.3.2 Behavioural determinants of childhood obesity**

#### *2.3.2.1 Diet-related behaviours*

Consumption of breakfast has been shown to have a protective effect on child BMI, while breakfast skipping has negative effects on BMI (Deshmukh-Taskar et al., 2010, Rampersaud et al., 2005). Breakfast skipping is reportedly typical of girls than boys (Rampersaud et al., 2005).

While children are less likely to eat the foods they don't like (Birch and Fisher, 1998), they generally tend to eat the foods which are usually available at home (Holsten et al., 2012) irrespective of its diet quality. When given a choice, children show preference for sweet, fatty or high calorie foods as opposed to sour, bitter or spicy options (Kubik et al., 2003, Cullen and Zakeri, 2004, Ludvigsen and Scott, 2009, Deshpande and Khammam). Dietary habits in general, gets worse in adolescence (Ilich and Brownbill, 2010).

Sugar-sweetened beverages (SSB) including soft drink consumption has been linked to child and adolescent obesity (Øverby et al., 2004, Malik et al., 2006, Vartanian et al., 2007). A possible reason for the role of SSB consumption on weight gain is the fact that sugary foods induce less satiation which results in incomplete energy compensations that lead to increased caloric intakes (Olsen and Heitmann, 2009). Evidence-based analyses of data from the United States extrapolates that for every additional serving of SSBs consumed daily, the odds of child obesity increases by 60% (Ludwig et al., 2001).

Increase in portion sizes has been linked to the development of obesity among children and youths. What is now a 'single serving' of food used to be a 'super-size', encouraging people to consume more (Freedman et al., 2008). Meanwhile, findings by Cullen et al. (2003) indicate that food consumption among children is greatly influenced by the types and amount of foods made available.

Consumption of fast food and frequent snacking among children and youths are associated with higher energy intakes, poorer diet status and weight status (Bowman et al., 2004, Rouhani et al., 2012, Poti et al., 2014).

Low fruit and vegetable consumption among children and youths have also been negatively associated with weight status (Janssen et al., 2005, Spruijt-Metz, 2011, Øverby et al., 2004). However, Peltzer and Pengpid (2011) found no association between overweight status and fruit and vegetable intakes among school-age adolescents in Ghana and Uganda.

### *2.3.2.2 Physical activity-related behaviours*

Nader et al. (2008) reports of significant declines in moderate—to-vigorous physical activity levels of school-aged children from 9 to 15 years of age. Also, worldwide data from 105 countries on adolescents showed that over 80% of 13-15 year olds fail to meet the required 60 minutes of moderate to vigorous intensity physical activity daily with more girls defaulting (Hallal et al., 2012). Evidence from longitudinal studies have shown consistently that physical activity is associated with lower BMI and girth of children (Ness et al., 2007, Metcalf et al., 2011, Ekelund et al., 2012).

Modern sedentary behaviours like hours spent watching TV and playing video games are positively associated with child BMI (Li and Hooker, 2010, Borghese, 2014, Chaput et al., 2011).

### **2.3.3 Social determinants of childhood obesity**

#### *2.3.3.1 Family and Parent Factors*

According to Birch (2006), the role of the parent is to “filter, buffer and interpret macro-environmental influences to children” by affecting the type, portion sizes, frequency and the social environment in which foods are consumed. Although this influence is greatest in early childhood, there is evidence that family meals are associated with higher diet quality and healthful meal patterns later in life (Larson et al., 2007). The influence of parental obesity on risk of childhood obesity may be through genetic mechanisms or shared familial environmental characteristics such as food preferences (Francis, 2003) or physical activity level (Sallis, 2000, Li and Hooker, 2010). The kinds of foods that parents eat by themselves or make available has effects on food preferences of their children due to continuous exposure (Birch, 1999, Birch et al., 1987).

Latent profile analysis of data from two longitudinal studies: ‘Identifying Determinants of Eating and Activity (IDEA) study’ and the ‘Etiology of Childhood Obesity (ECHO) study’ showed that higher parent and child BMI z-scores were significantly associated with ‘obesogenic’ family types (having less optimal social and physical environments to support healthy eating) after controlling for socioeconomic status and demographic factors (Martinson et al., 2011).

Most studies investigating the role of the parent on child eating behaviour and weight status have looked at parenting styles and feeding styles. While parenting style is known to be highly correlated with feeding style when it comes to nutrition (Wheat and Axford, 2009), they are distinct as child feeding is more of parenting practice which is embedded in a larger parenting style (Ventura and Birch, 2008). The evidence is unclear whether parenting style is influenced by child behaviour or parenting elicits child behaviour, yet, evidence of a relationship between the two is strong. Birch and Fisher (2000) report that mothers’ perception of child eating behaviours predicted prevailing feeding practices and daughters eating and weight status at age 5 years. Some authors (Patrick and Nicklas, 2005, Hoerr et al., 2009) have categorized feeding styles the same way as parenting styles: authoritarian, authoritative and permissive while others have categorized feeding styles differently as Laissez-faire<sup>3</sup>, controlling and responsive (Engle, 2002).

Authoritative feeding style has been associated with positive child outcomes in various studies (Darling and Steinberg, 1993). Among families with limited income, Hoerr et al. (2009) found authoritarian parenting style to be associated with better eating behaviours compared to permissive parenting style. Other studies have also found permissive

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<sup>3</sup> Laissez faire means providing least control or providing least possible guidance.

parenting style to be associated with disproportionately high BMIs and worse eating habits among children (Wake et al., 2007, Chen and Kennedy, 2005, Rhee et al., 2006, Mendoza et al., 2006).

Carnell and Wardle (2007), found that parental pressure or pushing the child to eat were associated with lower BMI z-scores of children. The authors however found no association between child BMI z-scores and parental restriction, emotional feeding and use of food as reward as documented by other authors (Fisher and Birch, 1999, Jansen et al., 2012, Yekani et al., 2013, Ritchie et al., 2005, Birch and Fisher, 2000).

Evidence by Jansen et al. (2012) showed that the association between child eating behaviour and BMI was attenuated yet persistent after controlling for parental feeding practices. They explained that parental feeding may be associated with child BMI through other dimensions of child eating behaviour such as loss of control or binge eating; and concluded that both parental and child behaviours are independently associated with child BMI.

Power et al. (2010) in a qualitative study assessing parent, teacher and adolescent views on the perceived influencers of health, physical activity and diets of adolescents, revealed that parents, friends and schools have the most of influences. Evidence from the 'Healthy Dads, Healthy Kids' lifestyle programme on the activity- and diet-related parenting practices of fathers and mothers showed that interventions targeted at parental behaviour had positive impacts on some parenting practices as well as weight and physical activity of both fathers and children (Lloyd et al., 2014).

Li and Hooker (2010), have suggested that parental education may be negatively associated with child's BMI; the influence of parental education on child's BMI could be due to income differential or the likelihood of having received knowledge regarding risk of childhood overweight. Saxton et al. (2009), found that mothers with lower education were more likely to use food as comfort, reward or as a way to control child behaviour.

Healthful home and family environments have been found to be associated with more healthful dietary intakes of adolescents (Neumark-Sztainer et al., 2010, Berge et al., 2010). Frequency of family eating away from home has been linked to obesity because foods consumed away from home tend to be more calorie dense and of poorer nutritional quality than those prepared at home (Guthrie et al., 2002). This evidence is lacking in low income countries where the nutrition transition is at the early stages and highly patronized food outlets (both franchised and non-franchised) or restaurants serve foods that are not much different from meals cooked at home. No studies have investigated the nutrient content of the same foods cooked at home compared to that served outside home in Ghana. Also, the role of other factors including the availability of sugar sweetened beverages in the home, parental provision of SSB, parental pressure on child to eat have not been examined in Ghana and this study seeks to explore these relationships.

#### *2.3.3.2 Socioeconomic factors*

Overweight prevalence among children have been found to be associated with the socioeconomic status (SES) of the neighbourhood. For instance, Oliver et al. (2005) found that children who lived in lower SES neighbourhoods had higher odds of being overweight compared to those from higher SES neighbourhoods in Canada. Similar

associations have been found among the adult populations (Robert and Reither, 2004, Pearce et al., 2007).

Results from a cross-national comparison of trends in overweight status from 1989 – 2007 (in 37 developing countries) found that high household SES was associated with higher gains in overweight prevalence (27 studies) compared to lower SES (10 studies) being associated with overweight prevalence (Jones-Smith et al., 2011). The authors also found that gross national domestic product was positively related to faster increase in overweight prevalence among the lower wealth groups as suggested by other investigators (Ebbeling et al., 2002, Wang and Lobstein, 2006). This suggests that developing nations are likely to record increasing levels of childhood obesity since they are and will continue to experience economic developments.

A more recent review of school-age children's data from sub-Saharan African countries (Muthuri et al., 2014b) suggests that high household socioeconomic status was associated with higher body composition measures. The authors found 19 out of the 24 studies reported associations between higher SES and higher body composition measures, while the remaining found no significant associations.

Generally when inflation across all goods is adjusted for, food prices have dropped over the decades (Cawley, 2010), yet, prices of fruits and vegetables continue to soar. The current structure of food prices puts high fats and sugars at the lowest costs for calorie provision. Individuals and families with limited incomes will in response to these price changes select energy dense foods in order to save money which leads to poor quality diets and subsequent poorer weight and health outcomes. Evidence from the USA shows

that the price increases of fruits and vegetables by 17% from 1997 to 2003 was associated with increased BMI among children and adolescents (Auld and Powell, 2009, Sturm and Datar, 2005, Powell and Bao, 2009). Huang and Lin (2000), reported that a 10% reduction in fruit and vegetable prices increased consumption by 7.2%. Evidence on the role of food prices in low income countries is lacking. Although it will be difficult to assess the exact impact of fruit and vegetable prices on consumption among the large rural populations engaged in farming, data can be provided on urban families which presents higher odds of overweight/ obesity. This information on diet quality and costs can inform national food policy and strategies to modify the food environment to improve outcomes especially among low- resourced families and settings (Story et al., 2008a).

#### *2.3.3.3 Neighbourhood and community factors*

While behavioural change is crucial for the prevention and management of obesity, this change is not sustainable without corresponding changes in the environment that interact with diet, physical activity, metabolism and genetics to produce weight status (Hill, 2006).

Although there is no conclusive evidence that changing the built environment will directly reduce obesity rates (Sallis and Glanz, 2006), its role in obesity development, prevention and management warrants further study in order to understand the role of the complex environmental influences on obesity (Kirk et al., 2010). While some studies have found no association between neighbourhood environmental variables and adolescent weight outcomes (Bodor et al., 2008), evidence of environmental influences have been documented. For instance, Gomez et al. (2004) examined the relationship

between outdoor physical activity among adolescents and neighbourhood safety and distance to nearest open play space. They reported positive significant correlation between outdoor physical activity among girls when the neighbourhood was perceived as safe; but this association was not found for boys. Boys' engagement in outdoor physical activity was rather determined by the distance to the nearest open play space.

Prins et al. (2012), have reported that in the absence of limited amount of park space, each standard deviation increase in neighbourhood capital was associated with a 50% increased odds of leisure-time participation in sports among 12 to 13 year olds in the Netherlands.

Berge et al. (2014) assessed the individual and joint associations of the home environment and the neighbourhood built environment with adolescent dietary patterns and BMI z-score in a racially/ ethnically and socioeconomically diverse population. Although the authors found fewer associations between adolescent outcomes and built environments, the presence of a neighbourhood environment supportive of healthful behaviour enhanced the relationship between a supportive family environment and fruit and vegetable intake and BMI of adolescents. Specifically, higher frequency of family meals and high parent encouraging or modeling of healthful eating were associated with much less fast food consumption when fast food restaurants were located far away than when it was nearby. The authors concluded that it may be very important that public health interventions should simultaneously target both home and neighbourhoods in order to have the greatest impact on adolescent obesity prevention.

Findholt and colleagues' (2011) investigation of environmental influences on children's physical activity and diets also identified the following barriers: barriers to physical activity included limited resources to recreational facilities, street and traffic safety hazards, fear of strangers, inadequate physical education and denial of pupils to recess; barriers to healthy eating included limited availability of healthy food, high cost of healthy food, busy lifestyles, convenience stores located near schools, few healthy meal choices at school, children permitted to bring snacks to school, candy used as incentives and teachers not modeling healthy eating to pupils. Findholt et al. further found popularity of youth sports and proximity to natural areas as facilitators of physical activity, while, popularity of gardening and the presence of orchards or agricultural settings facilitate healthy eating. Evidence on neighbourhood and community influences on child weight status in developing countries are limited.

#### *2.3.3.4 Media Environment*

The media environment also exposes children to unhealthy foods. Evidence from the USA indicate that children aged 8 to 12 years see the most food advertisements on television (TV); an average of 21 advertisements (ads) per day or more than 7,600 per year (Gantz, 2007). Gantz (2007), reports that none of the 8, 854 ads reviewed marketed fruits and vegetables; they were snacks, candies, sugary cereals and fast foods. Although TV ads have not been reviewed in the Ghanaian setting, there is evidence that children receive exposure to unhealthy foods. Amfo-Ayeh (2011), reported that the main reason pupils opted for a mini-sized coke popularly known as "Akuffo-Addo coke" was because of the TV commercial that goes like, "brrrrrrrrr, the coke side of life". Food advertisement to children have now gone beyond TV sets into digital media, cell phones,

video games and 3-dimensional virtual worlds (Story et al., 2008a) in most developed countries. Again, knowledge on the extent of food advertisements to children beyond TV/radio commercials, bill boards or branded items in Ghana is not available. There is compelling evidence that advertisement for nutritious foods to children can generate positive attitudes towards them in ways similar to their attitudes towards junk food (Dixon et al., 2007). Hence, the need for policies to regulate the exposure of children to unhealthy food ads.

#### *2.3.3.5 School Factors*

Schools could potentially present children and adolescents with options for unhealthy foods (Day and Pearce, 2011, Kubik et al., 2009, Johnson-Taylor and Everhart, 2006). There is evidence that pupils attending schools which do not restrict availability of these high-calorie low-density foods have higher BMI compared to those in restrictive environments (Kubik et al., 2005a). Also schools that presents children with many opportunities for physical activity via facilities, policies and provision of physical education have positive effects on child physical activity levels (Haug et al., 2010a, Haug et al., 2008, Haug et al., 2010b, Loucaides and Jago, 2006, Lagarde and LeBlanc, 2010).

In a study to explore the interactive effects of school physical environment and social capital on moderate-to-vigorous-physical activity (MVPA) of students while at school, it was found that both were positively associated with student MVPA levels at school (Button et al., 2013). Associations between schools' built environment and student MVPA was not mediated by school's social capital. Students attending schools with the highest number of physical activity features (eg. Fixed sports equipment, sports field, etc.) recorded 20 minutes extra MVPA compared to those with the least. The authors also

reported that students in schools with highest social capital performed about 40 minutes more MVPA weekly compared to students attending schools with lowest social capital.

Observations by Vu et al. (2006) in a qualitative assessment of how boys and girls perceived physically active girls suggests that culture in the school could explain differences in physical activity levels reported among male and female adolescents. This study revealed that both boys and girls have ‘worrying attitudes’ towards physically active girls. While girls themselves had positive attitudes towards physical activity, the negative response from boys (name calling, teasing, taunting, etc.) was a significant deterrent for many. Other barriers mentioned were time spent on house chores, being shy, competing interests and limited opportunities for physical activity.

A recent qualitative study investigating gender-specific barriers to recess physical activity among school-aged children (in a temperate zone) revealed barriers relating to weather, social issues, physical, and organizational barriers (Pawlowski et al., 2014). Cold, snowy or rainy weather was a barrier to most children and more especially, girls who preferred to stay indoors. However, some boys still preferred to be in the playground regardless of weather. Pawlowski et al. also found social relations during recess like conflicts, disagreements and dominance to be disruptors of recess play. Many girls who were interested in playing male dominated games (like board games and soccer) resigned to idling because there was no way boys will allow them to play together. Participants also felt that supervision by teachers during recess will control conflicts and dominance and positively improve on the social relations during play. Some physical barriers identified included lack of space and lack of play facilities which easily got overcrowded, deterring other children from getting onto the playground or area. The organizational barrier

identified by the authors was the use of electronic devices like smartphones and tablets during recess. Participants agreed that use of electronic devices was very tempting, but preferred and were willing to play outside if there was a rule against their use during recess. The investigators recommended the implementation of school policies which support physical activity irrespective of weather, more teacher presence during recess, creation of out-door boy and girl zones, organization of student-driven play equipment stations and regulations on electronic devices.

#### **2.4 Assessment of child weight status**

Body Mass Index (BMI) is widely accepted as an index for classifying weight status of individuals. Indices such as weight-for-height, weight-for-age and height-for-age, and weight percentiles have also been used to define weight status in children and adolescents (WHO, 2000).

Cole et al (2000) developed a definition of child overweight and obesity based on nationally representative data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore and the United States. The authors proposed sex-specific BMI cut-off points for children by extrapolating BMI cut-off points of  $25\text{kg/m}^2$  and  $30\text{kg/m}^2$  representing overweight and obesity respectively at age 18 years. Although the authors recommend the use of these cut-offs for international comparisons of overweight and obesity, there have been arguments that the reference data used by the authors were not representative of non-western populations hence could not clearly establish the health consequences for children across different population above those cut-offs as has been seen in adult populations. Nonetheless, observations by Wang et al. (2000) and Abrantes et al. (2003) suggest that the standard definitions for overweight and obesity published by Cole et al.

is comparable with the WHO standards for assessing overweight and obesity in children and adolescents.

The WHO released new growth standards in April 2006 for infants and young children (WHO Multicentre Growth Reference Study Group, 2006) and for school-age children and adolescents (World Health Organization, 2006). The reference cut-offs for infants and young children was based on data on healthy, breastfed children with no known constraints to growth from six countries from diverse geographical regions (Ghana, Brazil, India, Norway, Oman and the United States). The reference ranges for school-aged children and adolescents was also based on merged data from the WHO child growth standards and the 1977 National Center for Health Statistics/ WHO growth reference from age 5 to 19 years (de Onis et al., 2007).

Although BMI is widely used as a population measure of weight status, there are limitations to its use among pediatric populations (Higgins et al., 2001, Daniels et al., 1997, Pietrobelli et al., 1998) since it is just a measure of excess weight relative to height, rather than excess fat. It has been argued that measured BMI is not related to immediate biological risk for disease in children and poorly correlated to fat mass in younger ages. Researchers have therefore proposed percentage of fat standards for defining health related obesity in children (Obarzanek, 1993, Williams et al., 1992, Higgins et al., 2001, Dwyer and Blizzard, 1996). Williams et al. (1992) established cut-points of 30% fat and 25% fat for defining obesity in girls and boys respectively. Also using skinfold measurements as Williams et al., Dwyer and Blizzard established similar cut-points for boys and girls at 20% fat and 30% fat respectively.

Improving over previous methodologies, Higgins et al. (2001) using dual x-ray absorptiometry (DXA) derived two cut-off points, an upper 33% body fat and a lower cut-point 20% body fat to be associated with adverse cardiovascular risk profiles in children aged 4 to 11 years. The authors in addition proposed a waist circumference cut-point of 71cm for determining obesity related cardiovascular risk in children. The authors were of the view that these definitions provide alternative definitions of childhood obesity and may be useful in screening for adverse CVD risk-factor levels in children.

Freedman et al. (2008) assessed differences in body fatness among children aged 5 to 18 years from different racial backgrounds (white, black, Hispanic and Asian) in relation to their BMI-for-age based on the center for disease control and prevention (CDC) growth charts. The authors found that at equivalent levels of BMI-for-age, black children have less fat (3% mean) than white children and Asian children also had higher body fat (1% mean) levels than white children. However, among overweight children, white children have higher (~2-3%) body fatness than Asian, black and Hispanic children. They concluded that the relation of BMI-for-age to body fatness among children varies with racial/ ethnic differences and more so with different categories of BMI. However, the application of an 'average' racial body fatness across the BMI distribution will be inappropriate.

Notwithstanding the limitations of BMI use in pediatric populations, Lindsay et al.(2001) after analyses of over 900 Indian children aged 5 to 20 years concluded that BMI is a good measure of adiposity and is strongly associated with measures of adiposity derived from DXA and cardiovascular risk factors in children. Child BMI has also been shown to correlate well with cardiovascular risk factors in groups of overweight children from

different racial (African American, Caucasian and native Americans) backgrounds (Morrison et al., 1999a, Morrison et al., 1999b). In an editorial, Horlick (2001) explain that, *'the use of BMI in children is an attempt to measure a moving target of weight and stature - which increases and changes in composition with normal growth'*. Horlick therefore recommended that the strength of the relationship between BMI, DXA fat variables and cardiovascular risk factors should be established through future studies to increase the sensitivity of childhood obesity definitions.

## **2.5 Assessment of Diet and Physical Activity in children**

### **2.5.1 Dietary Assessment in children**

Assessing the diets of children presents major challenges regarding validity and reliability of methods. Dietary assessment methods used include direct observation of meals, meal recalls, food records, diet histories and food frequency questionnaires.

#### *2.5.1.1 Direct Observation Methods*

Direct observation of meals could take the form of trained researchers who watch the foods, brand names and portion sizes consumed by children or weigh the actual food consumed. The direct observation style is used mostly among much younger children during specific eating times or in controlled school group activities. While a single observation provides a measure of actual intakes appropriate for group mean estimation, it cannot be used to predict health outcomes (McPherson et al., 2000). Although this method can be used if the purpose is to compare on aggregate terms the types of foods consumed by children during a specified period like lunch or breakfast, Simons-Morton and colleagues (1992) found that differences in observed portion sizes simultaneously

estimated by different observers account for more differences in energy estimations. The relatively high researcher and respondent burden associated with the use of weighed food intake measurement makes its use among school-age children in the school setting less desirable when conducting large surveys. Although weighed food measurement gives accurate measures of foods actually consumed, the respondent burden is often associated with a higher tendency to alter regular consumption behaviour or increase tendency of underestimation of intakes (Livingstone et al., 1992). In the case of younger respondents, weighed food intake methods shifts the responsibility of weighing procedures onto adults (parents, child minders, teachers, food service staff, etc.). In a study to validate energy intakes assessed by weighed food intake measurements and diet history, Livingstone et al. (1992) found that weighed food intake measurements more accurately reported energy intakes of younger participants (< 9years old) but underestimates for older children (>12 years old) when compared with energy estimates from doubly labeled water measurements.

#### *2.5.1.2 Twenty-four-hour dietary recall*

Twenty-four-hour (24-hr) dietary recalls consists of structured interviews with children conducted by trained professionals to elicit information on all foods eaten by the child over a 24-hour period. Dietary information entails the names of foods eaten, estimated quantity (portion size) consumed, detailed description of contents of mixed dishes and food preparation methods (fried, boiled, roasted, smoked, etc.). Dietary recalls sometimes solicit information only for a given time period during the day like breakfast, lunch, supper or snack time. The time of the recall is known to affect accuracy of recalls and researchers are advised to consider recall time to minimize omissions and food intrusions

when working with children in the school setting (Baxter et al., 2009b, Baxter et al., 2009a). For much younger participants (< 8 years) parents or caregivers provide information on their behalf, while older children are assisted to provide dietary information. When conducted in a random sample, estimates of energy and nutrient intakes can provide population means but not as a tool to predict individual health outcomes (McPherson et al., 2000). Comparing energy estimates from 24-hour dietary recalls with a validation standard, both overestimation and underestimation was observed and validity increased with age. The 24-hour dietary recall method has been recommended especially for collecting dietary information on elementary children due to the unlikelihood of intake alteration (Buzzard, 1998). They also have added advantages of relatively shorter times of administration, can be used in large surveys, and requires no equipment (cheaper).

#### *2.5.1.3 Food Frequency Questionnaires*

Food frequency questionnaires (FFQs) have also been used among school children to measure usual intakes and easily adapted for population studies. FFQs can be quantitative, semi-quantitative or non-quantitative. Non-quantitative FFQs are used to assess frequency of consumption of specific foods or food groups of interest. Semi-quantitative types are used to both estimate frequencies of food consumptions and also to provide general estimates of energy and nutrient intakes at the population level. The quantitative FFQs solicit usual quantities of frequently consumed foods and can be used to estimate intakes of energy and specific nutrients of individuals. FFQs are however infrequently used in children compared to the 24-hr dietary recall due to the cognitive skills required in estimating frequency of intakes over the specified period of assessment.

Most studies that have used FFQs for school children did it with parental assistance or in schools as part of classroom activity and with adult assistance to ensure standard conditions for reporting (McPherson et al., 2000). Although food frequency questionnaires may be poor at estimating actual intakes of energy and nutrients, they are useful for establishing dietary patterns of populations which has higher predictability of chronic disease outcomes compared to measurement of specific nutrients (Domel et al., 1994).

#### *2.5.1.4 Diet Histories*

Diet histories are used to examine usual meal patterns, energy and nutrient intakes and food preparation methods used (Thompson and Byers, 1994). Usually administered by a trained professional, data is collected in much detail to describe dietary habits and foods consumed over a specified period purposefully to rank individuals for predicting health outcomes (McPherson et al., 2000). Livingstone et al. (1992), found that diet histories were more representative of usual intakes compared to weighed food intake when both methods were compared to the standard (doubly labeled water). While diet histories may be useful in epidemiological research, the high respondent burden and skill required of respondent makes it less frequently used among children.

#### *2.5.1.5 Food Records*

Food records are similar to 24-hr meal recalls except that the list of foods eaten are recorded concurrently as consumed, and the period of assessment usually goes beyond one day. Also, dietary information recorded include brand names, estimated portion sizes, food preparation methods and ingredients in mixed dishes. This method is usually used as validation standard because bias due to memory loss is reduced. Aside paper record

options, the use of electronic methods like telephones and tape recorders have been reported in research involving children (Van Horn et al., 1990). Van Horn and colleagues reported that pre-adolescent children can provide dietary data comparable to that obtained from parents using electronic methods (telephone and tape recording).

A recent systematic review of the validity of dietary assessment methods by Burrows et al. (2010), revealed varying degrees of misreporting; with only eight studies (out of 15 studies) indicating statistically significant differences. Compared to the gold standard of assessment (doubly labelled water), food records underreported intakes between 19% – 41%; 24-hour food recalls overestimated intakes in a range of 7 – 11%; diet history overestimated intakes in a range of 9% to 14%; and food frequency questionnaires also overestimated dietary intakes in a range of 2% to 56%. While validity of various measures continue to be improved through research, continuous efforts are essential to improve the reporting accuracy of school children (Gordon et al., 2009).

#### *2.5.1.6 Dietary Patterns*

Dietary patterns (DP) are assessed among populations because individuals typically consume combinations of foods over time which provides peculiar matrices of nutrient and dietary factors that can affect health outcomes. Several methods, including those described above, have been employed in dietary pattern determinations, which can be predefined or defined after data is collected.

The predefined DP is based on current nutrient intake recommendations and or dietary guidelines. Examples include the Healthy Eating Index (HEI), Dietary Quality Index (DQI), Mediterranean Diet Score (MDS) and Healthy Diet Index (HDI). A review by

Kant et al. (2004) showed that higher diet index scores were well correlated with positive health outcomes and lower scores were associated with adverse health or chronic disease outcomes. Since dietary habits are largely culturally determined, most indices are designed to reflect specific contexts, making comparability of index scores difficult (Wirfält et al., 2013).

Most post-data collection DP methodologies involve the defining of dietary patterns using statistics after data collection has been done. Some statistical methodologies use data reduction tools (principal component analysis or factor analysis) to construct linear combinations in food intakes that explain a high proportion of the variation in food intakes. Reduced rank regression and cluster analysis have also been used to predict dietary patterns in populations.

### **2.5.2 Assessment of Physical activity in children**

Measurement of physical activity is an important component of global action against physical inactivity (Kohl et al., 2012). Assessment methods for physical activity in children depend on the component of physical activity being measured, the target age group and sample size as well as the objective of the study. Methods used can be summarized under self-report measures or objective measures.

#### *2.5.2.1 Self-report measures*

Self-report measures of physical activity are most widely used for epidemiological research and it involves reporting of physical activity over a specified period using structured questionnaires, diaries, logs and recalls (Warren et al., 2010). Self-report measures are the least expensive and easiest way to collect data on a large sample but

also the least accurate. Limitations of self-report measures are difficulty in estimating frequency, duration and intensity of physical activity in all domains, and social desirability bias (Sallis and Saelens, 2000). The cognitive demands of recall, limits its use in children below 9 years. While parental, teacher or caregiver assistance may be beneficial in very young populations, their use may become more difficult as children get more independent (Pate, 1993). Due to validity and reliability issues associated with the use of questionnaires (Shephard, 2003), most questionnaires used are validated for use for specific cultures and age groups. Furthermore, some are validated alongside more objective methods like doubly labelled water or accelerometry and provide relatively accurate classifications of physical activity comparable to objective methods. For instance, the child physical activity questionnaire for older children (8 to 14 year olds) and adolescents (14 to 20 year olds) have been validated to provide a general measure of physical activity from childhood to adolescence (Crocker et al., 1997). However, these questionnaires cannot provide information on energy expenditure, frequency, intensity and duration of activities. They also do not discriminate between specific activity intensities and are only suited for use over the school year.

Several other questionnaires used to assess physical activity levels in children are, but not limited to, the following,: SAPAC - Self-Administered Physical Activity Checklist (McMurray et al., 2004); Adolescent Physical Activity Recall Questionnaire (A-PARQ)(Booth et al., 2002); Swedish Adolescent Physical Activity Questionnaire (SwAPAQ) (Ekelund et al., 2006) ; Youth Risk Behaviour Survey (YRBS)(Troped et al., 2007); Health Behaviour in School Aged Children (HBSC) (Booth et al., 2001); Children's Leisure Activities Study Survey (CLASS) (Telford et al., 2004); Godin

Leisure-Time Exercise Questionnaire (LTEQ) (Godin and Shephard, 1985) ; Seven-Day Physical Activity Recall (7D-PAR) (Sallis et al., 1993); Children's Physical Activity Interview (Simons-Morton et al., 1997); and Youth Media Campaign Longitudinal Survey (YMCLS) (Welk et al., 2007).

The use of computerized and/ or web-based questionnaires to assess physical activity have also been explored in children and adolescents (Ridley et al., 2006, McLure et al., 2009, Moore et al., 2008) although some difficulties have been identified with use of a web-based format (da Costa et al., 2013). Activity diaries have mainly been used among adolescents (Anderson et al., 2005, Bratteby et al., 1997).

#### *2.5.2.2 Objective Measures*

Objective methods of physical activity that offer higher precision of measurements include the use of pedometers and accelerometers. More accurate measures of energy expenditure include the use of doubly-labeled water, indirect calorimetry and heart rate calibration equations which may be needed for certain clinical studies, but the cost and inconvenience makes them impractical for field-based assessments with larger samples (Welk et al., 2000).

Pedometers are mobile equipment usually worn on the body that senses body motion and counts footsteps. In cases when the stride of the individual is known, distance covered can be calculated. They are relatively more affordable objective measures which have been increasingly used among populations including that of children. For instance, a recent review by Brusseau and Hannon (2013) identified 30 studies that have used pedometers to assess physical activity of children while at school alone. Across these

studies identified, seven different brands of pedometers were used. Pedometers have been used in examining habitual physical activity levels among children even in school settings (Loucaides and Jago, 2006, Tudor-Locke et al., 2006, Brusseau et al., 2011a, Brusseau et al., 2011b, Kang and Brintahupt, 2009). In a study that compared the accuracy of pedometers to measure walking steps among normal and overweight children, it was found that the errors were higher for lower speeds and significantly higher among overweight compared to normal children (Mitre et al., 2009). Mitre et al., therefore concluded that commercially available pedometers are less accurate in measuring low physical activity levels of both normal and overweight children and researchers must use them with caution. Tudor-Locke and Bassette (2004), recommended the following daily step indices for classification of physical activity status: 5000 steps = sedentary; 5000-7499 steps = Low active; 7500-9999 steps = somewhat active and 10000+ steps = physically active.

Accelerometers are more advanced types of pedometers. They are movement monitors that have the ability to capture intensity of physical activity (steps, the speed and distance). Accelerometers have in-built strain gauge that converts movements into electrical signals (counts) that are proportional to the muscular force producing motion (Freedson and Melanson, 1996). They are more accurate and reliable in counting steps than ordinary pedometers and the preferred objective method for measuring free-living physical activity levels (Schmitz et al., 2005). Their use is limited in measuring activities like cycling and swimming. The disadvantage of the accelerometer is its shorter battery life due to the constant sampling of the strain gauge. They also cost more than a regular pedometer. Accelerometers also do not accurately estimate other activities like stationary

biking and are unable to measure movements in upper extremities, which can lead to underestimation of household chores like washing dishes, etc. A comparison of the pedometer to the accelerometer under controlled conditions revealed that the errors of reporting steps for both equipment is not an important threat to the assessment of physical activity in free living ambulatory populations (Le Masurier and Tudor-Locke, 2003). The authors however reported the tendency of the pedometer to underestimate steps in frail and overweight persons whose gait may not be strong. Also, they reported on the tendency of the accelerometer to overestimate steps among individuals riding in motorized vehicles.

Presently, four other kinds of wearable monitors that are available to researchers for assessing physical activity include load transducers/foot-contact monitors, Heart rate (HR) monitors, combined accelerometer and HR monitors, and multiple sensor systems. These monitors are able to measure total physical activity as well as physical activity components of interest and are thus selected based on the objective of the study, characteristics of target population and feasibility in terms of cost and logistics (Butte et al., 2012). It is recommended that physical activity monitors from different manufacturers be calibrated for use in the field due to different sensor outputs (Freedson et al., 2012).

## **2.6 Assessment of Food and Physical activity environments**

### **2.6.1 Assessment of Food Environments**

An obesogenic environment refers to the sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals or populations (Swinburn et al., 1999). It has also been argued that the environmental

stimuli on obesity prevalence must be impacted to some extent by individual's metabolism (genetics) and behaviours (such as diet and physical activity), since they ultimately lead to a chronic positive energy imbalance and thus to obesity (Edwards, 2010). The obesogenic environment of children has been of great concern to researchers because children have much less control over their environment (compared to adults), and what they eat will be strongly influenced by their home and school environments (Edwards, 2010). Also, children generally have migrated less than the average adult, thus their immediate location is likely to have played a role in their developing obesity or otherwise.

The food environment involves sources of energy and nutrients and the circumstances surrounding their procurement and consumption (Holsten, 2009). The school food environment in particular has gained a lot of interest as a plausible cause of obesity since it can greatly impact on behaviour related to diet, weight and health outcomes (McKinnon et al., 2009). There is documented evidence that the school food environment has strong influence on dietary intakes and BMI of pupils (Kubik et al., 2005b, Fox, 2005, Jaime and Lock, 2009b, Briefel, 2009).

Very reliable and valid measures are required to assess any effect of the food environment on individual dietary behaviour, and form the foundation of research that may inform obesity related policy (McKinnon et al., 2009). Measures of the food environment fall under two broad categories which include standardized assessment tools and methodologies.

Standardized assessment tools are used to assess the observed or perceived food environment. This could be in the form of a checklist (identifying specific foods), market basket (list of foods representing total diet), inventories (all foods present) or questionnaire (predetermined list regarding environment). Most tools are designed for specific settings and may need to be modified and validated for use in different settings.

Methodologies commonly used to measure the food environment are nutrient analyses, menu analyses, sales analyses and geographic analyses (McKinnon et al., 2009). The most commonly employed measure to assess the school food environment are sales, menu and nutrient analyses. Since the school environment presents an opportunity to implement and assess interventions, additional information is usually collected on availability and quality of foods offered, labeling, cues and barriers for healthy eating and nutrient analysis, alongside a specific methodology or instrument.

A geographic analysis draws data from specific geographic measures. This method mostly employs Geographic Information System (GIS) to capture geo-referenced data which can be analyzed. This methodology provides detailed information on accessibility measures such as diversity, proximity and or variety (Apparicio et al., 2007). Relatively few studies have used geographic analysis to assess the children's food environment (Austin et al., 2005, Kipke et al., 2007, Carter and Swinburn, 2004, Day and Pearce, 2011). Most of these studies have been conducted in developed/ industrialized countries that have well-structured communities and schools, and hence more defined food environments. Additionally, geographic data and base maps are readily available in developed countries. Evidence therefore, is scarce for the use of this methodology in studying obesogenic environments of children in the developing world and for that matter

sub Saharan Africa where most communities are not well structured. While this method may work perfectly for the siting of supermarkets, restaurants and fast-food establishments, it may be unreliable in predicting the link with unhealthy food consumption since the food market in Ghana is not well defined; unhealthy foods can be obtained from any vendor type and not restricted to “fast-food establishments”, also fruits and vegetables are most commonly purchased from traditional markets rather than grocery stores.

Generally, evidence of the school food environments in sub-Sahara Africa is scanty and more so, limited for school food environments in Ghana (Amfo-Ayeh, 2011). Amfo-Ayeh assessed the school food environment using a manual audit collecting inventory of the foods available within the school environment. The author did not examine the relationship between the environment and child weight status.

### **2.6.2 Assessment of Physical activity Environments**

The different elements of the physical or built environment shapes access to physical activity of individuals differently (Ewing et al., 2006, Handy and Clifton, 2007) as well as the domains (i.e. leisure, transportation, etc.) of physical activity (Sallis et al., 2006, King et al., 2006). For instance, leisure physical activities may mostly be affected by access to and the characteristics of the recreational facilities (Norman et al., 2006, Kahn et al., 2002), while transportation will be affected by the ease with which persons can walk or travel from home to various destinations (Kerr et al., 2006, Heath et al., 2006). It is therefore essential that measures of the physical environment provide valid and reliable estimates to better understand its relationship with physical activity. Three main methods have been used to measure the physical environment: Interviews or self-administered

questionnaires; systematic observations or audits; layering features of interest over existing datasets employing GIS methodology.

Self-reported or perceived measures of the built environment by individuals have been widely used in studies to assess associations with physical activity behaviour (Brownson et al., 2009). Four main domains have been identified to guide the development of perceived measures of physical environments (Pikora et al., 2003). These domains include the: Functional (walking surface, streets, traffic, and permeability); Safety (personal and traffic); Aesthetic (street scape and views) and Destination (availability and accessibility of facilities). Tools used for assessment have varying lengths ranging from 7 to 68 questions (Brownson et al., 2009). Although perceived measures have been widely used in adult (Evenson and McGinn, 2005, Alexander et al., 2006, Mujahid et al., 2007, Casey et al., 2008) and adolescent populations (Mota et al., 2005, Evenson et al., 2006), its use in children has been limited to those above 4<sup>th</sup> year of primary school (Timperio et al., 2004, Hume et al., 2006, Timperio et al., 2006). Some validity and reliability challenges have been encountered when perceived measures of the physical environment are compared to direct observation or GIS as reference standards (Scott et al., 2007, McGinn et al., 2007, McGinn et al., 2008, Ball et al., 2008). However, higher validity and reliability have been reported when researchers measured attributes like presence of sidewalks (Boehmer et al., 2006). Gattshall et al. (2008), developed and tested the validity and reliability of a survey tool that assessed home environments for physical activity and healthy eating in overweight children. The authors reported that the physical activity availability scale had high test-retest reliability ( $r=0.99$ ) and inter-rater ability

( $r=0.88$ ) and acceptable reliability for the physical activity accessibility scale (Cronbach's  $\alpha = .66$ ).

Systematic observation or audit tools allow for the establishment of the presence and qualities of specific features hypothesized to influence physical activity (Brownson et al., 2009). These may include features that are not commonly captured in GIS databases like the character and status of facilities. Tools may be designed for research purposes or for other purposes such as community-level needs assessment for facility improvements. Tools are structured to measure different segments and domains of the physical environment and with varying details of features of interest. An example of a reliable tool designed specifically for schools is the System for Observing Play and Leisure Activity in Youth (SOPLAY)(McKenzie et al., 2000). Since this method requires in-person observation and often is time consuming, they are often used for studies that seek to answer questions that are beyond what existing data can present like issues of quality (of facility). This method of assessment also requires that observers are trained to measure the physical environment with high inter-observer reliability.

Geographic Information System (GIS)-based measures are used to capture, store and display all forms of geo-referenced data (Chang, 2010) regarding physical environments hypothesized to influence physical activity of populations at the neighbourhood or regional levels. The most frequently assessed variables are population density, land-use mix, sidewalk coverage, vehicular traffic, crime, access to recreational facilities, street patterns and other composite variables (Brownson et al., 2009).

Validity and reliability of GIS-based assessments rely on geographic scale at which measures are aggregated as well as the accuracy and completeness of existing data sources. While inaccurate and incomplete data have been identified as threats to GIS data validity (Forsyth et al., 2006, Porter et al., 2004), the situation is likely to be much worse for LMICs including Ghana where there is rapid urbanization and weak implementation of policies regarding community planning. Although data on features like streets and population density can be more easily updated, it is staggered, and available existing data may not be reflective (completeness or quality issues) of the time of assessment (outdated). The University of Ghana's resource center for GIS-related activities in Ghana focuses mainly on natural resource and land-use (CERSGIS, 2014). Also data on other measurable variables such as crime are scarcely available. Access to GIS technicians with expertise on relevant variables of interest may be limited (Brownson et al., 2009).

## **2.7 Interventions to control or prevent Childhood Obesity**

Prevention of obesity in children could be primary, secondary or tertiary. Primary prevention, which is the most advocated for and more likely to be the most cost effective method involves a range of measures aimed at preventing normal weight children from becoming overweight or preventing overweight children from becoming more overweight in a given population. Secondary prevention involves measures aimed at preventing children with increased risk of obesity (overweight children, children of obese parents) from becoming obese. Tertiary prevention, which usually involves clinical practices, involves measures designed to prevent obese children from becoming more extremely obese and to prevent the worsening of co-morbidities and disabilities

associated with the condition. Irrespective of the fact that primary prevention is generally agreed upon by public health practitioners, the scientific evidence base of its effectiveness is limited (Lobstein, 2005), thus efforts are being put into targeted interventions and treatments.

A systematic review of school-based interventions in Europe to promote physical activity and healthy eating among children revealed that interventions that target both ends of the energy balance (diet and physical activity) yield better effects than a single approach (De Bourdeaudhuij et al., 2011). Furthermore, systematic reviews of effectiveness of interventions to improve diets and physical activities of children and adolescents reveal that multi-component interventions involving families are more likely to be effective compared to those limited to school settings alone (Van Sluijs et al., 2007, De Meester et al., 2009, Salmon et al., 2007, Kriemler et al., 2011, Horne et al., 2004, Story et al., 2000, Romon et al., 2009).

