PREVALENCE AND DETERMINANTS OF OBESITY AMONG SCHOOL-AGED CHILDREN IN IBADAN, SOUTH WEST, NIGERIA

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B.Sc Biochemistry

(MATRIC NUMBER: 174488)

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IN PARTIAL FULFILMENT OF THE REQUIREMETNT FOR THE DEGREE OF

MATERS OF SCIENCE (EPIDEMIOLOGY)

UNIVERSITY OF IBADAN.

JANUARY, 2015

CERTIFICATION

This is to certify that this project titled Prevalence and determinants of obesity among school-aged children in Ibadan, Nigeria was carried out by Imhansoloeva Martins, an MSc student in the department of Epidemiology and Medical Statistics, under my supervision.

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DEDICATION

This work is dedicated to the Almighty God for His grace and unending love. To my wonderful parents and family. And to my mentors: Dr Adedotun Adetunji and Rev. Femi Otolorin.

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ABSTRACT

Background: Childhood obesity is associated with adverse health outcomes and ultimately lays a template for obesity and other non communicable diseases (NCDs) in later adulthood. In Sub-Saharan African region and other Low and Medium Income Countries (LMICs), over nutrition is rapidly swapping with under nutrition leading to a prevalence of overweight and obesity especially among children. Despite the teeming development of Ibadan, a growing city in South West Nigeria, there is dearth of data about the prevalence and risk factors for overweight/obesity among school aged children. Hence, this study provides valuable data to ascertain the current nutritional status among this population.

Aims and objectives: To estimate the prevalence of obesity and its associated risk factors among eligible school aged children in Ibadan metropolis.

Methodology: A cross-sectional study design was used to enroll 947 children and adolescents aged 8 to 19 years across randomly selected schools in five local government areas (3 urban and 2 semi-urban) within Ibadan metropolis, southern Nigeria. Using a modified questionnaire, information on the background and socioeconomic status of both children and their parents were obtained, while measurements of weight, height, and blood pressure (BP) were collected using standard methods. Overweight and obesity were defined according to 2007 WHO reference values for comparison. Children were classified into pre-high blood pressure (pre-HBP) and high blood pressure (HBP) using National High Blood Pressure Education Program Working Group on High Blood Pressure. Data analysis was done by descriptive statistics, chi-squared tests and binary logistic regression, with results interpreted at 5% level of statistical significance.

Results: Participants included 40.5% males and 59.5% females, with 54.0% from private schools while 66.4% attended schools in urban areas. Overall, the prevalence of overweight

obesity and combined overweight/obesity were 14.3%, 7.7% and 21.8% respectively. Overweight and obesity was highest among pre-teens (9 – 12 years) compared to older adolescents/teenagers (≥ 13 years) with highest estimates obtained for age 11 years. Females tended to be more overweight and obese (16.6% and 8.4%) compared to their male counterparts (11% and 6.30%), while children attending private schools and children from urban schools were significantly more overweight and obese ($p < 0.05$). The type of school attended, consumption of confectioneries and a desire to lose weight were statistically associated with overweight/obesity in children/adolescents at multivariate analysis. Children who attended private schools were about five times more likely to be overweight/obese (*OR*: 4.65; *95% CI:* 0.09 – 0.50), while children who consumed confectioneries at least once a day had about 5 times odds of being overweight/obese (*OR*: 5.36; *95% CI*: 1.69 - 16.97). The prevalence of high blood pressure (HBP) was 12.0%, while 16.7% of the study participants were pre-hypertensive (pre-HBP). The mean systolic and diastolic blood pressures were 112.29 ± 12.95 mmHg and 66.66 ± 12.95 mmHg respectively. BMI was also positively correlated with systolic blood pressure.

Conclusion: Findings from this study provides evidence of an increasing prevalence of both overweight and obesity among school aged children in growing cities across Nigeria, intervention efforts are needed focusing on dietary pattern particularly among children attending private schools to curb this menace.

Keywords: Child obesity, school age, risk factors, NCDs

Word count: 496

ACRONYMS

BMI	Body Mass Index
HBP	High blood pressure
IOTF	International Obesity Task Force
LMICs	Low and Medium Income Countries
LMS	Least Mean Square
MDGs	Millennium Development Goals
NCDS	Non Communicable Diseases
NCHS	National Centre for Health Statistics
SASSO	South African Society for the Study of Obesity
SPAN	School Physical Activity and Nutrition questionnaire
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture
WHO	World Health Organization

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CHAPTER ONE

INTRODUCTION

1.1. STUDY BACKGROUND

Obesity is a major risk factor for a wide range of non-communicable diseases (NCDs) including diabetes, hypertension, heart disease and cancer. Globally, 44% of diabetes burden, 23% of ischemic heart disease burden and more than 40% of certain cancer burdens are attributable to overweight and obesity (WHO, 2009). According to the report of the International Obesity Task Force (IOTF), about 10% of the young people aged 5–17 years globally were overweight; among whom 2–3% was obese in 2004 (Lobstein *et al.* 2004).

In Sub-Saharan Africa, there is a high burden of both infectious and NCDs. While the burden of communicable disease like HIV and TB is quite substantial, the prevalence of the leading NCDs--cardiovascular, cancer, diabetes and chronic respiratory disease NCDs is gradually reaching epidemic proportions. The WHO global burden of NCDs 2008 (WHO, 2008) has reported that 28% of all deaths in the Africa region were due to NCDs and also suggested that NCD mortality rate was highest in the region(779 deaths per 100,000 persons) compared to other well developed regions. This double burden of both infectious and NCDs has seriously undermined the attainment of Millennium Development Goals (MDGs) in this region particularly the areas of maternal health, pregnancy outcomes and child survival (de Onis *et al.* 2010).

The role of obesity in adults has been implicated in the actilogy of most NCDs. Recent findings suggest that the risk of adult obesity is associated with obesity during childhood and adolescence, with 50% to 75% of adult obesity shown to originate from juvenile obesity (Moon

S.I. 1996). The World Health Organization reported that prevalence of childhood overweight and obesity in Africa was 8.5% in 2010 and projected at 12.7% by 2020 (Charney *et al*. 1976). Several studies across Africa also shows that prevalence is highest in rapidly growing urban cities such as Dar es Salaam-Tanzania (5.2%), Kumasi-Ghana (10.9%) and Cape town-South Africa (4%) [Muhihi *et al* (2013); Mohammed and Vuvor (2012); Shisana *et al* (2013)].

In Nigeria, finding from several studies conducted among school age children in major urban cities suggests a rapid increase in prevalence of overweight and obesity with estimates ranging between 5.2% to 9.4% [Senbanjo and Adejuyigbe (2007); Omuemu and Omuemu, (2010); Oduwole *et al* (2012)], while "risk of overweight" is between 3.7% - 13.7%[Senbanjo and Adejuyigb (2007); Ben-Bassey *et al* 2007]. A recent survey conducted among school children in Nigeria however, shows that prevalence in four major urban cities of Port Harcourt, Aba, Nsukka and Lagos were 0.4%, 0.9%, 2.3%, and 10.2% respectively (Ene-Obong and Ibeanu, 2012).

Hence, as many developing countries including Nigeria grapple with epidemiological, nutritional and health transition, there is need for proactive and practical strategies to urgently address this menace which has a potential of seriously overstretching the already fragile health systems. This study therefore seeks to ascertain the magnitude of overweight/obesity among school age children in a semi-urban setting using definitions based on the recent WHO growth reference values and to ascertain the behavioral and lifestyle risk factors.

1.2. PROBLEM STATEMENT

While several obesity studies have concentrated on adults, especially reproductive age women and under five pre-schoolers, there is however, paucity of data exploring the intricacies of childhood obesity particularly among school age children and adolescents. Several obesity studies have also mainly been conducted among high income groups/urban dwellers with only a few conducted in growing cities like Ibadan with mixed socio economic distribution. The only recent study available exploring the prevalence of overweight and obesity among school aged children in Ibadan was conducted more than five years ago. Children whose parents are fro high socio economic class are generally considered as being at higher risk of obesity, compared to their other counterparts. Unfortunately, recent studies indicates that the increase in prevalence of overweight and obesity cuts across both rural-urban divide as well as socio economic class, thus indicating the need for a holistic approach in curbing this menace. While estimates are available for larger cities in Nigeria, only a few studies have been carried out among middle income group/semi-urban centers. Hence by exploring the prevalence of overweight and obesity within the context of a rapidly growing city and by extension a highly changing socio economic group. this study proposes to add to the body of knowledge regarding the rising epidemic of childhood obesity by exploring the various psychosocial and biologic factors associated with the rising prevalence among both urban and semi-urban school age children using Ibadan metropolis as a case study. It is hoped that results from this study can guide implementation of intervention programmes to curb this menace.

1.3. JUSTIFCATION OF STUDY

Obesity is a growing problem in Sub-Saharan Africa and Nigeria in particular. With a gradual rise in prevalence resulting from the rapid economic development, the World Health Organization has estimated that in the African Region, NCDs will increase by over 20%, causing around 3.9 million deaths by the year 2020 (WHO, 2008). This rising trend has a serious health implication for the children as obesity in childhood has been shown to be strongly associated with several psychosocial problems, mental accruity and academic performance. This is further aggravated by an increase in the use of energy-saving devices, the availability of cheap high-calorie dense foods and limited participation in physical activity at home and at school. This nutritional and physical activity transition currently taking place in most urban cities is complicated by socio cultural beliefs in which obesity and overweight are admired traits and seen as a sign of wealth, prestige and the 'good life'. This growing epidemic therefore needs to be addressed in the middle class and affluent urban/semi-urban areas.

1.4. RESEARCH QUESTIONS

The research questions that will guide the conduct of this study are:

1. What is the prevalence of overweight and obesity among school age children in Ibadan?
2. What are the predominant dietary patterns and level of physical activities among children attending private and public schools in Ibadan?
3. What are the lifestyle differences between public and private school-aged children?
4. What is the level of knowledge and attitude towards practice of healthy diet and physical activity?

5. What is the relationship between parental socio-demographics and prevalence of obesity in childhood?

1.5. STUDY OBJECTIVES

Broad Objective: To determine the magnitude and explore the determinants of overweight/obesity and related risks for NCDs among in-school children in Ibadan, Nigeria.