### **2.7.1 Global initiatives to control Obesity**

In response to the growing burden of chronic diseases, the 53<sup>rd</sup> World Health Assembly (WHA) affirmed physical activity as a key factor in the prevention and control, which led to the resolution that the WHO provide leadership in combating physical inactivity. In 2002, the 55<sup>th</sup> WHA requested the development of a Global Strategy on Diet, Health and Physical Activity (DPAS) within the framework of the prevention and control of non-communicable diseases. The WHO Global Strategy on Diet Health and Physical Activity (DPAS) was developed in 2004, to guide population-based approaches to increasing physical activity levels (WHO, 2004). The guide promotes development of national recommendations on physical activity for the general population or specific population

groups (children, adolescents, adults or elderly) and education on frequency, duration, intensity and types of physical activity necessary for health.

Countries like the United States, Australia, Canada, Fiji, New Zealand, Philippines and Switzerland have already developed national physical activity guidelines. In Ghana, efforts have been made through the Regenerative Health Unit of the Ghana Health Service using a strategy dubbed “Exercise is Medicine”. Focus is put on education of the general populace on the benefits of physical activity and how it should be carried out.

Considering that children are not immune to the growing burden of non-communicable diseases including obesity, the WHO has come up with the school policy framework to encourage member states to develop and implement school policies and programmes to promote healthy diet and increase physical activity levels. Paragraph 49 of the DPAS states, “School policies and programmes should support the adoption of healthy diets and physical activity. Schools are encouraged to provide students with daily physical education and should be equipped with appropriate facilities and equipment. Governments are also encouraged to adopt policies that support healthy diets at school and limit the availability of products high in salt, sugar and fats” (WHO, 2004). Other Global initiatives on school health in which WHO is a partner include: The Global School Health Initiative; focusing Resources on Effective School Health (FRESH); Nutrition Friendly Schools Initiative (NFSI) and the Global School Based Student Health Survey (GSHS).

Following the WHO’s Global initiatives, various countries have initiated national specific programmes to control obesity in the schools. These include: Chile (Vida Chile and EGO

Chile- implementing healthy living program in schools, education and extracurricular activities); Singapore (championing efforts resulting in improved school health (CHERISH), health education taught 30mins per week, physical education class (2-3 times and week, labeling of healthy foods in tuck shop; Slovenia (Aiming For Healthy Schools - specifying contents of school vending machines, integrating nutrition and physical activity into school curricular , apple in school project, etc.) and in Ghana (School Health Education Programme- integrating food and nutrition topics into curriculum of basic schools, and compulsory physical education in basic schools once a week in school in 1992). More recently, Ghana released the policy on prevention and control of NCDs (M.O.H., 2012) which targets all segments of the population including schools.

High level political commitment, collaboration between governments, communities and healthcare providers, and policy approaches have been identified as key components required for successful implementation of programmes for the prevention and control of NCDs (W.H.O., 2008).

### **2.7.2 School-based interventions**

School-based interventions to address childhood obesity are usually designed to influence the food environment and or physical activity environments directly or via educational messages regarding diet and physical activity. School based interventions usually take the form of nutrition guidelines, regulation of food and beverage availability or price interventions, while physical activity interventions take the form of classroom physical education and or practical involvement in physical activity. The effects of these school based interventions to control obesity have been assessed by various researchers.

According to Story, Nanny and Schwartz (2009), although the schools alone cannot solve the childhood obesity epidemic, it is also unlikely that childhood obesity rates can be reversed without strong school based policies and programmes to support healthy eating and physical activity.

A review by Kalakanis and Moulton (2006) indicated that all but one (Sherman et al., 1992) of the 16 studies that examined the effects of school based interventions on obese children found that the treatment reduced at least some measure of obesity.

#### *2.7.2.1 Physical activity-related interventions*

School-based physical activity-related interventions are delivered during school time as well as after school hours. Interventions can be grouped into three main strategies: curriculum-based strategies; environmental based strategies and policy-based strategies.

Physical education (PE) taught in schools is mandatory in many countries as a policy strategy. There is ample evidence that PE has positive impacts on habitual physical activity of children and children are more active on physical activity days (Tudor-Locke et al., 2006, Brusseau et al., 2011a, Kang and Brintahupt, 2009) and even more active when children had multiple classes of PE per week (Brusseau et al., 2011b). PE interventions carried out include: improving quality of PE classes, capacity building and staff training, changes in PE curricular and provision of materials and equipment (Donnelly et al., 2009).

A typical example of a successful school-based PE intervention is the Kinder-Sportstudie (KISS) study (Kriemler et al., 2010) in which the intervention group received two additional PE classes taught by PE teachers outdoors. At the end of the school year,

children in the intervention group showed significant reductions in measures of fatness determined by skinfold measurements, increased aerobics fitness, increased moderate-to-vigorous-physical activity and overall physical activity. The intervention group also reported significant improvements in biological risk factors like HDL cholesterol, triglycerides and glucose levels.

Other teacher or school staff-led interventions to improve and support physical activity among children have also been documented (Grydeland et al., 2013, Reed et al., 2008, Simon et al., 2008, Sichieri et al., 2009).

Some interventions have targeted girls' physical activity levels (Webber et al., 2008, Story et al., 2003, Robbins et al., 2013, Pate et al., 2005). The use of card games (Lakshman et al., 2010) and board games to increase physical activity among children and adolescents have also been explored.

After-school programmes have also been targeted for interventions to improve physical activity of children. Preliminary findings from a 3-year after-school physical activity intervention on fitness and body fat which included 40 minutes of academic enrichment, 80 minutes of moderate to vigorous physical activity, plus 40 minutes of vigorous physical activity through a variety of activities (Gutin et al., 2008). The authors found beneficial effects of the intervention on body fat and fitness of children during the school year. Successful after-school programmes have been reported by other authors (Vizcaíno et al., 2007, Lazaar et al., 2007).

A systematic review of school-based intervention to promote physical activity and fitness among children 6 to 18 years living in Australia, South America, Europe and North

America, found positive impacts on physical activity in school (57% of studies) and fitness of children (60% of studies) (Dobbins et al., 2009). The authors did not find any significant effects on leisure time physical activity outside school. However, a systematic review of all interventions to promote physical activity among adolescents (10 to 19 years) in Europe found 65% successes of interventions in improving physical activity although some longitudinal studies (3 out of 20) showed that increased physical activity levels were not sustained (De Meester et al., 2009, Crutzen, 2010).

In a review of literature from January 2007 to December 2010 on the effect of school-based interventions on physical activity, Kriemler and colleagues found that every single study that considered physical activity as an outcome reported intervention effects on at least one domain of physical activity (Kriemler et al., 2011). Contrary to previous evidence (De Meester et al., 2009, Crutzen, 2010), the authors found that increased physical activity recorded among children was sustained up to 12 months of follow-up.

Another systematic review and meta-analysis of effectiveness of physical activity interventions in controlled trials that used objective measures of physical activity found that all trials achieved small to negligible increases in physical activity although effectiveness was more in trials of exclusively overweight/ obese participants (Metcalf et al., 2012).

#### *2.7.2.2 Food-related interventions*

Children consume a substantial (between 19% and 50%) amount of their total daily calories at school (Gleason and Sutor, 2001), and since they spend more time in school than anywhere outside their homes, their involvement in physical activity while in school

will influence weight status. Further reviews of literature on school based interventions suggest that effectiveness have been shown for improvement in dietary patterns, intake of fruits and vegetables, and nutrient intakes; improving physical activity, but have shown mixed results for effect on BMI or other anthropometric obesity-related measures (Jaime and Lock, 2009b, Van Cauwenberghe et al., 2009). Policies that have been used to influence food environments include: fiscal food policies, mandatory food labeling, and restricting marketing of unhealthy foods.

A policy-based school intervention to prevent overweight and obesity involving 1349 students in grades 4 through 6 from 10 schools in a US city in the Mid-Atlantic region consisted of school self-assessment, nutrition education, nutrition policy, social marketing, and parent outreach (Foster et al., 2008b). The intervention resulted in 50% reduction in the incidence of overweight among children in the intervention schools.

After reviewing the effectiveness of school food and nutrition policies assessed in studies up to November 2007, Jaime and Lock (2009a) concluded that there was little or a lack of consistent evidence on effectiveness of regulations on food and beverage availability as compared to nutrition guidelines and price interventions focused on healthier foods within the school setting.

Regarding the influence of food price changes on consumption, Jeffery et al (1994) showed that fruit and salad patronage in a cafeteria increased three-fold when prices were cut to 50% and options were increased. Evidence provided by French et al. (2001) on pricing effects on low-fat snack purchases indicate significant increases in patronage of low-fat snacks at diverse worksites and schools following a price cut. Additionally, a

50% reduction in the price of fruits and vegetables in a school cafeteria doubled the consumption of carrots (French, 2003).

Evidence from the Pro Children study (Wind et al., 2008), which took place within three European countries, reported significant increases in fruit and vegetable intakes of children after a school curriculum-based intervention to fruit and vegetable intakes among children. The authors also found an association between the levels of fruit and vegetable consumptions and children's appreciation of programme, parental involvement and degree of implementation of the intervention by school. Other studies have also documented successes in increased fruit and vegetable consumption among children after a school curriculum-based intervention (Story et al., 2000, Horne et al., 2004, Caballero et al., 2003).

The 5-a-day power plus programme was a school-based intervention programme that combined classroom curriculum, school food services, food industry and parental support to improve fruit and vegetable intakes among multi-ethnic fourth and fifth grade children (Story et al., 2000). The authors found successes in consumption mostly at school lunches and not at home due to the low parental involvement observed.

Other interventions have also used school curriculum or school teacher to provide nutrition intervention (mainly education and encouragement) and have shown positive effects on desired outcomes including fruit and vegetable consumption, reduction of high fat/ sugar foods/snacks consumption, and child BMI (Marcus et al., 2009, Singh et al., 2009, Sichieri et al., 2009, Foster et al., 2008a). Board games have also been part of

interventions to increase nutrition knowledge and encourage healthy nutrition behaviour among children (Amaro et al., 2006).

Most European nations as well as the USA, and Canada, have policies that are enforced to regulate meals provided to children in schools. Within some of these countries, stricter guidelines at different levels of administration have been developed to regulate foods and drinks served to children in schools. This is not the case in most developing countries including Ghana. Since market environments (including sale of foods) generally develop in the absence of regulating policies (Moodie et al., 2006), the food environment within and around the basic schools in Ghana is expected to be varied and complex in nature. It is therefore necessary that the prevailing school food environment be studied to identify the possible opportunities for intervention.

The vast majority of these trials to assess effectiveness of physical activity interventions have been conducted in Europe and other developed or high income countries (US, Canada, Australia) with few from Brazil and Iran. Evidence on School-based interventions in low-income countries is scanty and none in sub-Saharan Africa (South Africa excluded). A review by Verstraeten et al. (2012) of interventions targeting dietary and/or PA behaviour in children and adolescents aged 6 to 18 years in LMICs showed that 82% of interventions targetting diet and physical activity of pupils were successful. However, they identified only 25 eligible studies, and the 22 that were retained were mostly from Latin America (n=13) and Asia (n=8). None of the studies was from sub-Saharan Africa. The very wide cultural, socioeconomic and policy differences between sub-Sahara Africa and other high income countries warrants more research first into the

design and implementation of existing school-based interventions and to examine their effectiveness in this setting.

### **2.7.3 Home or Family-centered interventions**

Home and family-based interventions to control overweight and obesity among children usually targets the entire household. Diet-related target areas are mainly to increase the availability of healthier food options like milk, fruits, vegetables, and low-fat or low-sugar snacks, while decreasing the availability of unhealthy options like sugar-sweetened beverages (SSBs), high fat and sugary snacks. Physical activity-related targets are mainly to reduce TV viewing and overall screen time and improve moderate to vigorous physical activity among children with parental encouragement and provision of logistics to assess recreational areas or play grounds. Home or family-based interventions usually takes four different forms: Parental education (direct individual or group education, provision of newsletters, self-assisted computer-based course materials, etc.), Parental behaviour modification (towards child weight status and healthy lifestyle adoption), Entire family therapy (offered by trained dietitians, pediatricians or other professionals) or combinations of the three different forms (Sung-Chan et al., 2013). Some examples of home or family based interventions are reviewed in the following paragraphs.

A randomized controlled trial testing the effects of SSBs on child weight outcomes used a 25-week nutrition intervention which consisted of home delivery of non-caloric beverages, nutrition education and counseling, monthly telephone calls to reinforce instruction and refrigerator magnets with messages under the theme, “think before you drink” (Ebbeling et al., 2006). The authors found an 82% reduction in caloric beverage consumption and reduced BMI among the intervention group.

Another intervention that used pediatrician consultations to inspire awareness of adequate nourishment and motion, with the aim of changing diet and exercise of selected children with impending obesity, found significant improvements in BMI z-scores (Keller et al., 2009). Davoli et al. (2013), also reported significant control of BMI in overweight children after pediatrician-led motivational interviews with children and families.

A one-year intervention designed to promote adoption and maintenance of improved eating and PA behaviors through a computer-supported intervention reported some improvements in diet, physical activity and sedentary behaviours of adolescents (Patrick et al., 2006). The intervention was initiated in primary health care settings with a parent component to encourage behaviour change through praise, active support, and positive role-modeling

An intervention designed to reduce excessive weight gain in families with at least one child at risk for overweight, encouraged families to increase walking by 2000 steps per day above baseline step-counts and to consume two ready-to-eat cereals, one at breakfast and the other for snack (Rodearmel et al., 2006). The results showed positive significant effects on child BMI-for-age percentile and percentage body fat as well as parent BMI and body fat percentage. There were also significant improvement in the steps taken per day in both parents and children.

Parenting behaviour is viewed as a good target for interventions to control obesity related diets and physical activity behaviours in children and adolescents since there is strong evidence of the relationship (Whear and Axford, 2009). However, no available published

study has examined its relationship with childhood obesity among school-age children and adolescents in Ghana.

#### **2.7.4 Neighbourhood or community based interventions**

Interventions to control overweight / obesity in communities and neighbourhoods usually take the form of community-wide campaigns, mass media campaigns, delivery of short messages at key community sites, social support interventions in community settings and physical activity classes in community settings.

Integrating community-wide programmes into interventions targeted at reducing childhood obesity has the potential for sustaining gains made at the individual or institutional levels. Valenzuela et al (2010) reports on the acceptability and impact of a community-based marathon and nutrition programme for children 5 to 14 years. According to the authors, the 'local ownership' of the programme demonstrated by the schools and families of participating children, coupled with the social context in which children were encouraged to eat healthily and be active were key to the successes gained. The effects of such community-based programmes often go beyond the targeted children in schools and spills over to their families, friends and neighbours as well. Although, general increases in physical activity were recorded for all children due to the long period over which the marathon was undertaken, improvement in fruit and vegetable intakes was not universal. Children in the oldest age group (11-14 years) were less likely to report reduced soda consumption or increased consumption of fruits and vegetables than the younger age groups. The authors suggested that there was a need to create developmentally appropriate ways that target the 11-14 years age group to improve diet-related behaviours and enhance success of nutrition interventions.

Lastly, the Mind, Exercise, Nutrition, Do it (MEND) Program, a multicomponent community-based childhood obesity intervention for obese children provided 18 two-hour group education and twice-weekly physical activity sessions in sports centers and schools, followed by a 12-week free family swimming pass (Sacher et al., 2010). After 12 months, significant reductions were recorded in child waist circumference and BMI as well as benefits of cardiovascular fitness, improved self-esteem and physical activity.

## **2.8 Summary**

This chapter explored the relevant literature on the burden of childhood overweight and obesity. It also assessed its determinants as well as interventions to address the challenge. Many of the studies reviewed had been conducted in high income countries, with very few from low-income countries especially sub-Saharan Africa. While the literature reviewed is quite conclusive on biological, early-life and behavioural determinants of childhood overweight and obesity, it has been inconclusive for environmental determinants. This notwithstanding, evidence from randomized control trials suggest positive effects on child weight status following changes made in homes, communities and school settings. More significant is the very little evidence on weight status of school-age children and their determinants in Ghana.

## CHAPTER THREE

### METHODS

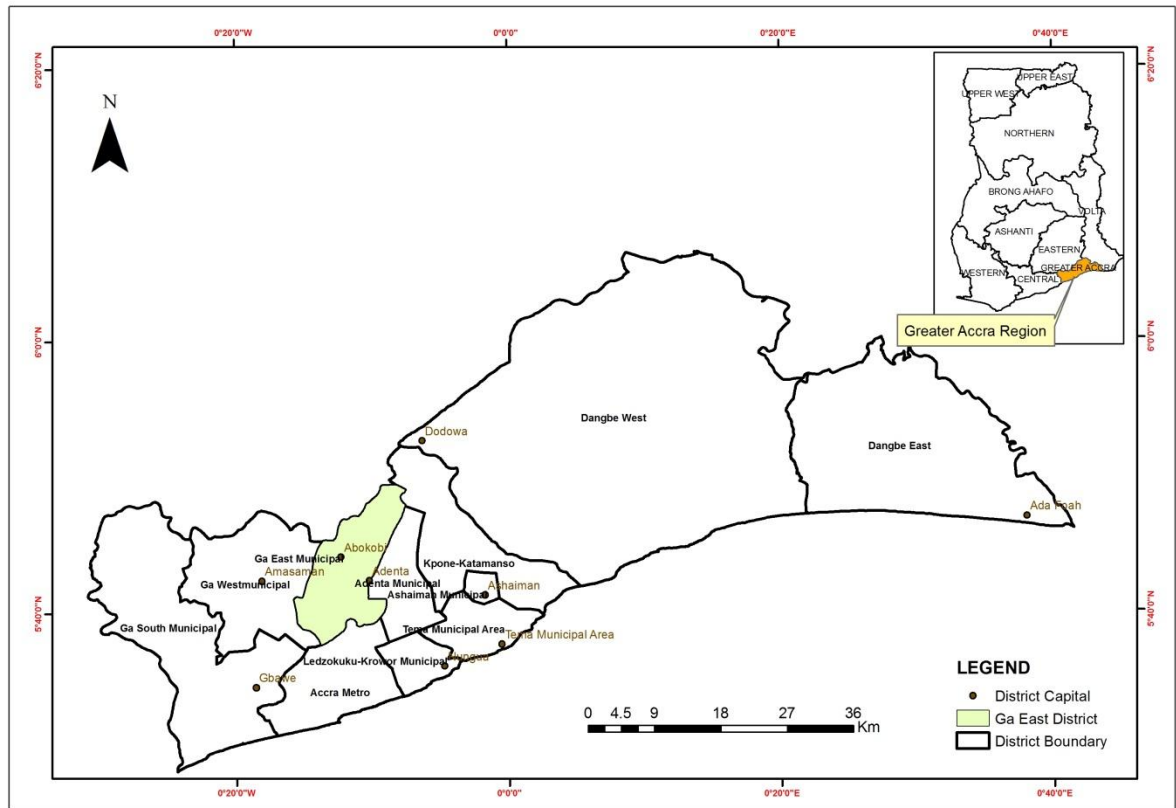
#### 3.0 Introduction

This chapter describes the methodology of the study. It describes the study area, study design, sampling procedures, sample size determination, data collection techniques and tools, data analysis, ethical considerations and confidentiality. Information about the study area were obtained from Ga-East Municipal Assembly (GEMA, 2006), Ministry of Food and Agriculture district summaries (MOFA, 2013), Ministry of Finance and Economic Planning composite budget for fiscal year (2012), summary results of the 2010 Ghana Population and housing census (Ghana Statistical Service, 2012) and the Greater Accra Region 2008 annual review of sector performance (Ghana Health Services, 2009).

#### 3.1 Study Area

This study was conducted in the Ga-East Municipality, located at the Northern part of the Greater Accra Region (Figure 3.1). This Municipality was created out of the former Ga District Assembly by an act of parliament (Legislative instrument 1589) in 2004, and is one of the 16 administrative districts of the Greater Accra Region, Ghana. The Municipality has a total land area of 166 km<sup>2</sup> (Ghanadistricts.com, 2006). It is bordered on the west by the Ga-West Municipal Assembly (GWMA), on the east by the La-Nkwantanang-Madina Municipal Assembly, the south by Adentan Municipal Assembly (AdMA) and on the north by the Akuapim South District in the Eastern Region of Ghana.

Figure 3. 1 District Map of the Greater Accra



Source: CERSGIS, University of Ghana, Legon

### 3.1.1 Administrative structure of the Ga-East Municipality

The Ga-East Municipality has Abokobi as its Municipal capital. The municipality consists of 10 electoral areas which are represented in the general assembly by 18 members: 10 elected members, 5 appointed members, the municipal chief executive and two members of parliament representing Abokobi-Madina and Dome-Kwabinya constituencies. The general assembly is headed by an elected Presiding member with the Municipal coordinating director as the secretary. The Assembly has the following sub-committees: Development planning; Finance and Administration; Justice and Security;

Works; and Social Services sub-committee. Decentralized departments under the Assembly are: Department for Urban roads; Department of Agriculture; Survey Department; Department of Social Welfare; Department of Feeder roads; Department of Births and Deaths; and Department of Cooperatives. Services within the assembly include Ghana Education Service, Ghana Health Service, Ghana National Fire Service and the Ghana Police service. Development work in the assembly is being supported by the establishment of 3 Zonal councils in Madina, Dome and Abokobi areas.

### **3.1.2 Climate, vegetation and Agriculture**

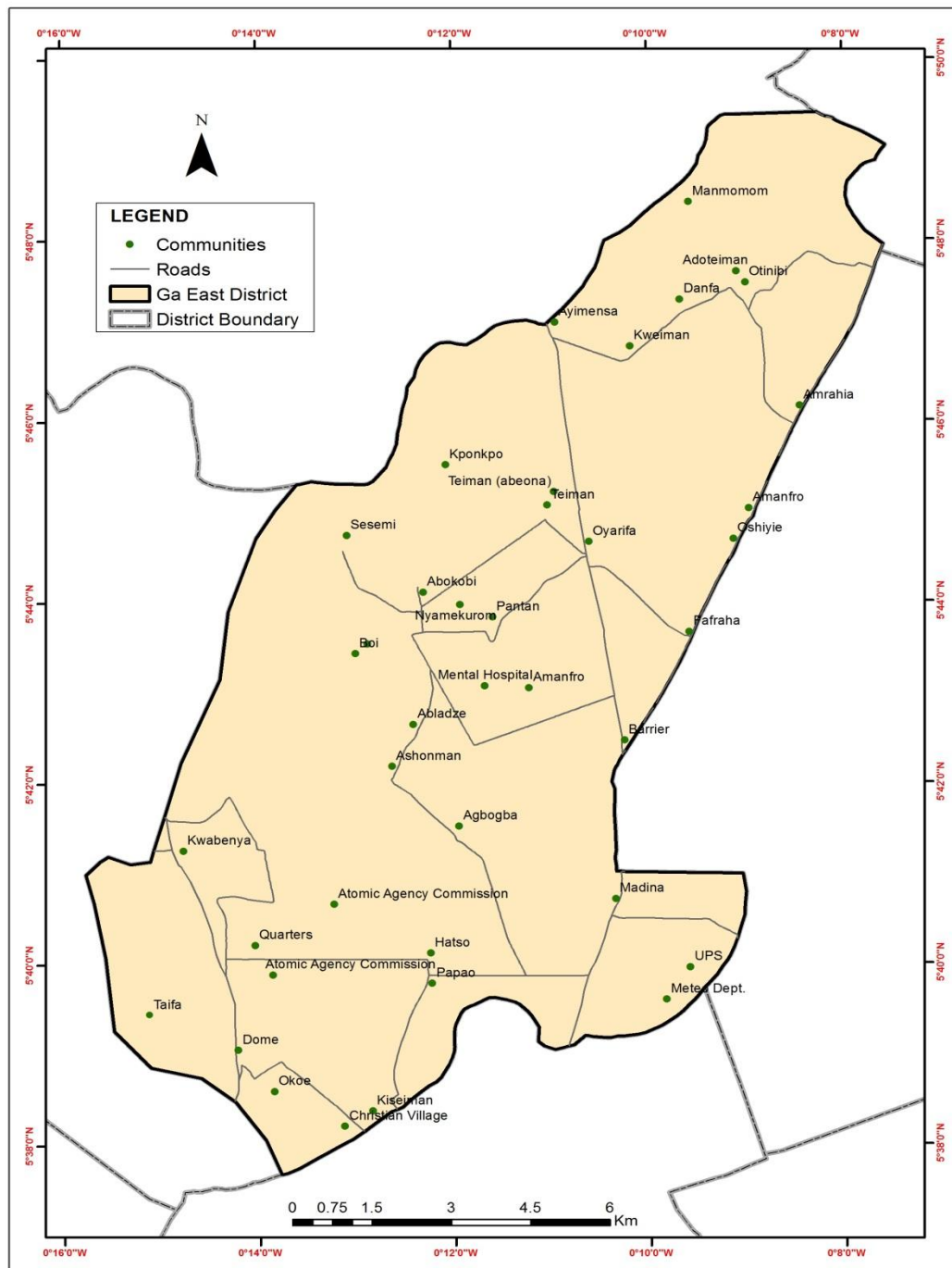
About 107.90 km<sup>2</sup> of the total land size is for agricultural production while the remaining 58.10 km<sup>2</sup> is urbanized. Farmlands are mostly in the rural communities and scarcely in the urban centers. The municipality lies within the savanna agro-ecological zone. Rainfall pattern is bi-modal with major season in April to July. Average temperatures range between 25.1 °C in August and 33°C in February and March. Relative humidity is about 75%. The two main vegetation types present are shrub-lands and grasslands. The shrub-lands, which consist of dense clusters of small trees and shrubs, are mostly in the western outskirts and the north towards the Aburi hills. The grasslands are mostly in the southern parts of the municipality and are gradually being replaced by human settlements and activities. There are few streams such as Sisami and Dakubi which are located in Sesemi and Ajako respectively. A few small ponds also exist at Ablorajei, Sesemi, Danfa, Otinibi and Old Ashongman.

Land in the Municipality is owned by chiefs, clan or family heads who hold them in trust for their subjects. Lands can be acquired through direct purchases, renting, leasehold and

share cropping. The soil types commonly found in the municipality are mainly sandy and clayey loam, with alluvia soils found in the bottoms of valleys.

About 55% of the economically active population is engaged in agricultural-related activities, with about 70% of those in the rural areas depending on agriculture for livelihood (Ghanadistricts.com, 2006). About 95% of farmers in the municipality are small holders. The major agricultural activities are crop production and livestock production. Inhabitants mostly grow vegetables such as pepper, tomatoes, cabbage, okra and garden eggs. Watermelons are also grown in the municipality. Major crops like maize, cow pea and rice are also produced. Major root crops grown in the area are sweet potato, yam, cassava and cocoyam. Most of the cassava produced is processed into gari and cassava dough by women in the municipality. The municipality also is home to Cassia and Neem tree growing. Livestock production includes large scale poultry farming, goat and sheep rearing. Other livestock produced on small scale are pig, rabbit, turkey and cattle farming. Snail farming, mushroom farming and grass cutter rearing are also common in the municipality. Major centers where feed mills are located in the municipality are Adenta, Oyarifa, Abokobi and Amrahia. Irrigation facilities are located in various areas for vegetable production such as Kweiman, Musuko, Kwabenya and Haatso. Various agricultural produce from the municipality are marketed both locally and on export markets. Most of the produce is bought at the farm gate level or at the marketing centers at Madina, Taifa and Haatso markets.

Figure 3.2 Map of Ga-East showing major towns and communities



Source: CERSGIS, University of Ghana, Legon

### 3.1.3 Socio-demographic Characteristics

The 2010 Demographic and Health Census put the population of the municipality at 259,668 with a male and female population of 127,258 and 132,410 respectively, (representing 51% and 49% of males and females respectively). About 82% of the municipality's total population resides in urban and peri-urban areas while the remaining 18% reside in the rural areas of the municipality towards the Akwapim hills (Ghanadistricts.com, 2006). There are about 65 settlements in the municipality and the average household size is 6.2 persons. About 39% of the population is below 20 years of age. Due to its close proximity to the Accra Metropolitan area, more people continue to migrate from other rural parts of the nation into the urban and peri-urban areas of the municipality, particularly into towns like Madina, Haatso, Dome, Taifa and Agbogba. The population density of the municipality based on the 2010 population and housing figures is 1564 persons per Km<sup>2</sup>, which is much higher than that of the Greater Accra region (1236 persons per Km<sup>2</sup>), thus putting pressure on land and resources in the municipality.

The four main economic activities in the municipality are commerce, agriculture, services<sup>4</sup> and industry (Ghanadistricts.com, 2006). The population is predominantly Christian (85.9%), about 10.6% Muslim, 2.3% with no religion and the remaining being traditionalists or of other religious domains (Ghana Statistical Service, 2012). Less than 10% of the population 11 years and older are not literate; more than half (53.4%) are literate in both English and Ghanaian languages; 30.5% are literate in English only and the minority are literate in various combinations of languages. About 36.2% of the

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<sup>4</sup> Services mainly comprises of banking and financial services

population aged 3 years and older are still in school and less than a tenth (6.9%) have never being to school.

#### **3.1.4 Health infrastructure and healthcare services**

The municipality is administratively divided into four sub-municipalities for the organization of primary healthcare services. These are: Madina; Danfa; Taifa and Dome. The Municipal Health Management Team (MHMT) is responsible for health services in the municipality; within each sub-district, there are sub-municipal health management team is responsible for the health services. These sub-municipal services are organized around a health center or community clinics that provide preventive and curative health care services. Other health resources in the municipality are maternity homes, traditional healers, trained TBAs, chemical shops, pharmacies. The current population to doctor and nurse ratio are 49,020: 1 and 2,254:1 respectively.

There are 39 health facilities in the municipality of which two are public polyclinics, two health centers and one Community-Based Health Planning (CHPS) compound). The two polyclinics are the Madina Polyclinic at Kekele and Madina polyclinic at Rawlings circle. The Health centers are at Abokobi and Danfa whiles the CHPS compound is located in Taifa. There is no public municipal hospital that caters for cases referred from the polyclinics and health centers. Alpha medical center, which is owned by a faith-based organisation, serves as the municipal hospital and has admission capacity of 40 beds. There is also a quasi-government health facility at Kwabenya which serves workers of the Atomic Energy Commission and the communities close to it. The Pantang Hospital also provides Out Patient Department (OPD) services. The remaining health facilities are privately owned and residents in Dome and Taifa, especially, access health facilities in

neighbouring municipalities as there are no public-managed health facilities in those sub-municipalities (See Figure 3.2 for location of communities). Public health services offered in both public and private health facilities include anti-natal care, supervised delivery, post-natal care, family planning, child welfare clinic and adolescent health services.

### **3.2 Study Design**

This study design was cross-sectional involving both private and public schools in the Ga- East Municipality, their pupils and parents. Information on obesity was measured at the same time together with other variables of interest including interception of pupil purchase, inventory of foods available to pupils during school hours, opportunities for physical activity at school, diet and general physical activity of pupils.

#### **3.2.1 Study Population**

The study population included: (1) basic school pupils between the ages of 9 – 15 years attending both private and public schools within the Ga-East Municipality of the Greater Accra Region, and their parents. Pupils within this age group were in Upper Primary classes 4 - 6 and Junior high school forms 1 – 3. Minimum age for participating pupils (9years) was chosen due to cognitive requirements required to provide dietary (Thompson and Byers, 1994) and physical activity data (Shephard, 2003) (2) Basic schools: The list of schools within the district was obtained from the Ghana Education Service (GES) (last updated 2009). Schools that indicated acceptance to participate by signing acceptance forms, had their entire environments assessed including facilities for feeding and physical activity. (3) Head-teachers or appropriate representative of schools

provided information on school policies and practices regarding eating and physical activity at school.

### 3.2.2 Sample size calculation

Sample size for pupils participants in this study was computed using Epi-Info software (version 6) sample size and power calculator. Based on obesity prevalence of 12% reported by Goh (2006) among basic school pupils in a private school in Accra, expected obesity prevalence in sample population was set at 10% for the entire district and the worst acceptable prevalence set at 7% due to the relatively lower prevalence expected among public school pupils. Values imputed into calculator were as follows:

- Population size = 50, 200 pupils
- Expected frequency = 10%
- Worst acceptable = 7%

At 95% confidence interval, sample size estimation from calculator was = 381(≈ 390) pupils

Assuming a non- consent rate of 15% (≈ 58) pupils, the total number of pupils to be invited to be part of the study was **448** pupils.

### 3.2.3 Inclusion Criteria

The Inclusion criteria were as follows:

Pupils: All pupils attending both private and public basic schools in the Ga- East Municipality of the Greater Accra Region of Ghana, aged 9 -15 years, who indicated willingness by providing assent to participate in the study and received parental consent

to participate even when parents themselves indicated unwillingness to participate in the study.

Parents: All parents of selected pupils who indicated willingness to participate in study by providing written/ signed consent.

Schools: All basic schools in the Ga-East Municipality were eligible, but only randomly selected schools were invited to participate. Assessment of school policies on foods and physical activity was obtained from all consenting heads of institutions or their representative. Only participating schools had their facilities and environment assessed.

#### **3.2.4 Exclusion criteria**

The exclusion criterion used to classify respondents as in-eligible for participation in this study included: Pupils who met the inclusion criterion but had physical deformities that interfered with body measurements and subsequent determination of Body Mass Index (BMI). However, no pupil was excluded due to physical deformity.

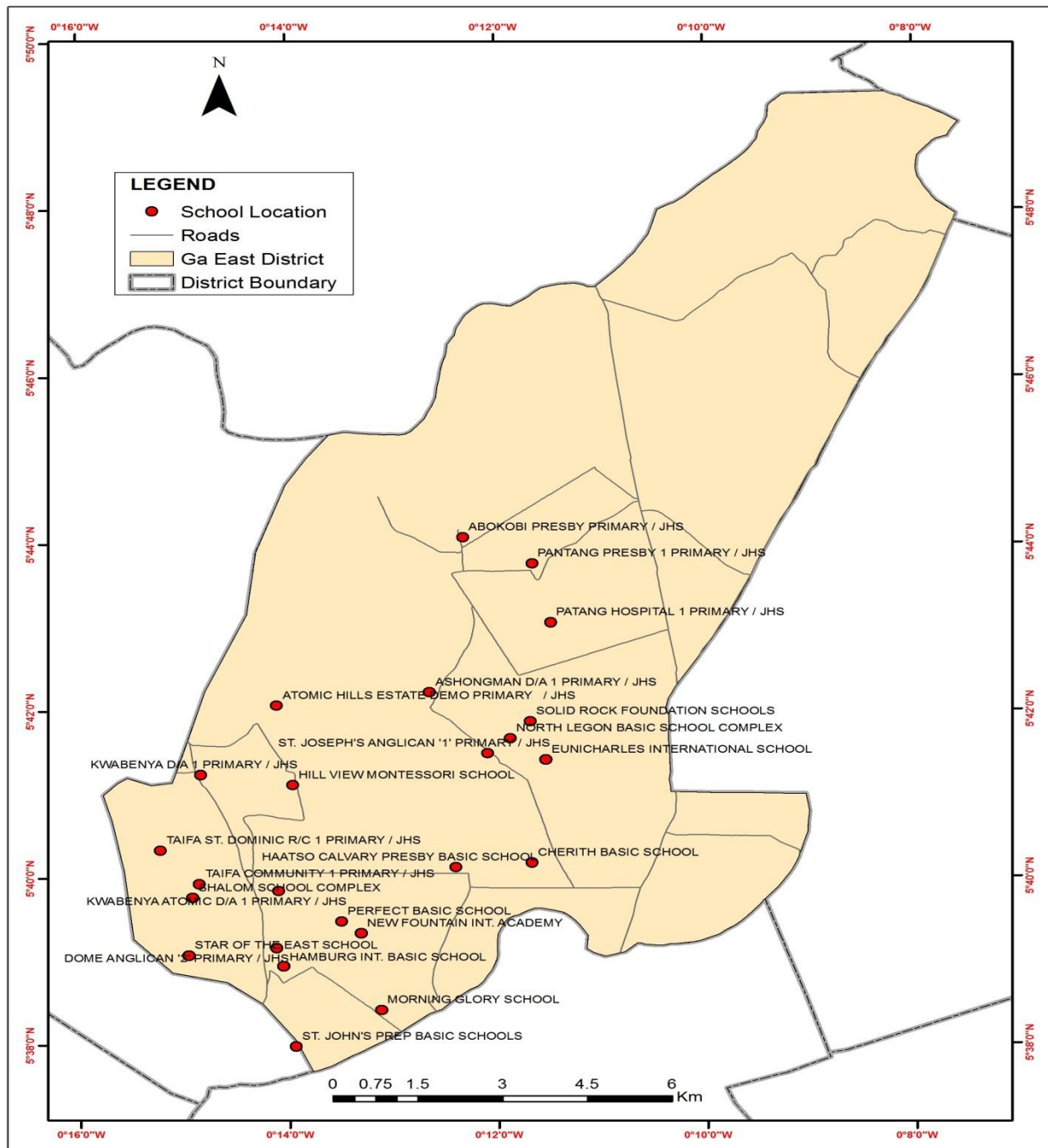
#### **3.2.5 Sampling Procedure**

A two-stage sampling technique was employed in this study. Simple random sampling (balloting technique) was used to select **12** private and **12** public schools from a total of 80 registered basic schools (about a third of schools having both primary and Junior High School) in the municipality: 43 public and 37 private (See Figure 3.3 for location of schools within Ga-East Municipality). The population of school children (both private and public) in the municipality was 50,119 with a male to female ratio of about 1:1. Decision taken prior to commencement of study was to replace schools that refused to give permission to be involved in study by another school with similar population and administration type. Only one school refused to give permission to be involved in this

study since it was going through major structural renovations at the time of the study, and was replaced appropriately.

A sample proportional to the size of each school was selected to make up the total sample size of 500 pupils. Since the sampling procedure for the study children was “balloting without replacement”, the total number of pupils selected from each school was increased by 30% in order to accommodate for losses to follow-up due to anticipated delays in receiving parental consents and actual commencement of pupil and parent interviews. Balloting was employed to select participating pupils (total = 707) in each school. Pre-labeled (either yes or no) ballot papers with expected number of required participants were sent (in no specific order) through primary 4 to JHS 3 for eligible pupils to pick. Pupils who picked “yes” were given parental consent forms to send home for endorsement. Those who picked “no” were exempted from the study. Weighted numbers of boys and girls were selected by splitting the number of required participants (‘yes’ ballots) equally into separate bowls for boys and girls and making it up to the total population of each sex by adding ‘No’ ballots. This selection method was employed to increase participation of pupils and to prevent overweight pupils or their parents from feeling stereotyped, which was the main reason for non-consents from obese pupils or their parents in a previous study (Ghana School Survey, 2012).

Figure 3.3 Map of Ga-East Municipality showing selected schools' locations



### **3.3 Data Collection techniques**

All data collected from pupils, parents and heads of selected basic schools in this study employed the interviewer- administered questionnaires technique. Data on school environment and facility assessment were obtained through observations and checklists completed by the researcher.

### **3.4 Study Instruments**

Separate structured questionnaires were used to obtain quantitative information from pupils and their parents. The questionnaire administered to the pupils (see Appendix 1) had six main sections soliciting information on socio-demographics, eating patterns, consumption of snacks, dietary assessments, physical activity and body anthropometry. The parent questionnaire solicited information on socio-demographics, home food environment and body anthropometry (appendix 2). Semi-structured questionnaires (Appendices 3, 4, 5, 6 & 7) were used to gather information on school policies relating to feeding and physical activity, school environment and facility for physical activity and feeding. The checklists were completed through observation and with the assistance of students or staff when necessary (e.g. recreational centers or video game stations around the school). Additionally, a separate structured questionnaire (Appendix 8) was used to assess foods frequently purchased by pupils during school hours. This was based on interaction of research assistants with each intercepted pupil. Average weight and cost of food were obtained for all purchases.

#### **3.4.1 Data information sources**

Most of the questions used in the child questionnaire were extracted from a previous study (Ghana School Survey, 2012). The child physical activity questionnaire (PAQ-C),

which has been shown as a valid and reliable method for assessing children's general levels of physical activity during school year, was used to establish child's physical activity status (Crocker et al., 1997). Some of the sports or games unfamiliar to Ghanaian children were replaced with more familiar games with comparable levels of exertion. Most questions in the parent questionnaire measuring aspects of the home food environment were extracted from previous studies: the last four questions in the parent questionnaire were obtained from the pressure-to-eat sub-scale of the child feeding questionnaire (Birch et al., 2001). Most questions on school policies were adapted from the Nneumark-Sztainer: food policies questionnaire (EPIfTAC 600 (7-7) 2/01 Ver. 1, <http://appliedresearch.cancer.gov/>), and school policy assessment tools used by French et al. (2002).

### **3.4.2 Type of data collected**

Different sets of data were collected from pupils, parents, heads of schools and the school environment. Data collected according to the source are described below.

#### *3.4.2.1 Child Questionnaire*

##### **3.4.2.1.1 Background/ Socio-demographic information**

Data collected include: completed age (years); date of birth; place of residence; household size; number of siblings; educational level of mother; occupation of both parents; residential status; household ownership of a car, refrigerator/ freezer, television, DVD/ VCD player, computer, gas/ electric stove and air conditioners; money brought to school each day for food.

#### 3.4.2.1.2 Eating Patterns

Data collected included consumption of breakfast, meal frequency, meals usually skipped with reasons, foods avoided by child, child's rating of like and dislike of certain meal times and reason.

#### 3.4.2.1.3 Consumption of Snacks

Snacks assessed in this study included biscuit, pies, cakes, doughnuts, plantain chips, spring rolls and imported packaged snacks like Pringles and potato chips. Information was collected on consumption over past 24 hours, average daily consumption and average number of days per week consumed. Also data was collected on soft drink and sugar- sweetened beverage (SSB) consumption in the past one week. Days per week on which soft drinks or SSBs were consumed, the quantity, availability in the home, parental reaction to soft drink intake and how often they bought soft drinks from vendors at school were also assessed.

#### 3.4.2.1.4 Dietary Assessment

This was based on a one-time 24-hr dietary recall and a 7-day food frequency questionnaire (Thompson and Byers, 1994). The dietary recall data was used to estimate the recent nutrient and caloric intake of the pupils. The 24-hour dietary recall form was used to collect information on all foods and drinks consumed by an individual over a 24-hour period. This included sections on breakfast, lunch, supper, food items or drinks taken with or in between the main meals. Pupils were assisted to estimate portions consumed using household measures that were displayed during interviews. The actual amount (grams) of food consumed was estimated using pre-weighed food quantities by household measures during a dietary validation study (Department of Nutrition and Food

Science, University of Ghana). Foods which were not included in dietary validation survey were purchased from three different locations and mean weights were recorded for various household measures.