Specific Objectives:

1) To estimate the prevalence of overweight/obesity among school age children in Ibadan Metropolis.
2) To determine the risk factors of overweight/obesity among school age children
3) To determine the blood pressure profile of school aged children and its correlation with their BMI.
4) To assess the level of knowledge and attitude towards body weight in school age children
5) To evaluate the relationship between various socio-demographic factors and obesity

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

Overweight and obesity, represents a threat to the health of populations, particularly in sub-Saharan Africa. The World Health Organization (WHO) has recognized obesity as a disease which is prevalent in both developed and developing countries, affecting adults and children alike. With an estimated 1.5 billion people overweight worldwide, millions of people are at risk of developing obesity-associated co-morbid diseases (WHO, 2008).

In recent times, this growing burden of obesity has replaced the more traditional public health concerns including under-nutrition and infectious diseases, thus implicated as a major risk factor for several NCDs causing an estimated 36 million deaths annually with 9 million deaths occurring before the age of 60. These deaths have also been shown to occur mainly in developing countries and especially in those with economies in transition, the poorest and vulnerable groups [Williams *et al*, (2009); NHBP Education Program, (2004)]

Most developing countries particularly sub-Saharan Africa is now disproportionately burdened with both communicable and non communicable diseases. Before now, these regions battled with the problem of maternal--child health and infectious diseases, with little focus on NCDs. However, with recent warnings issued recently by the World Health Organization (WHO) about the escalating pandemic of overweight and obesity, these regions are beginning to wake up to the realities of the heavy burden posed by these diseases.

Until recently, very little attention has been given to adolescent nutrition in developing countries, even though approximately a quarter of the population falls into this age group (Kurz & Johnson-

Welch, 1994; Kurz, 1996; Allen & Gillespie, 2001; Cordeiro *et al.*, 2006). In these countries including Nigeria, the focus of adolescents' health has primarily been on reproductive and sexual health to the exclusion of nutrition (Kurz, 1996).

Adolescence is the only period following birth when the relatively uniform growth of childhood increases in velocity (Spear, 1996). Furthermore, in several developing countries such as Nigeria, 20% of females are married by age 15 and over a half (52.7%) by age 20 (National Population Commission, 2000), increasing their nutritional demands and exposing them to additional risks and dire health consequences (Cordeiro *et al.*, 2006).

According to Tanner (1998), who coined the phrase 'growth as a mirror of the conditions of society', the growth and development of children and adolescents have been described as consistent indicators of the health and nutrition of the society in which they live.

With much long term effort still required, strategies that take account of both these important nutritional problems will need to be developed, particularly when dealing with children and adolescents.

2.2. DEFINITION OF OBESITY

Obesity has been defined simply as a condition of abnormal or excess body fat accumulation in adipose tissue to an extent that impairs physical as well as psychosocial health and well-being (Hoelscher *et al.* 2003). The degree of excess fat, its distribution and the associated health consequences vary considerably between obese individuals.

It has been shown that the critical periods for the development of Obesity are infancy, early childhood and adolescence (Lobstein T *et al.* 2004). Several studies [Cole *et al.* (2000), IOTF (2003); Smith *et al.* (2005)] have also shown that overweight and obese children are three times

more likely to develop obesity in adulthood compared to their none obese counterparts. This shows that the template for obesity in later adulthood is laid during early childhood.

Obesity results from the interaction of genetic susceptibility factors and modifiable environmental factors, with genetic variations influencing a person's susceptibility to environmental factors (Popkin. 2006).

We still have a remarkably weak global database for truly understanding these changes. Few countries put energy into monitoring or studying these dynamics at the national or regional level. Extensive documentation on micronutrient deficiencies and protein-energy malnutrition is available; however, remarkably little data exists about large-scale dietary and physical activity patterns, despite evidence that there are more overweight or obese than underweight or malnourished persons in the world; this disparity is growing rapidly.

2.3. EPIDEMIOLOGY OF CHILDHOOD OBESITY

Obesity is now recognized as a chronic disease, with approximately half of the world's adult population being affected by either overweight or obesity (i.e. body mass index (BMI) > 25 or 30 respectively). The World Health Organisation (WHO) recently issued a warning statement that immediate action is required to stem the escalating pandemic of overweight and obesity (Adediran *et al, 2012*). The worldwide prevalence, shows that about 1.5 billion people are overweight, with several millions at risk of developing obesity-associated co-morbid diseases(WHO. Press Release. 1997). The American Surgeon General report 2001, says that "overweight and obesity may soon cause as much preventable disease and death as cigarette smoking" (Sheperd and Dennison. 1996).

In children and adolescents, the prevalence of overweight and obesity follows a similar pattern of those of adults. Studies have shown the coexistence of under nutrition and over

nutrition, the latter manifesting as overweight and obesity. The coexistence of these conditions often referred to as the "double-burden of malnutrition," is the concurrent existence of under nutrition and stunting among young children and overweight and obesity among older children, adolescents, and adults within the same population [Senbanjo and Adejuyigbe (2007); Omuemu and Omuemu, (2010); Oduwole *et al* (2012)].

According to Caulfield *et al* (2004), childhood malnutrition diminishes adult intellectual ability and work capacity, causing economic hardship for individuals and their families. It also leads to poor school readiness and performance, resulting in fewer years of schooling, reduced productivity, and early childbearing. Early malnutrition also increases the risk of numerous chronic diseases later, leading to high adult healthcare costs.

Childhood and adolescence are critical periods for the development of obesity associated with the imbalance between energy consumed and expended through physical activity [14]. However, there are relatively few large-scale reports from developing countries on the prevalence of overweight and obesity among children and adolescents.

Hence identifying environmental and behavioural factors that contribute to weight gain is particularly paramount in curbing this menace.

2.3.1. Global Prevalence and Secular Trend in Obesity in Children

Evidence suggests that the prevalence of overweight and obesity in increasing at an alarming rate globally. This trend has also been shown to affect both adults and children in developed and developing countries. Hence estimating the prevalence and secular trend of overweight and obesity worldwide is important.

The calculated global prevalence of overweight (including obesity) in children and adolescents 5 to 17 years of age was estimated by the International Obesity Task Force (IOTF) to be 10% (Lobstein T *et al.* 2004)..

Wang and Lobstein (Wang and Lobstin, 2006) who also reviewed world trends in childhood obesity in 25 countries for the school-aged population and in 42 countries for the preschool population, observed that the prevalence of childhood overweight had increased in almost all countries for which data were available. These dramatic increases in overweight and obesity have been attributed to the nutritional transition: a departure from a traditional diet toward a Western diet with high intakes of saturated fat, sugar, and refined carbohydrates and low fiber intake, together with a sedentary lifestyle due to urbanization and technological advances [UN SC Nutrition, (2006); Popkin, (2006)].

The knowledge about the levels and changing distribution of overweight and obesity is important and useful for identifying populations at particular risk of obesity and its associated health and economic consequences, help policy makers and public health planners in the mobilization and reallocation of resources for the control of the disease and help provide baseline data for monitoring the effectiveness of national programs for the control of obesity.

2.3.2. Prevalence in Sub-Saharan Africa

In Sub-Saharan African, like most developing countries, obesity co-exists with under-nutrition. Obesity is however more prevalent in urban populations compared to those in rural settings and in economically advanced regions, prevalence rates may be as high as those obtainable in industrialized countries.

Cole et al. (Cole *et al*, 2000) and the IOTF (Lobstein T *et al*, 2004) has also showed the prevalence of obesity and overweight to be 0.1% and 1.2% for males and 0.3% and 1.4% for females 5 to 17 years old, respectively.

More studies from other African nations also shows an increasing trend in the prevalence of overweight and obese in rapidly growing urban cities such as Dar es Salaam-Tanzania (5.2%), Kumasi-Ghana (10.9%) and Cape town-South Africa (4%) [Muhihi *et al* (2013); Mohammed and Vuvor (2012); Shisana *et al* (2013)].

In rural settings, children living traditionally gained little or no weight with age until relatively recently. With the rise in socioeconomic status and increasing changes due to rapid urbanization, the prevalence of obesity may rise markedly to levels exceeding those in populations in industrialized countries. Childhood obesity is a reality and is already showing signs in Africa as a result of the nutrition and physical activity transition.

With this in mind and based on evidence and good practice, Africans need to be proactive and come up with practical strategies to address the problem of childhood obesity and overweight in the region.

2.3.3. Prevalence childhood obesity in Nigeria

The documentation of the geographical distribution and manifestations of undernutrition and overnutrition of macronutrients and micronutrients in Nigeria have been provided in national nutrition surveys conducted with supports and collaborations of USAID, UNICEF, USDA, PEPFAR, UNFPA and World Bank from 2001 to 2008. The Child Stunting and wasting which also have similar impact in leading to non-communicable diseases later, as well as overweight

and obesity in children and women are prominent features in these reports The National Health Demographic Survey and International Institute of Tropical Agriculture Ibadan study (Maziya – Dixon, 2004) have been documented.

Owa and Adejuyigbe (Owa and Adejuyigbe, 1997) found that 18% of children and adolescents aged 5 to 15 years old from a relatively privileged section of Nigerian society were obese; while studies conducted among public secondary school children in Ajaokuta Mid-Western Nigeria found That 17.28% were obese, and was higher in males (24.60%) compared to females (6.37%). Results from the aforementioned studies were however based on CDC's growth reference which has long been replaced with the more robust WHO growth reference.

Recent studies based on WHO growth reference standard for estimating nutritional status has been carried out in Nigeria. A similar study conducted among school children in Ibadan, showed that 2.3% of the adolescents studied were overweight, and were significantly more likely to be females, in private school and in post-pubertal developmental stages (Omigbodun *et al, 2010*).

A cross-sectional study of 1,599 children and adolescents conducted in four urban Nigerian towns (Lagos, Port Harcourt, Nsukka, and Aba), showed that the prevalence of overweight and obesity were 11.4% and 2.8% respectively, while females (3.7%) than males (1.8%) were obese (Ene-Obong *et al*, 2012). The prevalence of overweight was also higher among adolescents 10 to 18 years of age than among children 5 to 9 years of age and was highest (at age 15 years

These studies therefore, shows an increasing trend in the prevalence of overweight and obesity among children particularly in urban and semi-urban cities and towns.

2.4. CLASSIFICATION OF OBESITY IN CHILDREN

Obesity in children and adolescents has been largely difficult to classify. This is due to the fact that both height and body composition are continually changing, and these changes often occur at different rates and times, thus making universal indices of adiposity of little value. This is further complicated by differences in ages of onset of puberty and inter-individual rate of fat accumulation among children from different countries thus, making same level of agreements reached for classifying adult obesity difficult in the case of children and adolescents.

Graded classification of overweight and obesity is valuable for meaningful comparism of weight status within and between populations; the identification of priorities for intervention at individual and community levels; and serves as a firm basis for evaluating interventions.

Several methods have however been put forward to classify obesity in children. They include:

I. **Use of growth chart:**

Many countries have produced reference charts for growth based on weight for age and height for age. However, these measures are a collection of the child's size and provide no indication of relative fatness. The close correlation between height and weight during childhood means that an index of weight adjusted for height can provide a simple measure of fatness.

II. **Body Mass Index (BMI) for Age reference curve:**

While adult BMI increases very slowly with age, so that age-independent cut-off points can be used to grade fatness, in children however, BMI changes substantially with age, rising steeply with infancy, falling during the pre-school years, and then rising again into

adulthood. This has made the use of BMI to assess obesity in children largely unreliable, as differences exist in growth rate among different populations. Several countries have however, produced individual country based growth reference curves. Recent examples include BMI-for-age charts developed for Swedish, British and Italian children (REF) using the least mean square (LMS) method by Cole (REF). This method adjusts BMI distribution for skewness and allows BMI of individual subjects to be expressed as an exact centile or standard deviation score. The use of BMI-for-age is currently being explored, in parallel with other potential techniques, by an expert working group in order to determine the best method for classifying overweight and obesity in childhood. A common standard should allow the comparative evaluation of childhood obesity internationally. (REF), many of these charts are however imperfect either because the data are old or the age range is restricted.

III. International childhood reference population:

The most widely used growth reference, which WHO has recommended for international use since the late 1970s (REF) was developed by the US National Centre for Health Statistics (NCHS). However, a WHO Expert Committee (REF) recently drew attention to a number of serious technical and biological problems with the growth reference. The WHO therefore undertook the development of a new growth reference for infants and children above 5 years to 19 years. This was based on a sample of infants and children from different parts of the world whose caregivers follow internationally recognized health recommendations.

2.5. MAJOR RISK FACTORS FOR OBESITY IN CHILDREN/ADOLESCENTS

A risk factor is defined as an attribute, characteristic or exposure of an individual which increases the likelihood of developing a disease or injury. Risk factors are either non-modifiable such as genetic endowment, race, age and sex or are modifiable by behavioural or other interventions such as changing diet, use of exercise and reduction of tobacco and alcohol use. Historical data suggest that the risk for overweight is primarily influenced by 2 factors;

- **Age of child:** Overweight in 0- to 5-year olds is only minimally predictive of adult overweight; less than half of overweight pre-pubertal children have become overweight adults, whereas as many as 70% to 80% of overweight teens have become overweight adults.
- **Parental weight:** children with overweight parents, regardless of child's weight, are at increased risk of becoming overweight adults. While obesity is considered as a disease in its own right, it is also recognized as a risk factor for several NCDs.

The exposure of people to risk factors of unhealthy diets, physical inactivity, undue stress and pressure, are also major determinants of obesity in children.

2.5.1. Dietary factors

Dietary factors include the energy balance is affected by macronutrient composition the diet as well as the eating behaviors.

In most developing countries, diet is a big risk factor for obesity among children and adolescents, this manifests with increased consumption of unhealthy foods which include refined foods high in fat and simple sugars and low in plant fibre. This is largely driven by the nutritional transition which is a type of malnutrition ensuing from dietary shifts to foods rich in added sugar, saturated

fat and sodium for foods rich in vitamins, fibre, minerals and micronutrients such as fruits, vegetables and whole grains. Fatty food due to the pleasant mouth-feel when eaten, have been known to have a stimulatory effect on energy intake (). Although the body compensates tor the overconsumption of energy from high fat foods, the fat-induced appetite control signals are thought to be not strong enough, or too delayed to prevent the rapid intake of the energy from a fatty meal. On the other hand, sweetened foods which have a high fat content are expected to be conducive to excess energy consumption since palatability is enhanced by both sweetness and mouth-feel, and fat has only a small suppression effect on appetite and intake. Hence, fat appears to be the key macronutrient which undermines the body' s weight regulatory systems since it is very poorly regulated at the level of both consumption and oxidation (WHO Consultation on obesity. 1998).

The globalization of soft drinks culture (cocacolonisation) as articulated by Zimmet (2007) with excessive. persistent consumption of sugary drinks (dietary fructose) has also contributed to observed prevalence of obesity. Nigerian soft drinks for example have been shown to be high in sucrose and fructose (Onyemelukwe *et al*, 2006) which are much higher than the brands in South Africa (Vanderhorst *et al*, 1984).

Soft drinks	Sugar (g/100ml)			Total
	Glucose	Sucrose	Fructose	
Cocacola	0.22	1.31	0.67	2.2
Fanta	0.42	1.20	0.70	2.32
Sprite	0.20	0.68	0.60	1.48
Pepsicola	0.17	0.81	0.58	1.56
Mirinda	0.22	0.95	0.54	1.71
Maltina	0.22	1.13	0.50	1.85

Daily eating pattern/ behaviour vary widely across populations and cultures. Regular high fat snacking has been associated with increased overall dietary intake in affluent societies, although it remains a controversial area. (24). Other evidence from affluent societies also suggests that dietary restraint and slimming leads to skipping breakfast and that this may lead to overconsumption later in the day (25). A recent study has shown that prognosis of weigtht loss among obese women trying to lose weight was better in women who ate more smaller meals than those who ate fewer but larger meals (27).

2.5.2 Physical inactivity/sedentary lifestyle

Decreased physical activity plays an important role in obesity. A physical activity pattern, such as a sedentary lifestyle, is also associated with weight change as well as influences physiological regulation of body weight (Ogunbode, *et al,* 2011).

Several studies have also shown an inverse relationship between BMI and physical activity. Such correlations however, do not provide a cause and effect relationship and thus difficult to know whether obese individuals are less active because of their obesity or whether a low level of activity caused the obesity (WHO Consultation on obesity, 1998).

Several prospective studies have also alluded to this conclusion: for Rissanen *et al* (34). have show that a low level of physical activity during leisure in adults is predictive of substantial weight gain (≥ 5kg) in 5 years time.

Television viewing also has been noted to confer risk through a reduction in energy expenditure because watching television is associated with dietary intake, or because large amounts of time spent sedentary may contribute to impairment of the regulation of energy balance by uncoupling food intake from energy expenditure [Gortmaker *et al* (1996); Robinson (1999)].

Physical activity patterns have an important influence on the physiological regulation of body weight and contribute to the total energy expenditure. fat balance and food intakes.

2.5.3. Environmental factors

The rising trend in childhood obesity especially in developing countries reflects the profound changes in society and in the behavioural patterns of communities and societies resulting from rapid urbanization and industrialization. Although, some individuals may become obese, partly because they have a genetic or other biological predisposition to gain weight more readily when exposed to an unfavorable environment, others essentially results from lifestyle/behavioural factors.

2.5.4 Genetic Factors

Several studies including epidemiological and genetic and molecular studies, have suggested that there are people who are more susceptible than others to become overweight and obese. These observations have been made in populations all over the world across a wide range of lifestyle and environmental conditions. The role of genetics in weight gain for instance is currently focus of much research, and the discovery of leptin has led to a renewed interest in genetic and metabolic influences in the development of obesity. It is currently considered that the genes involved in weight gain increase the susceptibility or risk of an individual to the development of obesity when exposed to an adverse environment. Only in the case of certain genetic disorders are particular gene effects necessary for obesity (WHO Consultation on obesity, 1998).

Obesity tends to run in families, with obese children frequently having obese parents. Allison *et al* (1996) concluded from their study that the risk of developing obesity for a first-degree relative was about 2 for overweight, increasing to about 3 to 4 for growing levels of obesity.

A gene-environment has also been implicated for overweight and obesity. For example a prospective study by Heitmann BL *et al* (1995), found that high fat intake in humans was correlated with subsequent weight gain only in those subjects who were overweight at baseline and had obese parents.

2.6. HEALTH CONSEQUENCES OF OVERWEIGHT/OBESITY

Obesity has many and varied consequences, ranging from an increased risk of premature death to several non-fatal but debilitating complaints that impact on immediate quality of life. This is true particularly in children and adolescents where body weight can lead to poor self-esteem, poor social functioning, impaired academic success and reduced fitness and health.

Adolesscence and the teen-age is a period when a marked self-awareness of body shape and physical appearance develops. Therefore, it is perhaps not surprising that the pervasive, negative social messages associated with obesity in many communities have an impact at this stage.

Disturbingly, obesity in childhood, particularly in adolescence, is a key predictor for obesity in adulthood and the detrimental health consequences of obesity are influenced to a greater or leser extent by body weight, the location of body fat, the magnitude of weight gain during adulthood, and sedentary lifestyle. The persistence of obesity into adulthood is more likely when its onset is in late childhood or adolescence and when the obesity is severe. Moreover, morbidity and mortality in the adult population is increased in individuals who were overweight in adolescence, even if they lose the extra weight during adulthood.

The presence of increased body fat, especially when occurring in patients with a low birth weight and/or childhood stunting background, has been shown to compound failing beta-cell reserve, worsen relative insulinopenia and add to the development of glucose intolerance (Gray and Crowther, 2001). Recent studies revealed that the increase in childhood obesity is associated with an escalation in the incidence of type 2 diabetes by a factor of 10, hence the new term 'diabesity' [Pinhas-Hamie, (1996); Sinha *et al.* (2006)].