Foods and drinks consumed were analysed to determine their nutrient and caloric content using Ghana Food Composition tables (Ghanafoods, 2002) incorporated into ESHA FPRO version 10.0.0. Adequacy of calories and specific nutrients consumed by respondents over the 24 hour period were determined by comparing intakes with Recommended Dietary Allowances. Respondents' intakes that met the RDA and were within the upper tolerable limits for specific nutrients were described as adequate.

The 7-day food frequency questionnaire was used to capture dietary intakes over the immediate past 7 days. It was used to collect information on daily and weekly intake of foods from certain food groups. These included: fruits and vegetables; protein foods like eggs, meat and fish; legumes like beans, melon seeds and nuts; soups ; breads; staples like cereals and starchy foods; milk and dairy products; ice creams, lollipops and chocolates; fast foods like pizza, burgers, potato chips; deep fried local snacks like fried yam/ plantain/ cocoyam/sweet potato. Also, information on the usual source of food items was collected.

#### 3.4.2.1.5 Physical Activity

Data collected in this section covered: physical exercise/ sports (frequency and duration of participation in any sporting activity or outdoor game like soccer, ampe, stair climbing, swimming, volleyball, riding bicycle); Duration of leisure activities like television watching, playing video games, idling, listening to music, working on computers and

reading; transportation to school (i.e. whether child walks to school or is transported to school and the time spent doing either; child's estimation of how often they were physically active at recess, lunch time, right after school, evenings and weekends; Frequency and minutes spent doing household chores like washing clothes, sweeping, cleaning room, fetching water, washing cars and cooking.

#### 3.4.2.1.6 Anthropometry

Anthropometric measurement of weight (kg) and standing height (cm) was carried out. All measurements were taken in the school with participants wearing their usual school uniform but without foot wear, socks, watches, and items in pocket or any heavy clothing like jacket or sweater. Interference of complex hairstyles with height measurements were reduced by encouraging participants to let hair down when possible and or by firmly pushing the head piece of height rod to compress hair. All anthropometric measurements were taken in duplicate. The same research team that administered the questionnaires was trained to take weight and height measurements of participants.

Standing height was measured using the Charder HM200P portable stadiometer (Charder Electronic co., Ltd, Taichung, Taiwan) to the 0.1 centimeter. Measurement was taken with the child standing in upright position, feet together, with back, calf and heels touching the height rod and head positioned to have the Frankfurt plane perpendicular to the board. The child was made to take in a deep breath and the head piece was lowered unto the top of child's head. Reading from the board was taken at eye level. This procedure was adapted from Shorr (1986). Body weight was measured with a portable Seca electronic weighing scale (SECA, Hamburg, Germany) to the nearest 0.1 kg (Shorr, 1986).

### 3.4.2.2 *Parent Questionnaire*

#### 3.4.2.2.1 Background data

Data collected include age, relationship with index child, and marital status. Socio-demographic and economic section covered questions on educational levels of parents/guardians, occupation of parents/guardians, residential status, number of persons in household, number of children in household, and monthly household income.

#### 3.4.2.2.2 Home food environment

The first four questions were on 'parental modeling' of snacks and soft drinks consumption and included: frequency of consumption of snacks and soft drinks in general and the number of times consumed in the presence of the child. The next five questions assessing the availability and accessibility of snacks and soft drinks in the home solicited information on whether the items were stored in the home, whether children were allowed to have them at any time. The next two questions assessed parental provision of snacks and soft drinks to children by either packing it for children or specifically giving them money to purchase them for school. The next two were on the use of drinks and snacks as reward by parents. and the last four questions (pressure- to- eat sub-scale) gathered information on whether parents thought that their child should always eat all of the food on their plate, whether they were specifically careful to make sure that their child ate enough, whether they still try to get their child to eat even when child says 'I'm not hungry', and whether they thought that their child will eat much less if he/she did not regulate.

#### 3.4.2.2.2 Parent Anthropometry

The weight (kg) and height (cm) measurements of the parents followed the same procedure as that indicated for the pupils. Procedure was adapted from Shorr (1986).

#### 3.4.2.3 School Policies relating to feeding and physical activity

Information on school policies was obtained from heads of schools and /or school appointee. Responses regarding school policies were gathered from a total of 28 heads representing 24 schools that participated in this study. Four of the public schools had separate head-teachers for both the primary and Junior high schools which were located within the same compound. These 4 schools in question formed part of a cluster of schools and responses were combined together. Thus, this report describes the 24 schools that participated in the study. Information collected included: presence of any relevant written policy; rules and regulations related to diet (guiding the sale of food in school's premises, foods allowed into school compound, eating place and times for pupils, whether pupils are allowed to go outside school to buy food, food used as rewards); involvement of school in food sale to pupils; rules and regulations regarding physical activity (recess during school hours, availability of school sports facility for pupils to use); provision of physical education lessons and practical (including availability of a trained instructor, required involvement of pupils, usual level of activity allowed, duration and frequency), and possession of school teams for various sporting activities. Head teachers were also asked to provide their general remarks on school physical activity policies by rating the school's priority on a 5-point scale: strongly agree; agree; neutral; disagree and strongly disagree. Below are the statements:

1. "Nutrition/ nourishment is high on our list of priorities in this school"

2. “The management team of our school support the provision of healthy foods through school canteen service”
3. “Our school canteen service provides mainly foods with high nutritional value”
4. , “Our school canteen service provides mainly foods with high nutritional value”
5. “Physical activity is high on our list of priorities in this school’s”
6. “Our school has adequate facilities for pupils to be physically active regardless of weather”
7. “The management team of our school encourages pupils and staff participation in physical activity”
8. “Our staff are committed to, and support physical activity and extra-curricular activities”

Head teachers were also asked to indicate how important it was for schools to provide an environment that encouraged healthy food choice by pupils; importance of having a school/ district/ nationwide policy on food for basic schools; importance for schools to mostly provide only healthy foods to pupils.

#### *3.4.2.4 School Facility Assessment:*

Assessment of the school facility and environment included data on: presence or absence of canteens, structure of eating place, food vendors, availability of water and soap for hand washing and provision of clean drinking water; location of food vendors in school, types of food served, playing ground, sports facilities, recreational centers or video game stations around the school. An inventory of the types of foods sold by vendors within the school compound and those within a 100m radius round the school was taken. An environmental scan was conducted for each school using Geographical Positioning

Systems (GPS). Total area covered by school, open spaces, school parks and playgrounds were measured in square meters. The positions of all food sale points within and around school as well as physical facilities for physical activity were captured with the GPS and converted into maps.

#### *3.4.2.5 Assessment of foods frequently purchased by pupils*

In order to describe the type and nutrient content of foods frequently purchased by basic school pupils, pupils aged 9-15 years were intercepted by research assistants after purchasing items during break time. On the day of assessment, researchers stood at vantage points (school and classroom entrances, paths to vending sites, corners and entrances of canteen area, etc.) within school compound and pupils spotted were interviewed on items purchased during break time. Information was gathered on amount, and cost of foods purchased by pupils. Purchases were described based on type of food (soft drink/sweetened drinks; local snacks; fried local snacks; confectioneries; complete meals; pastries; imported packaged snacks; fruits; other items like soybean khebabs, boiled eggs, fried sausages, fried chicken, etc.), amount (in grams) and the place of purchase (within school compound or outside).

Nutrient content of packaged snacks were obtained from the packaging when available. Samples of frequently purchased foods that had no nutrition information on packaging were purchased and weighed, and subsequently analysed with the food processor plus and/ or the Ghana food composition database to get energy and nutrient content.

### **3.5 Pre- data collection activities**

The following activities were carried out before actual data collection on the field to ensure the reliability of the data.

#### **3.5.1 Training of field research assistants**

A 5-day intensive training was organized for the field research assistants. All research assistants were either university graduates or final year students from the Nutrition and Food Science department of the University of Ghana. The training involved a comprehensive exposition on key concepts and methods regarding the study. Twelve field research assistants including two supervisors were trained for data collection on this study. The following topics were discussed extensively:

1. The objectives of the study
2. Description of obesity and its risk factors
3. Selection of study participants
4. Interviewing skills with emphasis on interaction with children and courtesy for adult participants
5. Receiving informed consents from study participants
6. Review of all questionnaires and checklists
7. Dietary assessment techniques
8. Appropriate translations of questionnaire into two Ghanaian languages (Twi and Ga) for participants not fluent in English language
9. Mock interviewing and recording of responses

### **3.5.2 Pre-testing**

Questionnaires used for this study were pretested in two schools that were not in our selected sample. Child questionnaires were administered to pupils aged 9-15 years from primary 4 to JHS 3. Parent questionnaires were tested on some parents. Tools for assessing school policy and environment were also tested. A few of the questions were modified to ensure clarity and the reliability of the responses based on feedback from pre-testing exercise.

### **3.6 Confidentiality**

Separate interviews were conducted with the pupils in each school. As much as possible pupils were separated from others during interviews. This was to ensure that pupils were comfortable enough to provide responses for various questions. The same was done for parents who participated in this study.

### **3.7 Ethical considerations**

The rights of the participants were ensured through the following measures

1. Ethical Clearance was obtained from the Institutional Review Board (IRB) of the Noguchi Memorial Institute for Medical Research with reference number NMIMR-IRB CPN 102/11-12 (Appendix 22).
2. Permission was obtained from the Ghana Education Service (both from Director General's department and the Ga-East Municipal Director of Education) and heads of selected schools before any contact with pupils.
3. Consent forms explaining study objectives, procedure, confidentiality, benefits and voluntary nature of study were given to pupils to take home to seek parental

approval (appendix 9). Parents were also required to sign a separate consent forms (appendix 10) to indicate their willingness to participate in the study. Only children with parental consent were involved in this study. Each pupil also signed an assent (appendix 11) form before participation after receiving parental consent.

4. Privacy was ensured during individual interviews and free nutritional counseling was offered after participation in the study. All field tools had unique Identification numbers which were used on forms and during data entry. The document linking individuals with IDs was kept by researcher in locked cabinet and all data stored in the computer was password protected.

### **3.8 Actual data collection**

Data was collected from all pupils and some parents from June to July 2013. All 24 selected schools were visited within the period. All pupils (487) were interviewed in the school premises as well as 150 parents. Most (137) of the parents who indicated willingness to participate but could not come to the child's school on scheduled day for body measurements opted for weekend appointment in a selected school or at their home (August to October 2013) after data collection on pupils ended. A few parents (56) who were still interested but were not available for in-person interviews opted to answer questions on phone. Thus, no body measurements were obtained for those parents. Ninety-two parents could not be contacted at all and hence did not participate in the study although they provided consent.

#### **3.8.1 Field operational strategy**

Data for the school environment and policy was completed for all participating schools before survey of pupils was started. Interviews for parents were done within the same

period that pupils were interviewed in their schools. The team moved from one school to the other according to the working schedule agreed upon between the heads of schools and the researcher. The team sometimes split into two and visited different schools on same day if pupil populations were small ( $n \leq 25$ ).

### **3.8.2 Duration of interviews**

Interviews with pupils lasted between 30 minutes and 1 hour. Parent Interviews lasted an average of 10 minutes. In-depth interviews with heads of schools on policy lasted between 45 and 90 minutes.

## **3.9 Study variables**

Variables included in analyses for this study were categorized into dependent and independent variables.

### **3.9.1 Dependent variable**

The main dependent variable in this study was child BMI for age and sex. A binary outcome for BMI used was 'overweight/ obese' (BMI –for-age-and sex z-score (BMA)  $\geq +1$  SD) or 'not overweight/ obese' (BMA  $< +1$  SD). BMI z-scores were categorized into 'underweight' ( $< -2$  SD), 'normal weight' ( $-1SD < BMA$  z-score  $< +1$  SD), 'overweight' ( $+1SD \leq BMA$  z-score  $< + 2SD$ ) and 'obese' ( $\geq +2$  SD) based on WHO criteria (WHO 2007) for prevalence estimates.

### **3.9.2 Independent variables**

The independent variables considered in this study are broadly categorized under the following: background characteristics of respondents, physical activity level, Food and drink consumption, school food environment, school physical activity environment,

school policy on food, school policy on physical activity, school administration type and school characteristic, Parental modeling of snack and soft drink consumption and home food environment. The variables are described below.

### *3.9.2.1 Background Characteristics*

Age of respondent was measured as years completed. Respondents were grouped into 9 to 10 years, 11 to 12 years and 13 to 15 years age groups for comparisons; sex of pupil was either male or female; socio-economic status (SES) of respondents was ascertained using principal component analysis. The factor score based on ownership of 8 items (car/ vehicle, house, television, refrigerator, gas/ electric cooker, DVD/ VCR/ video player, air conditioner, and satellite dish) was used to group respondents' into rich, middle and poor households using the Filmer and Pritchett (2001) approach<sup>5</sup>; parent BMI was given in kilograms per m<sup>2</sup> ; BMI status of parent was reported as overweight/obese (BMI  $\geq$  25 kg/m<sup>2</sup>) or not overweight/ obese (BMI < 25 kg/m<sup>2</sup>); proportion of children (<16 years) in household was given in percentage.

### *3.9.2. 2 Physical activity levels of pupils*

Level of activity was based on a composite score from the Child Physical Activity Questionnaire (PAQ-C) score which ranged from 1 (low activity) to 5 (high activity). Z scores were generated for PAQ-C scores and split into four levels: The lowest 25% was labeled 'least activity level'; the second lower 25% was labeled 'lower activity level'; the second upper 25% was labeled 'moderate activity level' and the upper 25% labeled 'high activity level'. Time spent doing other physical activities (like walking or doing

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<sup>5</sup> Filmer and Prichette (2001) classified households based on a 40-40-20 split; lowest 40% of households categorised as 'poor', next 40% categorised as 'middle' and highest 20% categorized as 'rich'

household chores) or leisure activities (e.g. watching television, time spent on computers and playing video games in hours, time spent reading or listening to music) are reported in hours.

### *3.9.2.3 Food and drink consumption*

Type of food was grouped as local snack (dry/ non-fried, e.g. roasted corn, plantain, etc.), local snack (deep fried), imported/ packaged snacks, complete meal, sugar-sweetened beverages, soft drinks, ice creams and confectionaries, pastries and fruit and vegetables.

Nutrient content of foods were reported as total energy in kilo calories, and other nutrients in grams. Typical amount of food purchased were reported as grams per typical serving size sold to pupils. A dietary diversity score based on the 24-hour meal recall, ranging from 1 to 12 was used to describe the quality of the diet of pupils. It was a simple count of the number of food groups from which meals were selected. The 12 food groups used in assessing food diversity were: cereals, roots/tubers, pulses and nuts, green leafy vegetables, other vegetables, fruits, meat/poultry/insects, eggs, fish/sea food, milk/dairy products, oils and fats, drinks and miscellaneous, adapted from Savy et.al.,(2005)

The food diversity score, an index of diet quality, refers to a count of food groups to which constituents of pupils' diet belong. It does not take into consideration the number of times that particular food group is represented in the diet or the amount eaten. If the food consumed by a pupil has constituents belonging to any of the 12 food groups, a score of one is assigned (1) for that particular food group. Hence, a 'kontomire'<sup>6</sup> stew made with palm oil will give the pupil a score each for green leafy vegetable, other

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<sup>6</sup> 'Kontomire' is the local name for cocoyam leaves

vegetable and fats & oil groups. A score of zero (0) is assigned if the pupil did not consume any food item from a given food group.

### *3.9.2.3 School food environment*

School food environment data was summarized using scores (a total score ranging from 0 to 14) assigned to elements contained in policies and physical facility for feeding of pupils in the school.

Physical facility for feeding was based on a scoring system ranging from 0 to 5. A score of 1 was given for presence and 0 for the absence of the following: provision of complete meals within school compound; provision of soap and water for hand washing; provision of clean water for drinking; demarcated eating area; ready to eat foods well covered. A healthy school retail food environment score, which is a proportion of vendors selling healthy foods within the school compound, was also used as a variable describing the food environment of the schools.

School food policies were based on a score ranging from 0 to 9 (simple addition). Items scored are as follows: restricting offending foods (0, 1); prohibiting sale of offending foods (0 or 1); promoting the sale of healthier food options (0, 1); promoting sale of fruits in school (0 or 1); school canteen (none=0, canteen without menu =1, with one item menu=2, with 2 or more options=3); campus open during lunch (yes=0, no=1), campus open during other periods (yes=0, no=1).

Items measuring the school food environment were subjected to factor analysis to identify the major constructs that best measure the food environment. A principal component analysis (PCA) conducted on the 10 items with orthogonal rotation (varimax),

yielded 4 components. Initial extraction was based on Eigen values greater than 1 and in combination explained 72.2% of the variance. The Kaiser – Meyer- Olkin measure for sampling adequacy (KMO = .497) was below the expected minimum of .50 but items had sufficient correlations for PCA (Bartlett’s test of sphericity =  $\chi^2$  (45) = 1775.56,  $p < 0.001$ ). However, the items ‘campus open during lunch time’ and ‘provision of clean drinking water’ loaded high on two factors. When those two items were dropped, the remaining 8- items had low reliability, Chronbach’s  $\alpha = .57$  and the Kaiser-Meyer-Olkin measure for sampling adequacy for factor analysis (KMO = .426) indicated a diffusion in the pattern of correlation, possibly making factor analysis less likely to be appropriate. However, the Bartlett’s test of sphericity  $\chi^2$  (28) = 716.55,  $p < 0.001$ , indicated that correlations between items were sufficiently large for PCA. The 4 constructs in combination explained 73.3% of variance. The 4 factors generated represented the following constructs which were split into terciles (least, moderate and high) and used to predict likelihood of overweight/ obesity:

1. Control over eating place (included items ‘campus open at other times’ and ‘demarcated eating place’- explaining 21.5% of variation)
2. Control over food available (included items ‘canteen has menu adhered to’ and ‘policy restricting sale of offending foods’ explaining 19 % of variation)
3. Policies promoting healthy options (included items ‘policy promoting fruit sale’, policy prohibiting sale of offending foods’, policy promoting healthier food options’- explaining 17.4% of variation)
4. Hand washing facility (explaining 15.4% of variation)

Other components of the food environment that were considered independently were: number of food vendors (a simple count); type of food vendors in the school were grouped into canteen, tuck shop, hawkers, 'table top' vendors or 'outside of school vendors'; availability scored as 1(yes) and 0(no) and ownership of school canteen was graded as 1(run by school) and 0 (not run by school); Healthy school Retail Food environment score (HRFEI) is a proportion of healthy food retailers in school compound.

#### *3.9.2.4 School physical activity environment*

The school Physical activity environment was described based on scores (a total score ranging from 0 to 34) assigned to elements contained in policies and physical facility for physical activity.

Physical facility for physical activity was based on scores (total score ranging from 0 to 20) assigned to various elements contained in the physical environment: school has demarcated playground (0, 1); school has open spaces (0, 1); school has sports field/ soccer pitch (0, 1= yes but inadequate for soccer, 3 = adequate for soccer); facility for sports (none=0, available but inadequate=1, available and adequate=3 sum for all sporting facilities available (max= 5) available.

School physical activity policy environment were measured (a total score ranging from 0 to 14) based on a range of items: PE lesson on time table (no=0, yes=1); Has PE practical sessions (no=0, yes=1); has school team in sporting disciplines (0, max=5); has specific teacher(s) assigned to PE (no=0, yes=1); PE teacher trained (no=0, yes=1); availability of playing ground/field (none at all=0, before school, break time or after school only=1, any

two times=2, All times=3); any policy that encourages physical activity (no=0, yes=1); are pupils allowed to use sports equipment during break time (no=0, yes=1).

All 11 items measuring the school physical activity environment were subjected to factor analysis to identify the major constructs that best measure the physical activity environment. Initial extraction was based on eigen values greater than 1 using varimax rotation yielded four factors explaining 63 % of variation in the 11 items measuring the physical activity environment. The Kaiser-Meyer-Olkin measure verified the sampling adequacy (KMO = .538) and there was an indication of sampling adequacy (Bartlett's test of sphericity =  $\chi^2$  (55) = 1108.6,  $p < 0.001$ ). However, item 'specific teacher assigned to P.E' loaded high on two factors. When this was dropped, PCA still yielded 4 factors that explained 63.9 % of variation. The Kaiser-Meyer-Olkin measure verified the sampling adequacy (KMO = .521) as within acceptable limits (Field, 2009). Also, the Bartlett's test of sphericity  $\chi^2$  (45) = 781.818,  $p < 0.001$ , indicated that correlations between items were sufficiently large for PCA. The reliability of the 10-item scale was however low, Cronbach's  $\alpha = .60$ . The 4 factors generated represented the following constructs which were split into terciles (least, moderate and high) and used to predict likelihood of overweight/ obesity:

1. Policy that initiate physical activity (included items PE on time table' and 'availability of playground for pupil use' - explaining 20.5% of variation)
2. Supporting environment for PE and physical activity (included items 'PE teacher trained', 'has sports field' and 'has open spaces'- explaining 18.1 % of variation)

3. Increasing options for physical activity (included items ‘presence of other sporting facilities’ and ‘other policy that encourage physical activity’ - explaining 14.2% of variation)
4. Encouragement of active play ( included items ‘has a playground’ and ‘availability of sports equipment for pupil use during break time’ - explaining 11.1% of variation)

#### *3.9.2.5 Home food environment*

Home food environment was determined based on 17 questions covering: Parental modeling of snacks and soft drink consumption, availability of snacks and soft drinks at home, accessibility of snacks and soft drinks to children, regulation of child consumption, and parental pressure on child to eat. Thus the minimum score representing the worst home food environment is 15 and a maximum score of 77 represents optimal home food environment. Major constructs measured and various sub-scales used were as described below:

##### *3.9.2.5.1 Parental Modeling of soft drink and snack intakes*

Parental modeling of consumption was assessed with 4 items. General frequency was assessed using a Likert scale ranging from 1= ‘often consumed’ to 5 = ‘never consumed’. Responses of rarely and never were put into the category of ‘none = 1’ and other responses grouped into ‘ever’ = 0. Number of times consumed in child’s presence was scored as ‘none’ = 1 and ‘ever’ = 0. Hence parental modeling of both snack and soft drink intake was grouped into ‘none’ and ‘ever’. Items were:

1. Frequency of soft drink consumption in the past one month

2. Number of times in past one week that parent consumed soft drinks in the presence of child
3. Frequency of consumption of snack items (mostly pastries and imported packaged snacks) in the past one month
4. Number of times in the past one week that parent consumed snacks in the presence of child

#### 3.9.2.5.2 Availability of soft drinks and snacks at home, provision and accessibility to children

Nine items were used to measure availability and accessibility of drinks and snacks using a Likert scale ranging from 1= 'yes, all the time' to 5 = 'never'. The items were:

1. Are soft drinks and other sweetened drinks available/ stored in your home?
2. Are children allowed to have soft drinks and other sweetened drinks?
3. Are snack items like biscuit, chips and other pastries available/ stored in your home?
4. Are children allowed to have snack items like biscuit, chips and other pastries?
5. Are children allowed to eat snacks any time in the day including night time?
6. Do you specifically give money to your children to use to buy snack items at school?
7. How often do you give soft drinks and other sweetened drinks as reward?
8. How often do you give snack items like biscuit, chips and other pastries as reward?
9. How often do you pack drinks and other snacks for your child to take to school?

These 9 items were subjected to factor analysis to examine the main constructs that form the food environment. Initial extraction based on eigen values greater than 1 using orthogonal rotation (varimax) yielded three factors explaining 66 % of variation in the 9 items measuring food environment (KMO = .6458; Bartlett's test of sphericity =  $\chi^2$  (36) = 1230.02,  $p < 0.001$ ) However, the item, 'pack snacks and drinks for school' had very low loadings on two factors and was thus dropped. Resultant PCA with remaining 8 items still yielded 3 factors that explained 71.8 % of the variance with sampling adequacy (KMO = .628) well above acceptable limits and were correlated well enough for PCA (Bartlett's test of sphericity  $\chi^2$  (28) = 1163.45,  $p < 0.001$ ). The 8-item scale had high reliability, Cronbach's  $\alpha = .77$ . The 3 factors generated represented the following constructs which were split into terciles (least, moderate and high) and used to predict likelihood of overweight/ obesity:

1. Parental provision of access (included items 'children allowed to have drinks', 'children allowed to have snacks', children allowed to have snacks at any time including night time' and 'specifically give money for snacks at school' - explaining 38.8% of variation)
2. Use of drinks and snacks as reward (included items 'use of drinks as reward' , and 'use of snacks as reward'- explaining 19.2 % of variation)
3. Storage of drinks and snack items in home (included items 'store drinks at home' and 'store snacks at home'- explaining 13.8% of variation)

### **3.9.2.5.3 Parental Pressure to eat**

Four items representing the pressure-to-eat subscale validated by Birch et al.,(2001) was used to measure parental pressure on child to eat. Also, a 5-point Likert scale ranging

from 1= 'yes, all the time' to 5 = 'never' was used. The distribution of responses for this particular section was highly skewed and would be unsuitable for PCA. Hence, was collapsed into two categories. Parental pressure to eat responses of 'rarely' and 'never' were categorized into the group of 'no parental pressure to eat' and responses of 'yes, all the time' through 'sometimes' also classified as 'parental pressure to eat'. The items were as follows:

1. My child should always eat all of the food in his/her plate
2. I am especially careful to make sure child eats enough
3. If child says "I'm not hungry" I still try to get child to eat
4. I think my child will eat much less if not regulated

#### *3.10.2.6 School characteristic*

School administration type was grouped into 0 (public) and 1 (private).

### **3.10 Data entry and management**

#### **3.10.1. Data capture**

Database for entry of questionnaires was created in Microsoft access (2007 version). Screen for data entry was customized for easy entry and had checks activated to reduce errors.

#### **3.10.2 Data sets**

The study used six datasets collected from heads of schools, pupils and parents of selected pupils and schools selected from the Ga-east municipality from October 2012 to November 2013. The first dataset was obtained from heads of participating schools on their policies and practices regarding feeding and physical activity of pupils.

The second and third datasets were observations of school facility for feeding and physical activity to help describe the food and physical activity environments of the schools involved in the study. Spatial data was stored separately from other observation data. The fourth dataset was used to describe and quantify the types of foods frequently purchased by pupils within the school compound.

The fifth and sixth datasets obtained from pupils and their parents were quantitative data gathering information on background and other individual and home factors associated with obesity.

Datasets on school policies and environment were merged with that of parents and pupils for analysis on risk factor determinations. Data on foods frequently purchased by pupils was analysed separately.

### **3.11.0 Data analysis**

IBM SPSS version 20 was used for data analysis and an alpha level of 0.05 was used for statistical significance. ArcGIS desktop software was used to manage spatial data and generate maps from geo-referenced data.

Preliminary tests were carried out on data to check for normality/ distribution (z- scores for outliers, Komogorov Smirnov test, Q-Q plots) and also the reliability of the various scales used to measure various independent variables (Cronbach's alpha test statistic).

#### **3.11.1 Descriptive statistics**

Frequency distributions were summarized in tables and charts for nominal and ordinal data. Measures of central tendency (mean, median, and mode) for continuous variables were determined. Standard deviation was used to measure the spread of selected key

continuous variables (e.g. Calories and nutrient intakes, days, etc). Skewness and kurtoses were used to check the symmetry and peaks of data. Data on pupil food purchase were converted into multiple response data sets and reported as frequencies.

### **3.11.2 Inferential statistics**

The relationship between main outcome variable (BMI) and other independent variables were examined using bivariate and/ or partial correlations (e.g. child BMI versus diet-related variables, Physical activity, school environment variables, home environment variables, and parental characteristics).

Linear regressions were conducted to examine the linear relationships between child BMI and possible predictors. Individual level risk factors for child BMI considered in this study were socio-demographic, diet and physical activity related. Demographic factors considered were age, sex, parent BMI and socio-economic status of household. Dietary factors considered were frequency of fruit and vegetable intakes, variety of fruits and vegetable intake, fried food intake, sweetened drink intake, beverage intake, breads and pastries, other high calorie food intake, frequency of breakfast consumption, staple food intake, total calories and overall dietary diversity score. Physical activity-related factors included time spent on computer; time spent on watching TV, total media time, number of days child watched TV, time spent on household chores, days child walked to school per week, and overall physical activity level.

Considering the significant role of parental BMI on child BMI established by many studies, only pupils who had parent BMI (248) were considered in identifying the determinants of child BMI so that the role of other factors can then be established. This

means that only 58% of participating pupils formed the sample considered in the determination of the predictors of child BMI. The search for the determinants of child BMI was carried out in two stages. The bivariate associations test was followed by a multiple linear regression to investigate the predictors of child BMI after controlling for household SES, parental BMI and child age.

Chi square tests were used to examine group differences in selected categorical variables (background data) and Fisher's exact test was used when sample sizes were too small.

Independent samples t-test were used to test differences in means of continuous variables among various groups (scores on physical activity, dietary diversity scores, BMI, etc.).

ANOVA was used to test the variability in mean among different groups (e.g. differences in BMI of pupils by sex, physical activity level, dietary patterns, or household SES). Scheduled post-hoc investigations were carried out to determine differences in means among various sub-groups when applicable. Preliminary tests were carried out to check for the violations of normality, homogeneity of variance and independence before ANOVA was conducted.

#### *3.11.2.1 Multivariate analyses*

Hierarchical multiple linear and logistic regression modelling were used to assess the variations in the main outcome (child BMI or BMI status) variable explained by the various predictor variables when included in the model in a stepwise manner. The hierarchical multiple linear regression was used to estimate associations between child BMI and predictor variables at the individual child level; and the hierarchical multiple

logistic regression was used to estimate associations between environmental predictor variables and the likelihood of child BMI status (overweight/obesity). Overweight and obesity was defined as BMA  $> 1$  SD and  $\geq 2$  SD respectively (De Onis and Blössner, 2000). Independent variables that returned a p-value of less than 0.25 at the bivariate level were tipped as potential determinants in the multiple regression models.

For all logistic procedures, the Hosmer - Lemeshow goodness-of-fit was used to assess how well the model fitted the data. Adjusted odds ratios together with their 95% confidence intervals were used to describe the strength of these associations.

#### *3.11.2.2 Determinants of Child BMI*

The following variables were tipped for multiple regression: age, sex, household SES, household child constitution, physical activity level, parental BMI, frequency of consumption of sugar sweetened drinks, frequency of consumption of all beverages, breads and pastries, frequency of fruit consumption, breakfast intake days, hours spent on computer per week, days on which TV was watched, hours of TV viewing per week, total media time (hours), caloric intake, variety of vegetables consumed, frequency of consuming both fruits & vegetables, total variety of fruit and vegetables consumed, fried food intake and dietary diversity. Variety of fruit and vegetable intake was highly correlated with frequency and variety of fruits consumed (Pearson's  $r = .743$  and  $.85$ , all  $p < 0.01$  respectively). Also frequency of consumption of fruits and vegetables combined was highly correlated with variety of vegetables consumed. Hence, to avoid multicollinearity in the model, the following variables were dropped: hours spent on computer, sugar sweetened drinks, frequency of fruits& vegetables consumption, variety of fruits &

vegetables consumed, frequency of fruits consumption and frequency of vegetable consumption.

Using a stepwise selection method, the variables to be controlled for: sex, age, parent BMI, calories and household SES were put into model 1, while the remaining variables were put in model 2: physical activity level, variety of vegetables consumed, media time per week, fried food intake, dietary diversity, days of breakfast consumption per week and all beverages consumed per week. Final model did not change in characteristic whether total media time or hours and days of TV viewing were put into the model, thus total media time was used in final model. However, age was finally used as a predictor of choice since there were signs of multi-collinearity when age group (dummy coded) was used in the multiple regression. Age group 'age 9 – 10 years' dummy was found to load on 4 different dimensions, while age group dummy '11 – 12 years' was found to load highly on 2 different dimensions. Also, its presence in the model caused parent BMI and sex of child to load indistinctly on more than 2 dimensions. When taken out and replaced with age (years), all other predictors in final model loaded distinctly under one dimension, an indication of absence of collinearity. Age (years) was thus used in the multiple regression.

### *3.11.2.3 Environmental determinants of child BMI status*

Child BMI status was categorized into '0' 'overweight' or '1' 'not overweight' based on BMI – for –age z-scores cut-off for children (overweight = BMA z-score  $\geq +1SD$ ; not overweight = BMA z-score  $< +1 SD$ ). Environmental level predictors of child BMI status tipped for multiple logistic regression were: school control over eating place, school control over food available/ options, promoting healthier food options, provision of hand

washing facilities, Healthy retail food environment score, school administration type, supporting environment for physical activity and parental use of snack as reward.

Hierarchical multiple logistic regression was used to find environmental determinants of child BMI status (dependent variable). By keeping the significant predictors at the individual level constant in the model, the enter method was employed to choose the best environmental predictors of child BMI status. This way, the effect estimates obtained for environmental predictors will be solely for environmental factors in the presence of other known predictors or control variables.

### **3.12 Quality control**

The mock interviews and pre-test of study tools prepared research assistants adequately to eliminate inconsistencies in data reporting. Filled questionnaires were inspected by the field supervisors or researcher on the field to detect and correct any errors and/ or resolve inconsistencies immediately. All questionnaires were also checked by the researcher at the close of each day for consistencies and prepared for data entry. Body weighing scales used for study were sent to the Ghana Standards Authority for calibration before field work began.

## CHAPTER FOUR

### RESULTS

#### 4.1 Background characteristics of study participants

##### 4.1.1 Enrolment details of study participants

Five hundred and fourteen (514) pupils received parental consent to participate but only 432 parents indicated their willingness to be involved in this study. Eventually, a total of 487 pupils and 340 parents completed this study. Twenty-seven pupils were excluded from the study for the following reasons: >15 years at the time of survey (10); voluntarily opted out at interview stage (2) and absent from school on survey dates (15). The final sample comprised 38.8% private and 61.2% public school pupils and their parents. Ninety-two parents could not be reached although they provided consent. Fourteen parents had more than one child participating in study and data provided was assigned to the child identified on questionnaire by parent during school visit. Fifty-six parents were not available for body measurements but were available to complete survey questions on phone. Thus, 284 parents had complete data yielding a parent completion rate of 58.9%.

##### 4.1.2 Socio-demographic characteristics of parents

Table 4.1 provides the socio-demographic characteristics of 340 parents of pupils who participated in the study. These parents represented 74% and 67% of pupils in private and public schools respectively. Majority (70%) of parents were married, with a higher proportion (67.4%) being females, with significantly more females representing pupils from private schools compared to public schools (73.6% vs. 63%,  $p < 0.05$ ). Ages of parents/ guardians ranged from 18 years to 73 years, with a mean age of 40.2 years (SD= 14.4).

About two-thirds (62.2%) of the fathers of pupils were engaged in trading or artisanal activities; almost a third were engaged in formal sector work. A significantly higher proportion of fathers of pupils from private schools worked in the formal sector (42.1% vs. 26.3%,  $p < 0.001$ ). Unemployed fathers were more likely to have wards in public schools than private (6.4% vs. 3.2%). Almost all (96.9%) fathers had formal education; about 41% completed basic education. Significantly higher proportion of fathers of private school pupils had completed secondary education or higher compared to their counterparts from public schools (65.7% vs. 48.6%,  $p < 0.01$ ).

The occupation of mothers of pupils did not vary significantly by type of school. The majority (82.7%) of mothers were engaged in trading or artisanal activities, with 12.6% engaged by the formal sector and 4.8% being unemployed. Similar to their male counterparts, a majority (93.2%) of mothers of pupils had attended school with only 6.8% of them having no formal education. Almost 60% of mothers had completed basic education and about a third had secondary education or higher. Significantly more of the mothers of pupils in private schools had secondary education or more compared to those from public schools (41% vs. 27.8%,  $p < 0.05$ ).

Majority (71.2%) of parents were the biological parents of participating pupils; less than a quarter of them were other biological relation (older sibling, grandparent, and aunt/uncle) and a few (4.7%) were non-biologically related.

Table 4.1 Household and Socio-demographic characteristics of parents by school administration type

Characteristics	Total (N= 340)	Public (n= 200)	Private (n= 140)	p-value
<b>®Age in years, M(SD)</b>	40.2 (14.4)	40.4 (11.1)	40.0 (9.1)	0.746®
<b>Sex of respondent n (%)</b>				<b>0.049</b>
Male	111 (32.6)	74 (37.3)	37 (26.4)	
Female	229 (67.4)	126 (63.0)	103 (73.6)	
<b>Marital Status n (%)</b>				0.968
Single	58 (17.1)	35 (17.5)	23 (16.4)	
Married	238 (70.0)	139 (69.5)	99 (70.7)	
Separated/ Divorced	31 (9.1)	19 (9.5)	12 (8.6)	
Widowed	13 (3.8)	7 (3.5)	6 (4.3)	
<b>Educational level of Father/guardian n (%)</b>				<b>0.007</b>
No formal education	10 (3.2)	7 (3.8)	3 (2.3)	
Basic education	128 (41.2)	87 (47.5)	41 (32.0)	
Secondary	117 (37.7)	65 (35.5)	52 (40.7)	
Tertiary	56 (18.0)	24 (13.1)	32 (25.0)	
<b>Educational level of mother/guardian n (%)</b>				<b>0.045</b>
No formal education	23 (6.8)	17 (8.6)	6 (4.3)	
Basic education	202 (59.9)	127 (63.6)	75 (54.7)	
Secondary	88 (26.2)	44 (22.2)	44 (31.6)	
Tertiary	24 (7.1)	11 (5.6)	13 (9.4)	
<b>Occupation of Father/guardian n (%)</b>				<b>0.001</b>
Unemployed/Retired	16 (6.1)	12 (6.4)	4 (3.2)	
Artisan <sup>1</sup>	139 (44.6)	101 (54.3)	38 (30.2)	
Trading	55 (17.6)	24 (12.9)	31 (24.6)	
Formal sector <sup>2</sup>	102 (32.7)	49 (26.3)	53 (42.1)	
<b>Weight status of Parent/ guardian*</b>				<b>&lt; 0.001</b>
Overweight/ obese (BMI $\geq$ 25 Kg/m <sup>2</sup> )	168 (59.2)	83 (50.0)	85 (72.0)	
Not overweight/ obese (BMI < 25 Kg/m <sup>2</sup> )	116 (40.8)	83 (50.0)	33 (28.0)	
<b>Occupation of Mother/ guardian n (%)</b>				0.569
Unemployed/Retired	16 (4.8)	8 (4.1)	8 (5.8)	
Artisan	71 (21.2)	37 (18.9)	34 (24.5)	
Trading	206 (61.5)	124 (63.3)	82 (59.0)	
Formal sector	42 (12.6)	27 (13.8)	15 (10.8)	
<b>Relationship to Pupil n (%)</b>				0.115
Biological son/daughter	242 (71.2)	135 (67.2)	107 (77.0)	
Other biological relation <sup>3</sup>	82 (24.1)	54 (26.9)	28 (20.1)	
Non-biological relation	16 (4.7)	12 (6.0)	4 (2.9)	

\* Total parents with anthropometry= 284 (public = 166, private =118); ® p-value from ANOVA, all other p-values from Chi-square tests. 1=refers to a worker in a skilled trade especially one that involves making things by hand. E.g hair dressers, painters, tailors, etc. 2=these include skilled professionals such as nurses, teachers, bankers, etc. , 3= mainly sibling, grandparents, aunt/ uncles

### 4.1.3 Background characteristics of pupils

Mean age of pupils was 12.1 years (SD = 1.5), with pupils in public schools being significantly older than their counterparts in the private schools (12.4 years vs. 11.6 years,  $p < 0.001$ ). More pupils from private schools belonged to households with fewer children under 16 years old compared to their counterparts from public schools ( $\chi^2(2) = 9.9$ ,  $p = 0.01$ ). Age was not significantly different by sex and household sizes to which pupils belonged did not vary by school administration type.

More than half (59.2%) of the pupils lived with parents/ guardians who were overweight; parents of pupils from private schools had significantly higher overweight prevalence compared to their counterparts (72% vs. 50%,  $p < 0.001$ ). Regarding socioeconomic status (SES) of households of pupils, significantly more public school pupils belonged to the poor SES group compared to their private school counterparts (55.7% vs. 17.5%,  $p < 0.001$ ). Table 4.2 below shows the background characteristics of pupils.

Table 4.2 Background characteristics of pupils by school administration type

Characteristic	Total (N= 487)	Public (n= 298)	Private (n= 189)	p-value
<b>Age group</b>				<b>&lt;0.001</b>
9 - 10 years	73 (15.0)	22 (7.4)	51 (27.0)	
11 - 12 years	213 (43.7)	134 (45.0)	79 (41.8)	
13 - 15 years	201 (41.3)	142 (47.7)	59 (31.2)	
<b>Sex of pupil n (%)</b>				0.287
Male	226 (46.4)	144 (48.3)	82 (43.4)	
Female	261 (53.6)	154 (51.7)	107 (56.6)	
<b>Household size</b>				0.705
≤ 4 persons	112 (23.0)	72 (24.2)	40 (21.2)	
5 - 6 persons	215 (44.1)	128 (43.0)	87 (46.0)	
≥ 7 persons	160 (32.9)	98 (32.9)	62 (32.8)	
<b>Proportion of children (&lt;16 years) in household</b>				<b>0.010</b>
< 50 %	196 (40.2)	107 (35.9)	89 (47.1)	
50 - 65 %	192 (39.4)	119 (39.9)	73 (38.6)	
> 65 %	99 (20.3)	72 (24.2)	27 (14.3)	
<b>Household Socio-economic status*</b>				<b>&lt; 0.001</b>
Rich	101 (20.7)	27 (9.1)	74 (39.2)	
Middle	187 (38.4)	105 (35.2)	82 (43.4)	
Poor	199 (40.9)	166 (55.7)	33 (17.5)	

P-values are from Chi-square tests. \* based on possession of eight household items.

#### 4.2.0 Anthropometric indices of pupils

Table 4.3 below provides the weight status of pupils who participated in the study. Mean height of respondents was  $150.7 \pm 9.3$  cm and ranged from 129.9 cm to 176.1 cm. Height did not differ significantly by school administration type (public =  $150.9 \pm 9.2$  cm; private =  $150.4 \pm 9.4$  cm) or sex (boys =  $149.7 \pm 10.3$ ; girls =  $151.6 \pm 8.2$  cm) of pupils. Mean weight of pupils was  $42.4 \pm 10.6$  Kg and ranged from 23.7 Kg to 85.5 Kg. There also was no difference in pupil weights by school administration type (public =  $41.7 \pm 10.2$  Kg; private =  $43.3 \pm 11.2$  Kg). Girls however, were found to be significantly heavier than boys (44.6 kg vs. 39.8 kg,  $p < 0.001$ ).

Majority (78.6%) of the pupils had BMIs within the normal range, with significantly higher numbers of public school pupils falling in this category compared to private school pupils (83.2% vs. 71.4%,  $p < 0.01$ , Table 4.3). There were more overweight pupils from private schools than public schools (24.9% vs. 13.1%,  $p < 0.01$ ) and among girls than boys (23.4% vs. 10.9%,  $p < 0.001$ ). There were no significant differences in underweight prevalence across private and public schools, but there were fewer underweight girls found compared to boys.