Childhood obesity is also directly linked to abnormalities in blood pressure and lipid profile, which when combined with aberrant glucose homeostasis, substantially increases the risk of coronary artery disease in adulthood [Freedman *et al.* (2001); Little and Byrne (2001)]. Overweight and obese children are also at risk of developing the psychological and mechanical effects of obesity, and although not life-threatening, these complications impact heavily on their quality of life.

Obesity in children and adolescents also leads to several obesity-associated morbidities and NCDs including elevated blood pressure, cancer, dyslipidemia, insulin resistance and type-2-diabetes.

a) **Obstructive sleep apnea**: Obstructive sleep apnea is another complication of childhood obesity which has been reported to cause hypoventilation and even sudden death in severe cases

b) **Orthopaedic Complications**: Studies have shown that obese children can suffer from orthopaedic complications. The more serious of these include slipped capital femoral epiphysis and Blount's disease (a bone deformity resulting from overgrowth of the tibia)

while the more minor abnormalities include knock knee (genu valgum) and increased susceptibility to ankle sprains.

c) **Hepatic and gastric complications:** Hepatic complications, particularly hepatic steatosis which is characterized by raised serum transaminase level have been reported in obese children Abnormal liver enzymes may be associated with cholelithiasis but tis condition is rare in children and adolescents. Gastro-oesophageal reflux and gastro-emptying disturbances which affect a minority of obese children may be a consequence of raised intra-abdominal pressure due to increased abdominal fat.

d) **Cardiovascular risk factors:** Dyslipidaemia, hypertension and insulin resistance are frequently present in obese children and appears to be related to increased abdominal fat distribution Studies suggest that insulin resistance in children may also be associated with abdominal obesity. Serum lipid and lipoprotein levels, blood pressure and plasma insulin all follow from childhood into young adulthood, with obesity at baseline being a significant predictor of adult values

2.7. ECONOMIC COST OF OVERWEIGHT/OBESITY

The economic costs of overweight and obesity are important issues to health care providers and policy makers alike. Although limited evidence are available on the economics of overweight and obesity, a few studies have suggested that between 2% to 7% of total health care expenditure in a country may be directly attributable to overweight and/or obesity (WHO Consultation on obesity, 1998).

In the United States for example, the total costs attributable to obesity, calculated according to both direct and indirect costs for 1986, were estimated to be US$ 39 300 million representing 5.5% of the overall costs of illness for the USA in that year (Colditz, 1992). Studies from other developed countries also show similar pattern. While Australia spent AUD$464 million as direct cost and an additional AUD$272 million between 1989 to 1990 (NHMRC, 1996).

In the Netherlands, the total general practitioner costs attributable to obesity/overweight were equivalent to 3% to 4% of that country's total general practitioner expenditure (Seidell and Deerenberg, 1994). In France, the direct cost of obesity has been estimated to be almost 12000 million French francs, which corresponded to approximately 2% of the total health care expenditure in France for year 1992 (Levy E *et al.* 1995).

A substantial proportion of the economic cost of obesity has been shown to actually lie outside the formal health care sector. For example, weight loss programs have been shown to whoop up a considerable amount in most developed countries. A survey by the Consumer Advocacy an Financial Counseling Association of Victoria, Australia in 1992 estimated that 300,000 consumers purchased a weight loss programme each year from a variety of weight loss centers. and estimated that the industry turnover was in excess of AUD$ 500million per annum (CAFCA, AUS, 1992).

In developing countries, both the WHO and the World Bank have recently highlighted the escalating burden associated with the rapidly emerging NCDs. In this environment, these diseases now account for more deaths than infectious diseases [Murray and Lopez (1996); The World Health Report, (1997)].

The treatment needs of the rapidly expanding urban populations and the increasing affluent middle classes in developing countries are already overwhelming many medical services. Furthermore, the real costs of therapy associated with NCDS in developing countries far exceed those found in developed countries; the need to import expensive equipment and drugs with scarce foreign exchange and to divert limited numbers of trained specialists to medical care creates an extra burden.

2.8. PREVENTION/MANAGEMENT OF OVERWEIGHT/OBESITY

The future direction should be on urgent and comprehensive intersectoral collaboration involving Federal, state, local governments, communities, professional associations, women societies and labour organizations with sustained programmes that emphasize amongst other issues, surveillance –for risk factors using WHO step wise approach; health education that results in attitudinal and behavioural changes, and engagement in healthy lifestyles; promotion of tobacco smoking cessation; promotion of healthy diets; and the use of Nigerian foodstuffs to create food pyramids and the teaching of the populace cooking methods that maximize nutritional value.

The promotion of physical activity – both at home, school, workplaces and at leisure and the promotion of healthy attitudes and health seeking behavior are important.

In addition to controlling the sale and marketing of energy-dense high-fat foodstuffs, we also need to lobby for the creation and maintenance of child friendly exercise facilities, and all schools should offer physical education as part of the curriculum. Basic lifestyle changes are most successful if implemented at a young age. These lifestyle changes should include an increase in daily activity, regular exercise, altering high-risk eating habits and reducing time

spent watching television.20-22 Although these interventions have not yet had a significant impact on the obesity epidemic (partly due to the lack of aggressive promotion thereof), they are, at the very least, healthy goals to strive for and unlikely to do harm. While it seems reasonable to suggest that we concentrate on these strategies, the conduct of well-designed studies to gather information on parenting practices, the school environment and global demographic factors leading to childhood obesity should remain a priority.

The World Health Organization, having recognized the important role of diet and physical activity in preventing disease, developed a Global Strategy on Diet, Physical Activity and Health In a resolution by the World Health Assembly in May 2005 member states were mandated to:

- Initiate, strengthen, implement global, regional, national policies, plans, etc. to improve diets, promote physical activity that is sustainable, and comprehensively and actively engage all sectors.
- Increase awareness and understanding of the importance of diet and physical activity on health.
- Reduce risk factors through essential public action strategies, health-promoting and disease prevention measures.
- Increase awareness and understanding of the importance of diet and physical activity on health.

The following strategies have been suggested to promote active lifestyle among African children

I. Encouraging of physical activity as a way of life from childhood.

II. Promotion of the inclusion principle among governmental, private sectors and civil societies so as to speak with one strong accord.

III. Establishment of intellectual and institutional partnerships that would help gather and disseminate data on childhood obesity and physical inactivity.

IV. Collaboration with and high visibility in the mass media to enhance publicity, advocacy and awareness campaigns.

V. Having clear messages on physical activity and non-communicable diseases that are easy to understand bearing in mind the various cultural beliefs and barriers to communications.

VI. Promotion of strategies that are practical and feasible to achieve optimum levels of physical activity.

VII. Ensuring flexibility in adaptation of interventions to local socio-cultural realities.

VIII. Promotion opportunities for social interaction, enjoyment and mutual support among population segments at highest risk.

IX. Provision of opportunities for young people to become physically active.

Several strategies have also been put forward in improving healthier eating habits both at school and at home. Some of them include:

I. School management should ensure that only foods and beverages that contribute to the nutritional well-being of children are served.

II. Parents and guardians should be part of a healthy eating plan for their children.

III. Schools should discourage consumption of foods rich in sugar and fat and encourage consumption of fruit and vegetables regularly for the health and wellness of the children.

IV. There is need for awareness campaigns to enlighten populations on healthy eating and its benefits.

V. Schools should adopt a healthy eating policy to be observed at school and at home.

2.9. OBESITY AND BLOOD PRESSURE

Obesity and excessive central fat are changes that precede the increase in blood pressure in children and adolescents, according to epidemiological investigations that used high-precision technologies for estimating body adiposity (Wang *et al.*, 2008)

The prevalence of systemic blood hypertension in the juvenile population has increased around the world (de-Araújo *et al.*, 2008), with the highest proportion of hypertension observed in overweight and obese school children. According to Kearney *et al*, by 2025 about 75% of the world hypertensive population will be in developing countries. In Nigeria for example, it is the number one risk factor for stroke, heart failure, ischemic heart disease, and kidney failure. With an increasing adult population as well as rising prevalence of hypertension, Nigeria will experience economic and health challenges due to the disease if the tide is not arrested. BP levels particularly systolic has been shown to rise with increasing age and it is usually highest in children from urban area compared to semi urban areas (Hamidu, *et al.*, 2000).

The definition of hypertension in children and adolescents is based on the normative distribution of BP in healthy children. Normal BP is defined as SBP and DBP that is less than the 90th percentile for sex, age, and height, while Hypertension is defined as average SBP or DBP greater than or equal to the 95th percentile for sex, age, and height on at least three separate occasions.

It is now recommended that, as with adults, children and adolescents with BP levels at 120-80 mmHg or above, but less than the 95th percentile, should be considered pre-hypertensive. High BP in childhood had been considered a risk factor for hypertension in early adulthood. However, primary (essential) hypertension is now identifiable in children and adolescents. Primary hypertension in childhood is usually characterized by mild or Stage 1 hypertension and

is often associated with a positive family history of hypertension or cardiovascular disease (CVD).

Children and adolescents with primary hypertension are frequently overweight. Data on healthy adolescents obtained in school health screening programs demonstrate that the prevalence of hypertension increases progressively with increasing body mass index (BMI), and hypertension is detectable in approximately 30 percent of overweight children (BMI >95th percentile) (Sorof *et al.*, 2002).

The strong association of high BP with obesity and the marked increase in the prevalence of childhood obesity (Cook *et al.*, 2000) indicate that both hypertension and pre-hypertension are becoming a significant health issue in the young. Primary hypertension often clusters with other risk factors.[Ogden *et al.*, (1994); Williams *et al.*, (2002)]

These risk factors, in addition to high BP and overweight, include low plasma HDL-C, elevated plasma triglyceride, and abnormal glucose tolerance. Fasting plasma insulin concentration is generally elevated, but an elevated insulin concentration may be reflective only of obesity and is not diagnostic of the insulin-resistance syndrome.

CHAPTER THREE

STUDY METHODOLOGY

3.1. Study design

This study was cross-sectional school-based survey with consenting children aged between 8 – 19 years.