Table 4.3 Anthropometric characteristics of pupils by pupil sex and school administration type

BMI Status	All (N = 487)	School Administration type		Sex of pupil	
		Public (n = 298)	Private (n = 189)	Boys (n = 222)	Girls (n = 265)
Underweight	18 (3.7)	11 (3.7)	7 (3.7)	13 (5.9)	5 (1.9)
Normal	383 (78.6)	247 (83.2)	135 (71.4)	185 (83.3)	198 (74.4)
Overweight (Pre- obese)	48 (9.9)	25 (8.4)	23 (12.2)	11 (5.0)	37 (14.0)
Obese	38 (7.8)	14 (8.4)	24 (12.7)	13 (5.9)	25 (9.4)
<b>Total Overweight</b>	<b>86 (17.7)</b>	<b>39 (13.1)</b>	<b>47 (24.9)</b>	<b>24 (10.9)</b>	<b>62 (23.4)</b>

*Underweight = BMA<sup>7</sup> < -2SD, Normal weight = BMA  $\geq$  -2SD  $\leq$  +1 SD, Overweight = BMA > +1 SD  $\leq$  +2 SD, Obese = BMA > +2 SD, Total Overweight = BMA > +1 SD*

#### 4.3.0 Diet and Physical activity behaviour of pupils

##### 4.3.1 Diet of pupils

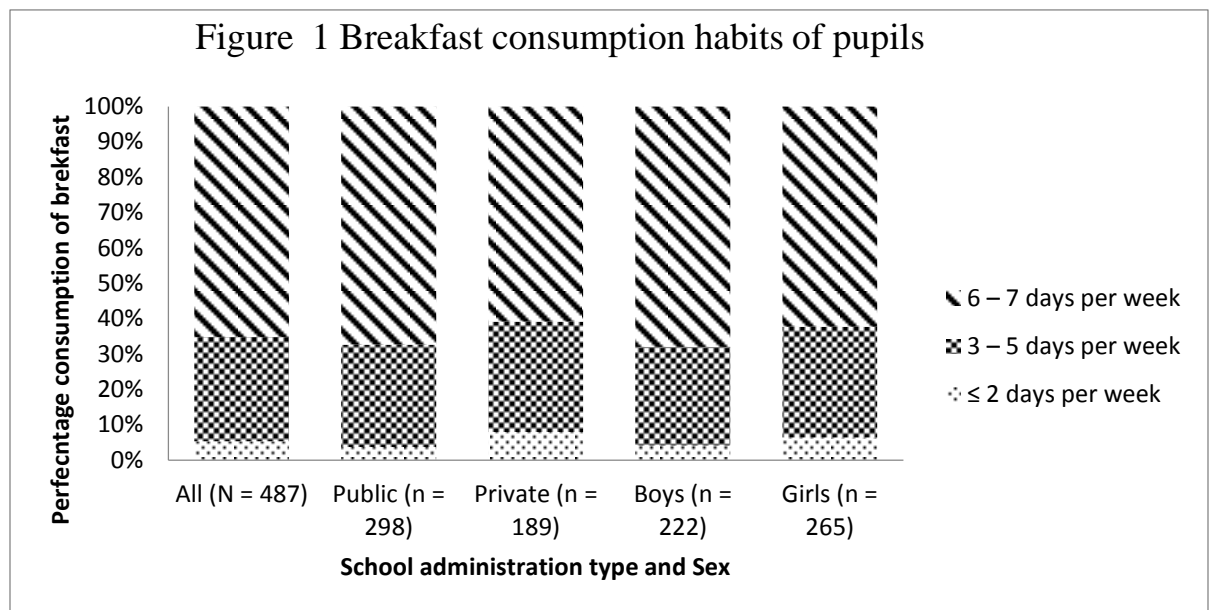
The majority of pupils (71%) ate three meals daily; a little over a tenth (10.7%) ate meals less than three times daily and 18% ate more than 3 times daily. Pupils in private schools significantly ate more times daily compared to their public school counterparts ( $\chi^2(2) =$

<sup>7</sup> BMA = BMI for age and sex z- score

9.177,  $p < 0.05$ ). No significant differences were recorded between boys and girls based on number of times they ate daily.

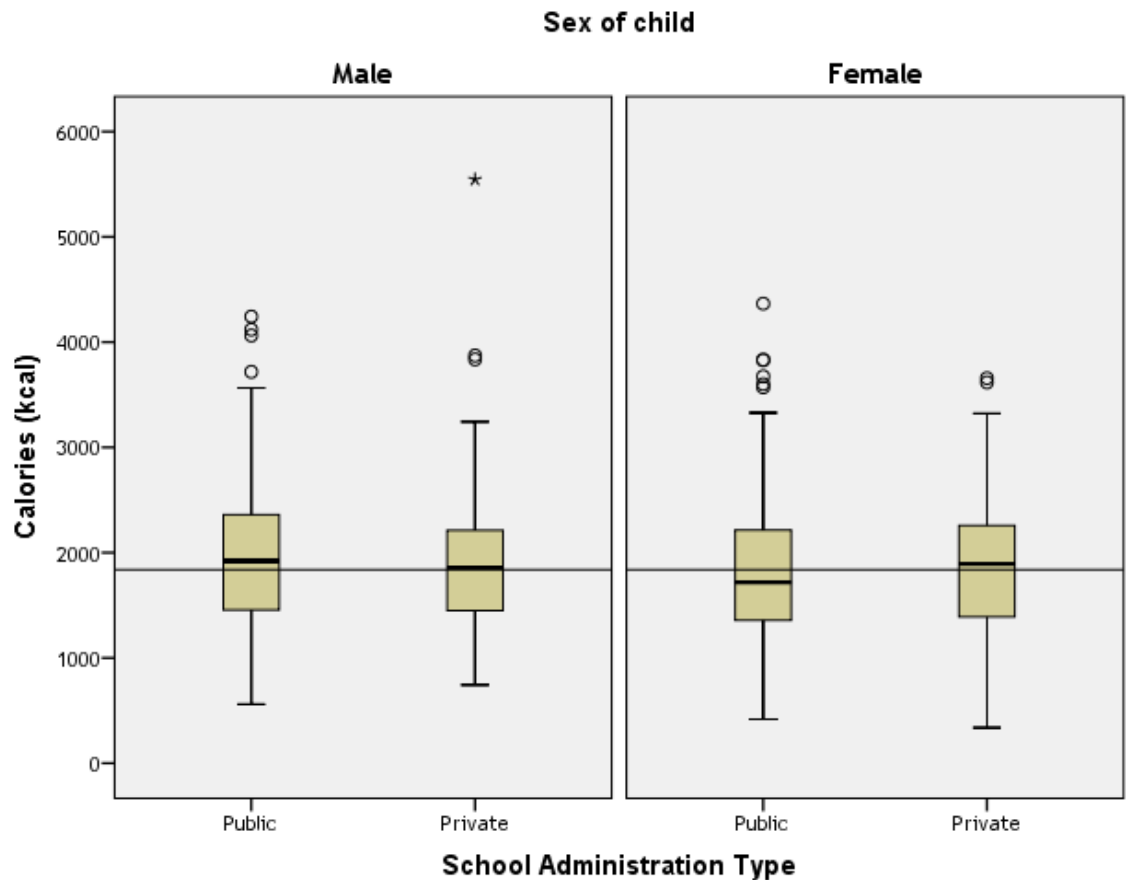
About 60% of pupils had breakfast on all school days with public school pupils consuming breakfast on more school days compared to those in private schools ( $4.1 \pm 1.4$  vs.  $3.9 \pm 1.5$ ,  $p < 0.05$ ). No differences were recorded between male and female pupils. Over 75% of pupils had breakfast on both weekend days and no statistically significant differences were recorded among pupils based on sex or school administration type. Less than half (46.8%) of pupils consumed breakfast every day in the week, but pupils in public schools had breakfast on more days than their private school counterparts ( $5.9 \pm 1.5$  vs.  $5.5 \pm 1.7$ ,  $p < 0.05$ ). Male pupils also had breakfast on more days in the week compared to females ( $5.9 \pm 1.4$  vs.  $5.6 \pm 1.8$ ,  $p < 0.05$ ). The usual number of times pupils ate each day positively correlated with the school days on which they ate breakfast ( $r = 0.11$ ,  $p < 0.05$ ).

Figure 4.1 Breakfast consumption habits of pupils by sex and school type



Mean caloric intake of pupils was  $1973 \pm 714$  Kcal ranging from 337 Kcal to 5545 Kcal, Chart 2. Differences in mean caloric intakes did not vary by sex (Mean difference=89Kcal) or school administration type (Mean difference=20 Kcal). About 65.9% of pupils did not consume adequate calories (consumed < 80% of requirement for age, sex and physical activity level); only 16.6% consumed adequate calories and 17.5% exceeded their caloric requirements. Approximately 18% of pupils did not meet 50% of caloric requirements for their age, sex and physical activity levels.

Figure 4. 2 Caloric intakes of pupils based on sex and school administration type



Median caloric intake of pupil population = 1839 Kcal

About 55% of pupils had consumed soft drinks (carbonated sugar-sweetened drinks) in the week preceding the survey. Of those who consumed soft drinks, consumption was only once for 56%, either twice or thrice for 35.3% and four or more times for less than a tenth (8.7%). The usual amount of soft drink consumed was one 300ml bottle (87.4%), while 12% consumed two bottles and very few (4.6%) exceeded two bottles on days of consumption. Only 16.6% of pupils (22% private vs. 13% public) reported buying soft drinks from vendors during school hours. Other non-carbonated sugar-sweetened drinks were consumed by about 91% of pupils. About 48.9%, 31%, and 20.4% of pupils who consumed it less than 3 times, 4-7 times, and more than 7 times respectively within one

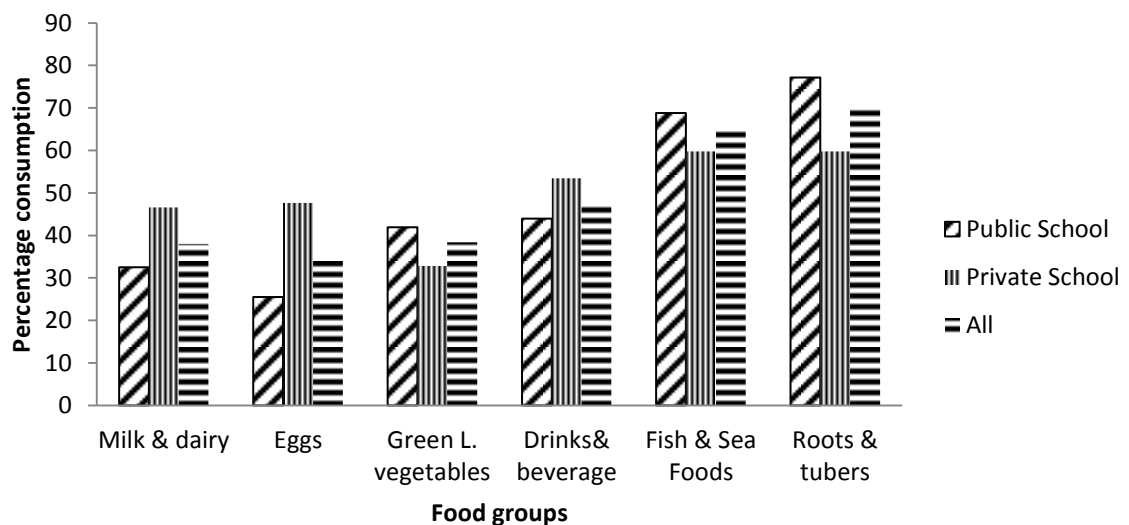
week. The number of times all sweetened drinks (including carbonated and non-carbonated drinks) were consumed within one week ranged from zero (0) to 34 with a mean of  $4.44 \pm 4.27$  drinks per week.

All pupils consumed snacks at least twice in the week with a maximum intake of 42 times in a week. Mean (SD) pastry intake was 11.92 (5.56) times in the week. About 57% of pupils consumed snacks at most 3 days in the week, 27.3% consumed it 4 – 5 days a week and about 16% consumed it more than 5 times in the week. The majority of pupils (72%) consumed snacks once on days of consumption, 23.2% twice, and 5.3% took it three times or more on days of consumption. Only 12.5% of pupils reported that parents packed snacks for them to take to school of which only about 2% had it packed for school on all 5 days of the week. Overall, 17.9% of pupils consumed snacks 7 times or fewer over the week, with the majority (82.1%) consuming it more than 7 times in a week which translates to more than once a day if spread over 7 days. No differentiation was made between home and school consumption of snacks and sweetened drinks reported by pupils.

All pupils ate foods from the cereal and fats & oils groups and over 70% consumed roots and tubers. With the exception of 7 pupils, all pupils had consumed other non-green leafy vegetables. The diets of these 7 pupils were that of beverage, milk and milk products, breads and pastries; none of them ate any dish made with the usual onion, pepper or tomato which was common in most Ghanaian dishes. Over 60% of pupils had consumed fish, meat or poultry; and less than 40% of them took milk and eggs. About 40% of pupils consumed green leafy vegetables. Significantly more pupils from public schools consumed fish and sea foods (69% vs. 60%,  $p < 0.05$ ), green leafy vegetables (42% vs.

33%,  $p < 0.05$ ) as well as roots and tubers (77% vs. 60%,  $p < 0.001$ ) compared to their public school counterparts. Conversely, significantly more pupils from private schools consumed milk & dairy (47% vs. 33%,  $p < 0.01$ ), eggs (47% vs. 26%,  $p < 0.001$ ) and beverages (53% vs. 44%,  $p < 0.05$ ) compared to those from public schools. Only 13.8% of pupils had consumed fruits within the 24-hour meal recall period. Overall dietary diversity scores ranged from a minimum of three to a maximum of twelve, and mean score was  $6.99 \pm 1.46$  groups and did not vary significantly by sex or school administration type (all  $p > 0.05$ ).

Figure 4.3 Differences in consumption of foods from selected food groups by school type

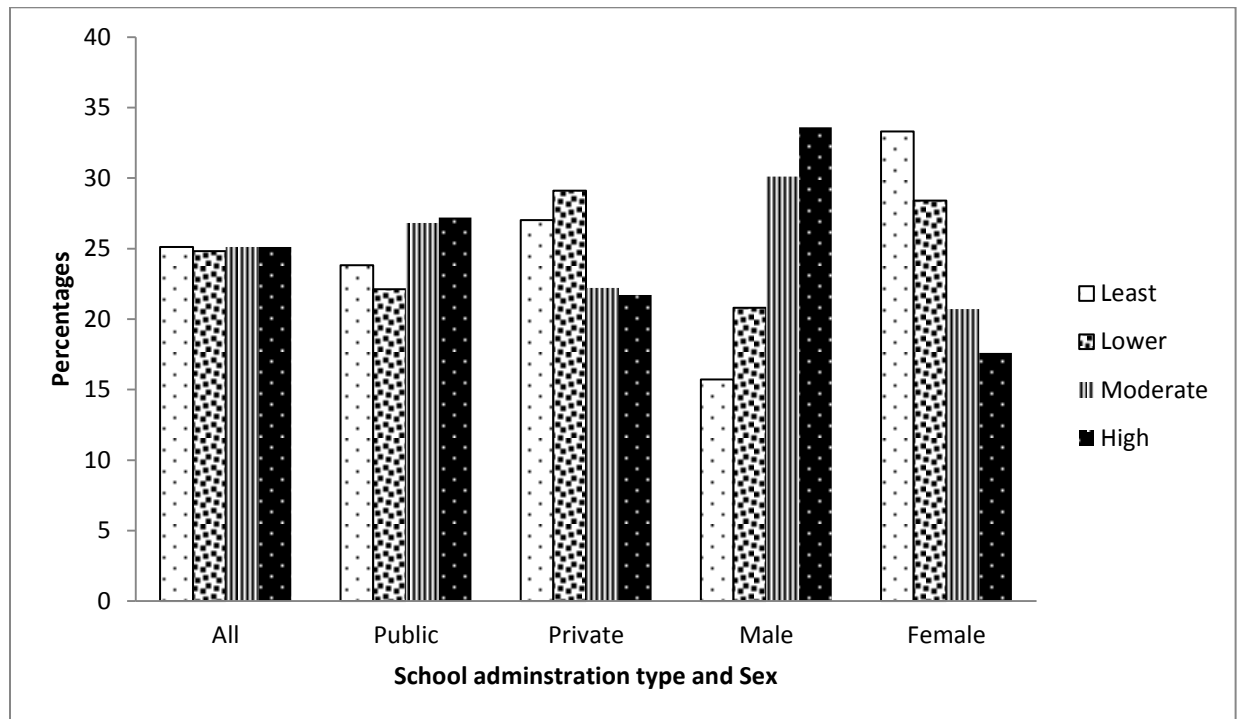


#### 4.3.2 Physical activity levels of pupils

The mean physical activity (PAQ-C) score was  $2.34 \pm 0.73$  with a minimum of 1 and a maximum of 4.15. Males had higher PAQ-C scores than females ( $2.56 \pm 0.7$  vs.  $2.15 \pm 0.69$ ,  $p < 0.001$ ). Consequently, more females compared to male fell in the two lower quartiles

of physical activity level, Chart 4. PAQ-C scores did not significantly vary across school administration types ( $2.39 \pm 0.74$  vs.  $2.26 \pm 0.69$ ,  $p > 0.05$ ).

Figure 4. 4 Physical activity levels of Pupils



#### 4.4.0 School policies relating to feeding and physical activity in school

##### 4.4.1 School Policies regarding feeding at school

None of the schools assessed had a written/ formal policies regarding eating by pupils during school hours. However, all schools had both informal/unwritten food-related policies and practices.

All schools disallowed food and drinks in the classroom. All schools, except two (private), never used food as reward to pupils. One school often used food as reward and had a policy that pupils be given ice cream, eggs and lunch when they excelled in sporting activities or competitions. Another used food as reward to pupils but had no

policy guiding its use. The majority of the schools (10 public; 8 private) allowed food and beverage advertisement in the school (on sign boards, T-shirts, sports courts, etc.) but none of them had branded beverage dispensers in their school. Two-thirds of public schools and one private school allowed pupils to go outside side premises to buy food during lunch time; three public schools and one private school allowed pupils to get food outside premises at other times apart from lunch. All schools had informal food-related practices that covered three broad areas: restriction of energy-dense foods; promotion of hot meals and fruit sale; and enforcing patronage of school canteen services (disallowing food sale/ or 'other' food entry into school compound and charging compulsory fees for school lunch). The majority of schools (15 out of 24) reported restricting the sale of energy-dense foods, which they described as "sugary" or "fatty" foods. The food items targeted in these policies were fried snacks and confectioneries, with special emphasis on ice creams and sugar-sweetened frozen drinks. All schools promoted the availability of hot meals during lunch and thus made arrangements for pupils to be have lunch on campus either through the school canteen service, private food vendors located within and outside school premises or the school feeding programme (SFP).

All Private schools had school-run canteen services and enforced patronage of meals served in canteen. In addition, they disallowed the sale of other cooked food within school premises (except one); allowed only the sale of snacks and fruits (three schools) in addition to canteen meals. All canteens had a menu which was followed in providing meals to children. Two-thirds had a one-item menu while the remaining third provided at least two meal options at lunch time (menu samples shown in appendix 12). However, it was a practice of some schools (3 out of 12) to serve only rice-based or 'easy to prepare

foods' to pupils. They did not serve kenkey<sup>8</sup>, banku<sup>9</sup>, rice-ball, fufu<sup>10</sup> or foods served with soups, which were local dishes enjoyed by many Ghanaians. Only one school had fruits on sale in the canteen. The nine schools which had school-operated stores/ tuck shop also had guidelines on foods permitted for sale to pupils. Majority (6 of 9) of schools allowed only snacks to be sold in shops, together with specific items like yoghurt, *kallypo* (a popular brand of packaged sweetened drink) and 'controlling' the 'sweets' available (allowing only selected brands). At least one teacher was involved in sale of snacks in two schools.

For the public schools, which had no school-run canteen services, all head-teachers allowed the sale of complete meals within the school premises. In addition, seven public schools restricted the sale of specific energy-dense foods (eg. Fried rice, frozen sweetened drinks, candies), six promoted healthier meal options (meals with higher protein or vegetable content. Eg. Waakye, vegetable soups, bean based meals) and one promoted the sale of fruits. Only three of the nine schools served by the SFP adhered to the menu pasted in head-teachers' office. The SFP service providers in the remaining schools served rice-based foods without any specific meal plan and same meals were often repeated. One teacher was involved in the sale of snacks to pupils at school. The three public schools not served by the SFP had pupils patronizing services of private food vendors within or outside of school premises.

When head teachers were asked how effective these policies have been in promoting healthy eating among pupils all but one public school head felt that their policies have

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<sup>8</sup> Kenkey is boiled fermented corn dough balls wrapped in corn husks; can be mashed and sweetened with sugar and enjoyed alone or with bread, or balls eaten with hot sauce, soup or stew.

<sup>9</sup> Banku is made from fermented corn dough mixed with fermented cassava dough

<sup>10</sup> Cooked starchy roots or tubers that have been pounded into a smooth paste; usually eaten with soup

been effective because of the following observations they have made: pupils brought fruits instead of sweetened drinks to school (7 private schools); pupils do not fall ill as often as they used to before restriction on sweets and frozen drink sale (8 public and 1 private school); only varied balanced meals are made available to pupils (2 private schools); pupils do not buy sugar-sweetened frozen drinks from hawkers who enter school compound (1 public school).

In private schools, the head-teacher and in some cases other administrative staff, was involved in the setting up of informal school policies; only in two schools were school prefect and parents involved in termly menu planning. In public schools, the school management committee and school health coordinator in addition to head-teachers were involved in the setting up of policies; no parents or pupils were involved.

Nineteen (out of 24) head teachers agreed to the following statements: “Nutrition/nourishment is high on our list of priorities in this school”; “The management team of our school support the provision of healthy foods through school canteen service”; “Our school canteen service provides mainly foods with high nutritional value” and “Our school canteen service provides mainly foods with high nutritional value”. Only one head-teacher was neutral to the statement, “Our school canteen service provides mainly foods with high nutritional value”.

Head teachers unanimously agreed to the importance of schools to provide an environment that encouraged healthy food choice by pupils. Twenty out of twenty-four head teachers felt that it was very important to have a school/ district/ nationwide policy on food for basic schools and also for schools to mostly provide only healthy foods to pupils. However, four head teachers (4 public, 4 private) felt that schools should provide

both healthful and less healthful food choices and allow pupils to choose. The thoughts of these four head teachers on the importance of school/ district/ nationwide policy on food for basic schools are as follows: two felt it was somewhat important, one was neutral and one felt it was unimportant.

#### **4.4.2 School policies relating to physical activity in school**

None of the schools examined had a written/ formal policy regarding physical activity of pupils in school. However, all schools had informal/ unwritten policies that guide physical activity in school. Eleven of the schools (5 public, 6 private) reportedly enforced the physical education (PE) period on the time table, three (1 public, 2 private) made PE and sports compulsory for all pupils, eight schools (4 public, 4 private) enforced a one-hour extra games period on Fridays, two public schools encouraged dance and 'right to play' activities in the school. All head teachers, except two, (1 public, 1 private) said that their policies have been very effective in that there has been 100% participation of pupils during PE and more pupils are now interested in sports.

Most of the schools (17 out of 24) had PE periods on their time table and also took pupils out for practical PE sessions. However, two public schools as well as five private schools had taken PE periods completely off the time table and thus only the time for play on Fridays after lunch was allowed for physical activity. One private school neither had PE periods nor allocated any other time aside regular break times for pupils to engage in physical activity. Six schools (1 public, 5 private) allocated between 30 minutes and an hour for PE while the majority (11 public, 6 private) allocated more than an hour for PE and the additional Friday physical activity period for pupils per week. Less than half of

the schools had a specific teacher assigned to PE; the majority of them relied on class teachers to take their pupils out for PE practical sessions. Only seven of the teachers specifically assigned to PE were trained PE instructors (in 3 public and 4 private schools). According to most of the head teachers (15 schools), wet weather conditions had little effect on PE classes, though 9 said PE classes were enormously affected during wet weather.

With the exception of one private school which had no playground, majority of the schools (n=17, 71%) allowed pupils access to playground only during recess while the remaining allowed additional use either before or after school. About a third of the schools allowed pupils to use sports equipment during break time.

All schools except one private school have a soccer team, seventy-five percent had an athletics team, half had a team for both volleyball and net ball, a quarter had a basketball team and three schools had a table tennis team. Other teams reported by two private schools were badminton and handball teams. A half of the schools had dance groups with members ranging from 4 to 70 and involving up to six school teachers. Members of these dance groups mostly danced about once in a month, but increased to weekly and subsequently daily depending on the timing of an impending contest or school programme.

Almost all head teachers agreed to the statement, 'Physical activity is high on our list of priorities in this school', with the exception of one private school head was neutral. Also, fifteen head-teachers agreed to the statement, 'Our school has adequate facilities for pupils to be physically active regardless of weather'; five were neutral and four

disagreed. Regarding the encouragement of staff and pupils' participation in physical activity by school management team, 20 head teachers agreed, three were neutral and one disagreed. Almost all head teachers (23) interviewed agreed that their staff was committed to and support physical activity and extra- curricular activities; one was neutral.

#### **4.5 School facility for feeding and physical activity of pupils**

All schools had buildings made with cement blocks. Fourteen of the schools (4 public, 10 private) assessed had a fence round the school premises and 13 of these had a restricted entrance. Of those that had gates, nine (1 public, 8 private) of them were kept closed until school ends while the others opened gate all day allowing pupils movement outside premises during school hours.

##### **4.5.1 School facility for feeding of pupils in school**

Majority of pupils (75.8%) reported they usually obtained food from within the school compound while 11.3% solely ate food brought from home and did not buy food. Only 7.6% and 5.3% of pupils solely obtained food from vendors outside school and the school feeding programme respectively. More public school pupils obtained food from vendors outside school compound compared to those from private schools ( $\chi^2(3) = 27.19$ ,  $p < 0.001$ ).

Only nine of the schools that provided canteen services had a physical structure for the canteen. These canteen services sold food to pupils either on a daily basis or on an advance payment schedule. Only three schools provided fruits for sale in canteens and none of them sold fruit juices to pupils. Four of the schools sold sweetened drinks, while

two sold carbonated drinks in school canteen. No packaged snacks or biscuits were sold in any of the school canteens.

In private schools meals were served to pupils in the canteen (9), dining hall (1), empty classroom (1), and in corridor of classroom (1). In most of the public schools, the school feeding programme served meals to pupils in classroom, corridor in front of classroom or under sheds and trees. Majority of pupils in public schools ate their meals near the vendors who sold meals to them within school compound. All ready- to- eat foods in canteens, school food vendors and hawkers were well covered and mostly kept in ice chests and food warmers and dished out to pupils when necessary. Less than half of the schools had a demarcated eating area.

All canteens, the dining hall and 11 food vendors provided soap and water for hand washing. In two private schools which served meals in the canteen structure, pupils were required to eat with cutlery and hence no soap and water were provided for hand washing. The school feeding programme (except in one school) provided water and soap for hand washing but in most cases was inadequate due to the pupil population. The water run out too quickly and pupils kept washing hands in the dirty water. Hawkers mostly sold snacks but the only one spotted selling complete meal did not provide water and soap for hand washing of pupil customers. Facility for hand washing was available in front of classrooms and washroom for most of the schools except that about half of the schools had no soap provided in front of classrooms.

Seventeen of the schools assessed either had pipe-borne water, polytank or veronica buckets (big buckets fitted with taps) that provided potable water for pupils to drink. In

four public schools, buckets of water were provided but water was unwholesome because pupils dipped cups inside and left water with food particles and visible dirt. In one private school, pupils had to purchase sachet water because no drinking water was provided.

The snack bars within school premises mostly sold sweetened drinks, pastries and confectioneries. Only one school sold carbonated drinks in the snack bar. In two schools, fried chicken and sausages were sold to accompany drinks. Only one store owned by a private person in a public school sold a variety of complete meals to pupils.

All school food vendors sold on make shift stands locally known as “table top stores”. Fourteen of the schools (All 12 public, 2 private) had these food vendors within the premises of the school. The number of food vendors ranged from 2 to 17 depending on the policy and the size of the school (part of a cluster of schools or a ‘stand-alone’). In one particular public school, the school boundary was not well differentiated and thus there was a ‘mini market’ with about 19 of these ‘table top stores’ almost pouring into the narrow space at the side of the classroom block and pupils actively patronized food sold in addition to the 13 others located within the school compound. All except one sold complete meals and pastries to pupils. A list of complete meals sold by these school vendors are shown in appendix 13. Vendors in 11 schools sold fried foods (yam, ripe plantain, doughnuts, etc.). Local snacks including roasted groundnuts, corn, ‘zowe’ and ‘adunle’ (roasted maize meal) were available in seven schools. Imported packaged snacks (cheese balls, potato sticks, potato chips, etc.) were available in four schools while confectioneries were sold in seven schools. Vendors in 10 schools sold sweetened drinks; carbonated drinks were available in only three schools. Fruits were sold by vendors in 11

schools but no fruit juices were sold by school food vendors. Other items like fried chicken, sausages, fried eggs, and soybean khebabs were sold in 10 schools.

Hawkers were spotted in 13 of the schools and these mostly sold sweetened drinks, pastries, and confectioneries to pupils. Only 5 of the 47 hawkers spotted in participating schools sold fruits. Other items sold by these hawkers were 'bofrot', soybean khebab, fried chicken sausages and boiled eggs. It was very common to see hawkers selling more than one type of food.

Overall proportion of healthy food retail points for the schools (HRFE score) was 44.7% and this did not vary by school administration type (43.01% vs. 46.46%,  $p > 0.05$ ). The main constructs representing the school food environment explained 73.3% of the variance. Characteristics of the school food environment based on the 4 main constructs are shown in Table 4.4 below. Private schools have more control over food available to pupils when in school.

Table 4.4 Characteristics of school Food environments by school administration type

Characteristic	All (N = 24)	Public (n = 12)	Private (n = 12)	p- value
<b>Control over eating place (%)</b>				0.102
Least	8	5	3	
Moderate	7	5	2	
High	9	1	7	
<b>Control over food available n (%)</b>				<b>0.011</b>
Least	7	6	1	
Moderate	8	5	3	
High	9	1	8	
<b>Promotion of healthier food options n (%)</b>				0.870
Least	6	3	3	
Moderate	10	4	6	
High	8	5	3	
<b>Hand washing facilities n (%)</b>				0.266
Least	9	6	3	
Moderate	7	4	3	
High	8	2	6	

*Differences between groups were tested using Chi-square test. Fisher's exact test was used to correct for the very small sample sizes involved.*

Other food sale points located within a 100 meter radius round the schools visited that pupils could patronize are: fast food joints (2); kiosks or containers (18); “table top stores” (16); restaurants (2); chop bar or local restaurant (3); homes selling foods (7) and stores (14). Appendices 14 – 21 are maps of selected schools showing typical school boundary, facility for physical activity and food sale points within school compound and around the schools (100 meter radius).

#### 4.5.2 School facility for physical activity of pupils in school

All schools with the exception of one private school had either a playing ground or open spaces located between classroom blocks where pupils can play. The only private school that didn't have any open space or playground for pupils had walk ways where pupils stood around during break time. Other facilities for physical activity are shown in Table 4.5 below.

Table 4.5 School facilities for sports and physical activity

Sports Facility	Frequencies N= 24	
	Public (n=12)	Private (n=12)
Soccer field	11	7
Table tennis equipment	1	3
Volley ball court	8	5
Basketball court	2	5
Net ball court	8	2
Others	1	2

*Others include: Skipping ropes, items for sack racing and items for hand ball*

Public schools mostly had bigger spaces available within school premises that pupils could engage in physical activity in compared to private schools (7854 m<sup>2</sup> vs. 3289 m<sup>2</sup>,  $p < 0.05$ ). Characteristics of schools physical activity environments based on the four underlying constructs measured are as shown in Table 4.6 below. The four constructs in combination explained 63.9% of the variance in the physical activity environment of schools. Significantly less number of private schools had policies that initiate physical activity (PE on time table, practical PE sessions, assigning teacher to PE,) compared to

public schools ( $p < 0.05$ ). Other characteristics of the physical activity environment of the schools did not significantly vary based on school administration type.

Table 4.6 Physical activity environments of schools by school administration type

characteristic	All (N = 4)	Public (n = 12)	Private (n = 12)	p- value
<b>Policy initiating physical activity n (%)</b>				<b>0.011</b>
Least	9	1	8	
Moderate	8	5	3	
High	7	6	1	
<b>Supporting environment for physical activity n (%)</b>				0.467
Least	9	4	5	
Moderate	8	3	5	
High	7	5	2	
<b>Increasing options for physical activity n (%)</b>				0.772
Least	8	3	5	
Moderate	9	5	4	
High	7	4	3	
<b>Encouragement of active play n (%)</b>				0.696
Least	10	4	6	
Moderate	6	4	2	
High	8	4	4	

*Differences between groups were tested using Chi-square test. Fisher's exact test was used to correct for the very small sample sizes.*

#### 4.6.0 Frequency and types of foods purchased by pupils in school

Almost three-fifths of the pupils (58.7%) brought spending money between GH¢ 1 and GH¢ 2 daily to school for food. A little over a fifth of pupils brought amounts between GH¢ 2 and GH¢ 5. Pupils in private schools had significantly more money to spend on food compared to their public school counterparts ( $\chi^2(4) = 62.29, p < 0.001$ ).

Over 77% of pupils intercepted during the first break period made food purchases within the school compound while the minority made purchases outside school premises.

Multiple response analysis was conducted to examine frequent purchases since the majority of pupils made more than one food purchase. Table 4.7 below shows the frequency of purchase of various types of food made by pupils by school administration type. Energy-dense foods (pastries, biscuits, fried foods and sugar-sweetened beverages) formed 46.6% of all purchases; representing 50.3% and 44.8% of all purchases made inside and outside school compound respectively. Energy densities of foods frequently purchased by pupils are shown in appendix 14.

Table 4.7 Frequency of purchase of foods by pupils during first break period

Food Type	Frequency of purchase (percentage)		
	Public school (n=842)	Private schools (n=292)	Total (n=1134)
Complete meals	348(41.3)	82 (28.1)	431 (38.0)
Sweetened drinks	155(18.4)	20 (8.2)	175 (15.4)
Pastries	74 (8.8)	61 (20.9)	135 (11.9)
Confectioneries	49 (5.8)	15 (5.1)	64 (5.7)
Fried foods	34 (4.0)	29 (9.9)	63 (5.6)
Milk & Cocoa drinks	37 (4.4)	19 (6.5)	56 (4.9)
Fruits	26 (3.1)	22 (7.5)	48 (4.2)
Local snacks (dry) <sup>1</sup>	23 (2.7)	13 (4.5)	36 (3.2)
Biscuits	28 (3.3)	7 (2.4)	35 (3.1)
Others <sup>2</sup>	68 (8.1)	24 (8.2)	92 (8.2)

*1. Includes roasted plantain, corn, and yams, 'darkwa or zowe'. 2. Other foods include fried sausages, fried eggs, boiled eggs, soybean khebab, fried chicken, which were bought by pupils and consumed alone or with drinks.*

#### **4.7 Characteristics of the home food environment**

These results represent the home environments of 340 pupils whose parents participated in this study. About 46% of parents had consumed snacks and soft drinks in the presence of their children (parental modeling) in the past one week. About 73% of participating parents put pressure on their children to eat. Less than half of parents used snacks and drinks as rewards to their children, while the majority (71.2%) did not restrict access to snack and soft drinks. Significantly more parents of pupils in private schools stored snacks and sweetened drinks in their home compared to their counterparts in public schools (46.8% vs. 28.4%,  $p < .01$ ; Table 4.8). Mean home food environment score was  $53 \pm 9.1$  and pupils in public schools had significantly better home environment scores compared to their private school counterparts ( $54.6 \pm 8.1$  vs.  $52.0 \pm 10.0$ ,  $p = 0.012$ ). The three main constructs (parental provision of access, use of snacks/drinks as reward, and storage of drinks/snacks in home) underlying the home food environment in combination explained 71.8% of the variance. Classifications of home food environments of pupils by school administration type based on the three main constructs underlying the home food environment, together with parental pressure to eat and modeling of snack and soft drink intakes are also shown in Table 4.8.

Table 4.8 Home food environment characteristics of pupils

Characteristic	All (N = 340)	Public (n = 201)	Private (n = 139)	p- value
*Parental Modeling of intakes n (%)	156 (46.0)	85 (42.3)	71 (51.4)	0.096
*Drinks & snacks stored in home n (%)	122 (35.9)	57 (28.4)	65 (46.8)	<b>0.001</b>
*Use of snacks & drinks as reward n (%)	143 (42.1)	91 (45.3)	52 (37.4)	0.149
*Parental provision of access to snacks & drinks n (%)	242 (71.2)	137 (68.2)	105 (75.5)	0.140
*Parental pressure to eat	247 (72.6)	152 (75.6)	95 (63.8)	0.139
<b><sup>4</sup>Parental provision of access to snacks &amp; drinks n (%)</b>				0.855
High	113 (33.2)	68 (33.8)	45 (32.4)	
Middle	114(33.5)	65 (32.3)	46 (35.3)	
Least	113(33.2)	68 (33.8)	45 (32.4)	
<b><sup>4</sup>Use of snacks and drinks as reward n (%)</b>				0.281
High	113 (33.2)	70 (34.8)	43 (30.9)	
middle	114(33.5)	71 (35.3)	43 (30.9)	
Least	113(33.2)	60 (29.9)	53 (38.1)	
<b><sup>4</sup>Storage of snacks and drinks in home n (%)</b>				< <b>0.001</b>
High	113 (33.2)	52 (25.9)	61 (43.9)	
Middle	114(33.5)	66 (32.8)	48 (34.5)	
Least	113(33.2)	83 (41.3)	30 (21.6)	

\* Variables were assessed as binary outcomes ('yes' or 'no'); <sup>4</sup>Home environment variable constructs split in terciles for comparison purposes. ; Differences between groups were tested using Chi-square test. The parental pressure-to-eat subscale used had poor internal consistency, Cronbach's  $\alpha = .523$  and was thus collapsed into "parental pressure" or "no parental pressure".

#### 4.8 Individual level determinants of child BMI

Considering the significant role of parental BMI on child BMI established by many studies, only pupils who have parent BMI (n=284) formed the sample considered in the determinants of child BMI so that the role of other factors can then be established. Results reported here represent only 58% of participating pupils.

#### 4.8.1 Correlates of child BMI

Simple linear regression or ANOVA was performed to explore the relationship between BMI and all possible determinants that were continuous in nature. Table 4.9 show that age, sex, parental BMI, variety of vegetables consumed, variety of both fruit and vegetables put together, sugar sweetened drinks, all beverages combined, breakfast consumption, hours spent watching TV per week, media time per week and calories consumed were significantly associated with child BMI.

Being female was associated with an increased child BMI of  $1.77 \text{ Kg/m}^2$  above that for a male pupil ( $F(1, 486) = 15.655, p < 0.001$ ). Each additional  $1.0 \text{ Kg/m}^2$  of parent BMI was associated with a significant  $0.082 \text{ Kg/m}^2$  increase in child BMI. The combined variety of fruits and vegetables consumed per week was also associated with a  $0.188 \text{ Kg/m}^2$  increase in child BMI. A one day increase in the number of days on which breakfast was consumed per week was associated with a  $0.277$  reduction in child BMI. Sugar-sweetened drinks as well as all beverages put together significantly increased child BMI by about  $0.1 \text{ Kg/m}^2$  (all  $p < 0.01$ ). The percentage of children  $< 16$  years (child constitution) in the household was negatively associated with child BMI. Thus a 1% increase in child constitution predicts a  $0.19 \text{ Kg/m}^2$  reduction in child BMI ( $p < 0.05$ ).

Table 4.9 Linear relationships between child BMI and Possible determinants

Variable	B (SE)	95% Confidence interval for mean	Statistical test
Age (years)	0.43 (0.100)***	0.229 - 0.629	F (1, 486) = 18.055, p<0.001
Sex (female)	1.77 (0.30)***	0.428 - 1.274	F (1, 486) = 15.655, p<0.001
Parent BMI	0 .082 (.031)**	0.022 - 0.143	F (1, 283) = 7.220, p<0.01
Fruit &vegetable	0 .033 (0.021)	-0.009 - 0.075	F (1, 486) = 2.421, p>0.05
Fruit & vegetable mix	0 .188 (0.060)*	0.000 - 0.236	F (1, 486) = 3.890, p<0.05
Fried foods	0.049 (0.026)	-0.002 - 0.101	F (1, 486) = 3.552, p>0.05
Sugar sweetened drinks	0 .106 (0.036)**	0.036 - 0.176	F (1, 486) = 8.842, p<0.01
All beverages	0 .092 (.027)***	0.038 - 0.145	F (1, 486) = 11.131, p<0.001
Breads and pastries	0 .051 (0.028)	-0.003 - 0.105	F (1, 486) = 3.446, p>0.05
Other high calorie foods	-0.001 (0.024)	-0.049 - 0.046	F (1, 486) = .004, p>0.05
Staple foods	-0.022 (0.026)	-0.072 - 0.029	F (1, 486) = .719, p>0.05
Breakfast intake/week	-0.277 (0.097)**	-0.467 - -0.086	F (1, 486) = 8.170, p<0.01
Dietary diversity score	0.191 (0.110)	-0.025 - 0.407	F (1, 486) = 3.011, p>0.05
Total calories	0 .000 (0.000)*	0.000 - 0.001	F (1, 486) = 4.658, p<0.05
Hours spent on computer/ week	0 .081 (0.068)	-0.053 - 0.215	F (1, 486) = 1.413, p>0.05
TV hours per week	0.033 (0.016)*	0.001 - 0.065	F (1, 486) =4.109, p<0.05
Days child watched TV	0 .128 (0.070)	-0.010 - 0.266	F (1, 486) = 3.324, p>0.05
Total media time	0 .032 (0.015)*	0.003 - .062	F (1, 486) = 4.623, p<0.05
Days child walked to school	-0.006 (0.078)	-0.159 - 0.148	F (1, 486) =.005, p>0.05
Minutes child walked to school	0.001 (0.002)	-0.002 - 0.005	F (1, 486) = .501, p>0.05
Child (<16yrs) constitution	-0.19 (0.009)*	-0.036 - -0.001	F (1, 486) = 4.252, p<0.05

Level of significance: \*p<0.05; \*\*p<0.01; \*\*\* p<0.001

One way ANOVA was conducted to examine the relationship between child BMI and possible predictors that were categorical in nature. A planned post-hoc test (Gabriel's test) was conducted to identify the differences between different levels of a possible predictor when it showed significant relationship with child BMI. The variables

examined in this way are household SES, physical activity level of pupils and age groupings of pupils.