3.2. Study Area

The study was conducted among secondary schools within Ibadan Metropolis. Ibadan city comprises of eleven (11) local Government areas. It is the capital city of Oyo State and the third largest metropolitan city by population, in Nigeria. According to the 2006 census, Ibadan has a population of 1,338,659 with the largest metropolitan geographical area. At Nigerian independence, the city was the largest and most populous in the country and the third in Africa after Cairo and Johannesburg. Located in southwestern Nigeria, the city's total area is 1,190 sq mi (3,080 km^2) and ranges in elevation from 150 m in the valley area, to 275 m above sea level.

There are eleven (11) Local Governments in Ibadan Metropolitan area consisting of five urban local governments and six semi-urban local government areas.

The educational system in Ibadan consists of both public (Government owned) and private secondary schools scattered across the 12 geo-political wards.

3.3. Study Population

Study participants: Children currently enrolled in a public or private secondary school in Ibadan, Nigeria were eligible for the study.

Study inclusion criteria:

(1) All children enrolled in a school (aged between 8 and 19 years)

(2) Children in an apparent state of good health

Study exclusion criteria:

(1) Children suffering from severe, debilitating illness at time of study.

(2) Unwillingness by students/parents to give informed consent

3.4. Study Variables

Dependent Variables: The dependent variable in this study was Body mass Index (BMI) calculated as the weight in kilograms divided by the square of the height in meters.

Independent Variables: The independent variables in this study were personal information which included; age, gender, religion, current academic level, place of residence, type of school, dietary pattern, level of physical activity, knowledge of healthy weight, attitude towards body weight and blood pressure.

3.5. Scope of study

This study was based on the new WHO child growth assessment 2008[16] of weight. Overweight and obesity is defined as the proportion of school children with values >1 SD and >2 SDs respectively, from the WHO growth standard median. Being "at risk of overweight." is defined as the proportion of school children with values >1 SD and _<2 SDs from the median.

3.6. Anthropometric Measurements

All anthropometric measurements were taken by the investigators and research assistants who received adequate training in these procedures. Weight was measured with a digital weighing scale after checking for zero error at each measurement and the reading was taken to the nearest 0.1 kg. Participants were also weighed barefooted, standing still, without support and in light clothing. Belts and other accessories were removed and pockets emptied. Height was measured with a stadiometer to the nearest 0.5 cm with the subjects barefooted, standing erect with heels together and looking straight ahead.

3.7. Measurement of blood pressure

Blood pressure (BP) were also obtained and classified according to the recommendations of the National Blood Pressure Education Programme (2004): Pre-hypertension ≥90th to <95th percentile; hypertension ≥95th percentile. Measurements were taken using a standard digital sphygmomanometer. With subjects comfortably seated with legs uncrossed and feet resting on a firm surface. Two BP readings for Systolic BP (SBP) and diastolic BP (DBP) were obtained at 5-minute interval between readings, and the mean recorded as the subject's BP.

3.8. Sampling Technique

A multistage random sampling technique was used to select the sample population as follows:

Stage 1: Selection of Local Government Area

Five LGAs were randomly selected (3 urban and 2 semi-urban) out of the 11 LGAs in Ibadan.

Stage 2: Selection of Schools

A total of fifteen (15) schools (9 private and 6 public) were randomly selected from a list of all the schools, from the selected Local Government Areas.

Stage 3: Selection of number of respondents in each school

Proportionate random sampling was used to select total number of respondent from each school. In order to determine the number of respondents that would be selected from each school, the number of students in each selected school would be divided by the total number of students in all 10 schools, multiplied by the sample size (N).

$$\frac{\text{Number of students (each school)}}{\text{Total number of students (all 10 schools)}} \times \text{Sample size (N)}$$

Stage 4: Selection of respondents from each school

From each school, respondents will be stratified into junior (JSS) and senior (SSS). A proportionate random sampling will then be used to select respondents from each stratum.

- To calculate the number of respondents from each strata;

$$\frac{\text{Number of students in JSS/SSS}}{\text{Total number of students}} \times \text{Total required respondents from school}$$

3.9. Sample Size Determination

Sample size will be determined using the formula for estimating sample size for one-sample comparison of proportion at 95% level of confidence.

$$n = \frac{(Z\alpha/2)^2 \times pq}{d^2}$$

where n is the desired sample size when population is greater than 10,000;

z is the standard normal deviate set at 1.96 [corresponding to 95% confidence interval];

p is the proportion in the target population estimated to have a particular characteristic

q = 1-p;

and d is the degree of accuracy desired at 0.05 level).

p = 9.4% [Ben-Bassey *et al.* 2007]

q = 1- P = 1-0.575= 0.425

d = 0.05

$$n = \frac{(Z\alpha/2)^2 \times pq}{d^2}$$

$$n = \frac{1.96^2 \times 9.4(100-9.4)}{3^2}$$

$$= 363.52$$

Assume 10% of non response rate. 1-10/100 = 0.9

363.52/0.9 = 403.9 ≈ 404

A design effect of (x2) has been employed in this study = 404 x 2 =808

Therefore a minimum sample size of approximately 808 studies participants.

3.10. Data collection instruments

Four key data sets were collected. These included socio-demographic characteristics, physical activities, dietary pattern and anthropometric measurements of weight, height and blood pressure. All information were elicited from participants using a semi-structured interviewer administered questionnaire, modified from the School Physical Activity and Nutrition questionnaire (SPAN) (Hoelscher *et al*, 2003). The SPAN questionnaire was developed as a surveillance tool for monitoring the prevalence of overweight/obesity in school-aged children. The modified SPAN questionnaire was reviewed by nutritionists in the department of Human Nutrition, University of Ibadan for content validation and their corrections and modifications were incorporated in the questionnaire. All interviews and physical measurements were obtained with assistance from specially trained research assistants.

3.11. Data Management and Analysis

Data management: Data management plan involved data entry and protection, data cleaning, and data back-up to an external hard-drive.

Data Analysis: All analyses was performed using Statistical Package for the Social Sciences (SPSS) version 16 to achieve summary and inferential statistics. Results were interpreted as statistically significant at 5% level or less ($p \leq 0.05$).

3.12. Ethical Considerations

Ethical approval for study implementation was obtained from the Ethical Review Committee, Ministry of Health, Oyo State. Permission for study was also obtained from each participating school authority.

Informed assent: Written informed assent was obtained from all participants.

Confidentiality of data: Confidentiality of participants' information was ensured by adopting a de-identified approach to data handling, with the use of unique identifiers for study participants.

Beneficence to participants: All participants received counseling of the importance of maintaining a healthy weight and engaging in a healthy lifestyle. Each school were sent a report of findings from their school participants.

Non-maleficence to participants: The risk of harm to study participants is estimated as low. Participants with obesity and/or high blood pressure were advised and where possible referred to a specialist for care. Password protected computerized systems was used for data management.

Voluntariness: Participation in this research is entirely voluntary. Eligible individuals was assured of their choice to participate in the study or not.

CHAPTER FOUR

RESULTS

4.1. Socio-demographic characteristics

A total of 947 students participated in the survey. The ages ranged between 8 – 19 years, while the mean age of respondents was 14 ± 2.05years. Table 4.1 shows the socio demographic distribution of the study participants. Results showed that majority of the children were aged between 13 – 19 years while more than half of the respondents were females (59.5%), from private schools (54.0%), were in senior secondary (67.1%) and 66.4% of the schools were in urban areas. Majority of the respondents were Yorubas (82.8%), the predominant ethnic group in the study area, practiced Christianity (77.1%), currently lived with their parents (84.7%) and had parents who were currently living together (88.3%). The mother's occupations were majorly business owners (54.8%), others were civil servants (17.1%) and professionals (16.5%) respectively; while the Father's occupation included professionals (32.3%), business owners (30.9%), while a few were civil servants (12.8%), artisans (9.2%) and clergy (3.9%). Majority of the respondents' parents had tertiary education (74.8% and 69.4% for fathers and mothers respectively).

Table 4.1: Socio-demographic distribution of study participants.

Description	Frequency (N = 947)	Percent (%)
Age		
9 – 13 Years	249	26.3
13 – 19 Years	698	73.7
Sex		
Male	384	40.5
Female	563	59.5
Type of School		
Private	511	54.0
Public	436	46.0
Class Form		
Junior Secondary	308	32.5
Senior Secondary	635	67.1
Ethnicity		
Yoruba	784	82.8
Ibo	96	10.1
Others	63	6.7
Location of school		
Urban	629	66.4
Semi urban	318	33.6
Religion		
Christianity	730	77.1
Islam	209	22.1
Currently lives with		
Parents	802	84.7
Other relatives	108	11.4
Parents are currently		
Living together	836	88.3
Divorced	17	1.8
Separated	36	3.8

Widowed	25	2.6
Birth position		
First	326	34.4
Second	270	28.5
Third	181	19.1
Fourth and above	159	16.8
Mothers Occupation		
Artisan	41	4.3
Business	520	54.9
Civil servant	163	17.2
Professional	172	18.2
Fathers Occupation		
Artisan	92	9.2
Business[1]	293	30.9
Civil servant	142	12.8
Professional[2]	343	32.3
Mother's Education		
Primary & less	36	3.8
Secondary	215	22.7
Tertiary	659	69.6
Father's Education		
Primary & less	28	2.9
Secondary	170	17.9
Tertiary	709	74.8

[1] Business category includes all forms of business including trading, self employment and large scale farming.
[2] The professional occupation group was computed as all professional practitioners including doctors, bankers, Architect and others

4.2. Pattern of dietary intake

The dietary assessment of study participants was based on a food frequency questionnaire using a 24-hour recall. The 24-hour dietary recall was adopted in eliciting responses in order to prevent recall bias particularly since the study population are children/adolescents. Questions about their previous day's dietary intake as well as information about family food-related behaviors and eating habits were assessed. The foods were then categorized into various food groups.

Table 4.2 shows the distribution of participants' dietary intake of various food groups. Results showed that majority (more than 72%) of the children ate a portion from all the various food groups at least once the previous day. Only about 58.3% of the respondents took a soft drink previous day.

Table 4.2: Participants' dietary intake of various food groups based on a 24hour recall.

	Frequency (N=947, %)	Percent
Meat, poultry and its products		
None	53	5.6
At least Once	862	91.0
Missing	32	3.4
Fats and oils products		
None	25	2.6
At least Once	845	89.2
Missing	77	8.1
Fruits, vegetables and products		
None	184	19.4
At least Once	735	77.6
Missing	28	3.0
Soft drinks		
None	378	39.9
At least Once	552	58.3
Missing	17	1.8
Cereals		
None	146	15.4
At least Once	770	81.3
Missing	31	3.3
Starch foods		
None	242	25.6
At least Once	685	72.3
Missing	20	2.1
Confectionery		
None	61	6.4
At least Once	846	89.3
Missing	40	4.2

4.3. Dietary pattern and behaviors of study participants.

Table 4.3 shows the general dietary patterns and behaviors of the respondents. Majority of the participants said they always took soft-drinks including malt drinks (95.4%), always had meals from fast food restaurants (83.1%) and were always rewarded with sweets for good behaviour by their parents (73.2%.). More than half of the respondents (51.2%) said they usually skipped breakfast, while 63.6% said they eat at least three meals daily. Participants had their most daily servings from cereals/pasta (36.9%), followed by meat/poultry/eggs (17.4%) and then from fruits (12.5%). The least daily servings were from vegetables (8.3%), dairy products (3.6%) and fatty/oily foods (3.4%).

Table 4.3: Dietary patterns and behaviors of the study participants.

		Frequency (N = 947)	Percentage (%)
Do you usually take soft drink (including malt) at home/school			
	Yes	903	95.4
	No	34	3.6
Do you usually take meals from fast food Restaurants			
	Yes	787	83.1
	No	134	14.1
Do you usually skip breakfast			
	Yes	485	51.2
	No	453	47.8
Parents reward with sweet for good Behavior			
	Yes	693	73.2
	No	232	24.5
How many times do you eat daily			
	Once	126	13.3
	Twice	205	21.6
	Thrice and more	602	63.6
Most daily servings			
	Cereals/Pasta	349	36.9
	Fat, oil	32	3.4
	Meat, Poultry, Eggs	165	17.4
	Dairy	34	3.6
	Fruits	118	12.5
	Vegetables	79	8.3
	I don't know	169	17.9

4.4. Pattern of physical Activities

The assessment of physical activities was based on a seven (7) day preview of activities. Table 4.4 shows the physical activities of the respondents in the last seven (7) days. Results shows that majority of the respondents (79.3%) had participated in some form of activity that made their heart beat fast at least one day in the last 7 days, while 60.4% participated in actual physical exercises during the PE classes in school for at least 30 minutes. More than half of the respondents also engaged in at least one sport at school as well as took part in other physical activities like martial arts, gymnasium and tennis, 76.7% and 56.7% respectively.

Table 4.4: Respondents' physical activities in the last seven (7) days.

	Frequency N = 947	Percent (%)
In the Past 7days have you participated in any activity that made heart beat fast		
None	175	18.5
1 - 2 days	340	35.9
3 – 4 days	201	21.2
5 days & above	210	22.2
In an average week how many days Do you participate in Physical Education PE		
None	399	42.1
1 day	163	17.2
2 - 3 days	203	21.4
4 - 5 days	153	16.2
In an average PE class how many minutes do you spend exercising		
None	342	36.1
< 30 minutes	186	19.6
≥ 30 minutes	192	20.3
> 60 minutes	194	20.5
how many sports are you engaged in at school		
None	12	1.3
one	545	57.6
two	92	9.7
3 and above	89	9.4
How do you usually transport to school		
Public transport	180	19.0
Parents drop off	457	48.3
walk to school	186	19.6
public transport and walk	74	7.8
I engage in other physical activities like martial arts, gym, tennis		
Yes	537	56.7
No	375	39.6

**Table includes some missing data for each sets of variables, hence the discrepancy in the frequency

4.5. Sedentary behaviors

Table 4.5 shows the sedentary behavior of the participants. Majority of the respondents (83.9%) spent at least one hour watching TV/movies, while 47.2% of respondents spent at least one hour playing video games and 58.8% on a PC. Majority of the respondents (79.3%) said they usually ate dinner in front of a TV, while 42.2% said they had a TV in their bedrooms. About half of the respondents (48.3%) reported being driven in their parents' cars to school daily, about 19% said they either walked or took public transport.

Table 4.5: Distribution of participants' sedentary behavior

	Frequency N = 947	Percent (%)
How many Hrs spent watching TV or movies		
I don't usually watch TV/movies	129	13.6
1 hour	295	31.2
2 hours	213	22.5
Above 2 hours	286	30.2
Missing	24	2.5
How many Hrs do you spend on PC		
I don't use Computer	362	38.2
1 hour	253	26.7
2 hours	135	14.3
3 hours and above	169	17.8
Missing	28	3.0
How many Hrs do you spend on video games		
I don't play video games	477	50.4
1 hour	243	25.7
2 hours	95	10.0
3 hours and above	109	11.5
Missing	23	2.4
Are there rules about watching TV or playing PC games by parents		
Always	267	28.2
sometimes	492	52.0
Never	128	13.5
Missing	60	6.3
I have a TV in my bedroom		
Yes	400	42.2
No	479	50.6
Do you usually Eat dinner in front of TV		
Yes	751	79.3
No	134	14.1

4.6: Perception of participants' to body weight, lifestyle and health

Table 4.6 shows the perception of the study participants towards their body weight, lifestyle and health. 45% of the respondents agreed that skipping meals affected their mental ability, while majority (88.8%) said that the relationship between Physical activity and Health was important for students of their age.

More than half of the respondents (55%) also agreed that overweight people were more likely to have health problems like hypertension or heart attack than people who weren't.

Majority of the participants (69.3%) said they were satisfied with their current body weight, while 83.5% said they felt good about the way they looked.

31.1% of the respondents said they wanted to lose weight, 43.9% of the respondents also admitted to have ever been bullied /mocked because of their body weight.

Table 4.6: Perception of the study participants body weight, health and lifestyle.

	Frequency (N=947)	Percentage (%)
Skipping meals affect my mental ability		
Agree	364	38.4
Disagree	426	45.0
Neither agree/disagree	133	14.0
Overweight people are likely to have health Problem		
True	521	55.0
False	128	13.5
I don't know	248	26.2
The relationship btw Physical activity and Health is Important		
Yes	841	88.8
No	73	7.7
I am satisfied with current weight		
Yes	656	69.3
No	267	28.2
I want to lose weight		
Yes	313	33.1
No	611	64.5
I feel good about way I look		
Yes	791	83.5
No	128	13.5
Ever been bullied /mocked because of your weight		
Yes	416	43.9
No	519	54.8

4.7. Weight Profile of participants

The nutritional status of the study population based on anthropometric measurements is presented in Table 4.7. The result showed that the prevalence of overweight and obesity were 14.3% and 7.7% respectively. The combined prevalence of both overweight and obesity was 21.8%. The mean weight and height of the study participants was 52.36 ± 12.45 kg and 160.18 ± 10.09cm respectively.

Table 4.7: Anthropometric measurements of weight profile for participants

	Frequency (N = 947)	Percent (%)
Weight status		
Overweight	135	14.3
Obesity	71	7.7
Combined overweight /obesity	206	21.8
BMI (Mean ± SD)	20.2 ± 3.80	
Weight (Mean ± SD)	52.36 ± 12.45 kg	
Height (Mean ± SD)	160.18 ± 10.09 cm	

4.7.1: Weight profile of participants by sex.

Table 4.7.1 shows the mean anthropometric measurements of the participants by sex. The mean weight and BMI were significantly higher in females compared to males, although, the males were significantly taller than the females (161.25m versus 159.45m; $p < 0.005$).

Table 4.7.1: Anthropometric measurements of participants by sex

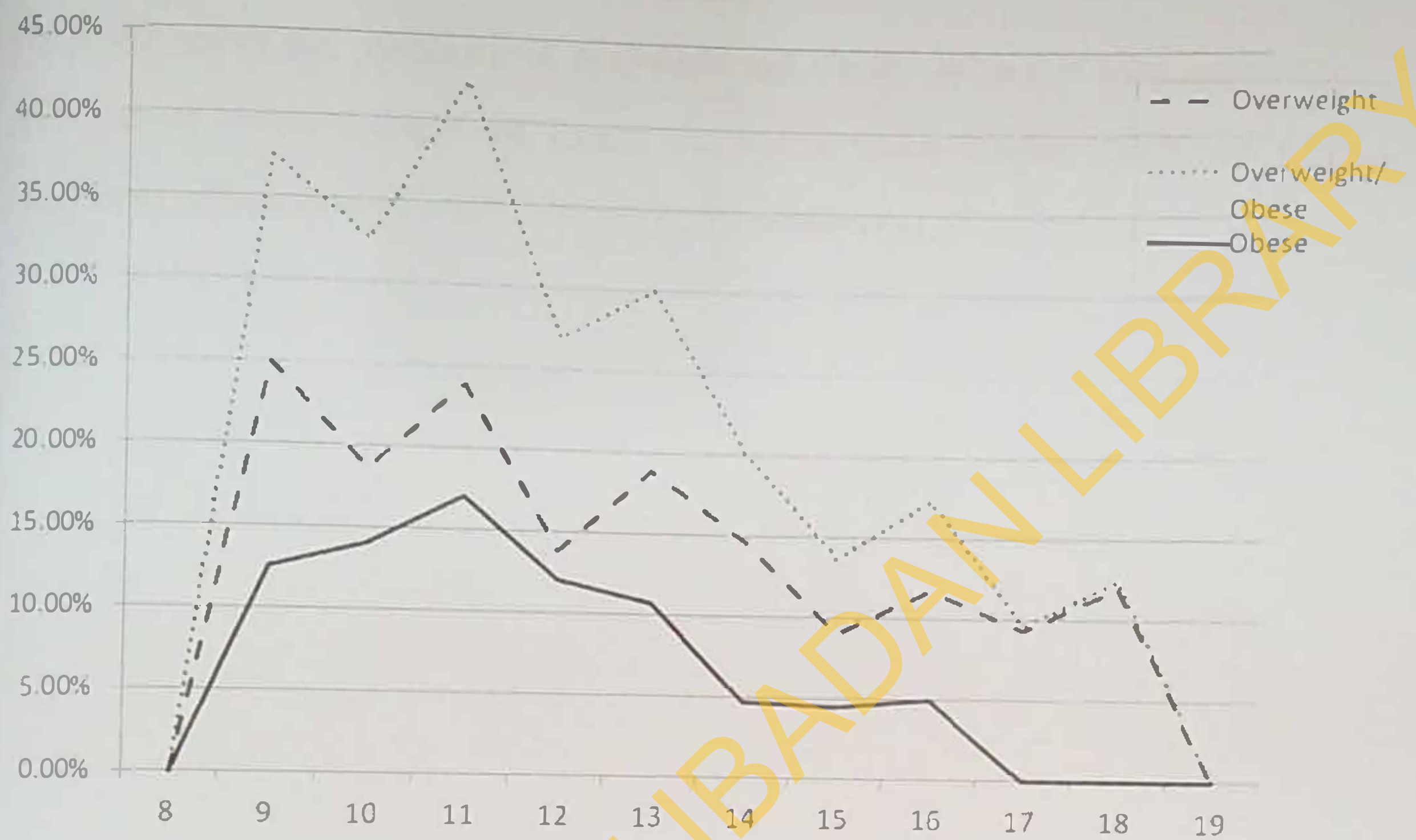
	Male	Female	P value
Weight	51.35 ± 13.03 kg	53.04 ±12.01	0.044
Height	161.25 ± 11.90 m	159.45 ± 8.58	0.007
BMI	19.49 ± 3.50	20.75 ± 3.91	<0.001

NB: Results was based on independent sample t-test for comparing means.