Age group of the child had a significant linear relationship with BMI,  $F(2, 486) = 7.968$ ,  $p < 0.001$ , Table 4.10. This means that the BMI of child generally increases as the child advances in age. The post hoc test (Gabriel's test) established significant variations in BMI of pupils belonging to different age groups. On average, the BMI of pupils in the 9 – 10 age group ( $17.25 \pm 3.64 \text{ Kg/m}^2$ ) was about  $1.07 \text{ Kg/m}^2$  (95% CI = -2.12 - -0.02,  $p < 0.05$ ) and  $1.78 \text{ Kg/m}^2$  (95% CI = -2.85 - -0.72,  $p < 0.001$ ) lower than those in the 11- 12 and 13 – 15 age groups respectively (Table 4.11). The BMI of pupils in the 11 – 12 years age group was however not significantly different from those in the 13 – 15 years age group (Mean difference = 0.17, 95% CI = -0.07 - 1.50,  $p > 0.05$ ).

Table 4.10 Relationship between child BMI and Age group

Age group	N	Mean	Standard Deviation	Child BMI		
				95% Confidence interval for mean	Minimum	Maximum
9 - 10 years	73	17.25	3.64	16.40 - 18.10	13.6	30.8
11 - 12 years	213	18.32	3.45	17.85 - 18.78	13.56	31.49
13 - 15 years	201	19.03	3.09	18.60 - 19.46	14.23	32.14
Total	487	18.45	3.38	18.15 - 18.75	13.56	32.14

Overall F test:  $F(2, 486) = 7.968$ ,  $p < 0.001$

Table 4.11 Gabriel's post hoc multiple comparisons for BMI within child Age group

(I) Age group	(J) Age group	Mean difference (I -J)	Standard Error	Significance	95% Confidence Interval
9 -10 years	11 - 12 years	-1.07*	0.45	<b>0.044</b>	-2.1
	13 - 15 years	-1.78*	0.46	<b>&lt;0.001</b>	-2.13
11 - 12 years	9 -10 years	1.07*	0.45	<b>0.044</b>	0.02 - 2.12
	13 - 15 years	-0.71	0.33	0.087	-1.57
13 - 15 years	9 -10 years	1.78*	0.46	<b>&lt;0.001</b>	0.072 - 2.85
	11 - 12 years	0.71	0.33	0.087	-1.57

\* The mean difference is significant at 0.05 level.

There was a significant linear trend between household SES and BMI of pupils,  $F(1, 486) = 8.410$ ,  $p < 0.001$  as shown in Table 4.12 below. Suggesting that child BMI increases proportionately as family wealth increases from poor to middle and drops from middle to rich. The post hoc test shown in Table 4.13 revealed that the mean BMI of children in poor households are significantly lower than those in the middle SES group (Mean difference = -0.95, 95% CI = -1.77 - -0.14,  $p < 0.05$ ) and much less than those in the rich SES group (Mean difference = -1.58, 95% CI = -2.54 - -0.61,  $p < 0.0001$ ). Mean BMI was not significantly different between pupils in the middle and rich SES group (Mean difference = 0.63, 95% CI = -0.35 - 1.60,  $p > 0.05$ ).

Table 4.12 Relationship between child BMI and Household SES

SES group	N	Mean	Standard Deviation	95% Confidence interval for mean	Minimum	Maximum
Rich	101	14.34	3.61	18.62 - 20.05	14.32	31.49
Middle	187	18.71	3.44	18.22 - 19.21	13.56	32.11
Poor	199	17.76	3.08	17.33 - 18.19	13.78	32.14
Total	487	18.45	3.38	18.15 - 18.75	13.56	32.14

Overall F test:  $F(1, 486) = 8.410, p < 0.001$

Table 4.13 Gabriel's post hoc multiple comparisons for child BMI within household SES

(I) SES	(J) SES	Child BMI			
		Mean difference (I - J)	Standard Error	Significance	95% Confidence Interval
Rich	middle	0.63	0.41	0.330	-0.35 - 1.60
	poor	1.58*	0.41	<0.001	0.61 - 2.54
Middle	rich	-0.66	0.41	0.330	-1.60 - 0.35
	poor	0.95*	0.34	0.016	0.14 - 1.77
Poor	rich	-1.58*	0.41	<0.001	-2.54 - -0.61
	middle	-0.95*	0.34	0.016	-1.77 - -0.14

\* The mean difference is significant at 0.05 level.

Table 4.14 shows the relationship between child BMI and physical activity levels. Child BMI had an inverse relationship with physical activity level,  $F(3, 486) = 4.820, p < 0.01$ . This generally indicates that child BMI reduces with increasing levels of physical activity. The post hoc test reveals a significant difference in mean BMI of pupils in the high and least physical activity levels (Mean difference = 1.61, 95% CI = 0.48 - 2.74,  $p < 0.0001$ ). Mean differences in child BMI did not significantly vary for pupils within the lower, moderate and high physical activity levels (Table 4.15).

Table 4. 14 Relationship between child BMI and Physical activity level

Physical activity level	N	Mean	Standard Deviation	95% Confidence interval for mean	Minimum	Maximum
Least	122	19.31	4.00	18.6 - 20.03	13.78	32.14
Lower	121	18.47	3.50	17.84 - 19.10	13.56	32.11
Moderate	122	18.32	3.07	17.77 - 18.87	13.81	30.18
High	122	17.7	2.66	17.22 - 18.18	13.6	29.31
Total	487	18.45	3.38	18.15 - 18.75	13.56	32.14

Overall F test:  $F(3, 486) = 4.820, p < 0.01$

Table 4. 15 Gabriel's post hoc multiple comparisons of child BMI within various physical activity levels of pupils

(I) Physical activity level	(J) Physical activity level	Mean difference (I - J)	Child BMI		95% Confidence Interval
			Standard Error	Significance	
Least	lower	0.84	0.43	0.265	-0.29 - 1.98
	moderate	0.99	0.43	0.117	-0.14 - 2.13
	high	1.61*	0.43	<b>0.001</b>	0.48 - 2.74
Lower	least	-0.84	0.43	0.265	-1.98 - 0.29
	moderate	0.15	0.43	1.000	-0.98 - 1.29
	high	0.77	0.43	0.365	-0.36 - 1.90
Moderate	least	-0.99	0.43	0.117	-2.13 - 0.14
	lower	-0.15	0.43	1.000	-1.29 - 0.98
	high	0.62	0.43	0.618	-0.51 - 1.75
High	least	-1.61*	0.43	<b>0.001</b>	-2.74 - -0.48
	lower	-0.77	0.43	0.365	- 1.90 - 0.36
	moderate	-0.62	0.43	0.618	- 1.75 - 0.51

\* The mean difference is significant at 0.05 level

#### 4.8.2 Determinants of child BMI

The full model containing all predictors (Table 4.16) was significant compared to both the constant-only model and model 1,  $F(6, 282) = 8.98, p < 0.001$  with a significant change in R-square (model 1  $R^2 = .056$ , full model  $R^2 = .163$ ). Results of the evaluation of multicollinearity revealed that there was none since all tolerance levels were very much greater than 0.1 (Menard, 1995). After controlling for age of child, sex, parental

BMI, household SES, household child (<16 years) constitution and calories, frequency of beverage consumption per week and child having least physical activity positively predicted BMI. This suggests that an extra occasion of beverage consumption per week predicts a significant 0.1 Kg/m<sup>2</sup> increase in child BMI (p=0.004) and being in the least physical activity level category also predicts a 1.27 Kg/m<sup>2</sup> increase in child BMI over that of pupils in the high physical activity level category. All other diet-related factors tipped for prediction including calories and fruits and vegetables made no significant contribution to the model and were thus dropped.

Table 4. 16 Hierarchical Multiple linear regression predicting child BMI

Variable	B (SE)	95% Confidence interval for mean	Significance
Constant	8.83 (1.98)	4.92 – 12.73	0.001
Sex (female)	1.27 (0.41)	0.47 – 2.07	0.002
Age (years)	0.36 (0.13)	0.10 – 0.62	0.007
Parent BMI	0.07(0.03)	0.01 – 0.13	0.015
Middle wealth	0.87 (0.41)	0.06 – 1.67	0.035
Beverage consumption	0.10 (0.03)	0.03 – 0.17	0.004
Least physical activity	1.27 (0.46)	0.37 – 2.18	0.006

Dependent = child BMI; Model R<sup>2</sup> = .163, adjusted R<sup>2</sup> = .145; F (6, 282)=8.984, p<0.001

#### 4.9.0 Environmental determinants of overweight among pupils

Results of binary logistic regressions are shown in Tables 4.17 and 4.18 below. Sex of child, beverage consumption, parental BMI status and household SES were significantly associated with child BMI status and were controlled for in the multiple logistic model. Age group, physical activity level and calories consumed were not significant predictors

of child BMI at the bivariate level but will be controlled for in the model. Parental use of snacks and sweetened drinks as reward was about the only home food environment variable that was significantly associated with child overweight status; all others did not make up the minimum significance level (0.25) for consideration into the main model. These are shown in Table 4.17.

School control over eating place of children and control over food and option available were negatively associated with child overweight status. Schools exerting moderate control was associated with reduced odds of pupils being overweight (OR=0.214, CI 0.178 – 0.573,  $p<0.05$ ; OR= 0.305, 95% CI =0.253 – 0.822,  $p< 0.01$ ) compared to those that exerted high control, Table 4.18. Schools promoting healthier food options and hand washing facilities did not significantly predict child overweight status at the bivariate level. School healthy retail food environment score and private school administration type were associated with significant increased odds of child being overweight at the bivariate level (OR=1.011, 95% CI=1.00 – 1.023,  $p<0.05$  and OR=2.198, 95% CI= 1.372 – 3.521,  $p<0.01$  respectively).

Table 4. 17 Crude relationship between child overweight status and some background and home food

Variable	Wald	Significance	Odds Ratio	95% Confidence interval for Odds Ratio
<b>Sex<sup>1</sup></b>	12.123	<b>&lt;0.001</b>	2.452	1.480 - 4.063
<b>Age group<sup>2</sup></b>	4.672	0.097		
9 - 10 years	0.817	0.366	1.396	0.677 - 2.879
11 - 12 years	4.67	0.031	1.775	1.055 - 2.987
Constant				
<b>Parent BMI status<sup>3</sup></b>	4.959	<b>0.026</b>	<b>2.130</b>	<b>1.95 - 4.143</b>
<b>Calories (Kcal)</b>	0.038	0.846	1.000	1.00 - 1.00
<b>Child physical activity level<sup>4</sup></b>	4.562	0.207		
lower	2.465	0.116	0.597	0.314 - 1.136
moderate	1.599	0.206	0.667	0.356 - 1.250
high	3.782	0.052	0.519	0.268 - 1.005
Constant	30.019	<0.001	0.312	
<b>Beverage consumption</b>	6.972	<b>0.008</b>	<b>1.053</b>	<b>1.013 – 1.093</b>
<b>Household SES<sup>5</sup></b>	12.906	<b>0.002</b>		
Middle	12.282	<b>&lt;0.001</b>	<b>3.093</b>	<b>1.645 - 5.815</b>
rich	6.889	<b>0.009</b>	<b>2.162</b>	<b>1.216 - 3.844</b>
Constant	85.803	<0.001		
<b>Provision of access<sup>6</sup></b>	0.26	0.878		
least	0.126	0.722	0.881	0.438 - 1.771
Moderate	0.02	0.888	1.05	0.534 - 2.065
constant	38.878	<0.001	0.215	
<b>Use of snacks as reward<sup>6</sup></b>	7.004	<b>0.030</b>		
least	6.432	<b>0.011</b>	<b>0.395</b>	<b>0.192 - 0.810</b>
Moderate	2.799	0.094	0.569	0.294 - 1.101
constant	25.971	<0.001	0.329	
<b>Snacks storage at home<sup>6</sup></b>	0.282	0.869		
least	0.278	0.598	1.205	0.603 - 2.406
Moderate	0.106	0.745	1.123	0.559 - 2.256
constant	41.876		0.189	
<b>% of children (&lt;16yrs) in Household</b>	3.579	0.059	0.987	0.974 – 1.000
<b>Family eating out<sup>7</sup></b>	0.48	0.488	1.275	0.642 - 2.532
<b>Pressure -to - eat<sup>7</sup></b>	0.134	0.715	1.127	0.593 - 2.141
<b>Parental snack&amp; soft drink modeling<sup>7</sup></b>	0.144	0.705	1.116	0.633 - 1.965

Reference categories: 1=male; 2=13-15 years group; 3= not overweight; 4= least; 5=poor; 6=high; 7= non-occurrence

Table 4. 18 Crude relationship between overweight status and school environment factors

Variable	Wald	Significance	Odds Ratio	95% Confidence interval for Odds Ratio
<b>Control over eating place *</b>	16.439	<b>&lt;0.000</b>		
least	14.66	<b>&lt;0.000</b>	<b>0.320</b>	<b>0.178 - 0.573</b>
Moderate	6.567	<b>0.010</b>	<b>0.472</b>	<b>0.266 - 0.838</b>
Constant	32.386	<0.001	0.374	
<b>Control over food available/option*</b>	6.937	<b>0.031</b>		
least	1.802	0.179	0.687	0.397 - 1.189
Moderate	6.827	<b>0.009</b>	<b>0.456</b>	<b>0.253 - 0.822</b>
constant	42.221	<0.001	0.305	
<b>promoting healthier food options*</b>	3.443	0.179		
least	0.237	0.626	0.870	0.496 - 1.526
Moderate	3.271	0.071	0.588	0.331 - 1.163
constant	43.502	<0.001	0.269	
<b>Hand washing facilities*</b>	3.683	0.159		
least	2.03	0.154	0.670	0.386 - 1.163
Moderate	3.209	0.073	0.586	0.327 - 1.052
constant	40.234	<0.001	0.291	
<b>Policy initiating physical activity *</b>	0.561	0.755		
least	0.141	0.707	1.120	0.620 - 2.023
Moderate	0.56	0.454	1.244	0.702 - 2.204
constant	57.594	<0.001	1.191	
<b>Supporting environment for PA*</b>	2.894	0.235		
least	0.822	0.365	1.320	0.724 - 2.403
Moderate	2.891	0.089	1.651	0.926 - 2.941
constant	65.017	<0.001	0.163	
<b>Increasing options for PA *</b>	1.353	0.508		
least	0.938	0.333	0.748	0.415 - 1.346
Moderate	0.009	0.925	1.027	0.590 - 1.786
constant	51.784	<0.001	0.233	
<b>Encouragement of active play *</b>	1.552	0.460		
least	0.013	0.910	0.969	0.559 - 1.678
Moderate	1.329	0.249	0.708	0.394 - 1.273
constant	52.349	<0.001	0.241	
<b>HRFE Score</b>	3.972	<b>0.046</b>	<b>1.011</b>	<b>1.000 - 1.023</b>
<b>School Administration type**</b>	10.728	<b>0.001</b>	<b>2.198</b>	<b>1.372 - 3.521</b>

\*Reference category = 'high'; \*\*reference category = 'public'

#### 4.9.1 Environmental determinants of child overweight status

Model 1 contained the significant individual level determinants of child BMI and other control variables: sex, age group, household SES, Beverage consumption, physical activity level, parent BMI and calories, which were to be controlled for in model. All environmental level determinants were entered into model 2: parental use of snack as reward, school control over eating place of pupils, control over food available, promotion of healthier food options, provision of hand washing facilities, supporting environment for physical activity, school healthy retail environment score and school administration type. Compared with the constant only model (with no predictors), the full model was statistically significant,  $\chi^2(25) = 77.421$ ,  $p < 0.001$  indicating that the model was good enough in distinguishing which factors were determinants of child overweight status. The final model demonstrated a good fit with a non-significant Hosmer and Lemeshow test  $\chi^2(8) = 5.761$ ,  $p = 0.674$ . The model explained 23.9% (Cox & Snell R square) and 38.9% (Nagelkerke R square) of the variance in child BMI status and correctly classified 84.2% of respondents' BMI status. As shown in Table 4.19, four of the seven environmental level factors tested in the model made significant contribution to the model (use of snack as reward, school control over food available to pupils, promotion of healthier food options and provision of a supporting environment for physical activity). The most significant predictor of child overweight status was schools' promotion of healthier food options, with an adjusted odds ratio of 5.55; 95% CI = (1.430 – 21.511). This suggests that schools that promoted healthier food options were over five times more likely to have overweight pupils, which was a relationship that was significant at the bivariate level. Age group of pupil, physical activity level, proportion of children (<16 years) in

household and beverage intake, which were significant at the bivariate level did not make significant contribution to the model in the presence of environmental factors. Although child age group collectively did not significantly predict child BMI status ( $p > 0.05$ ), the 11 – 12 years age group was associated with significantly increased odds of child overweight compared to those in the 9 – 10 years age group (OR=3.375, 95% CI= 1.080 – 10.554,  $p < 0.05$ ). Calories consumed by pupils remained an insignificant predictor of child overweight as demonstrated at the bivariate levels. An increase in Parent BMI by  $1\text{kg/m}^2$  significantly increased the odds of child overweight by 9.6% while being female increased the odds by over two times that of males (AOR= 1.091, 95% CI = 1.036 – 1.148,  $p = 0.001$  and AOR= 2.386, 95% CI= 1.037 – 5.491,  $p < 0.05$  respectively). Being in the middle household SES category increased the odds of child overweight three times compared to being in the poor category. Being in the rich SES category was not significantly associated with increased odds of child overweight as suggested at the bivariate level (OR = 2.162, 95% CI = 1.216 - 3.8440,  $p = 0.009$ ), but in fact associated with decreased odds (OR = 0.936, 95% CI = 0.283 - 3.095,  $p > 0.05$ ). This finding was in agreement with the findings of the post-hoc test examining the relationship between child BMI and household SES, where pupils in high SES group recorded lower mean BMI compared to those in the poor category (Mean difference (SE) = 1.58 (0.41), 95% CI = -0.61 - 2.540;  $p < 0.001$ ). Moderate parental use of snacks and drinks as reward was associated with a 71.8% (AOR= 0.282; 95% CI = 0.105 – 0.759,  $p = 0.012$ ) reduced odds of child overweight compared to least parental use, while the high use of snacks as reward did not significantly predict the odds of child overweight. Schools' exerting moderate control over the food options available to pupils compared to those who had

least control had 84.3% reduced odds of having overweight pupils. School provision of hand washing facilities as a whole did not significantly predict child BMI status. However, the school's moderate provision was significantly associated with reduced odds of child overweight (OR=0.214, 95% CI= 0.052 – 0.883,  $p<0.05$ ) compared to schools that provided the least. High provision of a supporting environment for physical activity (open spaces, sports field) in a school was associated with an 80.2% reduction in the likelihood of pupils being overweight compared to the least provision, while moderate provision did not significantly predict child overweight status.

Table 4. 19 Environmental determinants of child overweight status

Variable	B(SE)	Wald	p-value	Odds Ratio	95% Confidence interval for OR
Constant	-4.116 (1.591)	6.481	0.010	0.011	
<b>Sex (female)</b>	0.870 (0.425)	4.180	<b>0.041</b>	<b>2.386</b>	<b>1.037 - 5.491</b>
<b>Household SES</b>		7.722	<b>0.021</b>		
Poor	ref			1.000	
middle	1.114 (0.483)	5.324	<b>0.021</b>	<b>3.046</b>	<b>1.183 - 7.844</b>
Rich	-0.066 (0.610)	12.000	0.913	0.936	0.283 - 3.095
<b>Child age group</b>		5.114	0.078		
9 - 10 years	ref			1.000	
11 - 12 years	1.216 (0.582)	4.374	<b>0.036</b>	<b>3.375</b>	<b>1.080 - 10.554</b>
13 - 15 years	0.617 (0.659)	0.878	0.349	1.854	0.510 - 6.745
<b>Calories</b>	-0.001 (0.000)	3.286	0.070	0.999	0.999 - 1.000
<b>Parent BMI</b>	0.087 (0.026)	10.931	<b>0.001</b>	<b>1.091</b>	<b>1.036 - 1.148</b>
<b>Use of snacks as reward</b>		6.294	<b>0.042</b>		
least	ref			1.000	
Moderate	-1.265 (0.505)	6.280	<b>0.012</b>	<b>0.282</b>	<b>0.105 - 0.759</b>
High	-0.495 (0.454)	1.190	0.275	0.610	0.250 - 1.484
<b>Control over food available</b>		11.996	<b>0.002</b>		
least	ref			1.000	
Moderate	-1.854 (0.788)	5.537	<b>0.019</b>	<b>0.157</b>	<b>0.033 - 0.734</b>
High	0.643 (0.923)	0.485	0.486	1.903	0.312 - 11.623
<b>promoting healthier food options</b>		7.984	<b>0.018</b>		
least	ref			1.000	
Moderate	-0.295 (0.681)	0.187	0.665	0.745	0.196 - 2.829
High	1.713 (0.692)	6.135	<b>0.013</b>	<b>5.546</b>	<b>1.430 - 21.511</b>
<b>Hand washing facilities</b>		4.759	0.093		
least	ref			1.000	
Moderate	-1.541 (0.723)	4.544	<b>0.033</b>	<b>0.214</b>	<b>0.052 - 0.883</b>
High	-0.472 (0.626)	0.568	0.451	0.624	0.183 - 2.129
<b>Supporting environment for PA</b>		7.712	<b>0.021</b>		
least	ref			1.000	
Moderate	-0.059 (0.540)	0.012	0.914	0.943	0.327 - 2.720
High	-1.617 (0.624)	6.721	<b>0.010</b>	<b>0.198</b>	<b>0.058 - 0.674</b>
<b>HRFE score</b>	-0.012 (0.012)	1.020	0.312	0.988	0.966 - 1.011
<b>School type (private)</b>	0.113 (0.754)	0.022	0.881	1.119	0.255 - 4.905

Dependent: child overweight; control variables: sex, SES, age group, calories and parental BMI

## 4.10 Summary of findings

The summary of the key findings from the data analyses are presented below.

### 4.10.1 Anthropometric indices of study participants

Overweight prevalence among basic school pupils in the Ga-East Municipality was 17.7% [95%CI: 14.2 - 21.1]. Overweight prevalence was higher in private schools compared to public schools (24.9% vs. 13.1%,  $p < 0.01$ ) and higher among girls than boys (23.4% vs. 10.9%,  $p < 0.001$ ). Almost 8% of pupils sampled were obese and the distribution was similar to general overweight.

### 4.10.2 Diet and Physical activity of pupils

1. Majority (70%) of pupils eat three meals daily. Significantly more public school pupils ate less than thrice daily compared to those in private school type ( $\chi^2 (4) = 10.934$ ,  $p < 0.05$ ) and girls ate more times each day compared to boys ( $\chi^2 (4) = 10.996$ ,  $p < 0.05$ ).
2. About 60% of pupils consumed breakfast on all school days, with public school pupils consuming it on more school days than private school pupils. Less than half (46.8%) of all pupils ate breakfast on all days of the week, yet, males and pupils from public schools consumed breakfast on more days of the week compared to their counterparts.
3. Caloric intake of pupils ranged from 337 Kcal to 5, 545 Kcal with a mean intake of 1973 Kcal, which did not significantly vary by sex of pupil or school administration type.
4. Majority of pupils (91%) consumed non-carbonated drinks and about 55% of them carbonated drinks as well. Average intake per week was  $4.4 \pm 4.3$  drinks.

5. All pupils had taken snacks (mostly pastries) at least twice in the week. About 12.5% of pupils had snacks packed for them to send to school by parents/guardians and only 2% had snacks packed for them every school day in the week.
6. Only 13.8% of pupils had consumed fruits over the 24-hour diet assessment period.
7. Mean (SD) dietary diversity score for all pupils was 6.99(1.46) groups and this showed no group differences.
8. Males generally had higher physical activity levels than females ( $2.56 \pm 0.7$  vs.  $2.15 \pm 0.69$ ,  $p < 0.001$ ).

#### **4.10.3 School food and physical activity environments and pupil purchase**

1. None of the schools assessed had a written/ formal policy regarding eating and physical activity of pupils in school.
2. Existing informal policies guiding eating include restriction of sale of sugary foods, prohibiting the sale of certain foods (mostly frozen drinks), promoting the sale of complete meals to pupils, adhering to planned weekly menu, and in private schools, restricting food availability to only that which is provided by school canteen.
3. Existing informal policies guiding physical activity were directed at giving extra time to pupils on Fridays to play, enforcing PE periods on time table, making sports and PE compulsory for all pupils and encouraging extra-curricular activities. Almost a third of schools had taken PE off school's time table and thus was never taught.

4. All schools except one private school at least had an open space in which pupils could play. All but 4 schools had sports facilities and a school team for soccer in the least. A half of the schools had dance groups and encouraged physical activity of pupils through dancing.
5. Fourteen of the twenty-four schools assessed had a fence round their premises and a restricted entrance, yet only nine schools kept gates closed until end of school session.
6. All schools had arrangements for the feeding of pupils on campus. All private schools had a school-run canteen that provided at least a hot lunch to pupils. Two-thirds of public schools assessed were served by the school feeding programme and the remaining one-third relied on food vendors situated within and outside the school depending on the policy.
7. Over 77% of all purchases made by pupils during break time were from within the school compound. Foods associated with obesity formed 46.6% of all purchases.

#### **4.10.4 Individual level determinants of child BMI**

1. Frequency of beverage consumption, least physical activity level and being in the middle SES group significantly predicted an increase in child BMI after controlling for parental BMI, age, sex, and calories consumed.
2. An extra occasion of beverage consumption per week predicted a 0.1 Kg/m<sup>2</sup> (95% CI = 0.03 – 0.17, p<0.01) increase in child BMI while being in the least level of physical activity category predicted a 1.27 Kg/m<sup>2</sup> (95% CI = 0.37 – 2.18, p<0.01) increase in child BMI above that of pupils in high physical

activity level category. Being in the middle SES group predicted a 0.87 Kg/m<sup>2</sup> increase in child BMI.

3. The full model explained 16.3% of variation in child BMI.

#### **4.10.5 Environmental level determinants of child overweight**

1. Schools' control over food and options available, promotion of healthier food options, and provision of supporting environments for physical activity of pupils significantly predicted child overweight status after controlling for age group, sex, physical activity level, parent BMI, household SES and calories consumed.
2. High provision of a supporting environment for physical activity in school was associated with reduced odds of child overweight (AOR = 0.198, 95% CI = 0.058 – 0.674). Schools exerting medium control over food available to pupils was associated with reduced odds of child overweight (AOR = 0.157, 95% CI = 0.033 – 0.734, p<0.01) compared to those who exerted least control. Interestingly, schools' high promotion of healthier food options was associated with increased odds of child overweight (AOR = 5.546, 95% CI = 1.430 – 21.511, p<0.05) compared to those who had least promotion of healthier food options.
3. The only significant home environment factor that predicted child overweight status was parental use of snacks and drinks as reward. Higher parental use of snacks and drinks as reward from the least to the middle category was associated with reduced odds of child overweight (AOR = 0.282, 95% CI = 0.105 – 0.759, p<0.05).

4. The model explained 23.9% (Cox & Snell R square) and 38.9% (Nagelkerke R square) of the variance in child BMI status and correctly classified 84.2% of respondents' BMI status.

## CHAPTER FIVE

### 5.0 Discussion

The objective of this study was to determine the prevalence of overweight and its risk factors among basic school pupils in the Ga-East Municipality of the Greater Accra region of Ghana. This chapter presents a detailed discussion of the study findings which is organized along the objectives of this study:

5.1.0 Prevalence of Overweight among study participants

5.2.0 School Food and Physical activity environments

5.3.0 Frequency and types of foods purchased by pupils in school

5.4.0 Individual level determinants of Child BMI

5.5.0 Environmental determinants of child Overweight among pupils

#### 5.1 Prevalence of overweight among study participants

The observed prevalence of overweight and obesity among basic school pupils in the Ga-East municipality are 17.7% and 7.8% respectively. These are higher than the 15% and 4% reported by the Ghana Schools survey(2012) for pupils sampled from the two largest cities of Ghana (Accra and Kumasi). Our finding on overweight/obesity prevalence among basic school pupils is also higher than (9.8%) was reported by Amidu et al. (2013) among Ghanaian basic school children in the Tamale Metropolis of Ghana. Other researches that measured BMI of basic school children across the rural - urban divides of Accra and Ashanti regions reported much lower overweight prevalence compared to this

study's finding (Agyemang et al., 2005, Larbi et al., 2011b). Peltzer et al.(2011) in their assessment of weight status among adolescents in basic school (13-15) collected as part of the 2007 global school health survey also reported much lower overweight prevalence (girls=10.4% and 3.2% boys). However, a study conducted in the Accra metropolis (Abachingsa, 2001), reported higher obesity prevalence (19.3%). Outside of the major cities of Ghana, Kwaw et al.,(2013) reported an almost 50% prevalence of overweight/obesity with 23.9% obesity prevalence among children enrolled in all basic schools (both public and private) within the Mfantseman Municipality of Ghana. Certainly, there is an indication that childhood overweight/ obesity is prevalent in different parts of Ghana although much lower when compared to other high income countries on average (Muthuri et al., 2014b).

The findings of this study supports the hypothesis that girls are more likely to be overweight than boys. The higher overweight/obesity prevalence recorded among girls compared to boys in this study (23.4% vs. 10.9%) is consistent with findings of all studies that have assessed nutritional status of school-age children in Ghana to date (Larbi et al., 2011b, Agyemang et al., 2005, Peltzer and Pengpid, 2011, Kwaw et al., 2013, Mohammed and Vuvor, 2012, Goh, 2006, Ghana School Survey, 2012, Amidu et al., 2013, Abachingsa, 2001). This may be as a result of the lesser physical activity levels observed in girls compared to boys during adolescence (Lubans et al., 2012). Another possible reason is the higher disposition of girls to be dissatisfied with their bodies (Makinen et al., 2012) which is usually precipitated during puberty with the marked deposition of fats in various parts. Body dissatisfaction and low self-image increases their risk of unhealthy dietary habits like dietary restriction (including breakfast skipping) and

extreme dieting which may be followed by binge eating and eating for comfort (Verplanken and Tangelder, 2011). These behaviours are known to be associated with higher BMI and increased risk of overweight among adolescents (Neumark-Sztainer et al., 2006). Although this study did not assess body dissatisfaction among the pupils, girls were found to consume breakfast on fewer days in the week compared to boys. However, contrary evidence is reported in Europe (Currie et al., 2009, Yngve et al., 2008) and rural India (Chhatwal et al., 2004), where higher obesity prevalence is reported among boys than girls. This may be attributed to differences in body-size preferences or desirability among populations in different settings for boys and girls.

Differences have also been recorded across public and private schools with the latter recording higher prevalence (24.9% vs. 13.1%) in this study and all other previous studies that compared weight status among public and private school pupils in Ghana. Household SES of the pupils has reportedly explained the differences observed among public and private school pupils. It is plausible, that parents belonging to higher income groups are more likely to afford to keep their wards in private schools compared to those within much lower incomes groups. Abachingsa (2001), reported that obesity was positively correlated with household SES of children. Overweight and obesity among public basic school pupils have risen from 12% reported by Goh (2006) to 13.1% in 2013 when this study was conducted. Widespread and/or sustained increases in obesity prevalence could be challenging considering the health, social and economic costs associated with childhood overweight and obesity.

Evidence from this study also suggests the co-existence of both under- and over-nutrition within the same setting which is well documented as a feature of most countries

undergoing the nutrition transitions in developing countries (Popkin, 2003, Abrahams et al., 2011).

Overweight/obesity prevalence among parents of participating pupils was 59.2%, which is much higher than the 42.7% reported by Biritwum et al. (2005) for the entire Greater Accra region. This is because the current study sample had significantly more women (67.4% vs. 32.6%,  $p < 0.05$ ), among which high overweight prevalence (64.9%) have been reported than men (Benkeser et al., 2012). The association between parental weight status on child weight is well documented (Fox et al., 2014, Moraeus et al., 2012). Parental BMI is positively associated with child BMI; hence the majority of pupils in this study are at increased risk of child overweight and overweight in adulthood as established by Fox et al. (2014) in a longitudinal study. This calls for increased efforts to control obesity among the reproductive age population and increasing awareness on the risks to their offspring.

## **5.2 School food and physical activity environments**

This study found that none of the basic schools from the Ga-East municipality had written policies relating to eating of pupils during school hours. This is very different from evidence reported in most developed countries. The absence of written policies creates the situation where intended guidance remains ambiguous and subject to individual interpretations that make it difficult to enforce. Putting guidance into a written format accepted at the school committee level increases the commitment of all staff at enforcing the directives. This study revealed that the prevailing guidance relating to food and physical activity in the basic schools were mostly the ideas of the head-teacher and in some cases other administrative staff. Currently, the Ministry of Education through the

Ghana education service does not require basic schools to have school health policies (including food-and- physical activity-related policies) as recommended in the Focusing Resources on Effective School Health (FRESH) framework proposed at the Dakar education forum, 2000 by the joint UNESCO, UNICEF, WHO, World Bank and Education International collaboration (UNESCO, 2002).

### **5.2.1 School food-related policies and environments**

Although the head-teachers description of ‘healthy foods’ was mostly acceptable, they were in some cases questionable. For example, most of them thought that sugar-sweetened drinks in tetra packs were fruit juices or predominantly contained fruit juices and thus supported their sale over other milk, cocoa, malted, and coloured or flavoured sweetened drinks. Meanwhile, this study did not find a single brand of fruit juice (containing > 65% actual fruit) during the inventory of foods sold by various vendors within the school compound. The few that were seen were sold by stores or containers outside the school and were in 1 liter portions which are not readily affordable to pupils considering their daily spending money. However, head-teachers had it right on promoting hot complete meals over snacks and meals that were not complete (like fried rice and fried pasta that was mostly sold separately from protein sources). One food promoted by almost all head-teachers was *waakye* (cooked rice and beans) which they argued was ‘complete in itself’ and was still nutritious even when pupils purchased it without extra protein, a common phenomenon among pupils. The promotion of foods served by school canteen was a measure to ensure the safety and variety of the foods eaten by pupils especially during lunch time. However this policy was only found in private schools. The predominance of policies directed at controlling energy-dense foods

(sugary, frozen/cold foods and confectioneries) in public schools was because of the nature of their campuses. Most of them have no fences round the school compound and in some cases undefined boundaries which provided unrestricted access to hawkers. The hawkers, who often sold these energy-dense foods wait around school and show up at recess or closing time. Hawkers also stood behind the fence and sold to pupils across the walls without entering the restricted entrance. This behaviour of hawkers has also been reported in South Africa (de Villiers et al., 2012). Hawkers generally sold sugar-sweetened drinks, confectioneries and pastries and must be restricted in efforts directed at reducing pupil patronage of less nutritious energy-dense foods. The restriction of activities of hawkers among basic school pupil populations will require community involvement and local government legislations for success. There are also issues of food safety as these hawkers are not checked for health examination and food sale certificates as is the case for private food vendors located within and around school premises.

An overwhelming majority of the head-teachers strongly agreed that nutrition was high on their school's priority list, that their management team supported the provision of healthy foods through the canteen service, and that their school canteen mainly provides meals of high nutritional value. The head-teachers believed that their informal policies and practices were effective in promoting healthy eating among pupils. Having all head-teachers agreeing on the importance of schools to provide an environment that encouraged healthy food choice by pupils was a good indication of their willingness to adopt policies. This provides an opportunity for the stakeholders to guide basic schools to make nutrition-related policies to that foods made available to pupils are safe and nutritious. Although head-teachers in this study seek to ensure the quality of meals

provided to pupils, they admitted that they have not received any training or guidance on definition for and ways of ensuring quality of meals provided to pupils. Enquiries from head-teachers revealed that the district School Health Education Programme (SHEP) coordinator often came round to ensure that food vendors selling to pupils had health certificates and are licensed (food safety); no mention was made of their influence in getting food vendors to provide a variety of foods. Findings from this study on the absence of written policies contradicts the report of Amfo-Ayeh (2011) in which head-teachers in public schools had on display a policy document on head-teachers ensuring health certification of vendors, monitoring of hygienic food environment and appearance of vendors. Also attached to the document was a monitoring score-sheet and terms of contract to guide food vendors on and off school premises. None of the head-teachers in this study presented or made reference to any document relating to any aspect of food provision or availability at school. There was however one head-teacher in a public school who explained her active involvement and that of the teacher on duty in making sure that meals sold to pupils was wholesome. The research team witnessed her daily checking on the food vendors, inspecting and sometimes tasting foods before they made the first sale to any pupil on almost all early morning visits to school. This observation is suggestive that she was aware of the contents of policy documents as reported by Amfo-Ayeh but those documents were physically absent. It is also possible that the other public schools had those documents but were neither replaced when worn-out nor enforced by the Ghana education service; thus newly appointed head-teachers were not aware of the existence of such documents, shifting all the responsibility onto the district SHEP coordinator.

Two-thirds of public schools allowed open campus during lunch time, while the ‘no exit’ rule was flouted by pupils anyway when there was no fence. This undermines any efforts at controlling the safety of and types of foods purchased by pupils, which usually targets the prevailing food environment in the school alone. Thus, the enactment of nationwide or district-wide policies in relation to providing only healthy foods in basic school campuses will not be every effective until school compounds are provided with restricted entrances or polices restricting sale of energy-dense foods around schools.

It was commendable that all schools had arrangements that ensured the provision of at least lunch to pupils. The use of a menu is to ensure that there is some predictability and variety in the meals provided to persons since no single food group can provide all required nutrients to consumers. The refusal of the caterers (two-thirds) employed by the National school feeding programme to adhere to prescribed menu is worrying, especially when they resorted to serving only rice based foods that had little or no vegetable and proteins to pupils. This undermines the aim of the school feeding programme to serve balanced meals to improve nutrition and health of pupils in public schools. Most of the private schools (8 out of 12) had only one meal on their menu while the remaining had two or more meal options for pupils to select from daily. Yet, some school canteens avoided the preparation of ‘labour-intensive’ local foods (e.g. Rice ball, banku, kenkey, or kokonte served with soup) that may be preferred by pupils as we observed in public school food purchases. Most of the rice-based foods served to pupils during lunch was with very little or no vegetables. Pupils’ satisfaction with meals served in schools is key to patronage, yet only in two private schools were pupils involved in the planning of the menu used in the school canteen. The lack of student involvement in food service is

likely to limit the acceptance or patronage of meals by pupils (Yoon et al., 2005), which may result in purchases of snacks and other competitive foods that are energy-dense and have negative impacts on weight status in the long-term. We also observed that very few (5.3%) pupils in public schools relied on the school feeding programme as the main source of feeding at school and purchased other foods in addition. This may be a sign of some form of dissatisfaction with the meals served, or insufficiency of portions served. Another major factor that also influences pupil satisfaction with school lunch services is the taste of the food. Bergstrom et al. (2012) recommend that children be allowed to indicate their taste preferences as they may be useful guides to foodservice and offer an opportunity for improvements in foods served.

All schools had a policy that disallowed food and drinks in the classroom and it was uncommon for schools (only 2 schools) to use food as reward in this study area. This restriction on eating opportunity could be beneficial in controlling frequent but avoidable snacking among pupils. A qualitative study conducted by Hesketh et al. (2005), found that pupils believed anything permitted at school to be healthy. Hence, the use of food as reward to pupils can negatively influence purchases and consumption as they are likely to perceive foods given to them by their schools as “good”. In this study, the two schools that used it as reward did so exclusively after pupils exceeded in sporting activities. The foods mentioned (ice cream and eggs) are protein-rich foods which have the potential to complement the diet of pupils during school sports seasons. The implementation of nutrition guidelines for basic schools will be helpful in guiding schools on what foods may be beneficial to pupils after physical exertion during sports competitions.

Food and beverage advertisement allowed in schools present challenges to efforts to improve healthy diets among children. This feature has also been reported by de Villiers et al. (2012), in low-resourced South African primary schools. Children are known to be easily influenced by advertisements and this practice will in the long-term increase patronage of those high calorie foods. Over 60% of pupils from this municipality had reported in an earlier study that their preferences for type of foods purchased during break time have been informed by advertisements (Amfo-Ayeh, 2011). In this same regard, pupils are likely to view foods and beverages shown on their school bill boards, or provided at school as inherently healthy and will tend to increase patronage of those foods. Head-teachers were aware of and exercised their role in controlling the availability of unhealthy foods in the schools and foods brought into classrooms. This presents an opportunity to educate head-teachers on the potential negative effects of less healthy food and beverage advertisements on child food preferences and consumption for them to take necessary action.

While vendors located within the school premises are the main source of nutritious foods in the absence of school-run canteen, they also provided access to high density-low calorie food options. School food policies controlling the types of food allowed for sale within school premises will be invaluable in enhancing the availability of more healthful food options available to pupils.

Food hygiene practices was strictly observed in all schools as foods from all sources documented were stored properly and not exposed to flies. However, the absence or inadequacy of eating places and hand washing facilities resulted in children engaging in unhygienic practices that could expose them to food-related infections. For example,

pupils placed bowls on the bare dusty floor in front of classrooms to eat (probably because they got tired standing) or refusing to wash hands before eating. Worm infestation and frequent infections in school-age children have been linked to the high anaemia prevalence (Nxasana et al., 2014). Most of the Ghanaian foods sold to pupils are mostly enjoyed using the hand, making hand washing a necessity. The absence of adequate hand washing facilities is also likely to discourage a lot of pupils from eating hot meals at school, which may result in frequent consumption of energy-dense drinks and pastries. For pupils who still have preference for local foods, the option was to buy fried foods (yam, sweet potatoes, plantains, cocoyam) served with pepper sauce in polythene bags which can be picked with finger tips allowing minimum contact with unwashed hands compared to soup or stew-based options.

Evidence from developed countries confirm the positive effects on child BMI by replacing sugar-sweetened beverage with water from childhood to adolescence (Zheng et al., 2013, Zheng et al., 2014). The situation of pupils having to buy drinking water due to absence or unwholesomeness of water provided may actually promote consumption of sugar-sweetened beverages. Pupils who are not thirsty may prefer to buy cheaper sugar-sweetened beverages which were just about the same price (5 pesewas less) as the sachet water usually put on sale. The danger here is that children generally tend to consume less than half of their fluid requirements and are usually in a mild state of voluntary dehydration (Fadda et al., 2012); replacing water with drinks will worsen the situation. Proper hydration of children is known to have positive impacts on cognition and vigor and all efforts must be made by schools to provide pupils with free clean drinking water

to encourage its ingestion by pupils. This is also to ensure that the few pupils who do not have pocket money stay hydrated when in school.

The finding that school-run shops mainly sold high-calorie foods present an opportunity for excessive calorie consumption, especially in private schools where canteen- provided-lunch was virtually compulsory to pupils. Since the schools or their staff controls profits in these shops, they may not be motivated to reduce the availability of these energy-dense foods that are highly patronized. However, literature from North America provides little evidence that profits are reduced upon the adoption of healthier policies (Wharton et al., 2008).

The low popularity of carbonated drink sales in basic schools is probably because of its relatively higher cost compared to the other sweetened drinks and vendors perceived pupils will not patronize them. About 16.6% of pupils reported purchasing soft drinks at school within the week preceding survey. However, pupils were not asked whether purchase was made within the school premises or not. Out of the over 1500 purchases made by the pupils during break time during the interception study, only one was a carbonated drink, hence relationship between soft drink sale in school and pupil purchase could not be established in this study.

Overall proportion of healthy food retail points in schools visited was 44.7%, an indication that fewer healthy food options were sold in schools compared to less healthy ones. This has implication for purchasing choices available to pupils over the course of basic education especially when children are known to be easily influenced by appearance (Amfo-Ayeh, 2011) and peer choices (Birch, 1980). Although healthier food

options were present within the school compound, they were crowded out by energy-dense options. There is evidence that children consumed less of healthy foods (fruits, vegetables, milk) when they had access to energy dense foods (Kubik et al., 2003, Cullen and Zakeri, 2004). The only way then, to increase the consumption of healthier options is through policies that reduce availability of unhealthy options.

Schools in the Ga-East municipality have varied policies and facilities when it came to provision of food to pupils. The clustering of fast food outlets near schools constitutes an ‘obesogenic’ environment for pupils which is hypothesized to lead to higher consumption. Data from this study did not suggest a clustering of fast food joints around the schools assessed as there were just two of such sited within a 100 meter radius of the 24 school assessed.

### **5.2.2 School physical activity-related policies and environments**

The school environment can have significant influence on children’s physical activity due to the many opportunities for daily activity; during break time, beginning and end of school day as well as PE lessons (Jones et al., 2010). There is evidence that interventions at the school level have some potential of influencing the physical activity levels of pupils (Robertson-Wilson et al., 2012, Ridgers et al., 2012, Williams et al., 2013). All schools had informal policies that guide physical activity of pupils in school, which was a confirmation of the head-teachers’ agreement to the statement “physical activity is high on our list of priorities in this school”. The enforcement of PE periods on time table, making PE compulsory for all pupils, allowing an extra one-hour games period on Fridays as well as encouraging dance among the pupils were all efforts made by the head-

teachers to increase physical activity. All head-teachers except two felt their policies have been very effective as there was 100% participation in PE and sports.

Of much concern is the fact that some schools (7 out of 24) had completely removed PE from school curricular and less than half of head-teachers enforcing PE on timetable. This disposition of school heads to eliminate practical or out-of-class PE lessons has also been reported in South Africa (de Villiers et al., 2012) where having PE on time table did not translate into out-of- classroom physical activity. The main reasons cited for non-observance of PE by head-teachers is the lack of time in the curriculum and the absence of trained PE instructors (Van Deventer, 2009). The head-teachers cite the lack of time in curriculum because much more emphasis is being put on examinable subjects which are usually used to rate performance of schools. For private schools, this ‘pressure to deliver good grades’ from parents is much higher and time allowed for recess and physical activity decline gradually, giving way to the more ‘results-oriented’ stand chosen by school administrators. Evidence provided by de Villiers et al., in South Africa suggests that the participation of pupils in physical activity outside the classroom decreased with higher classes or grades. The generally observed drop in physical activity levels during adolescence and a situation where an opportunity such as PE is neglected could be detrimental to efforts at getting adolescents to achieve daily requirements of physical activity. The practice of schools allowing more than one hour of PE and an extra one hour games period on Fridays, in addition to the 30 minutes recess daily should enhance physical activity of pupils although evidence linking the duration of recess with physical activity of pupils in school is lacking (Ridgers et al., 2012).

There is evidence that pupils were most active when supervision was provided during organised games in addition to the provision of sports equipment and facilities (Leviton, 2008). The observed practice of non-supervision of PE practical lessons by schools is suggestive that head-teachers did not appreciate the lack of physical activity among pupils as a health problem similar to evidence from South Africa (de Villiers et al., 2012). This study also found that less than a third of the teachers assigned to PE were trained PE instructors. The evidence in a review by Lagarde and Leblanc (2010) suggests that policies that target improvements in quality and variety of PE as well as mandatory qualification for PE teachers increases physical activity among pupils. This finding clearly points to the need for the Ghana Education Service to facilitate the training of and assigning of qualified PE instructors to the basic schools as a way to improve benefits of PE in pupils. Use of playground was generally restricted to recess periods in this population, less than a third of schools allowed pupils to use it before and after school. This practice further reduces the opportunities for pupils to engage in adequate moderate to vigorous physical activity which confers invaluable health benefits.

Schools having a playing field has been found to have more active pupils than those that do not have (Haug et al., 2008). Although this study did not find significant differences between physical activity levels of pupils based on school type, the Ghana Schools survey (2012) found pupils in public schools to be more physically active compared to those in private schools. The lower physical activity levels of pupils in private schools may be attributable to their relatively smaller spaces available for pupil play. All public schools had adequate facility at least for one sport (soccer, volleyball or netball) and inadequate facilities for others. For private schools, marked variation was observed in

possession of sport facilities, except that, they were more likely to have adequate facility for basketball and other sports that did not require fixed ground space (table tennis, skipping ropes, sack racing, etc). The disparities in schools possession of fixed play equipment including that for major sports need to be addressed since the presence of fixed equipment is documented to encourage physical activity among pupils (Jones et al., 2010).

In Ghana, the majority of private schools start operations by acquiring lands in already established residential areas, leaving no room for expansion. Even within the acquired plot of land, classroom blocks are often extended to accommodate the rising pupil population, limiting available floor space for physical activity. While public schools may also witness classroom block extensions, the size of land usually demarcated for schools by the local government or traditional rulers is large enough to allow a soccer pitch and other open spaces. For private investors, acquiring such large spaces for school may be a daunting task with serious financial challenges. Nevertheless, if the provision of space for physical activity of pupils is made mandatory and enforced by the education sector, other arrangements like using nearby fields can be made by already established schools to encourage physical activity of pupils.

The role of extra mural sports in keeping pupils physically active cannot be underestimated. Although major competitive sports involve relatively very few pupils, it can have positive impacts on pupils' attitudes towards physical activity due to pupils' feeling of ownership of school teams. Also, the presence of and the need to sustain school teams can influence authorities to allocate more time for physical activity in order to identify prospective members. Although participation in competitive sport may be

unattractive to pupils averse to higher physical exertion, the aura and observed participation of teachers during competitions can be interpreted as schools' support for physical activity which is known to affect activity levels of pupils (Hohepa et al., 2009). The provision of skipping ropes, items for sack racing and lime and spoon racing by private schools in the absence of fixed sports equipment also provides pupils with an opportunity to be physically active. Increasing physical activity of pupils through dance was also a positive practice of head-teachers. The music that goes with most of these traditional dances as well as the skills demonstrated makes it attractive to a lot of pupils. Although these dance groups had varying frequencies of performing (usually tied to grand performance dates), it was common practice to see pupils rehearsing dance moves during play- a source of physical activity.

There was a general indication that PE and physical activity were affected by wet weather conditions and schools did not have adequate facility for pupils to remain physically active. Although some heads (mostly private school) said disruption of PE was not severe because they had enough spaces between classroom rows for pupils to at least stretch out and jump, the same could not be said for most public schools which had overcrowded classrooms and very narrow corridors. There is the need to improve school facilities in general to allow for pupils to be physically active irrespective of weather.

Regarding the overall school physical activity environment, more private schools were found to consistently fall within the least category in all characteristics of the physical activity environment, with significantly fewer private schools having policies that initiate physical activity. More efforts will need to be directed at private schools to improve school environments regarding physical activity of pupils.

### **5.3.0 Foods frequently purchased by pupils**

Some high-protein foods (e.g. fried sausages, eggs, soybean khebabs and fried chicken) purchased by pupils have the potential to improve the dietary protein intakes of pupils. Findings of Micah et al. (Micah et al., 2012), suggests that street foods contribute to animal source foods consumption among children and improvement in the diet quality. Nevertheless, these foods which are mostly fried may also increase fat intakes among the pupil population if they have more preference for fried foods.

The low fruit purchases suggest pupils either preferred high calorie and low-nutrient dense foods to fruits, or were not motivated enough to buy fruits due to relatively higher prices. Amfo-Ayeh (2011), reported that only 9.3% of pupils preferred to buy fruits compared to 45.6% who preferred to buy energy-dense foods during break time. Comparing fruit consumption among basic school pupils in various studies suggest less satisfactory fruit consumption habits. For instance, Avedzi (2005) reported 45.3% consumption of fruits three days preceding the survey, the Ghana School Survey (2012) reported 20% consumption in week preceding the survey, and in this present survey, only 13.8 % consumed fruits. Considering that over a third of Ghanaian adults (females = 36.6% and males = 38%) have low fruit consumption according to the World Health survey 2002-2003 (Hall et al., 2009), the pupils may just have been exhibiting fruit purchasing and consumption patterns learned from the adult population.

Fried foods like yams and ripe plantains made 5.6% of purchases. The frequent consumption of fried foods has the potential to negatively impact BMI due to elevated caloric consumptions associated with fried food fats (Taveras et al., 2005) or through gene-fat interactions among persons genetically susceptible to obesity (Qi et al., 2014).

#### **5.4.0 Individual level determinants of increased child BMI**

##### **5.4.1 Relationship between background characteristics and child BMI**

As expected, age was associated with child BMI. Pupils of age 11 and 12 years had over 3 times the odds of overweight (AOR = 3.375, 95% CI = 1.080 – 10.554,  $p < 0.05$ ) compared to those of the 9 to 10 year age group in this study. This evidence is contrary to findings of Chhatwal et al. (2004), where prevalence of overweight significantly decreased from age 9 years to 14 years before rising again at age 15 years. Puberty has been documented as a high risk time for abnormal weight gain and there is evidence that weight gained during early adolescence is unlikely to change over time (Wardle et al., 2006). Being female predicted an increased child BMI by  $1.27 \text{ kg/m}^2$  after controlling for parental BMI, age, breakfast consumption, beverage consumption, physical activity level, household SES, percentage of children (<16 years) in household, and calories. Being female also predicted an additional 139 % increased odds of being overweight over that of a male after controlling for all significant background, home, school and individual level factors. This evidence supports the hypothesis that girls are more likely to be overweight than boys. Obesity is associated with earlier onset of puberty and other important health outcomes such as increased incidence of psychiatric disorders, substance abuse, sexual risk taking and teen pregnancy (Jasik and Lustig, 2008). There is the need to provide adequate nutritional counseling to pre-adolescent girls to control increased risk of weight gain during early adolescence. There is also the need to encourage physical activity among girls as physical inactivity has been associated with increased fat penetration within muscle of girls (Farr et al., 2012). Walking, for instance, can be promoted among girls to achieve physical activity targets.

This study found that a unit rise in parental BMI predicted a 0.07 Kg/m<sup>2</sup> increase in child BMI after controlling for sex, age, breakfast consumption, beverage consumption, physical activity level, household SES, percentage of children (<16years) in household, and calories. Parent overweight was associated with increased odds of child overweight (unadjusted OR= 2.130, 95% CI = 1.95 – 4.143, p<0.05). This evidence is supportive of the study hypothesis that pupils with overweight parents are more likely to be overweight. A single unit increase in parent BMI increased a pupil's odds of overweight by 9.1% after controlling for all significant background, home, school and individual level factors. This is much lower than the 17.2% increase in odds of child overweight reported by Muthuri et al. (2014a) in Kenya. The reason could be that more social and environmental factors contribute to child weight status in this setting. It is also possible that the lack of parent data for all participating pupils could have reduced the strength of this relationship. Overweight and obesity rates among the adult population and especially those of reproductive age will have to be controlled to reduce the risks to the offspring either through biological or environmental pathways (Gibson et al., 2007, Huffman et al., 2010).

Initial findings of this study revealed that a 1% increase in the proportion of children (<16 years) in household significantly predicted a 0.19 Kg/m<sup>2</sup> reduction in child BMI (p<0.05). This is consistent with the findings of Preston (2014) where being an only child or having only one sibling was associated with child overweight. This relationship however was not statistically significant at the multivariate level. Larger household sizes with high proportion of children (<16 years) have been positively associated with under-nutrition in children (Bloss et al., 2004, Oddo et al., 2012). With the decline in fertility

rates in Ghana (GSS et al., 2009), proportion of children in households is expected to decline together with the associated child under-nutrition, presenting a new phase of increased risk of child over-nutrition as has reported by Preston in Peru.

The analysis supported the positive linear relationship between child BMI and household SES as proposed by the study hypothesis. Although the association was statistically significant, the mean BMI difference was only significant between the poor and middle SES groups. In fact, pupils in the rich category had lower mean BMIs compared to the poor SES group. However, pupils of middle and high household SES had increased odds of child overweight (unadjusted). After controlling for all other variables in the model, this study found middle household SES to consistently predict increased child BMI and child overweight at both bivariate and multivariate levels for individual and environmental level determination of predictors. Middle SES predicted over 3 times increased odds of child being overweight (AOR =3.046, 95% CI=1.183 - 7.844, p=0.021). This is in agreement with evidence from urban Cameroon (Dapi et al., 2009) where overweight was higher (11%) in the middle SES group compared to the low and high SES groups (8% and 9% respectively). Overweight/obesity in developing countries has been associated with high SES due to the nutrition transitions taking place, although the reverse has been reported in high income countries. Monteiro et al (2004) in a review of SES and obesity in adult populations concluded that, *'obesity can no longer be solely a disease of high SES groups; but shifts towards the groups with lower SES as the country's gross national product increases'*. The rapid urbanization witnessed in Ghana (Yankson and Bertrand, 2012) predicts significant changes in diet and physical activity levels that promote obesity and other negative health outcomes. Benkeser et al. (2012),

also reported that women in the highest and lowest wealth quintiles were less likely to be obese compared to those in the middle quintile groups and food insecurity could explain the lower prevalence of overweight among lower SES groups. Among the high SES groups, education and affordability of more expensive healthier food options are most probable reasons for the lower risks of overweight observed. Food preparations have also witnessed changes over time and homemade foods are gradually being replaced by convenient ready-to eat foods. For example, only 11% of pupils in this study reported homemade foods as their usual source of food when at school. While this was higher than the 5% reported by Amfo-Ayeh (2011) among pupils within the Ga-East municipality, the evidence is different in Northern Ghana. Amidu et al (2013) reported that 65% and 48% of private and public school pupils respectively brought packed lunch to school in the Tamale metropolis. This difference can be attributed to the relatively higher urbanization of Accra, associated with the reliance on foods cooked outside of home and the ready availability of meals.

#### **5.4.2 Diet of pupils**

The energy and nutrient demands for active growth in school-age children require that meals are eaten regularly and in adequate amounts to prevent malnutrition (both over-nutrition and under-nutrition). Breakfast is generally promoted as the most important meal of the day; and its consumption as part of a healthful diet has been found to significantly impact the health and well-being of children (Rampersaud et al., 2005). Regular consumption of breakfast is known to maintain weight among children. Breakfast skipping has been associated with more frequent snacking, fast food consumption, less likelihood of meeting nutrient and food group (such as fiber, fruits and

vegetable) requirements and higher BMI (Deshmukh-Taskar et al., 2010). Breakfast consumption among pupils was high and comparable to the findings of the Ghana schools survey which recorded over 87% of pupils consuming breakfast more than 3 days in a week. Significantly more girls and pupils from private schools skipped breakfast compared to their male or public school counterparts respectively. The skipping of breakfast is more typical of girls (Rampersaud et al., 2005) and has also been linked with other lifestyle factors like dieting and infrequent exercise.

Consumption of snacks was universal among the pupils with the minimum frequency of consumption within the week being twice. Snack consumption patterns reported in this study is slightly higher than that reported in the Ghana schools survey (2012), where more than half of the pupils consumed snacks three or more times in the week. In addition to snacks, majority of pupils (91%) consumed non-carbonated sweetened drinks within the week and about 55% of them consumed carbonated drinks as well. The average weekly consumption of drinks was  $4.4 \pm 4.3$  drinks which is just slightly lower than the 4.7 reported by Bruening et al (2014) among pupils in Minneapolis, USA. This is of concern particularly because participants of this study were at pre-adolescent and mid-adolescent stages and there is evidence that dietary habits gets worse towards older adolescence (Ilich and Brownbill, 2010). Adolescence is a critical period for establishing lifetime dietary patterns and if a significant proportion of dietary calories are obtained from added sugar, it imposes extra risk of poor nutrition and adverse health outcomes

The overall diet of pupils was of average quality (DD score = 6.99 food groups). Although results from this study did not support an association between diet quality and child weight status, the health benefits of a varied diet cannot be overemphasized.

However, the minimum DD score (3) obtained by some pupils meant that they consumed foods from the cereal, fats & oils and other non-green leafy vegetable group which are not as nutrient dense compared to the other food groups and could increase pupils' risk of micro-nutrient deficiencies. The differences found in the food group consumption patterns between private and public schools mirrors household SES distribution of pupils and could be linked with household food security.

Milk and eggs are more expensive than roots & tubers and green leafy vegetables and are less accessible to food-insecure households. This presents a challenge in the general use of food diversity score as a diet quality index, as subtle differences in individual food group consumptions may be ignored at face value. The nutritional value of milk in the diets of children has been well documented. However, milk consumption in low-income countries is low, denying children of the much needed calcium, protein and other minerals required for normal growth (Dror and Allen, 2011).

Green leafy vegetables (a feature of local diet) are very good sources of iron and other nutrients in the diet and non-consumption can negatively impact iron status of pupils. Iron- deficiency anemia is prevalent among basic school pupils in Ghana (Egbi et al., 2014, Abizari et al., 2012) and there is the need to encourage consumption of iron-rich foods like green-leafy vegetables, liver and lean meats to ensure adequate dietary intakes among children in general. Diets poor in diversity have been linked with several micronutrient deficiencies like zinc, iron, folate, B vitamins and iodine. Child under-nutrition is associated with reduced intellectual and cognitive abilities in children and must be prevented if the goal of ensuring universal basic education can be achieved.

This study could not clearly establish an association between calories consumed and BMI probably due to the generally low caloric consumption as well as the wide variability in consumption (335 Kcal to 5,545 Kcal) observed. Several micronutrient deficiencies have been tied to insufficient caloric intake. Hence, the inadequate caloric consumption of the pupils as well as low dietary diversity scores may predict both macro and micro-nutrient deficiencies in this population (Steyn et al., 2006).

Frequency of consuming fruits and vegetable did not predict child BMI in this population, but the variety of fruits and vegetables consumed predicted a 0.19 Kg/m<sup>2</sup> increase in child BMI at the bivariate level. This finding, which is contrary to current knowledge on the protective effects of fruit and vegetable consumption (Spruijt-Metz, 2011), may be a limitation of the dietary assessment method (food frequency questionnaire) which only takes into consideration the presence and not the quantity that was consumed. An observation of data from the 24 hour dietary recall showed a pattern where pupils who purchased rice-based foods (especially '*wakye*') also purchased an average of GH0.20 worth of cut mixed vegetables in addition (about 2 table spoonful). Also, foods like fried rice and the noodles contained small amount of vegetables (less than a table spoon full) already mixed up in the foods, yet all different types of vegetables present in food will be reported.

Consumption of breads and pastries, other high calorie foods (like popcorn, chocolates, candies, etc.) and staple foods did not significantly predict child BMI. This is probably because overall calorie intakes among this population were low.

This study revealed that each additional occasion of sugar sweetened beverage consumption predicted a 0.10 Kg/m<sup>2</sup> increase in child BMI after controlling for child age, sex, parental BMI, physical activity, household SES, proportion of children (<16 years) in household and calories. This translates into a 10.5% increase in the odds (AOR= 1.105, 95% CI = 1.030455 - 1.185) of a child having an increased BMI by consuming a sugar-sweetened beverage. This presents a major challenge especially when sugar-sweetened beverages were cheaper compared to 100% fruit juices or healthier drink options. Malik et al. (2013), reported that a daily serving of sugar-sweetened beverages was associated with 0.06 unit increment in child BMI. This current study could not assess the effect of daily consumption of sugar-sweetened beverages because more than half of the sample had consumed it less than 7 times in the week. The price advantage presented by these beverages can provoke higher consumptions with time if value for money is given more priority than nutritional value, which is usually the case in consumer behaviour. Comparing the pricing of sugar-sweetened beverages to other foods reported in this present study to that reported by Amfo-Ayeh (2011), there seems to be a general drop in prices in favour of sweetened drinks. In the earlier study, these sugar sweetened drinks were more expensive than complete meals which were priced equally to biscuits/ savory foods and fruits were only slightly more expensive than confectioneries. However, this study found complete meals to be the highest priced item, fruits being second priced but comparable to better packaged sweetened drinks and biscuits and the cheapest food items were sweetened drinks and confectioneries. These price changes can have negative impacts on the food choices made by pupils at school if not regulated.

### 5.4.3 Physical activity of pupils

Boys had higher physical activity levels compared to girls in this study, significantly more girls were in the least physically active category. This is consistent with the findings of the Ghana School survey (2012) where male pupils engaged more in sporting activities than females. Previous reviews have also supported this finding. Studies that have looked at activity levels during recess have found boys to be more physically active possibly because they view it as an opportunity to play competitive games while girls on the other hand view recess as an opportunity to socialize with friends (Ridgers et al., 2012). The relatively low physical activity recorded in girls is a contributing factor to the higher overweight and obesity prevalence observed.

The Ghana School survey also found pupils in public schools to engage more in sporting activities, walk to school often, and generally more physically active compared to their private school counterparts. Conversely, private school pupils engaged in more sedentary lifestyles like longer television viewing, computer use and being transported to school compared to their public school counterparts. This present study did not find any difference in general physical activity levels of pupils based on school administration type. However, there was an association between physical activity levels and BMI of pupils ( $p < 0.01$ ). A significant mean difference in BMI was found among pupils in the least and highest physical activity level categories (mean difference =  $1.61 \text{ Kg/m}^2$ ,  $p < 0.001$ ). This finding, supports the hypothesis that pupils with lower physical activity are more likely to be overweight. Differences in BMI for other physical activity level categories were not significant (least vs. lower vs. moderate; or high vs. lower vs. moderate). This means that in the presence of all factors statistically accounted for in the

variation in the model, pupils with low or moderate physical activity levels could not significantly reap positive effects on BMI beyond those of the least category as compared to pupils in the highest activity level. Thus, pupils will need to engage in more vigorous physical activity in order to improve BMI status. That notwithstanding, pupils who engage in light to moderate physical activity can benefit from cardiorespiratory fitness and improved cardiovascular risk factors (Wang et al., 2011, Ortega et al., 2010, Anderssen et al., 2007).

Hours spent watching TV per week and total media time were associated with increased child BMI in this study. The relationship between television viewing and obesity has been documented by several authors. According to Borghese (2014), this association can be explained by: the displacement of possible opportunities for physical activity with television viewing; general reduction of children's energy expenditure during viewing; the promotion of between-meal snacking which increases caloric intake and the negative influence of food advertisements child is exposed to on TV viewing on food choices and attitudes. Time spent on computer alone did not predict child BMI in this population mainly because very few pupils had worked on computer or played computer games.

Active transport of pupils to school has been identified as an important source of physical activity for the youth (Lubans et al., 2011) and is associated with overall physical activity level. Data from this study did not find association between walking to school and child BMI. This is probably because most pupils walked to school on most days of the week and majority of those transported to school used public transport and reportedly engaged in some walking before reaching school. Another reason is that the volumes and intensity completed by young people this way may be inadequate to effect health-related benefits

like body composition (Armstrong and McManus, 1994). However, it is suggested by Lubans et al (2011) that the habitual nature of the exercise may improve health-related fitness among the youth although the evidence linking active transportation and child BMI is little.

### **5.5.0 Environmental level determinants of child overweight**

#### **5.5.1 Determinants of child overweight at the school level**

This study hypothesized that pupils in schools with healthier food and physical activity environments are less likely to be overweight/ obese. Of the four variables measuring the school food environment, only two significantly predicted child overweight status. These were Schools' promotion of healthier food options and control over food options available.

Schools that exert moderate control over food options available had 84.4% lower odds of having overweight pupils compared to schools that exerted least control. This was in support of the study hypothesis that predicted lower odds of child overweight in healthier food environments. Schools having some control over food options available through restriction of sale of sugary foods, restricting operations of hawkers, having a canteen and having more items on menu have a better chance of getting pupils to patronize meals provided. This is likely to limit snacking, which is associated with weight gain among children.

Interestingly, schools' high promotion of healthier food options was associated with over 5 times higher odds of child overweight compared to those who least promoted healthier food options. This evidence did not support the study hypothesis and actually supported

the reverse. The possible explanation to this finding is that schools that had higher prevalence of overweight among pupils were more likely to be concerned and institute measures known to control the situation. Evidence from Peru indicates that teachers and staff of schools are aware of the negative health effects of child overweight and obesity (Preston, 2014). The head-teachers therefore promoted the sale of fruits in the school and encouraged pupils to bring fruits to school in place of sugar-sweetened drinks and pastries. It is possible that the effect of such a policy is yet to reflect in the weight status of pupils assuming there is compliance. This study did not ask head-teachers to provide a time frame within which their policies have been in existence hence more plausible conclusion cannot be made on findings.

Schools' provision of hand washing facilities did not predict child overweight status, however, moderate provision was significantly associated with reduced odds of child overweight (OR =0.214, 95% CI = 0.052 -0.883,  $p<0.05$ ) compared to schools that provided the least. As mentioned earlier, majority of pupils preferred to use fingers to eat hot meals provided, hence the presence of hand washing facilities would enhance patronage of hot meals as opposed to fried tubers or other snacks which permitted minimum contact with fingers. A possible explanation to why this effect was not seen with school's high provision of hand washing facilities is that the schools which provided best hand washing facilities were the ones that provided compulsory lunch. The pupils under this circumstance were more likely to spend pocket money on snacks and drinks compared to those who had to fund their lunch first before spending rest on snacks, drinks or confectioneries.

Data from this work did not support the association between the proportion of healthy food retail points in school and child overweight status. This study found a 1% increase in healthy school retail food environment score initially predicting 1.1% increased odds of child overweight at the bivariate level but did not significantly predict child overweight at the multivariate level (although it showed a 1.2% reduced odds of child overweight). The inconsistency and non-significant relationship observed between weight status of pupils and the proportion of healthy food retail points in the school is because of the overwhelming options of energy-dense options presented to the pupils as opposed to the healthy ones. For instance, a vendor selling confectioneries can have up to 20 different varieties on sale compared to the one selling fruits or complete meal, which will have at most 2 options. Hence, the representation of healthy foods based on a simple count cannot be matched in any way to the unhealthy options available. Since most of these energy-dense foods are the ones that received mass media advertisements and always beautifully displayed by vendors, patronage among pupils will be higher as pupil preferences are greatly influenced by advertisements (Amfo-Ayeh, 2011).

Physical activity is beneficial to children's physical, cognitive and social development (Lubans et al., 2010) and a public health priority for the prevention of obesity and other lifestyle-related chronic diseases. Recess at school provides an opportunity for pupils to engage in physical activity and improve general behaviours and attitudes towards physical activity. Access to different sports facilities including spaces or equipment during recess have been beneficial to children's physical activity (Ridgers et al., 2012). This study evaluated the school physical activity environment as a whole and not the separate effects of policies, fixed and unfixed equipment, playground space and markings

on child overweight status as has been done by other studies. The school physical activity environment was described under four main constructs based on PCA: policy initiating physical activity; supporting environments; increasing options for physical activity and encouragement of active play, which together explained about 64% of variation in school environments visited. None of the school physical activity environment variables significantly predicted child overweight status at the bivariate level. However, at the multivariate level, Schools' high provision of a supporting environment for physical activity predicted lower odds of child overweight (OR 0.198, 95% CI = 0.058 – 0.674,  $p=0.01$ ) compared to least provision. Meaning that the position of schools to provide a trained PE teacher, a sports field and open spaces within which pupils could play influenced the BMI status of pupils. The study hypothesis predicting lower odds of child overweight/ obesity in better physical activity environments, was supported by only schools' provision of supporting environments for physical activity. Ridgers et al. (2012) in a systematic review stated that, ' the provision of access to a range of spaces and facilities may stimulate physical activity by increasing a sense of choice and providing supportive environments that facilitate active behaviours'. Although this study did not find any association between school's increasing options for physical activity, encouragement of active play and policies initiating physical activity, the perceived encouragement of the school, parents and peers of children have been found to be associated with higher self-reported physical activity levels during recess periods (Hohepa et al., 2009).

Being in a private school was significantly associated with child overweight status at the bivariate level (OR= 2.198, 95% CI= 1.372 – 3.521,  $p<0.01$ ). However, this relationship

became non-significant at the multivariate level in the presence of all background, individual level, home environment and school environment variables. This is probably because the relationship seen between the school type and child overweight status was mediated by other variables like household SES of pupils, home environments and parental factors, school food and physical activity environments.

### **5.5.2 Determinants of child overweight at the home level**

The social environment in which children find themselves in the home can also impact food choices through social support, role modeling and social norms (Story et al., 2008b). This study hypothesized that pupils with healthier home food environments are less likely to be overweight. About 46% of parents modeled snacks and soft drink consumption to their children in the past one week. However, parental modelling of soft drink and snack intakes did not predict overweight status in this population as hypothesized and also reported by Bere et al. (2008). The link between frequency of parent consumption and that of their wards has also been reported by other studies (Van Lippevelde et al., 2013, Van der Horst et al., 2006). However, data from this study could not support any of these findings.

The storage or availability of soft drinks in the home has been strongly associated with soft drink consumption among children (Grimm et al., 2004). Pupils in private schools are therefore more likely to consume soft drinks since high accessibility at home increases the odds of consumption (Van der Horst et al., 2006). Data in this study did not support this link between the storage of soft drinks and snacks at home and child overweight status. This study found no association between child overweight status and parental provision of snacks and soft drinks, family eating out of home, and parental

pressure on their children to eat although some authors have established this link (Birch, 1999).

Of the 10 home environment variables tested in this study, only parental use of snacks and sugar sweetened drinks significantly predicted child weight status at both bivariate and multivariate levels. However the analysis did not support the hypothesis which predicted that least use of food as reward (healthier food environment) will be associated with reduced likelihood of child overweight. Rather the reverse was rather true. Moderate parental use of food as reward was associated with 71.8% reduced odds of child overweight compared to least parental use, while high use did not significantly predict child overweight. Evidence from Peru (Preston, 2014) revealed that parents, teachers and children themselves are aware of the health implications of childhood overweight and obesity. Ayesu (2013) found that mothers could correctly describe overweight/ obesity based on appearance and had a fair idea that it was caused by poor diet and physical inactivity. The study also revealed that they were concerned with the health implications of the overweight. This may be an indication that the societal preference for larger body sizes as a sign of wealth, wellbeing and beauty (Amoah, 2003) in our society is gradually waning. Against this background, parents are more likely to take steps to control overweight among their children, which includes regulating the intakes of snacks and soft drinks. This study showed that majority of parents did not restrict snacks and soft drink intake of children. Hence the reduced odds of child overweight associated with the use of snacks and drinks as reward could buttress the fact that parents are trying not to worsen the weight status of already overweight children. The reverse may also be true, that parents probably do not see any harm in giving snacks and drinks as reward to children

perceived as non-overweight. The dynamics of this relationship in this setting may have to be investigated in a future study since it has implications on child overweight status.

### **5.6.0 Strengths the Study**

1. This study is probably the first in Ghana and perhaps in sub-Saharan Africa to have modeled the role of individual level, school and home level factors in the determination of child weight status. This is an improvement over the design of most other studies that only looked at the relationship between child nutritional status and either diet, physical activity or household socio-economic status. This study is among the few that have been able to control for parental BMI when looking out for determinants of child overweight in Ghana.
2. This study examined both the policy and facilities available for the feeding and physical activity of pupils in basic school. This is novel and provides an understanding of the environment within which pupils are expected to be physically active and feed. The approach of this study to describe the environments using PCA makes it possible to measure the resultant effect of both policy and prevailing facility as opposed to viewing them as separate entities.
3. This study assessed overall levels of physical activity of pupils over one week taking into consideration evenings and weekend activities; which give little room for errors in activity estimations as children were not required to give duration of various forms of physical activity or sports engaged in. This allowed the pupils to give a more objective description of their activity levels over the entire week during the school term.

### **5.7.0 Limitations of the study**

This study had limitations that need to be considered when interpreting findings. These are:

1. This study was cross-sectional and the findings therefore are associations and not causative.
2. Schools randomly selected for this study were located in peri-urban and urban areas of the Ga-East municipality and findings may not necessarily reflect the situation in the rural parts of the district or other parts of the country.
3. This study used a 7-day food frequency questionnaire to establish dietary patterns of children. While this is considered valuable for this purpose (Thompson and Byers, 1994), data yielded on foods whose impact are quantity dependent may be less informative as in the case of fruits and vegetables. Also the use of a one-time 24-hour dietary recall in this study may have provided caloric consumption data that were not typical for the individual pupils assessed. However, data generated is adequate for population estimates.
4. The lack of complete parent data in this study prevented the use of all pupil data available. This may have affected the strengths of the relationship between child weight status and possible determinants.
5. This study assessed the role of the home food environment by assessing availability of sugar-sweetened drinks and snacks, parental modelling, pressure-to-eat, family eating out of home, and use of snacks and drinks as reward. It is possible that the effect of the home environment may have been poorly characterized due to the exclusion of other variables in this study (eg. Parenting

style, % of overweight household members, parental physical activity, opportunities for physical activity at home or for household members, etc.).

6. It is possible that assessment of household SES in this study was over-simplified and poorly ranked households as it was based on the possession of 8 household items.

## CHAPTER SIX

### 6.0 CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the concluding remarks based on the findings of this study. Specific recommendations to address childhood overweight and obesity at the individual, home and school level are also presented here.

#### 6.1.0 Conclusions

Childhood overweight/ obesity in the Ga-East Municipality is estimated at 17.7%; is more likely among girls, pupils attending private schools and children belonging to households of middle SES. Our findings challenge the notion that overweight/ obesity is ‘a problem of the richest’ in society. The observed mean BMI of pupils in the high SES group was lower than those of the middle and low SES groups, while middle SES significantly predicted higher odds of child overweight. Finally the effect of parental weight status on child BMI and overweight status was significant.

This study reveals that although schools did not have written or formal policies in relation to physical activity and eating of pupils in school, head-teachers who are not knowledgeable in nutrition are making efforts at controlling the school food and physical activity environments in the school through informal policies and practices. The food-related policies currently being implemented in basic schools are subjective and not based on any scientific or programmatic guidelines. The most popular guidance, “restrict/ prohibit the sale of sugary and fatty foods” was not effective as there was abundance of energy-dense items available on sale to pupils within school compound. Pupils have ready access to energy-dense foods within the basic school setting. The preference of

pupils for energy-dense foods coupled with the price advantage offered by energy-dense foods over healthier options available in the school compound is a major challenge that needs to be addressed with robust policies that control prices and food access.

The failure of schools to provide well-ventilated eating places, clean drinking water and hand-washing facilities for pupils was worse in public schools. Schools were very much under-resourced with respect to providing pupils with optimal physical activity environments. This was evident in the limited PE instructors available to the schools, inadequate fixed sports facilities and limited floor spaces for pupils (mostly private schools) to be physically active.

Physical inactivity and sugar-sweetened beverage consumption were the two behavioural factors significantly associated with increased child BMI in this population. This study found that just a quarter of pupils had high physical activity levels and caloric consumption among the majority of pupils in this study was less than 80% of the requirement for their age and sex. It is possible that the coexistence of low caloric consumption and low physical activity levels may have masked the true relationship between child BMI status and caloric intakes and physical activity levels in this population.

The role of school physical activity and food environments in explaining child overweight status of basic school pupils in this study was substantial. Schools' control over food/ options available, provision of hand washing facilities, promotion of healthier food options, and provision of support for physical activity were significantly associated with child weight status. This provides the basis for the introduction of interventions that

modify the food and physical activity environments in basic schools to encourage healthier behaviours in school-age children.

Findings from this work suggest that parents are aware of childhood obesity and had started taking measures to control it at the home level. This is shown by the reduced likelihood of parents to use snacks and drinks as reward when children were overweight. The awareness of childhood obesity was also demonstrated in the higher likelihood of head-teachers to promote healthier food options when overweight pupil population was high. Parents and teachers will need education and support in order to create healthier environments through policies that make healthier options the default options for children whether at home or in school.

## **6.2.0 Recommendations**

The findings of this study have important implications for school health in Ghana. The following recommendations are made to appropriate institutions below.

### **6.2.1 Ghana Education Services (GES)**

1. The implementation of Physical Education to pupils should be enforced in basic schools since it is the critical for physical activity-related habit building. The education service should spearhead the training and proper distribution of qualified PE instructors who have the technical skills to promote physical activity in pupils.
2. The nutrition and hygiene education components of the basic school curriculum should be strengthened. Additionally, the role of the School Health Education Programme (SHEP) in educating pupils on adopting healthy lifestyles should be

strengthened. The GES must make the nomination and training of SHEP coordinators mandatory for private schools in order for their pupils to benefit from the SHEP.

3. The GES should collaborate with the Ghana Kids Athletic foundation and other civil society organisations to provide necessary support towards raising pupils interests in physical activity and sports.
4. The provision of play-grounds, sports fields and open spaces for pupil use should be enforced in private schools.
5. The GES should partner with the Municipal assembly to ensure that school premises are fenced as a school permit requirement to increase school's control over food options available to pupils.
6. The GES must develop and make available policies relating to food vending (not only limited to food hygiene but should also focus on nutrient quality of foods) in all schools. Also, the SHEP under the GES should spearhead communications with stakeholders in health to design different food menus with healthier options for schools in the absence of district-wide and nationwide school nutrition guidelines.
7. The quality and adequacy of food and services provided to pupils under the school feeding programme (SFP) must be monitored to ensure that pupils receive a varied and nutritious diet. Public schools should also make more efforts at improving the conditions under which SFP meals are served and eaten by pupils.

### 6.2.2 Ghana Health Services (GHS)

1. The GHS should collaborate with the GES to set up policies to guide the diet and physical activity of pupils while at school. Policies should promote new practices at the schools to ensure the provision of appropriate nutritious meals and opportunities for physical activity among pupils. They can also collaborate with the Ghana standards authority to set up some quality standards for snacks and beverages to be permitted for sale in basic school compounds.
2. The GHS should facilitate the efforts of parents and teachers by providing easy-to-read education materials on dietary guidelines commensurate with healthy growth among children and the entire population. This will make it easy for them to take definite steps towards prevention and control of childhood overweight and obesity. Parents must be made aware of their strong influence (both biologically and socially) on child weight and health outcomes.
3. The GHS in conjunction with the GES must make available in school compounds, teaching and learning materials promoting healthy lifestyles that pupils can adopt. These materials can be displayed on the walls, school signage boards and canteens for pupils in place of the advertisements of energy-dense foods and beverages that may be unhealthy.
4. The GHS must actively educate the entire population on the rise in NCDs and the harmful effects of unhealthy weight gain and provide guidelines to prevent it. This must take many forms in order to reach all sections of the population especially lower SES groups. The activities of the Regenerative health and

Nutrition department of the GHS must be strengthened to foster behavior change towards more healthy lifestyles.

### **6.2.3 Future Research direction**

1. This study did not examine all aspects of the home food environment that could possibly affect child weight status. Also, the possible effects of the home on physical activity of pupils were not assessed by this study. Future studies can examine the home environment in much more detail.
2. Other behavioural factors like sleep duration or dieting were not examined in this study. Future studies can assess their contribution to weight status of children in the Ghanaian setting.
3. This study was unable to assess pupil and head-teacher views on childhood obesity and how this may have influenced their practices that were reported in this study. A qualitative study on the subject can yield more insights on prevailing views and their impacts on diet and physical activity-related behaviours. This can inform policy implementation strategies directed at the schools.
4. This study could not assess pupils' views and satisfaction with prevailing school food and physical activity environment and how it affects their behaviour. A future study can generate this knowledge to inform policy and programmes intended to improve school environments.
5. A qualitative study school heads, pupils and parents will be needed to examine the decline in prominence given to PE in schools to identify opportunities for intervention.

6. This study was cross-sectional and hence could not establish causality. Longitudinal studies may have to be conducted to ascertain how the prevailing environment and practices (at school and home) affect child behaviour and weight status in the long-term.