4.7.2: Prevalence of overweight and obesity by age.

Figure 4.1. shows the distribution of the weight by participants' age. The prevalence of overweight and obesity was highest among pre-teens (9 – 12 years) compared to older adolescents/teenagers (≥ 13 years). The prevalence of both overweight and obesity was highest at age 11, with about 42% of the children aged 11years either overweight or obese. The prevalence of overweight persisted till ages 18 years and started declining afterwards; while obesity was generally absent from ages 17 to 19 years.

Figure 4.1: Distribution of the weight status of participants by age. The prevalence of overweight



4.7.3: Prevalence of overweight and obesity by Sex

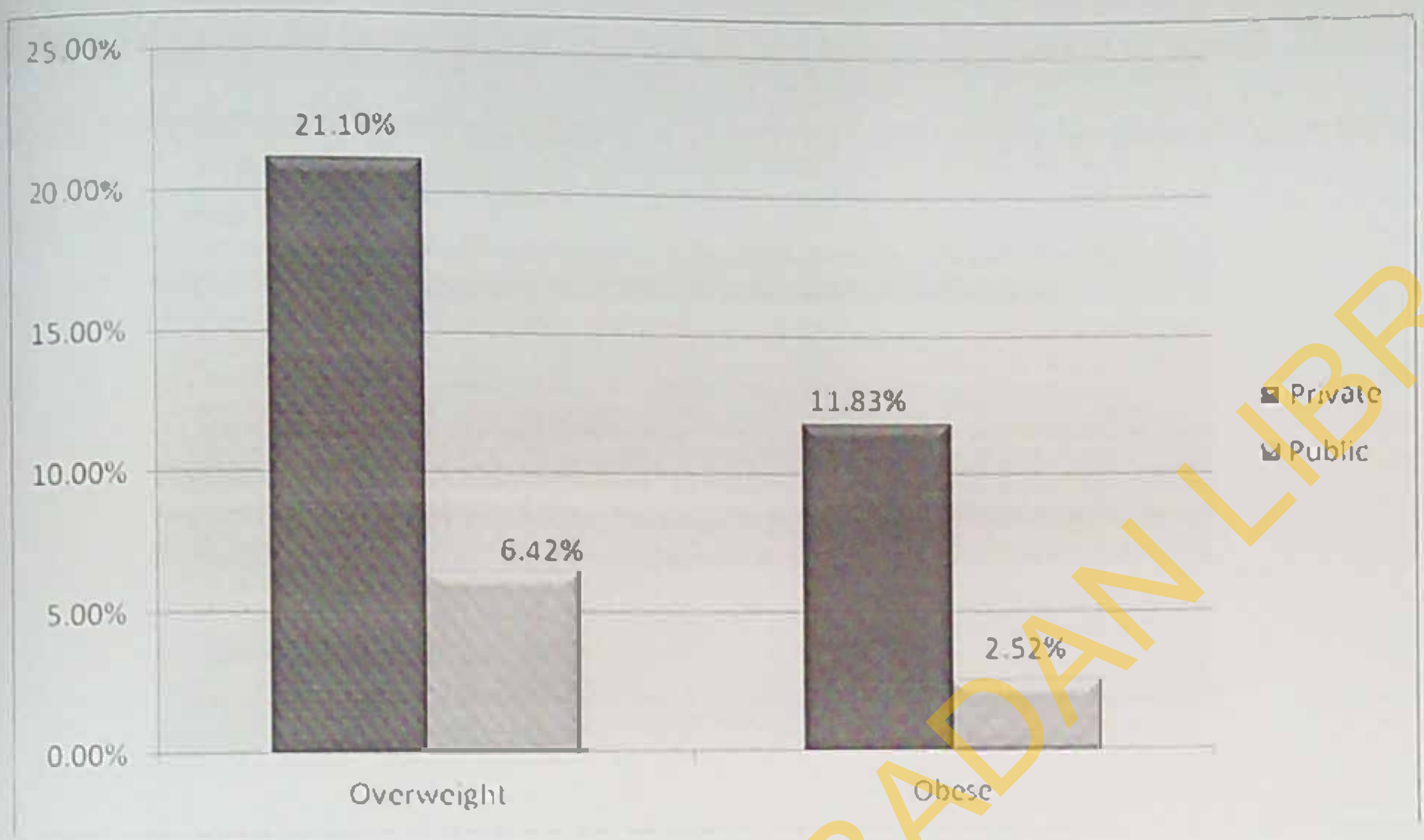
Figure 4.2 shows the prevalence of overweight and obesity by sex of participants. The prevalence of both overweight and obesity was highest among females (16.6% and 8.4% respectively) compared to the males (11% and 6.30% respectively).

Figure 4.2: Prevalence of overweight and obesity by Sex

4.7.4: Prevalence of overweight and obesity by Type of school

Children from private schools were generally both overweight and obese. The difference in the prevalence of overweight among children between private and public school was about 15.00%; while 11.83% were obese in private schools compared to 2.5% in public schools (figure 4.3).

Figure 4.3: Prevalence of overweight and obesity by Type of school



4.7.5: Prevalence of overweight and obesity by location of school

Figure 4.4 shows the prevalence of overweight and obesity by location of school. There was about 3.0% difference in the prevalence of overweight and obesity between children from urban and semi-urban schools.

Figure 4.4: Prevalence of overweight and obesity by location of school

4.8. Blood Pressure Profile of participants

The mean systolic and diastolic blood pressure was 112.29 ± 12.95 mmHg and 66.66 ± 12.95 mmHg respectively.

16.7% of the study participants were found to be pre-hypertensive, while the prevalence of both Stage 1 and Stage 2 Hypertension were 10.3% and 1.7% respectively. (Table 4.8)

Table 4.8: Blood Pressure Profile of participants.

Blood Pressure status		
Normal	652	68.8
Pre-hypertensive	158	16.7
Stage 1	98	10.3
Stage 2	16	1.7
Systolic Blood Pressure (Mean ± SD)	112.29 ± 12.95mmHg	
Diastolic Blood Pressure(Mean ± SD)	66.66 ± 12.95mmHg	

NB: Hypertension was based on systolic blood measurements

4.9 Bivariate analysis

Bivariate analysis was carried out to ascertain association between the weight status and socio-demographic characteristics, dietary pattern, physical activities, sedentary behaviours and perception of body weight. Correlation analysis was also carried to explore the relationship between Body Mass Index (BMI), and systolic blood pressure.

4.9.1 Overweight/Obesity and socio demographic characteristics

Bivariate analysis between overweight/obesity and socio demographic factors, shows that the rates of combined 'overweight/obesity' varied significantly ($p < 0.05$) according to age, sex, category of class, type of school attended, and maternal level of education (table 4.9.1a); while obesity was significantly associated with age, category of class, type of school attended, location of the school and maternal level of education (table 4.9.1b).

The prevalence of combined 'overweight/obesity' was significantly higher among females compared to males [(25.3% versus 18.1%;) $p < 0.005$]; while children aged between 9 – 13years, who were in junior secondary school, attended private schools, and whose mothers had a tertiary education were significantly more overweight and obese compared to their counterparts ($p < 0.05$). Similarly, the prevalence of obesity was significantly higher among children whose schools were located in urban areas compared to those from semi urban areas (9.0% versus 5.3%; $p < 0.05$). Other factors like ethnicity, religion, maternal occupation and with whom children currently lived, had no statistically significant association with either combined 'overweight/obesity' or obesity.

Table 4.9.1a: Bivariate analysis between overweight/obese and socio demographic factors.

	Overweight/Obesity			
	Yes	No	X^2	P Value
Sex				
Male	66 (18.1%)	298 (81.9%)		
Female	140 (25.3%)	413 (74.7%)	6.50	0.011
Age				
9 – 13 Years	81 (33.6%)	160 (66.4%)		
13 – 19 Years	125 (18.5%)	551 (81.5%)	23.31	< 0.001
Class Category				
Junior Secondary	87 (29.1%)	212 (70.9%)		
Senior Secondary	119 (19.3%)	496 (80.7%)	10.94	0.001
Type of School				
Private	167 (33.9%)	326 (66.1%		
Public	39 (9.2%)	385 (90.8%)	79.68	< 0.001
Location				
Urban	149 (24.3%)	465 (75.7%)		
Semi-urban	57 (18.8%)	246 (81.2%)	3.46	0.063
Ethnicity				
Yoruba	163 (21.4%)	597 (78.6%)		
Ibo	27 (29.3%)	65 (70.7%)	3.11	0.211
Others	15 (24.6%)	46 (75.4%		
Religion				
Christianity	167 (23.6%)	541 (76.4%)		
Islam	37 (18.4%)	164 (81.6%)	2.41	0.126
Mother's Occupation				
Artisan	8 (20.0%)	32 (80.0%)		
Business	101 (20.0%)	404 (80.0%)		
Civil Servant	42 (27.1%)	113 (72.9%)	6.20	0.102
Professional	46 (27.5%)	121 (72.5%)		

Table 4.9.1a: Bivariate analysis between weight status and socio demographic factors (cont'd).