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## APPENDICES

### APPENDIX 1: QUESTIONNAIRE FOR CHILD

**SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA  
DEPARTMENT OF POPULATION, FAMILY & REPRODUCTIVE HEALTH  
A STUDY TO ASSESS THE DETERMINANTS OF OBESITY AMONG BASIC SCHOOL  
PUPILS IN GA-EAST MUNICIPALITY**

#### A. BACKGROUND INFORMATION

#### CODE

- |  |           |          |   |
|--|-----------|----------|---|
| 1. Date of interview (dd/mm/yy):                           | DATE      | __/__/__ |   |
| 2. Child ID.....   | CHILIDID  |          | <input style="width: 50px; height: 20px;" type="text"/>   |
| 3. Name of school .....                                    | School ID | SCHID    | <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> |
| 4. School Type:            1. Public            2. Private |           |          | <input style="width: 50px; height: 20px;" type="text"/>   |
| 5. Name of respondent .....                                |           |          |   |
| 6. Sex of respondent        1=Male            2=Female     | SEXRES    |          | <input style="width: 50px; height: 20px;" type="text"/>   |
| 7. Age of respondent (completed years) .....               | AGERES    |          | <input style="width: 50px; height: 20px;" type="text"/>   |
| 8. Date of birth of respondent (dd/mm/yy) .....            | DATBTH    |          | <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> |

#### **NEXT TWO QUESTIONS FOR GIRLS ONLY**

- |   |         |  |   |
|---|---------|--|---|
| 9. Have you started menstruating?    1.Yes            2. No | MENS    |  | <input style="width: 50px; height: 20px;" type="text"/>   |
| 10. If yes, when did you start menstruating?                | DATEMEN |  | <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> <input style="width: 20px; height: 20px;" type="text"/> |

#### B. SOCIODEMOGRAPHIC INFORMATION

- |  |        |  |   |
|--|--------|--|---|
| 1. Occupation of mother/Guardian<br>1=Artisan (Carpenter, hairdresser, seamstress etc.)<br>2=Professionals (Teacher, lawyer, accountant)<br>3=Office worker (Secretary)        4=Trading            5=Not employed | OCUMTH |  | <input style="width: 50px; height: 20px;" type="text"/> |
| 2. Education level of mother/Guardian<br>1=Primary/Elementary    2=Secondary        3=Post-secondary<br>4=Tertiary            5=None        6= Don't know    7= Other (specify) .....                              | EDUMTH |  | <input style="width: 50px; height: 20px;" type="text"/> |
| 3. Occupation of father/Guardian<br>1=Artisan (Carpenter, hairdresser, seamstress etc.)<br>2=Professionals (Teacher, lawyer, accountant)<br>3=Office worker (Secretary)        4=Trading            5=Not employed | OCUFTH |  | <input style="width: 50px; height: 20px;" type="text"/> |
| 4. Residential status:<br>1=Own house            2=Family house        3=Rented house<br>4=Company/mission house        5=Government house    6=Caretakers   | RENSAT |  | <input style="width: 50px; height: 20px;" type="text"/> |
| 5. How many persons are in your house hold? .....  | HHSIZE |  | <input style="width: 50px; height: 20px;" type="text"/> |
| 6. How many children are you in your family (< 16yrs)?.....  | HWCHN  |  | <input style="width: 50px; height: 20px;" type="text"/> |

7. Does your family own any of the following?

Saloon car or any other vehicle	1=Yes	2=No	VHCL	<input type="text"/>
Refrigerator/Deep freezer	1=Yes	2=No	FRIDG	<input type="text"/>
Gas/electric cooker	1=Yes	2=No	COKR	<input type="text"/>
Television	1=Yes	2=No	TELEV	<input type="text"/>
Video deck/VCD/DVD player	1=Yes	2=No	VIDDEC	<input type="text"/>
Air conditioner	1=Yes	2=No	AIRCON	<input type="text"/>
Satellite dish/ DSTV/ Multi TV	1= Yes	2=No	DSTV	<input type="text"/>

**C. FOOD / EATING HABITS (School aged child to answer)**

1. How many times per day do you usually eat? TIMEAT   
 1=Once      2=Twice      3=Thrice      4=Four-five times  
 5=Greater than five times      6=Other (specify) .....
2. Where do you usually get your food when you are in school? USUFD   
 1=Home      2=Vendors/sellers at school      3=Vendors/sellers outside school  
 4=School feeding program      5= Other (specify) .....
3. What foods don't you like/do you avoid? (please write food)..... AVFD   
 1=Animal protein      2=Plant protein      3=Fruits      4=Vegetables      5=Starchy foods  
 6=Fats and oils      7=Milk and dairy products      8= Cereals      9= Other.....  
 99. None
4. Why don't you like this food? WDLFD   
 1= Not applicable      2=Taste/Appearance      3=Health (allergy)      4=Culture/Religion/Taboo  
 5. Family doesn't eat it      6. Other (specify) .....
5. What is your favorite meal time? FVMT   
 1=Breakfast      2=Lunch      3=Supper      4=Snacks      5=Other (specify) .....
6. Which of the following meals do you usually skip? WCSKP   
 1=Breakfast      2=Lunch      3=Supper      4= Snacks      5= None  
 6= Other (specify) .....
7. Why do you skip the above meal? WYSKP   
 1=Not hungry      2=Lack of time      3=Don't like foods served (taste)  
 4= Food is inadequate      5= NA      6=Other (specify) .....

**QUESTIONS ON EATING OF BREAKFAST**

8. On how many school days in a week do you generally take breakfast? BRKFSTSC   
 0= never take breakfast on school days      1= 1day      2=2days  
 3=3days      4= 4days      5= 5days
9. On how many days of the weekends do you generally take breakfast? BRKFSWKD   
 0=I never take breakfast during the weekends  
 1= I generally take breakfast on one day of the weekend (Saturday or Sunday)

2=I generally take breakfast on both days of the weekend

10. How much money are you given to school per day **for food** (in GHC/GP)? HWMNY   
 1 = 0.10-0.50 GHC      2 = 0.60-0.99GHC      3 = 1-2GHC      4 = >2-5GHC  
 5= Greater than 5GHC      6 = None      6 = Other (specify).....

**D. QUESTIONS CONCERNING SOFT DRINKS CONSUMPTION IN THE PAST ONE WEEK**

1. During the past week, how many days per week did you drink soft drinks? DRINKMIN   
 0= I never drink soft drinks/minerals      1= 1day per week      2= 2 days per week  
 3=3 days per week      4=4 days per week      5=5 days per week      6=6 days per week  
 8. Each day

2. If you drank soft drinks/minerals, how many drinks/day did you take on the average? NUMDRINK   
 0=1/2 bottle      1=1 bottle      2=2 bottles      3=3 bottles      4=4 bottles  
 5=5 bottles      6=6bottles      7=7 or more bottles      8= N/A

3. How many soft drinks/minerals did you drink yesterday? NUMYDAY   
 0= None      1= 1 bottle      2= 2 bottles      3= 3 bottles      4= 4 bottles  
 5= 5 bottles      6= 6 bottles      7= 7 or more bottles

4. How do your parents feel about you taking soft drinks or minerals? PTFELMIN   
 1=Completely good    2=Good    3=Not good/not bad    4= Bad    5=Very bad

5. How easy is it for you to get soft drinks/minerals? GETMIN   
 1=Quite easy    2=Easily    3= Not easily/not with difficulty    4=With difficulty  
 5=Very difficult

6. Can you find soft drinks/ minerals in the house to drink? MINHOUS   
 1=Yes      2=No

7. How frequently do you buy soft drinks/minerals from sellers at school? BUYMIN   
 a. 0= Never      1= I day per week      2= 2 days per week      3= 3 days per week  
 b. 4= 4 days per week      5= 5days per week.

**E. QUESTIONS CONCERNING SNACKS IN THE PAST ONE WEEK**

(These questions refer to the consumption of cakes, pies, doughnuts, biscuits, pastries)

8. How many days per week do you generally eat such foods? DAYSBFST   
 0= I never eat snacks      1= 1day per week      2= 2 days per week      3= 3 days per week  
 4= 4 days per week      5= 5days per week      6= 6 days per week      7= Each day

9. On the average, how many times per day do you take such foods? .....times TIMSBFST

10. How many times did you eat such foods yesterday? .....times TIMSWTCK

11. On average how many days per week do your parents pack/buy such foods for you on school days?

**F. 7-DAY FOOD FREQUENCY QUESTIONNAIRE**

Please tell me whether you ate any of the following foods during the past one week and how often?

CODE	SWEETENED DRINKS AND FRUIT JUICES	Past One week 1=Yes 2=No	NO. OF TIMES PER WEEK	WHERE DID YOU GET YOUR FOOD FROM? (Please write) 0=Not Applicable 1=Home 2=School vender 3=Street food
SWTD	Sweetened drinks (Tampico, Kalypyo, Refresh)			
FRUJ	Fruit juices (Pure Heaven, Ceres, Nourisher)			
MALD	Malt drinks (Malta Guinness, Vitamalt, Amstel)			
MIN	Minerals (eg. Fanta, Sprite, Coca Cola)			
LOCD	Local drinks (asana,shitor da, etc.)			
<b>COCOA, MILK AND DAIRY PRODUCTS</b>				
MILK	Milk (evaporated/powdered/fresh)			
MILD	Milk drinks (Countre Milk, Milko)			
YOGT	Yogurt			
CHES	Cheese / Wagashi			
MILO	Milo/ cocoa beverages			
<b>BREADS, BISCUITS AND PASTRIES</b>				
BRED	Bread (sugar or tea bread)			
BISC	Biscuits / cookies/ crackers			
CAKE	Cakes			
PAST	Other pastries (pies, baked chips, bans etc.)			
PIZA	Pizzas			
BBP1	Other:			
<b>FRIED FOODS</b>				
BOFR	Bofrot / Donuts			
KOSE	Akara / Koose			
FRIET	Fried plantain / Kelewele/yam/ sweet potatoes/			
FRYPO	Fried potato/ chips			
PASTR	Chips / Pastries			
FREEG	Fried eggs			
FRYCH	Fried chicken and poultry			
FRYMT	Fried meat			
FRYRC	Fried rice/ jollof rice/ braised rice			
FFO1	Other:			

<b>CODE</b>	<b>PROTEIN FOODS</b>	<b>Past One week:1=Yes 2=No</b>	<b>NO. OF TIMES PER WEEK</b>
MEAT	Meat (pork, beef, mutton, bush meat)		
POUL	Poultry (chicken, duck, turkey, birds)		
KHEB	Kebab		
CORNB	Corned beef / luncheon meat		
SAUS	Sausage / Bacon		
EGGS	Eggs		
BURG	Burgers		
FISH	Fish		
PFO1	Other:		
<b>SPREADS AND TOPPINGS</b>			
MAGR	Margarine / Butter		
JAM	Jam		
GPAST	Groundnut (peanut) paste		
CHOS	Chocolate spread		
SALC	Salad cream		
MAYO	Mayonnaise		
SPRO1	Other:		
<b>FRUITS</b>			
CITR	Citrus (Orange, Tangerine, Grape fruit, star fruit)		
PINE	Pineapple		
WATM	Water melon		
MANG	Mango		
BANN	Banana		
PEAR	Avocado pear		
PAWP	Pawpaw		
GUAV	Guava		
APPL	Apple		
SUGC	Sugar cane		
FRO1	Other:		
<b>VEGETABLES</b>			
KONT	Kontomire		
GREL	Other dark green leafy vegetables		
CARP	Carrots		
OKRO	Okra		
GEGG	Garden eggs/ Aubergines		
VEGO1	Other:		
VEGO2	Others		
<b>SOUPS</b>			
PALMS	Palm soup		
GNUTS	Groundnut soup		
KONTS	Kontomire soup		
<b>OTHER HIGH FAT/CALORIE FOODS</b>			
CHOCO	Chocolate		
TOFFE	Toffees/candies/lollipops		
NUTS	Nuts (groundnuts/peanuts, cashew, tiger nuts)		
SUGA	Sugar		
ICECR	Ice cream		
POPC	Popcorn		
<b>STAPLE FOODS</b>			
MAIZE	Maize based foods (eg. Kenkey, Aple, Banku, TZ)		
CEREAL	Other cereals (eg. Rice, millet, sorghum, wheat)		
TUBER	Root and tubers (eg. Fufu, kokonte, cassava, gari)		
LEGUME	Legumes (Beans, bambara, soya beans)		
WAKYE	Waakye		

**G. QUESTIONS CONCERNING TELEVISION VIEWING**

1. Do you enjoy watching television? ENJTV   
 1= Very well 2= Well 3= Not good/not bad 4= Bad 5. Very bad
2. Do you watch TV before going to school in the morning? TVMN   
 1 = Yes 2 = No
3. If yes, for how many hours do you watch TV before going to school? TVHRM   
 1 = Less than one hour 2 = One hour 3 = Two hours  
 4 = Three hours 5 = More than three hours 6 = N/A 7 = Other (specify) .....
4. How often does your father watch TV? FATHERTV   
 1= A lot 2= Much 3= Not much 4= Little 5= Never
5. How often does your mother watch TV? MOTHERTV   
 1= A lot 2= Much 3= Not much 4= Little 5=Never
6. How do your parent feel about you watching TV? PRTFELTV   
 1= Quite good 2= Good 3= Not good/not bad 4= Bad 5= Very bad
7. How easy is it for you to watch TV at home? EASWACTV   
 1= Quite easy 2= Easily 3= Not easily/not with difficulty 4= With difficulty  
 5= Very difficult
8. What kinds of programs do you usually watch on TV? PROGWAT   
 1= Music clips 2= Sports 3=Soaps and series 4= News and documentaries  
 5= African and foreign movies 6= Fashion and talk shows 7= Other specify.....  
 8= N/A
9. How many days per week do you watch TV? TVAFS   
 0= I never watch TV 1= 1day per week 2= 2 days per week 3= 3 days per week  
 4= 4 days per week 5= 5days per week 6= 6 days per week 7= Each day
10. If yes, How many hours on average do you watch TV each day? HRTVAS   
 1= One hour 2 = Two hours 3 = Three hours 4 = Four hours 5 = Five hours  
 6 = More than five hours 7 = N/A 8 = Other (specify) .....

**H. PHYSICAL ACTIVITY DURING THE PAST ONE WEEK**

1. How many days during the past week did you walk to/ from school? WALKSC
2. If you walked, how long did it take you to reach school? (min) TIMWALK
3. How many days during the past week were you transported to school? TRASC
4. If you traveled by vehicle, how long did it take you to reach school? (min) TIMTRA
5. How many days during the past week did you work on computers or play computer games during your free time? COMPUTER
6. On the average how long did you spend on the computer/computer games per day?(min) TIMCOMP
7. How many days during the past week did you do house hold chores? HOUSCHOR
8. If you did house chores, on the average how long did it take you/day? (min) TIMCHOR

**Have you done any of the following activities in the past 7 days (last week)? If yes, how many times?**

**NB: Response for Frequency:** 0= Never 1= 1 – 2 times 2= 3 – 4 times 3= 5 – 6 times 4= 7 times or more

Game	Frequency
Tag (of peace/ war)	TAGF:
Walking for exercise	WALKF:
Bicycling	BYCLF:
Jogging or running	JOGRF:
Aerobics	AEROF:
Volley ball	VOLBF:
Skipping rope	SKPRF:
Lawn Tennis	LTF:
Table Tennis	TTF:
Skateboarding	SKATF:
Gardening	GARDF:
Handball	HANDF:
Swimming	SWIMF:
Stair climbing	STCLF:
Soccer/ Football	SOCCF:
Dance	DANCF:
Hockey	HOKF:
Ampe/ Tu matu	AMPEF:

9. In the last 7 days, during your physical education/ PE classes, how often were you very active (playing hard, running, jumping, throwing)?
- 0=I don't do PE 1= Hardly ever 2= sometimes 3=Quite often 4= Always

In the last 7 days, what did you do most of the time **at recess/ 1<sup>st</sup> or 3<sup>rd</sup> break time?**

0= Sat down (talking, reading, doing school work)      1=Stood around or walked around  
 2= Ran or played a little bit      3= Ran around and played quite a bit      4= Ran and played hard most of the time

10. In the last 7 days, what did you normally do **at lunch time** (besides eating lunch)?

0= Sat down (talking, reading, doing school work)      1=Stood around or walked around      2= Ran or played a little bit      3= Ran around and played quite a bit      4= Ran and played hard most of the time

11. In the last 7 days, on how many days **right after school**, did you play/ do sports, dance or play games in which you were very active?

0= none      1= One time last week      2= Two or Three times last week      3= Four times last week      4= Five times last week

12. In the last 7 days, on how many **Evenings**, did you do sports, dance or play games in which you were very active?

0= none      1= One time last week      2= Two or Three times last week      3= Four or Five times last week      4= Six or Seven times last week

13. **On the last weekend**, on how many times did you do sports, dance or play games in which you were very active?

0= none      1= One time      2= Two or Three times      3= Four to five times      4= Six or more times

14. Which of the following describes you best for the last 7 days? Read all 5 statements before deciding on one!

1. All or most of my free time was spent doing things that involve little physical effort
2. I sometimes (1-2 times last week) did physical things in my free time (eg. played sports, run, swim, bike riding, did aerobics)
3. I often (3-4 times last week) did physical things in my free time
4. I quite often (5-6 times last week) did physical things in my free time
5. I very often (7 or more times last week) did physical things in my free time.

Mark how often you did physical activity (like playing sports, games, doing dance or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

8. Were you sick last week, or did anything prevent you from doing your normal Physical activities?  
 1. Yes      2. No  
 If yes, what prevented you? .....

**I. ANTHROPOMETRY FOR CHILD**

**Height (cm):** Ht1    .  Ht2    .

**Weight (kg):** Wt1    .  Wt2    .

**BMI:** BMI1   .

**J. 24-HOUR MEAL RECALL QUESTIONNAIRE**

1. Date of interview (dd/mm/yy): DATE \_\_\_/\_\_\_/\_\_\_
2. Child ID..... CHILDID
3. Name of school ..... School ID SCHID
4. School Type: 1. Public 2. Private
5. Name of respondent .....
6. Sex of respondent 1=Male 2=Female SEXRES
7. Age of respondent (completed years) ..... AGERES
8. Date of birth of respondent (dd/mm/yy) ..... DATBTH

TIME OF MEAL	TYPE OF MEAL	FOOD ITEM	ESTIMATE OF QUANTITY CONSUMED (household measures)	WEIGHT OF ESTIMATED QUANTITY(g)

## APPENDIX 2: QUESTIONNAIRE FOR PARENT

**SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA**  
**DEPARTMENT OF POPULATION, FAMILY & REPRODUCTIVE HEALTH**  
**A STUDY TO ASSESS THE DETERMINANTS OF OBESITY AMONG BASIC SCHOOL**  
**PUPILS IN GA-EAST MUNICIPALITY**

A. BACKGROUND INFORMATION

CODE

1. Date of interview (dd/mm/yy): DATE \_\_\_/\_\_\_/\_\_\_
2. Child ID ..... CHILDID
3. Name of school ..... School ID SCHID
4. School Type: 1. Public 2. Private SCTYP
5. Name of respondent .....
6. Sex of respondent 1=Male 2=Female SEXRES
7. Age of respondent (completed years) ..... AGERES
8. What is your relationship with the child involved in the study? RELCH   
 1=Biological son/daughter 2= Niece/Nephew 3=Non-biological son/daughter  
 4= Brother/Sister 5= Grandchild 6 = Other relation .....
9. Marital status: MARSTAT   
 1=Single 2=Married 3.=Separated/Divorced 4=Widowed/Widower

B. SOCIODEMOGRAPHIC INFORMATION

10. Highest educational level of child's mother/Female guardian EDUMTH   
 1= Primary/Elementary 2= Secondary 3= Post secondary  
 4= Tertiary 5= None 6= Other (specify) .....
11. Highest educational level of child's father/Male guardian EDUFTH   
 1= Primary/Elementary 2=Secondary 3= Post secondary  
 4=Tertiary 5=None 6= Other (specify) .....
12. Occupation of child's mother/Guardian OCUFTH   
 1=Artisan (Carpenter, hairdresser, seamstress etc.) 2=Trading  
 3=Professionals (Teacher, lawyer, accountant) 4= Office worker (Secretary)  
 5=Not employed 6. Retired 7. Other(specify) .....
13. Occupation of child's father/Guardian: OCUMTH   
 1=Artisan (Carpenter, hairdresser, seamstress etc.) 2=Trading  
 3=Professionals (Teacher, lawyer, accountant) 4= Office worker (Secretary)  
 5=Not employed 6. Retired 7. Other(specify) .....
14. Residential status: RENSTAT   
 1= Own house 2= Family house 3= Rented house

- 4=Company/mission house      5=Government house      6=Caretakers
15. How many persons are in your household? ..... HHSIZE
16. How many children (< 16 yrs) are there in your household? ..... HWCHN
17. How much school fees do you pay per term for your index child? SCHFE
18. On the average, how much income comes into the house per month? HHINC   
 1= <100      2=100-300      3= 300-600      4=600-900  
 5=1000-3000      6= >3000
19. Is the amount provided above for just you or the entire household? INCOM   
 1. Partial income      2. Total household income      3. Remittances
20. How often in the past one month has your family eaten outside your home?   
 1. Never      2. Occasionally      3. Sometimes      4. Often      5. Very often
21. What is the usual family eating time for the following meals?  
 a. Breakfast   
 b. Lunch   
 c. Supper

### C. CHARACTERISTICS OF THE HOME FOOD ENVIRONMENT

Preamble- I am going to ask you a few questions concerning soft drinks/ minerals and snack items like biscuits, chips and other pastries. I will also ask a few questions about your child's feeding at home.

Questions	Codes	
1. How often do you usually take soft drinks/ minerals? <i>In the past one month</i>	1.very often 2. Often 3. Sometimes 4. Occasionally 5. Never.	
2. How many times in the past 7 days have you taken soft drinks while your children were present?		
3. How often do you take snack items like biscuits, spring rolls and other pastries? <i>In the past one month</i>	1.very often 2. Often 3. Sometimes 4. Occasionally 5. Never.	
4. How many times in the past 7 days have you taken such snack items while your children were present?		

<i>Codes for next set of questions:</i> 1= Yes, all of the time    2= Yes, most of the time    3= Yes, some of the time    4= Yes, occasionally    5= Never						
5. Are soft drinks and other sweetened drinks available/ stored in your home?	1	2	3	4	5	
6. Are children allowed to have soft drinks and other sweetened drinks?	1	2	3	4	5	
7. Are snack items like biscuit, chips and other pastries available/ stored in your home?	1	2	3	4	5	
8. Are children allowed to have snack items like biscuit, chips and other pastries?	1	2	3	4	5	
9. Are children allowed to eat snacks any time in the day including night time?	1	2	3	4	5	
10. Do you specifically give money to your children to use to buy snack items at school?	1	2	3	4	5	
11. How often do you give soft drinks and other sweetened drinks as reward?	1	2	3	4	5	
12. How often do you give snack items like biscuit, chips and other pastries as reward?	1	2	3	4	5	
13. How often do you pack drinks and other snacks for your child to take to school?	1	2	3	4	5	
14. Do you think your child should always eat all of the food on his/her plate?	1	2	3	4	5	
15. Are you especially careful to make sure your child eats enough?	1	2	3	4	5	
16. If your child says ‘‘I’m not hungry’’, do you try to get him/her to eat anyway?	1	2	3	4	5	
17. Do you think that your child would eat much less than he/she should if you don’t regulate?	1	2	3	4	5	

### PARENT ANTHROPOMETRY

**Height (cm):**    Ht1     .     Ht2     .

**Weight (kg):**    Wt1     .     Wt2     .

**BMI:**            BMI1     .

### APPENDIX 3: SCHOOL POLICIES REGARDING FOOD AND PHYSICAL ACTIVITY

#### SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA DEPARTMENT OF POPULATION, FAMILY & REPRODUCTIVE HEALTH

##### A. BACKGROUND INFORMATION

##### CODE

11. Date of interview (dd/mm/yy): DATE \_\_\_/\_\_\_/\_\_\_
12. Name of school ..... School ID SCHID
13. School Type: 1. Public 2. Private
14. Name of respondent .....
15. Position of respondent in school  
1= Proprietor (ess) 2= Headmaster / mistress 3= Assistant Head 4=Other
16. How many years have you worked in this position?  
1= < 1 year 2= 1 – 5 years 3= 6 – 10 years 4= > 10 years

##### **POLICIES RELATING TO FOODS**

1. Is the school campus open or closed:  
a. For Lunch period 1. Open 2. Closed   
b. For Other periods 1. Open 2. Closed
2. Are foods or beverages allowed in the classroom during classes?   
1. Yes 2. No
3. Are there situations where food is used as a reward for students individually or as a group? (e.g. pastries, candy bars, cookies, drinks, ice cream, etc.)   
1. Often 2. Sometimes 3. Rarely 4. Never 5. Don't know
4. Are there any school policies about teachers using food to reward students?   
1. Yes 2. No 3. Don't know
5. Are there any school stores or snack bars in your school?   
1. Yes 2. No 3. Don't know
6. Is school involved in selling any foods, snacks etc.?   
1. Yes 2. No 3. Don't know
7. Who operates school stores or snack bars in your school?   
1. Don't know 2. School 3. Private individual 4. Staff of school 5. Other 6. No store
8. Who controls commissions/ profits from school stores or snack bars?

1. Don't know 2. School 3. Private individual 4. Staff of school 5. Other 6. No store

9. Are there any school policies about the types of food that can be sold at the school stores?

1. Yes 2. No

If yes, indicate below:

.....  
 .....

10. Is any teacher involved in selling any foods, snacks, etc.?

1. Yes 2. No

11. Are there any school policy (ies) about the types of food that can be sold within school premises? 1. Yes 2. No

If yes, indicate below:

.....  
 .....

12. Does your school have any other written nutrition/ school food policy (e.g. what type of food is offered, promoted or prohibited)? (*attach a copy*)

1. Yes 2. No 3. Don't know

13. Are there any informal (unwritten) food- related school policies (e.g. what type of food is offered, promoted or prohibited)? 1. Yes 2. No 3. Don't know

What are they? .....

.....  
 .....

14. If any, how effective has your policy been in promoting healthy eating?

.....  
 .....

15. Are food and beverage promotions or advertising allowed in the school

( on bill boards, posters, branded T-shirts, caps , dispensers etc.)? 1. Yes 2. No

16. Does your school have a branded drink/ beverage vendor or dispenser? 1. Yes 2. No

17. Which people were/ are involved in the setting of your school's food policy? **Tick as appropriate**

- A. Parents  
 B. School health coordinator  
 C. Head teachers/ proprietors  
 D. Other school administrative staff  
 E. Pupils  
 F. District SHEP coordinator  
 G. N/A


18. How important do you think it is to have a school-wide, district-wide or nation-wide policy about food and nutrition issues for basic schools?

1. Very important      2. somewhat important      3. Neither      4. somewhat unimportant      5. Very unimportant

19. How important do you think it is for schools to provide an environment to encourage healthy food choices?

1. Very important      2. Somewhat important      3. Neither      4. Somewhat unimportant      5. Very unimportant

20. Which of the following do you agree with most?

1. Schools should provide both more healthful and less healthful food choices and let the pupils choose  
 2. Schools should provide mostly only healthful foods to pupils in school

### **POLICIES RELATING TO PHYSICAL ACTIVITY**

21. Does your school have a written physical activity/ education policy? (**attach a copy**)

1. Yes      2. No

22. Are there any informal (unwritten) school policies regarding physical activity/ education (e.g. what type of physical activities are taught, allowed, promoted or prohibited)?

1. Yes      2. No      3. Don't know

What are they? .....

.....

23. If any, how effective has your policy been in increasing participation in physical activity in your school?

.....

24. Please rate how wet weather conditions affect physical activity levels during physical education (PE) classes?
1. Hardly at all 2. A little 3. Somewhat 4. Enormously
25. Are students allowed to use sports or physical education equipment at break time?
1. Yes, All students 2. Yes, Some students 3. No
26. Are children allowed to use (play in) the school compound or field at any time?
1. Yes 2. No
1. Before or after school
2. Break time
3. All of above times
4. Not at all
5. No playing Field
27. How many hours each week would pupils as part of curriculum have PE?(hrs)
28. Is there a specific Teacher(s) assigned for PE classes? 1. Yes 2. No
29. Is PE teacher a qualified PE instructor? 1. Yes 2. No
30. How many staff participate in sports in your school?
31. Does your school have a team in any of these sporting disciplines? 1. Yes 2. No
1. Football/ Soccer
2. Table tennis
3. Volley ball
4. Basketball
5. Athletics (racing, javelin, etc.)
6. Netball
7. Other (specify) .....
32. Does your school have an active cultural dance group? 1. Yes 2. No
33. About how many pupils are members of this dance group?
34. About how many teachers are involved in the dance group?
35. How often do pupils in the dance group rehearse each month?

**GENERAL REMARKS ON SCHOOL FOOD AND PHYSICAL ACTIVITY POLICIES**

36. Please rate the following statements to indicate how they apply in your school, by ticking the appropriate box.

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Physical activity is high on our list of priorities in this school					
Our school has adequate facilities for pupils to be physically active regardless of weather					
The management team of our school encourages pupil & staff participation in physical activity					
Our staff are committed to, and support physical activity and extra-curricular activities					
Nutrition/ nourishment is high on our list of priorities in this school					
The management team of our school support the provision of healthy foods through the school canteen service					
Our school canteen service provides mainly foods with high nutritional value					

37. What is your own philosophy about food policies in basic school?

.....

38. What is your own philosophy about physical activity policies in basic school?

.....

**THANK YOU VERY MUCH FOR TAKING TIME TO COMPLETE QUESTIONNAIRE**

**SCHOOL FEES PER TERM**

CLASS	FEES ONLY (GHC)	FEES AND STATIONERY (GHC)
P4		
P5		
P6		
JHS 1		
JHS 2		
JHS 3		



12. Is there water and soap provided by sources 1 – 5 above for hand washing?

- 1. Canteen/ cafeteria: 1. Yes 2. No
- 2. School vendors: 1. Yes 2. No
- 3. Dining hall: 1. Yes 2. No
- 4. Hawkers: 1. Yes 2. No
- 5. Vendors outside school 1. Yes 2. No


Comment: .....

13. Does school have a stand pipe/ veronica buckets/ barrels with fitted taps to provide clean water?

- 1. Yes 2. No

--

Comment: .....

14. Does school have a playing ground or park? 1. Yes 2. No

--

15. Approximate size of playing ground

--

16. Does school have sports facilities for the following disciplines? 1. Yes 2. No

- 1. Football/ Soccer
- 2. Table tennis
- 3. Volley ball
- 4. Basketball
- 5. Other (specify) .....


**SCHOOL SURROUNDINGS**

17. Are there sports facilities (football field, basketball, tennis, volley ball courts) around the school that pupils are allowed to use during or after school hours? 1. Yes 2. No

--

18. What types of recreational facilities within 100 meters radius around the school are patronized by pupils? (circle all that apply)

- 1. Game centers 2. Internet café 3. Board games 4. Children’s playing court
- 5. Other (specify) .....

19. What are the food- sale points round (100 meter radius) the school? (check box as appropriate)

- 1. Fast food joints (check check)
- 2. Kiosks/ containers
- 3. Table top
- 4. Supermarkets
- 5. Restaurants
- 6. Chop bars
- 7. Homes
- 8. Stores






APPENDIX 7: GIS DATA SHEET

NAME OF SCHOOL ..... SCHOOL ID .....

LOCALITY OF SCHOOL..... LOCATION OF SCHOOL.....

DIMENSIONS OF SCHOOL

<input type="checkbox"/>	SDA	.....
<input type="checkbox"/>	SDB	.....
<input type="checkbox"/>	SDC	.....
<input type="checkbox"/>	SDD	.....

DIMENSIONS OF SCHOOL PARK

<input type="checkbox"/>	SPA	.....
<input type="checkbox"/>	SPB	.....
<input type="checkbox"/>	SPC	.....
<input type="checkbox"/>	SPD	.....

DIMENSIONS OF PLAYING GROUND

<input type="checkbox"/>	PGA	.....
<input type="checkbox"/>	PGB	.....
<input type="checkbox"/>	PGC	.....
<input type="checkbox"/>	PGD	.....

DIMENSIONS OF OPEN SPACE

<input type="checkbox"/>	OSA	.....
<input type="checkbox"/>	OSB	.....
<input type="checkbox"/>	OSC	.....
<input type="checkbox"/>	OSD	.....

DIMENSIONS OF OPEN SPACE2	<input type="checkbox"/>	OSA2	.....
	<input type="checkbox"/>	OSB2	.....
	<input type="checkbox"/>	OSC2	.....
	<input type="checkbox"/>	OSD2	.....

### **FOOD ENVIRONMENT WITHIN SCHOOL COMPOUND**

CANTEEN AREA (CA)	<input type="checkbox"/>	FICA	.....
DINNING HALL (DH)	<input type="checkbox"/>	FIDH	.....
SCHOOL VENDORS (SV)	<input type="checkbox"/>	FISV	.....
SNACK BAR (SB)	<input type="checkbox"/>	FISB	.....
DRINKS VENDOR (DV)	<input type="checkbox"/>	FIDV	.....

### **SPORTS FACILITY**

VOLLEY BALL (V)	<input type="checkbox"/>	SFV	.....
BASKET BALL (B)	<input type="checkbox"/>	SFB	.....
LAWN TENNIS (L)	<input type="checkbox"/>	SFL	.....
TABLE TENNIS (T)	<input type="checkbox"/>	SFT	.....
HOCKEY (H)	<input type="checkbox"/>	SFH	.....
NETBALL (N)	<input type="checkbox"/>	SFN	.....
OTHER (OTH)	<input type="checkbox"/>	OTH	.....

**FOOD ENVIRONMENT OUTSIDE SCHOOL COMPOUND**

NO. / CODE	FOTT	FOFF	FOR	FOCB	FOH	FOKC	FOSM
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

**TABLE TOPS (TT); FAST FOOD (FF); RESTAURANT (R); CHOP BAR (CB); HOUSE (H);  
KIOSK/CONTAINER (KC); SUPERMARKET (SM)**

**COMMENTS:**

APPENDIX 8: QUESTIONNAIRE TO DOCUMENT FOODS FREQUENTLY  
PURCHASED BY PUPILS

**SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA**  
**DEPARTMENT OF POPULATION, FAMILY & REPRODUCTIVE HEALTH**  
**A STUDY TO ASSESS THE DETERMINANTS OF OBESITY AMONG BASIC SCHOOL PUPILS IN**  
**ACRRA**

1. Date of interview (dd/mm/yy): DATE \_\_\_/\_\_\_/\_\_\_
2. Name of school ..... School ID SCHID
3. Interception number:
4. Name of Respondent: .....
5. Age of Respondent (completed years):
6. Sex of respondent:      1. Male      2. Female
7. School Type:            1. Public      2. Private

**Codes for type of food:**

1. Soft drink    2. Sweetened drink    3. Pastry    4. Packaged snack    5. Local snack(dry)  
6. Local snack (fried)    7. Candy bar/ lollipop/sweets    8. Milk/ cocoa drink    9. Complete meal  
10. Ice cream    11. Fruits    12. Other (specify).....

Item name	Type	Amount (g)	Unit Cost (Ghc)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

## APPENDIX 9: PARENT CONSENT FORM – For child’s participation

### **Title: Determinants of obesity among basic school pupils in the Ga-East Municipality**

Principal Investigator: Deda Ogum Alangea (Mrs)

Address: Department of Population, Family and Reproductive Health, University of Ghana  
School of Public Health. P. O. Box LG 13. Legon, Accra.

#### **General Information about Research**

Your child has been selected to participate in a childhood obesity study. Childhood Obesity is a problem in most parts of the world including Ghana. When children become too heavy for their age and height, it is very likely to persist into adulthood. It also sets the stage for the onset of chronic diseases like diabetes, hypertension and other heart diseases. We currently do not know the extent of the problem here in Accra. We also do not have full understanding of the factors that contribute to unhealthy weights among children of school going age in Accra. This study will involve basic school children aged 9 – 15 years, their parents and schools (both private and public). This study seeks to find the proportion of basic school children who have unhealthy weights and identify the factors that may contribute to this problem. It is hoped that knowledge gained from this study will help us devise more appropriate ways to help the children eat healthily and have healthy body weight.

If you agree for your child to participate, we will take your child’s body weight and height measurements. We will also collect information on his/her eating habits and physical activity. Both body measurements and completion of questionnaires will take place in your child’s school. Your child will be involved in this study for just one day.

#### **Possible Risks and Discomforts**

There are no foreseeable risks associated with this study as procedures to be carried out are routine.

#### **Possible Benefits**

There will be no direct benefit of this study to your child. It is however, hoped participation will help generate information that will help researchers identify the factors that contribute to unhealthy weights among school-age children and develop ways to encourage healthy eating among children.

#### **Confidentiality**

All information collected from your child will be kept in strict confidence and be used for research purposes only. Subjects will not be identified by name during data entry and only study investigators will have access to your information. However, staff of the Institutional Review Board of the University of Ghana may request to look at his/ her research records. Your child’s identity will not be disclosed in any publication.

#### **Compensation**

Your child will be given results of his/ her body measurements and interpretation to bring home. In addition, your child will receive an exercise book and a pen for participating in the study.

#### **Additional Cost**

You will bear no cost for your child's participation in this study.

### **Voluntary Participation and Right to Leave the Research**

Participation in this study is completely voluntary. Your child is free to withdraw from the study at any time. You may also withdraw your child's participation in this study at anytime without any consequence to you or your child.

### **Contacts for Additional Information**

In case you have further questions regarding this study, please direct them to Deda Ogum Alangea (Mrs) on telephone numbers 0244-981024 and 0284981024. You may also call Prof. Richard Adanu on 0244238556 when necessary.

### **Your rights as a Participant**

This research has been reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB). If you have any questions about your rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email addresses: [nirb@noguchi.mimcom.org](mailto:nirb@noguchi.mimcom.org) or [HBaidoo@noguchi.mimcom.org](mailto:HBaidoo@noguchi.mimcom.org) . You may also contact the chairman, Rev. Dr. Ayete-Nyampong through mobile number 0208152360 when necessary.

## **VOLUNTEER AGREEMENT**

The above document describing the benefits, risks and procedures for the research title (*name of research*) has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

\_\_\_\_\_

Date

\_\_\_\_\_

Name and signature or mark of volunteer

### **If volunteers cannot read the form themselves, a witness must sign here:**

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

\_\_\_\_\_

Date

\_\_\_\_\_

Name and signature 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 10: PARENT CONSENT FORM**

### **Title: Determinants of obesity among basic school pupils in the Ga-East Municipality**

Principal Investigator: Deda Ogum Alangea (Mrs)

Address: Department of Population, Family and Reproductive Health, University of Ghana  
School of Public Health. P.O.Box LG 13. Legon, Accra.

### **General Information about Research**

Childhood Obesity is a problem in most parts of the world including Ghana. When children become too heavy for their age and height, it is very likely to persist into adulthood. It also sets the stage for the onset of chronic diseases like diabetes, hypertension and other heart diseases. We currently do not know the extent of the problem here in Accra. We also do not have full understanding of the factors that contribute to unhealthy weights among children of school going age in Accra. This study will involve basic school children aged 9 – 15 years, their parents and schools. This study seeks to find the proportion of basic school children who have unhealthy weights and identify the factors that may contribute to this problem. It is hoped that knowledge gained from this study will help us devise more appropriate ways to help the children eat healthily and have healthy weights.

If you agree to participate in this study, we will book an appointment with you and meet you at your ward's school. On the day of the study we will ask you some questions about you and concerning your household. We will also ask questions regarding the food environment in your home. Lastly, we will take your weight and height measurements and compare it with that of your ward. Your participation in this study will just be for one day (Less than one hour).

### **Possible Risks and Discomforts**

There are no foreseeable risks associated with participation in this study.

### **Possible Benefits**

Your participation in this study together with your ward will enable us gather enough information to better understand the factors that contribute to unhealthy weights among school-age children and how we can develop better approaches to prevent it by encouraging healthy eating.

### **Confidentiality**

All information collected from you and your child will be kept in strict confidence and be used for research purposes only. Subjects will not be identified by name during data entry and only study investigators will have access to your information. However, staff of the Institutional Review Board of the University of Ghana may request to look at your research records. Your identity will not be disclosed in any publication.

### **Compensation**

You will receive a copy and interpretation of your body measurements at the end of the study. There will be no other compensation for participation.

### **Additional Cost**

There is no cost to you for participating in this study.

### **Voluntary Participation and Right to Leave the Research**

Participation in this study is completely voluntary. You may withdraw from or leave the study at any point in time without any penalty

### **Contacts for Additional Information**

In case you have further questions regarding this study, please direct them to Deda Ogum Alangea (Mrs) on telephone numbers 0244-981024 and 0284981024. You may also call Prof. Richard Adanu on 0244238556 when necessary.

### **Your rights as a Participant**

This research has been reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB). If you have any questions about your rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email addresses: [nirb@noguchi.mimcom.org](mailto:nirb@noguchi.mimcom.org) or [HBaidoo@noguchi.mimcom.org](mailto:HBaidoo@noguchi.mimcom.org) . You may also contact the chairman, Rev. Dr. Ayete-Nyampong through mobile number 0208152360 when necessary.

### **VOLUNTEER AGREEMENT**

The above document describing the benefits, risks and procedures for the research title “Determinants of obesity among basic school pupils in the Ga-East Municipality” has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and signature or mark of volunteer

### **If volunteers cannot read the form themselves, a witness must sign here:**

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and signature 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 11: CHILD ASSENT FORM

### **TITLE: A STUDY TO ASSESS THE DETERMINANTS OF OBESITY AMONG BASIC SCHOOL PUPILS IN THE GA-EAST MUNICIPALITY**

#### **Introduction**

My name is Deda Ogum Alangea (Mrs.) and I am from the Department for Population, Family and Reproductive Health at the University Of Ghana School Of Public Health. I am conducting a research study entitled Determinants of obesity among basic school pupils in Accra. I am asking you to take part in this research study because I am trying to learn more about the things that contribute to unhealthy weights among basic school pupils aged 9 to 15 years. Unhealthy weights among children is a problem in most parts of the world including Ghana. We want to find ways to prevent it because it can lead to some future health problems, especially in adulthood. Your participation in this study will last for only one day.

#### **General Information**

If you agree to be in this study, you will be asked to give some information about you and your household, your eating habits and the foods and drinks you have taken over the past 7 days, your physical activity and how often you do certain things like watching television or playing video games. We will measure your height and let you stand on a weighing scale to measure your weight. The body measurements and answering of questions will take place in your school.

#### **Possible Benefits**

Your participation in this study will give us more information to help us understand some of the things that contribute to unhealthy weights among school-age children and how best we can prevent this. The results of your measurements will be given to you to take home and share with your parents. You will also be given an exercise book and a pen for participating in this study.

#### **Possible Risks and Discomforts**

There are no risks to you for participating in this study. You will also not miss any class, class test or examination when participating in this study.

#### **Voluntary Participation and Right to Leave the 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.

#### **Confidentiality**

Your information will be kept confidential. No one will be able to know how you responded to the questions and your information will be anonymous.

**Contacts for Additional Information**

You may ask me any questions about this study. You can call me at any time on 0244-981024 or 0284-981024 or talk to me the next time you see me.

Please talk about this study with your parents 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.

**VOLUNTARY AGREEMENT**

By making a mark or thumb printing 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. You and your parents will be given a copy of this form after you have signed it.

This assent form which describes the benefits, risks and procedures for the research titled *“Determinants of obesity among basic school pupils in the Ga-East Municipality”* 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.

**Child’s Name:.....****Researcher’s Name:.....****Child’s Mark/Thumbprint.....****Researcher’s Signature:.....****Date: .....****Date: .....**

## APPENDIX 12: SAMPLE MENU FROM PRIVATE SCHOOL CANTEENS

DAY OF WEEK	MEAL SERVED (ID# 1)
MONDAY	Plain cooked rice + tomato stew + fried fish
TUESDAY	Jollof rice + fried fish
WEDNESDAY	Waakye + fish/ egg/ chicken
THURSDAY	Jollof rice + fried fish
FRIDAY	Waakye + fried fish

DAY OF WEEK	MEAL SERVED (ID# 2)
MONDAY	Plain cooked rice + tomato stew + fried chicken
TUESDAY	Waakye + fried chicken
WEDNESDAY	Banku + okro soup + fish
THURSDAY	Jollof rice + fried sausage + egg
FRIDAY	Kenkey + fried fish

DAY OF WEEK	MEAL SERVED (ID# 3)
MONDAY	Plain cooked rice + tomato stew + fried chicken
TUESDAY	Waakye + boiled egg
WEDNESDAY	Banku + groundnut soup + fish
THURSDAY	Boiled yam + Kontomire stew + fried fish
FRIDAY	Jollof rice + fried fish + vegetables

DAY OF WEEK	MEAL SERVED (ID# 4)
MONDAY	Pasta + fried sausage or Plain cooked rice + tomato stew + sausage/corn beef
TUESDAY	Kenkey + fried fish
WEDNESDAY	Beans + Fried ripe plantain

THURSDAY	Boiled yam + garden egg stew + fried fish
FRIDAY	Banku + okro soup + meat or Plain cooked rice + tomato stew + corn beef

DAY OF WEEK	MEAL SERVED (ID# 5)
MONDAY	Jollof rice + fried egg
TUESDAY	Plain cooked rice + tomato stew + powdered fish
WEDNESDAY	Pasta + tomato stew + powdered fish
THURSDAY	Banku + groundnut soup/ palm soup + powdered fish
FRIDAY	Waakye + stew + powdered fish

DAY OF WEEK	MEAL SERVED (ID# 7)
MONDAY	Plain cooked rice + tomato stew + fried chicken
TUESDAY	Beans + Fried ripe plantain
WEDNESDAY	Boiled yam/ rice + kontomire stew + fried fish
THURSDAY	Banku + okro soup + meat/ wele
FRIDAY	Waakye + boiled egg

DAY OF WEEK	MEAL SERVED (ID# ID# 8) Pupils choose from sausage, meat, fish or egg
MONDAY	Jollof rice
TUESDAY	Plain cooked rice + tomato stew
WEDNESDAY	Boiled yam + kontomire stew
THURSDAY	Banku + okro + groundnut soup
FRIDAY	Waakye + vegetables
DAY OF WEEK	MEAL SERVED (ID# 11)
MONDAY	Banku + okro + groundnut soup + fried chicken <b>OR</b> Plain cooked rice +chicken
TUESDAY	Jollof rice + egg + vegetables

WEDNESDAY	fried rice + chicken
THURSDAY	Kenkey + fried fish OR Plain cooked rice +chicken
FRIDAY	Beans + Fried ripe plantain OR Fried yam + sausage

DAY OF WEEK	MEAL SERVED (ID# 12) all meals are served with fish or egg
MONDAY	Waakye OR Banku OR Jollof rice
TUESDAY	Plain rice OR Boiled yam + kontomire OR Banku + okro +groundnut soup + fish
WEDNESDAY	Fried rice + sausage OR Plain rice + chicken OR Waakye OR Banku + okro
THURSDAY	Jollof OR Banku OR Waakye OR Yam + Kontomire
FRIDAY	Fried rice OR Plain rice OR Waakye OR fried yam OR Banku

DAY OF WEEK	MEAL SERVED (ID# 22)
MONDAY	Plain cooked rice + tomato stew + fried chicken
TUESDAY	Banku + groundnut soup + meat/ fish OR Plain cooked rice + tomato stew
WEDNESDAY	Beans + Fried ripe plantain OR Plain cooked rice + tomato stew
THURSDAY	Banku + Pepper + fried fish
FRIDAY	Plain cooked rice + tomato stew + fried chicken/ sausage

DAY OF WEEK	MEAL SERVED (ID# 24) NB. Meals served with fish/ chicken/ egg
MONDAY	Jollof rice
TUESDAY	Waakye
WEDNESDAY	Plain cooked rice + tomato stew
THURSDAY	Banku + gravey + fried fish OR Jollof
FRIDAY	Waakye

## APPENDIX 13: LIST OF COMPLETE MEALS SOLD BY FOOD VENDORS IN PUBLIC SCHOOLS

1. **Taifa Community (ID#21)**  
 Fried egg + bread + oats/ milo  
 Indomie + fried sausage/ chicken  
 Kokonte + groundnut soup  
 Rice ball + groundnut soup  
 Jollof rice  
 Banku + okro stew + groundnut soup  
 Sobolo + cocoa drink  
 Bread + cocoa drink  
 Kenkey + okro stew or pepper  
 Waakye (3)  
 Fried yam + chicken/ sausage/ fish  
 Wheat porridge + milk + bread  
 Plain rice
2. **Abokobi (ID#6)**  
 Beans + fried ripe plantain  
 Plain rice + tomato stew + fish  
 'Lamuge' + bread  
 Fried yam + fried fish  
 Waakye + fish/ wele
3. **St. Dominic's R/C Prim (ID#23)**  
 Waakye+ egg/ fish/ wele/  
 Fried yam + fried chicken/ fish  
 Beans + fried ripe plantain  
 Tea/ milo + bread  
 Fried rice + chicken  
 Kenkey + fish + okro/ pepper  
 Banku + okro + fish
4. **Haatso calvary (ID#19)**  
 Waake + fish  
 Kenkey + fish  
 Fried yam + sausage
5. **Kwabenya-Atomic M/A (ID#17)**  
 Banku + okro  
 Kenkey + fish  
 Hausa koko + bread/ sweet ban/  
 Waakye
6. **Atomic Hills Estate (ID#16)**  
 Jollof  
 Waakye  
 Fried rice  
 Fried yam  
 Bread + fried egg  
 Ice kenkey + bread  
 Indomie noodles/ pasta + fried egg
7. **St. Joseph's Anglican (ID#15)**  
 Fried yam/ fried plantain + sausage +  
 chicken  
 Waakye  
 Plain rice  
 Banku + groundnut soup + okro +  
 chicken
8. **Pantang Hospital (ID#14)**  
 Kenkey + fish  
 Jollof + meat/ egg  
 Plain rice + meat/ egg  
 Fried yam + fish
9. **School Feeding Programme meals**  
 Jollof /Plain rice + tomato stew  
 Banku + okro/ groundnut soup  
 Waakye  
 Beans + fried ripe plantain

**NB: Meals served to pupils most often contained pieces of fish or were served with fired chicken sausages.**

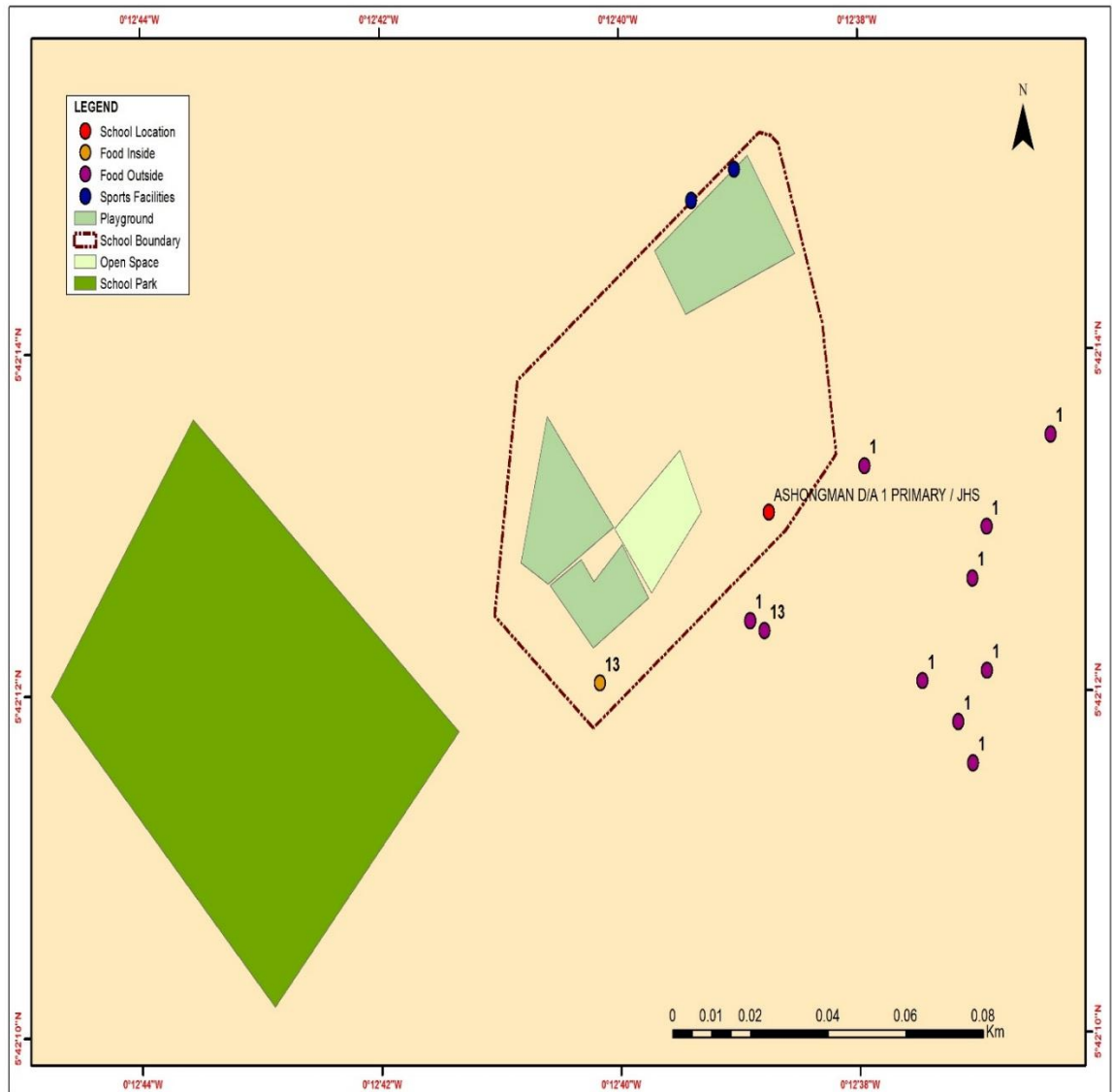
APPENDIX 14: ENERGY DENSITY OF FOODS FREQUENTLY PURCHASED BY PUPILS AT SCHOOL

food item	Energy density Kcal/g	typical portion size (g)	Cost (GhS)	Calories
<b>Sweetened beverages &amp; candies</b>				
asaana +milk	0.86	224	0.3	192.64
juicee	0.55	212	0.6	116.6
cocoa drink	0.1	161	0.3	16.17
skimmed milk ice cream (local)	0.36	118	0.2	42.598
sobolo/ hibiscus iced tea	0.37	80	0.2	29.6
new star drink/ u-fresh drink	0.42	80	0.1	33.68
ice cream (fanice)	0.81	94	0.7	76.14
soy milk	0.33	66	0.1	21.78
caramel candy	4.89	7	0.1	34.23
milk candy	4.19	18	0.2	75.42
mint toffee	3.45	5	0.05	17.25
<b>Snacks</b>				
cookies	4.46	12	0.3	53.52
chips (pastry)	4.96	56	0.4	277.76
crackers	4.76	16	0.1	76.16
digestive biscuit (lola)	3.19	15	0.05	47.85
cake doughnut	4.22	43	0.2	181.46
jack n jill biscuit	0.75	40	0.7	30
Jack n jill fun o biscuit	1.2	57	0.6	68.4
biscuit	3.95	27	0.1	106.65
Bourbon biscuit	4.46	41		182.86
milk shortcake biscuit	3.46	92	0.7	318.32
spring roll	1.78	37	0.2	65.86
bofrot	2.76	61	0.2	168.36
Atsomo	3.25	55	0.5	178.75
koose	2.77	22	0.2	60.94
meat pie	2.89	49	0.2	141.61
bread	2.75	51	0.2	140.25

APPENDIX 15: ENERGY DENSITY OF FOODS FREQUENTLY PURCHASED BY PUPILS AT SCHOOL – Cont'd

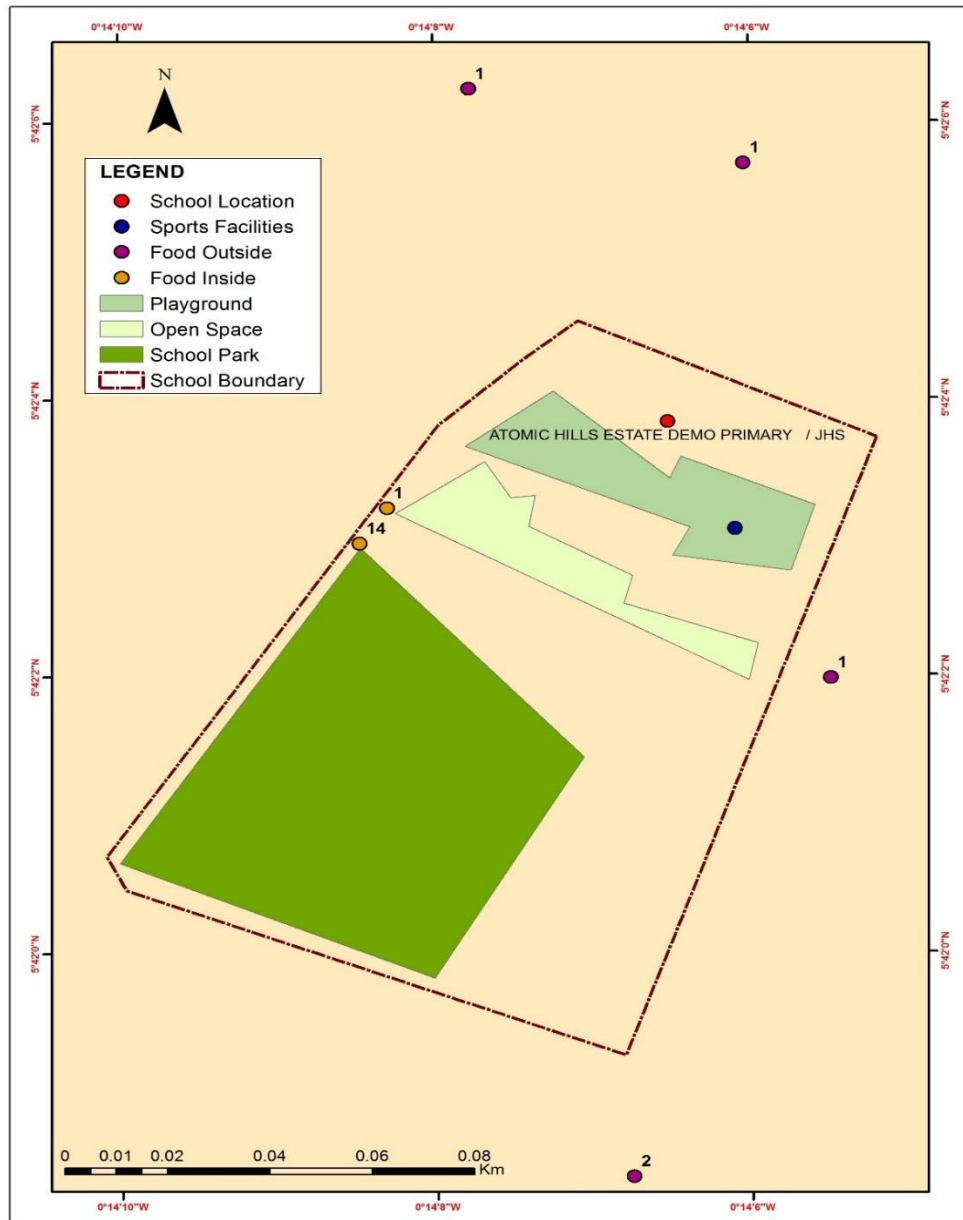
food item	Energy density Kcal/g	typical portion size (g)	Cost (GhS)	Calories
<b>Complete meals</b>				
Banku	1.08	179	0.3	193.32
banku (30p) + okro soup	0.86	365	0.3	315
beans and gari	2.28	336	0.3	766.08
tom brown porridge	0.47	182	0.3	85.722
waakye	1.3	208	0.5	270.4
wheat porridge	0.54	256	0.6	138.5
ga kenkey	1.24	119	0.3	147.56
groundnut soup (any 20p fish/food purchased)	1.17	408	0.2	477.36
hausa koko+ sugar	0.37	431	0.4	157.32
ice kenkey	0.49	247	0.4	120.78
indomie/ noodles	1.24	148	0.6	183.52
jollof rice	1.52	356	0.5	541.12
rice porridge + sugar+milk	0.58	476	0.5	276.08
riceball (20p) + groundnut soup	1.27	153	0.2	194.31
kokonte (20p) +groundnut soup	1.32	660	0.4	871.2
oats +sugar + milk	0.92	283	0.4	260.08
plain rice + stew	1.16	264	0.6	306.24
<b>Fried foods</b>				
fried chicken	2.82	14	0.2	39.48
fried chicken sausage	1.9	8	0.1	15.2
fried egg	1.57	48	0.4	75.13
fried fish	4.71	11	0.2	51.81
fried rice	1.59	276	1	438.84
fried ripe plantain	2.23	32	0.1	71.36
fried yam	2.37	39	0.3	92.43
plantain chips	5.2	17	0.2	88.4
<b>Fruits</b>				
banana	1.06	219	0.2	232.14
water melon	0.23	220	0.5	50.6
orange	0.47	167	0.1	78.49
pawpaw	0.35	173	0.5	60.55
pineapple	0.49	170	0.2	83.3
<b>Others</b>				
boiled egg	1.56	47	0.4	73.32
soya khebab	0.94	27	0.2	25.42
popcorn	5	48	0.4	240
roasted corn	2.64	32	0.2	84.48
roasted groundnut	5.88	10	0.1	58.8
roasted groundnut+ maize	4.26	64	0.3	272.64

APPENDIX 16: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A TYPICAL PUBLIC BASIC SCHOOL (WITHOUT A FENCE) LOCATED IN THE CENTER OF A COMMUNITY



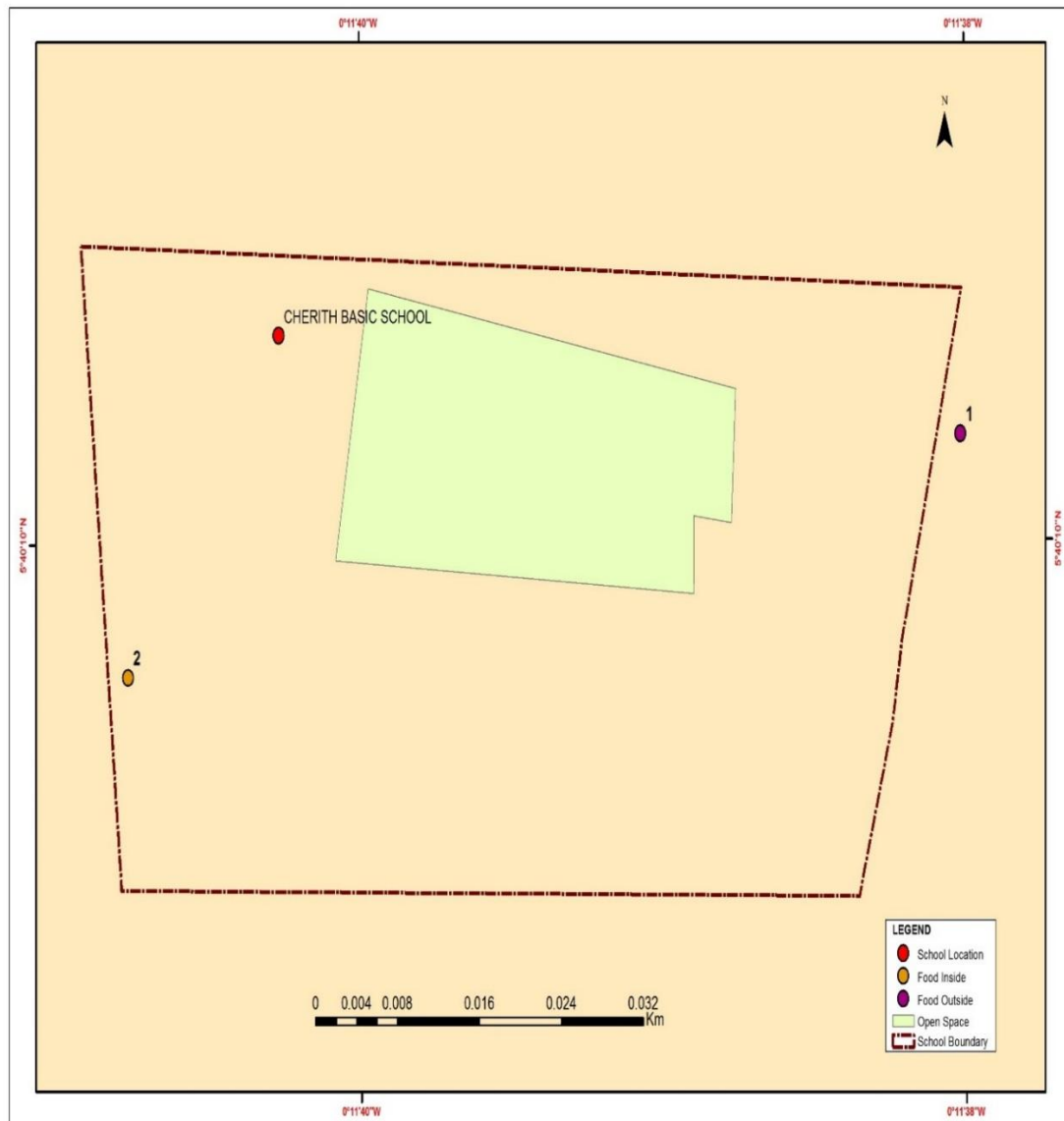
Notes: This school fell within the least category for healthfulness of food environment and in moderate category for physical activity environment. Soccer field used by pupils is owned by community and located outside school boundary. Food sale activities (mini-market) along school boundary is within a minute walk from classroom and impossible to restrict pupils from making purchases when classes were ongoing.

APPENDIX 17: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PUBLIC SCHOOL (WITHOUT A FENCE) LOCATED WITHIN A RESIDENTIAL ESTATE



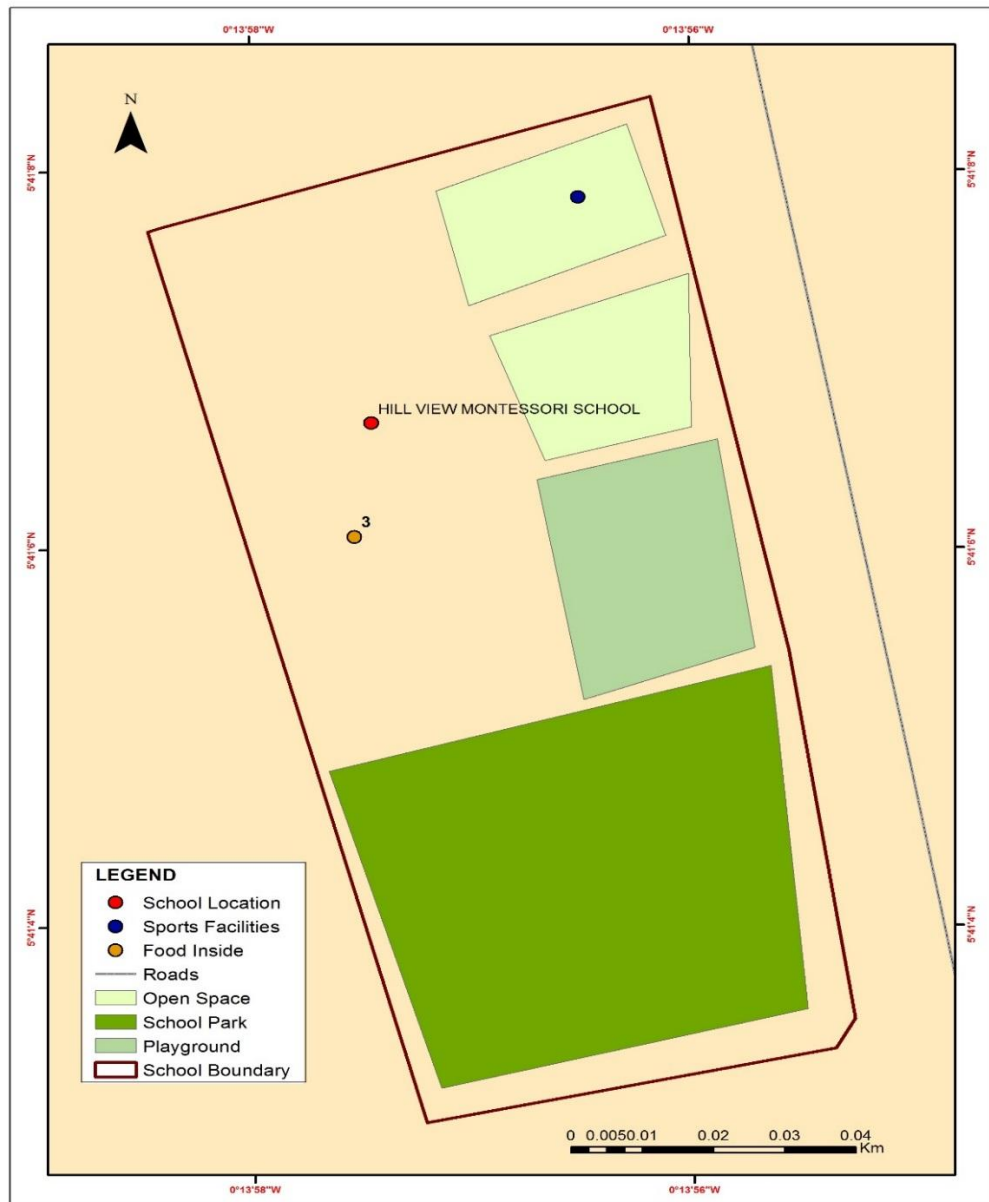
Notes: This school fell within the least category for healthfulness of food environment and in moderate category for physical activity environment

APPENDIX 18: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PRIVATE SCHOOL (FENCED) LOCATED WITHIN A RESIDENTIAL AREA



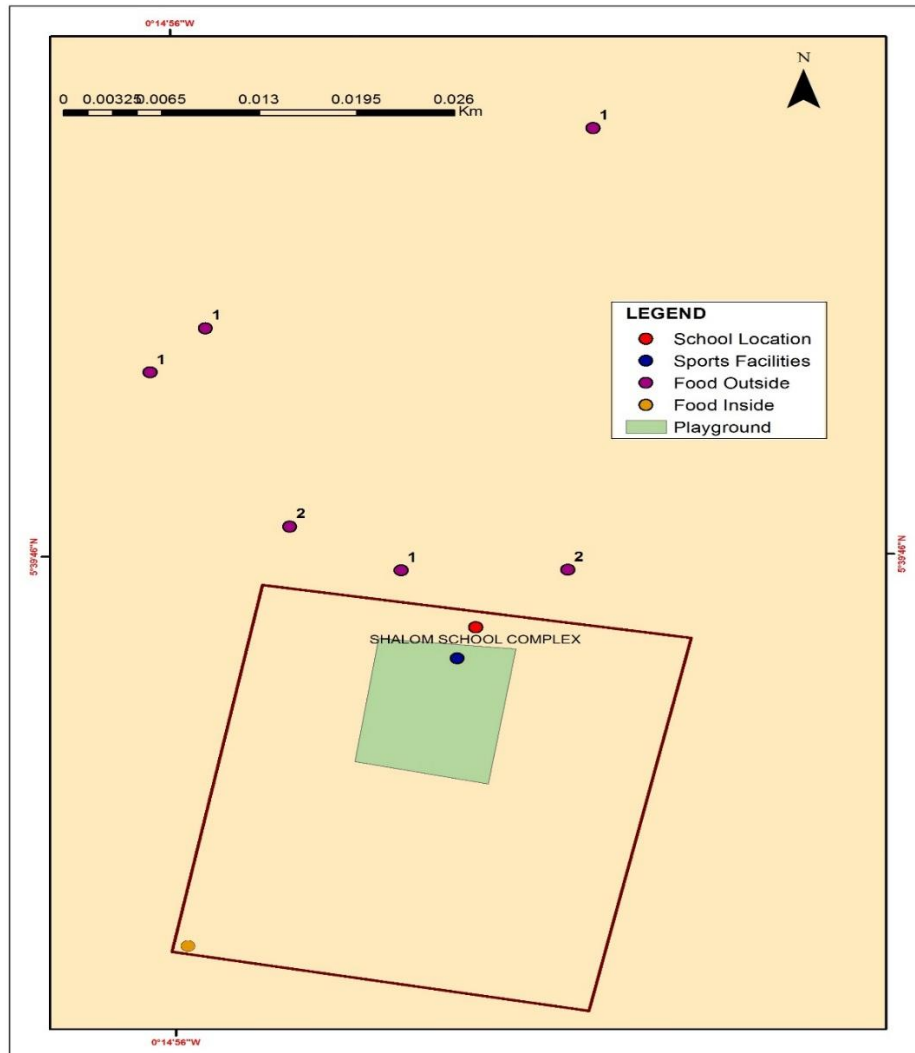
Notes: This school fell within the moderate category for healthfulness of both food physical activity environment. School scored high on physical activity-related policies although physical facility was lacking. Un-fixed sports equipment were available.

APPENDIX 19: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PRIVATE SCHOOL (FENCED) LOCATED WITHIN A RESIDENTIAL AREA



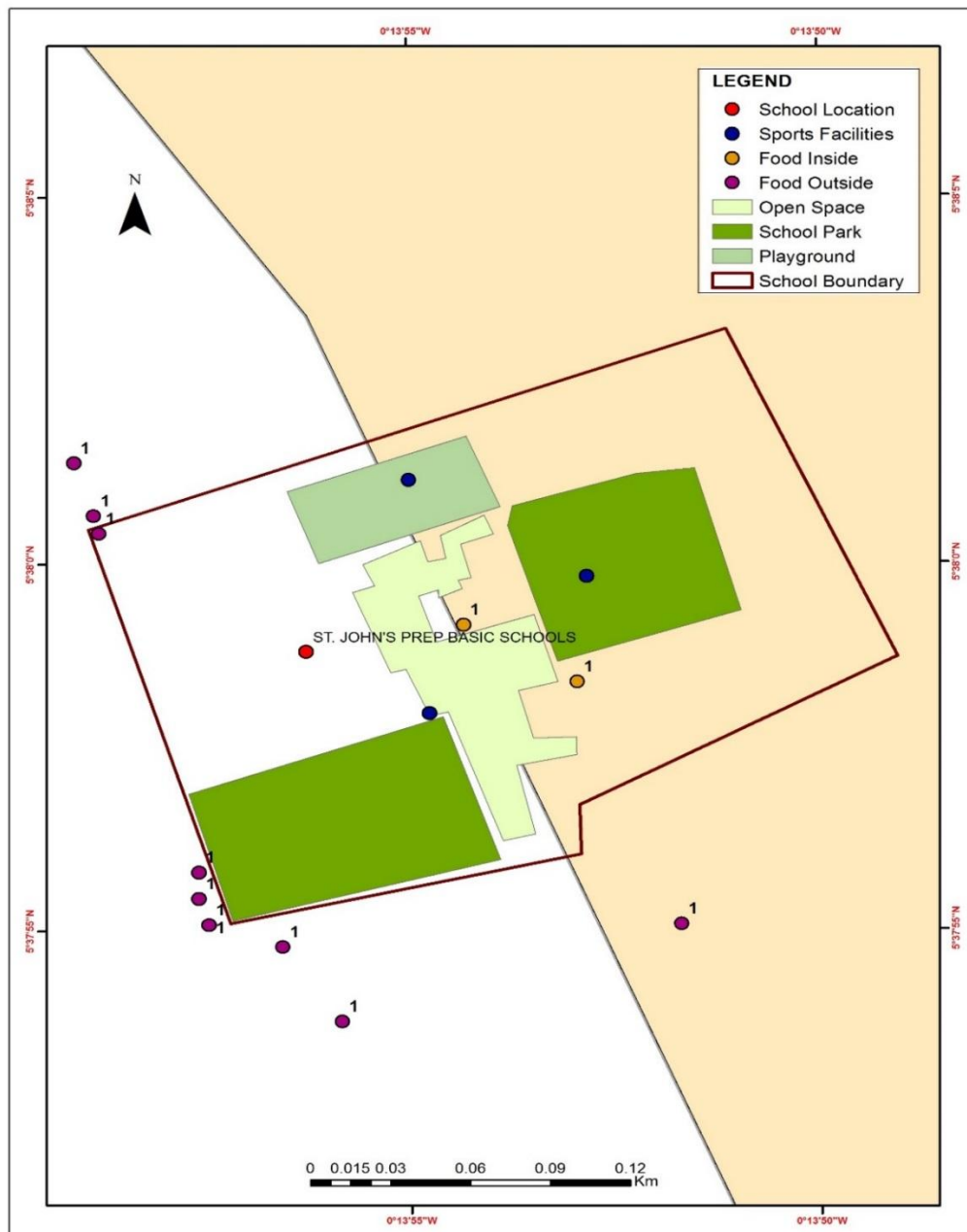
This school fell within the moderate category for healthfulness of both food physical activity environment. Un-fixed sports equipment were readily available for pupil use.

APPENDIX 20: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PRIVATE SCHOOL (FENCED) LOCATED WITHIN A RESIDENTIAL AREA



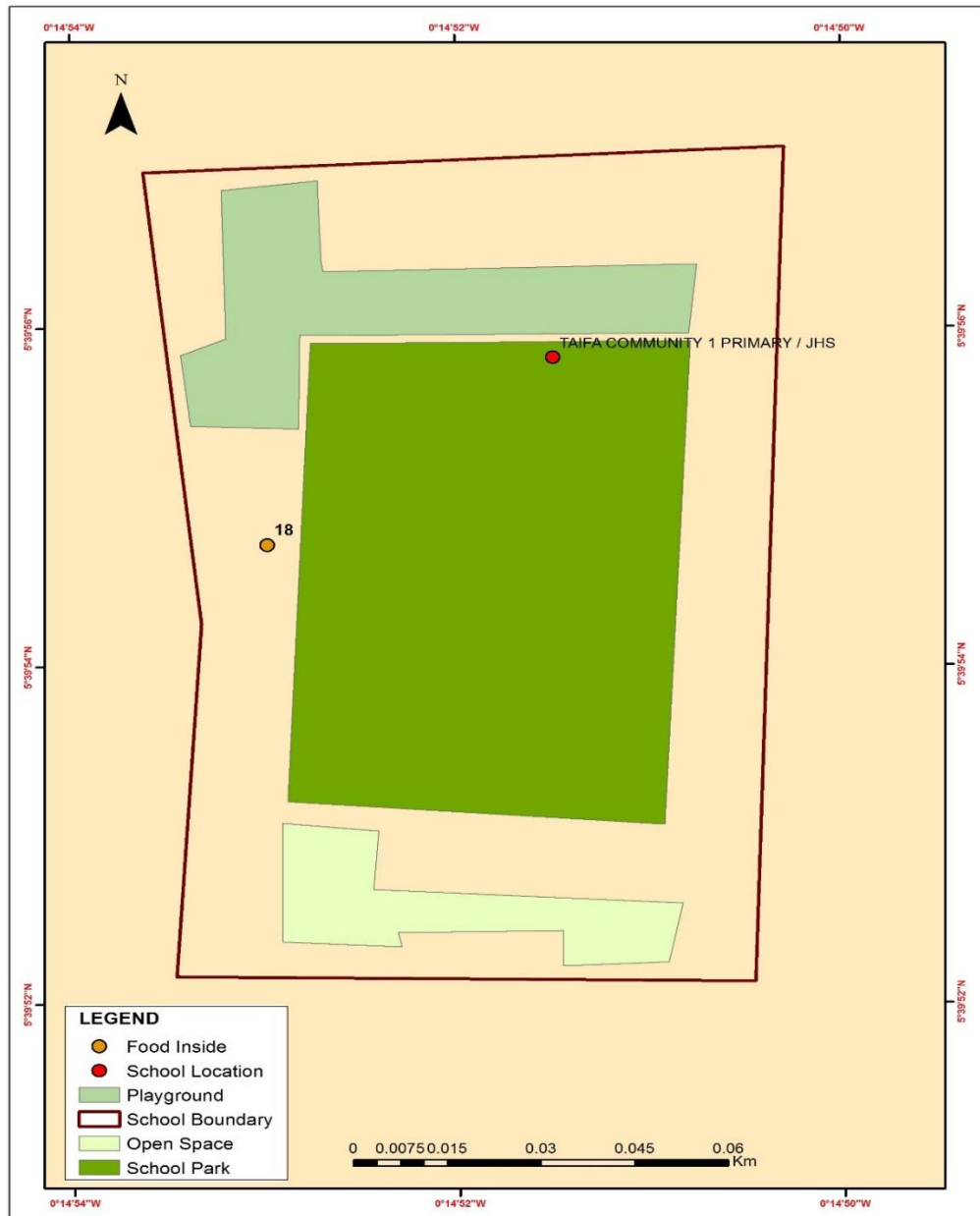
Notes: This school fell within the least category for healthfulness of food environment and in moderate category for physical activity environment. This school had the smallest available floor space with a fitted basketball post; however, pupils usually played on wide street in front of school. Un- fixed play equipment are made available for pupils use at recess.

APPENDIX 21: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PRIVATE SCHOOL (FENCED) LOCATED WITHIN A RESIDENTIAL AREA



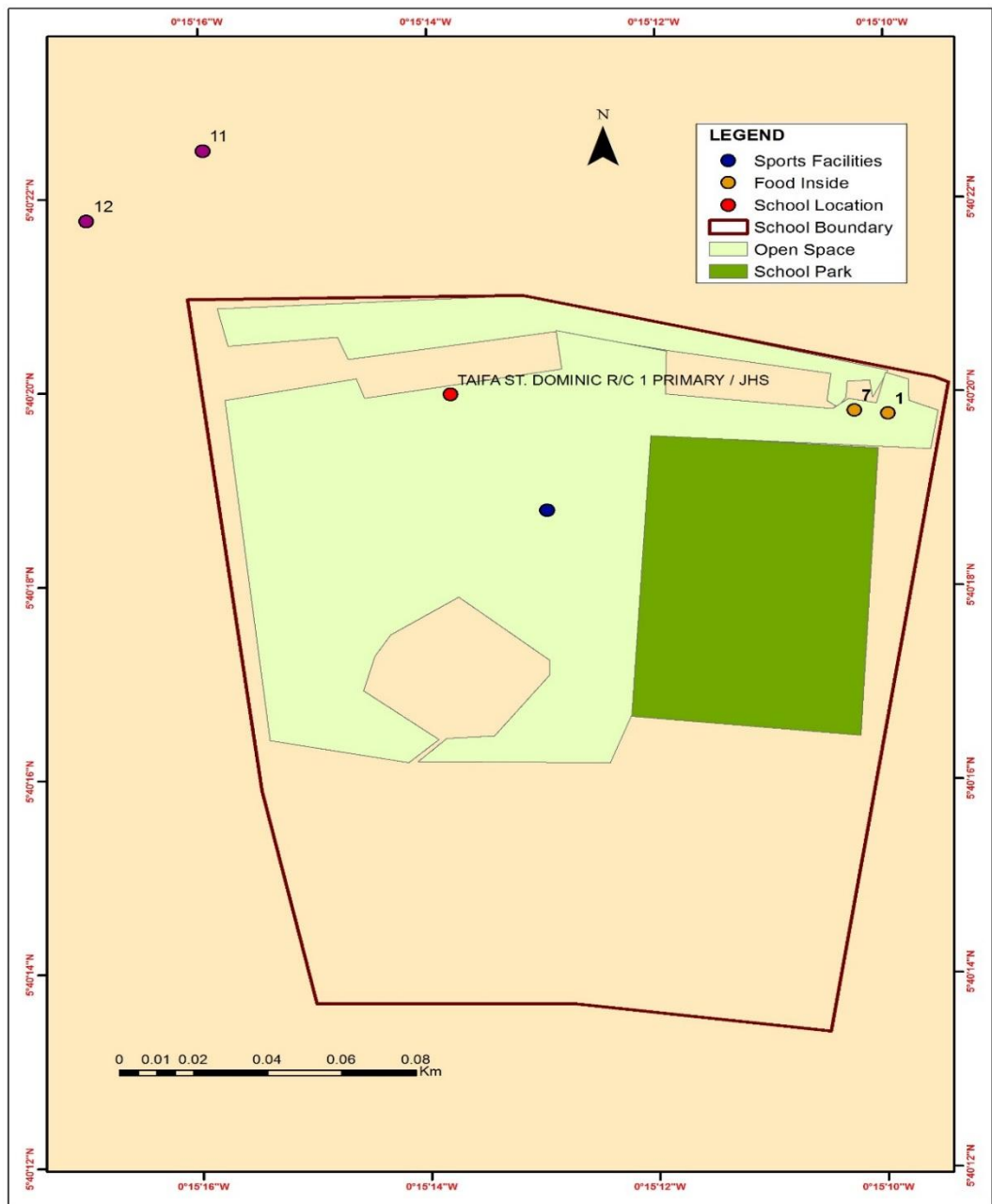
Notes: This school fell within the moderate category for healthfulness of food environment and in high category for physical activity environment.

APPENDIX 22: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PUBLIC SCHOOL (FENCE) LOCATED WITHIN A RESIDENTIAL ESTATE



Notes: This school fell within the least category for healthfulness of food environment and in moderate category for physical activity environment

### APPENDIX 23: MAP SHOWING FOOD AND PHYSICAL ACTIVITY ENVIRONMENTS OF A PUBLIC SCHOOL (FENCED)



Notes: This school fell within the moderate category for healthfulness of both food and physical activity environments. This school had wide spaces available for pupil use but lacked adequate fixed facility for physical activity.

## APPENDIX 24: ETHICAL CLEARANCE

**NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH**  
*Established 1979* *A Constituent of the College of Health Sciences*  
**University of Ghana**

Phone: +233-302-916438 (Direct)  
 +233-289-522574  
 Fax: +233-302-502182/513202  
 E-mail: [nirb@noguchi.mimcom.org](mailto:nirb@noguchi.mimcom.org)  
 Telex No: 2556 UGL GH

**INSTITUTIONAL REVIEW BOARD**

Post Office Box LG 581  
 Legon, Accra  
 Ghana

My Ref. No: DF.22  
 Your Ref. No:

4<sup>th</sup> July, 2012

**ETHICAL CLEARANCE**

**FEDERALWIDE ASSURANCE FWA 00001824**

**IRB 00001276**

**NMIMR-IRB CPN 102/11-12**

**IORG 0000908**

On 4<sup>th</sup> July, 2012, the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (IRB) at a full board meeting reviewed and approved your protocol titled:

**TITLE OF PROTOCOL** : **Determinants of obesity among school pupils in the Ga-East Municipality**

**PRINCIPAL INVESTIGATOR** : **Deda Ogum Alangea, Mrs (PhD Candidate)**

Please note that a final review report must be submitted to the Board at the completion of the study. Your research records may be audited at any time during or after the implementation.

Any modification of this research project must be submitted to the IRB for review and approval prior to implementation.

Please report all serious adverse events related to this study to NMIMR-IRB within seven days verbally and fourteen days in writing.

This certificate is valid till 3<sup>rd</sup> July, 2013. You are to submit annual reports for continuing review.

Signature of Chairman:   
 Rev. Dr. Samuel Ayete-Nyampong  
 (NMIMR – IRB, Chairman)

cc: Professor Alexander K. Nyarko  
 Director, Noguchi Memorial Institute  
 for Medical Research, University of Ghana, Legon