Mother's Highest level of education				
Primary and less	3 (8.6%)	32 (91.4%)		
Secondary school	23 (11.0%)	187 (89.0%)	26.65	<0.001
Tertiary	170 (26.7%)	466 (73.3%)		
Respondent currently lives with				
Parents	168 (21.7%)	607 (78.3%)		
Other relatives	28 (26.4%)	78 (73.6%)	0.27	0.265

Table 4.9.1b: Bivariate analysis between obesity and socio demographic factors.

	Obesity			
	Yes	No	X^2	P Value
Sex				
Male	24 (6.6%)	340 (93.4%)		
Female	47 (8.5%)	506 (91.5%)	6.50	0.291
Age				
9 – 13 Years	35 (14.5%)	206 (85.5%)		
13 – 19 Years	136 (5.3%)	640 (94.7%)	21.03	< 0.001
Class Category				
Junior Secondary	35 (11.7%)	264 (88.3%)		
Senior Secondary	36 (5.9%)	579 (94.1%)	9.96	0.002
Type of School				
Private	60 (12.2%)	433 (87.8%		
Public	11 (2.6%)	413 (97.3%)	29.26	< 0.001
Location				
Urban	55 (9.0%)	559 (91.0%)		
Semi-urban	16 (5.3%)	287 (94.7%)	3.84	0.050
Ethnicity				
Yoruba	54 (7.1%)	706 (92.9%)		
Ibo	10 (10.9%)	65 (89.1%)	2.07	0.354
Others	6 (9.8%)	55 (90.2%		
Religion				
Christianity	56 (7.9%)	652 (92.1%)		
Islam	15 (7.8%)	186 (92.2%)	0.43	0.835
Mother's Occupation				
Artisan	4 (10.0%)	36 (90.0%)		
Business	37 (7.3%)	468 (92.7%)		
Civil Servant	11 (7.1%)	144 (92.9%)	1.26	0.738
Professional	16 (9.6%)	151 (90.4%)		

Table 4.9.1b: Bivariate analysis between weight status and socio demographic factors (cont'd).

Mother's Highest level of education				
Primary and less	2 (5.7%)	33 (94.3%)		
Secondary school	8 (3.8%)	202 (96.2%)	6.151	<0.046
Tertiary	57 (9.0%)	579 (91.0%)		
Respondent currently lives with				
Parents	58 (7.5%)	717 (92.5%)	0.001	0.981
Other relatives	8 (7.5%)	98 (92.5%)		

4.9.2 Overweight/Obesity and Dietary pattern.

Table 4.9.2a shows the association between combined 'overweight/obesity' and dietary factors. Results showed that eating fatty/oily foods, soft-drinks, starchy foods, and confectioneries were significantly associated with being overweight/obese. Dietary factors such as skipping of breakfast and having most daily servings from fruits/vegetables were significantly associated with being either obese or overweight. Prevalence of both combined 'overweight/obesity' and obesity was significantly higher among children who usually skipped breakfast (25.4% and 10.7%) compared to those who didn't (19.4% and 4.4%). Other dietary factors such as eating dinner in front of a TV, having take away from restaurants and eating meals or snacks from fast food restaurants were not statistically associated with overweight or obesity.

Table 4.9.2a: Association between overweight/obesity in children and dietary intake

	Overweight/Obese			
	Yes	No	X^2	P Value
Meat, poultry and its products				
None	13 (25.5%)	38 (74.5%)	0.21	0.645
At least Once	190 (22.7%)	647 (77.3%		
Fats and oils products				
None	10 (40.0%)	15 (60.0%)	4.16	0.041
At least Once	184 (22.5%)	632 (77.5%)		
Fruits, vegetables and products				
None	45 (25.3%)	133 (74.7%)	0.86	0.353
At least Once	157 (22.0%)	556 (78.0%)		
Soft drinks				
None	99 (26.8%)	271 (73.2%)	6.42	0.011
At least Once	104 (19.6%)	427 (80.4%)		
Cereals				
None	36 (25.2%)	107(74.8%)	0.64	0.423
At least Once	165 (22.1%)	581(77.9%)		
Starch foods				
None	75 (31.8%)	161 (68.2%)	16.36	<0.001
At least Once	126 (19.0%)	537 (81.0%)		
Confectionery				
None	26 (42.6%)	35 (57.4%)	14.67	<0.001
At least Once	174 (21.3%)	643 (78.7%)		
Do you usually skip breakfast				
Yes	121 (25.4%)	356 (74.6%)	4.55	0.033
No	84 (19.4%)	348 (80.6%)		
Parents reward with sweet for good Behavior				
Yes	32 (20.3%	126 (79.7%)	0.57	0.448
No	170 (23.0%)	568 (77.0%)		

Most servings daily				
Bread/cereals	68 (20.3%)	267 (79.7%)		
Fat/oil/proteins	29 (14.9%0	165 (85.1%	7.79	0.020
Fruits/Vegetables	50 (26.5%)	139 (73.59%)		
Do you usually take meals from fast food Restaurants				
Yes	15 (22.7%)	51 (77.3%)	0.00	0.987
No	187 (22.6%)	639 (77.4%)		
Eat dinner front of TV				
Yes	55 (20.9%)	208 (79.1%)	0.64	0.422
No	139 (23.4%)	455 (76.6%)		
How many times do you eat daily				
Once	18 (19.6%)	74(80.4%)		
Twice	45 (22.4%)	156 (77.6%)	0.67	0.714
Trice and more	136 (23.4%)	446 (76.6%)		

Table 4.9.2b: Association between obesity in children and dietary intake

	Overweight/Obese			
	Yes	No	X^2	P Value
Meat, poultry and its products				
None	5 (9.8%)	46 (90.2%)	0.31	0.576
At least Once	64 (7.6%)	773 (92.4%		
Fats and oils products				
None	5 (20.0%)	20 (80.0%)	4.92	0.027
At least Once	63 (7.7%)	753(92.3%)		
Fruits, vegetables and products				
None	25 (14.0%)	153 (86.0%)	11.19	0.001
At least Once	46 (6.5%)	667 (93.5%)		
Soft drinks				
None	36 (9.7%)	334 (90.3%)	3.37	0.066
At least Once	34 (6.4%)	497 (93.6%)		
Cereals				
None	13 (9.1%)	130(90.9%)	0.42	0.517
At least Once	56 (7.5%)	690 (92.5%)		
Starch foods				
None	26 (11.0%)	210 (89.0%)	5.04	0.025
At least Once	43 (6.5%)	620 (93.5%)		
Confectionery				
None	12 (19.7%)	49 (80.3%)	12.23	<0.001
At least Once	58 (7.1%)	759 (92.9%)		
Do you usually skip breakfast				
Yes	51 (10.7%)	426 (89.3%)	12.63	< 0.001
No	19 (4.4%)	413 (95.6%)		
Parents reward with sweet for good Behavior				
Yes	10 (6.3%)	148 (93.7%)	0.51	0.476
No	58 (8.0%)	879 (92.0%)		

Most servings daily				
Bread/cereals	22 (6.6%)	313 (93.4%)		
Fat/oil/proteins	9 (4.6%0	185 (95.4%	8.63	0.013
Fruits/Vegetables	23 (12.2%)	166 (87.8%)		
Do you usually take meals from fast food Restaurants				
Yes	2 (3.0%)	64 (97.0%)	2.21	0.137
No	67 (8.1%)	759 (91.9%)		
Eat dinner front of TV				
Yes	17 (6.5%)	246 (93.5%)	0.68	0.410
No	48 (8.1%)	546 (91.9%)		
How many times do you eat daily				
Once	7 (7.6%)	85(92.4%)		
Twice	16 (8.0%)	185 (92.0%)	0.02	0.993
Trice and more	68 (7.8%)	537 (92.2%)		

4.9.3 Overweight/Obesity and Physical Activities.

The prevalence of combined 'overweight/obesity' was highest among participants whose parents dropped them off at school in their cars (29.4%) compared to those who either walked or took public transport to school (16.0%). This was statistically significant ($p < 0.05$) (Table 4.8.3a).

We also observed a higher prevalence of combined 'overweight/obesity' among children who participated in two or more sporting activities (32.0%) compared to those who participated in either one (18.8%), or none (27.3 %). In contrast, results showed no statistically significant association between obesity and any of the physical activity factors (Table 4.8.3b).

Table 4.9.3a: Association between overweight/obesity in children and Physical Activities (PA)

	Overweight/Obese			
	Yes	No	X^2	P value
In the past 7days, participated in any activity that made my heart beat fast				
None	43 (25.3%)	128 (74.9%)		
1 - 2 days	73 (22.3%)	254 (77.7%)	1.02	0.601
3 or more days	85 (21.3%)	1314 (78.7%)		
In PE class how many minutes did you spend exercising				
I don't take PE	73 (21.8%0	262 (78.2%)		
less 30 minutes	43 (23.6%)	139 (76.4%)	0.28	0.869
greater 30 minutes	85 (23.6%)	283 (76.9%)		
How many hours do you spend watching TV or movies in a week				
I don't usually watch TV/Movies	28 (22.2%)	98 (77.8%)		
1 hour	58 (20.6%)	224 (79.4%)	1.12	0.570
2 hours or more	116 (23.9%)	370 (76.1%)		
How many hours do you spend on PC in a week				
I don't use Computer	76 (21.7%)	274 (78.3%)		
1 hour	56 (23.0%)	187 (77.0%)	0.31	0.854
2 hours or more	70 (23.5%)	228 (76.5%)		
How many hours do you spend on video games in a week				
I don't play video games	117 (25.2%0	348 (74.8%)		
1 hour	43 (18.4%)	191 (81.6%)	4.16	0.125
2 hours	43 (21.9%0	153 (78.1%)		
How many sports do you regularly engage in at school weekly				
None	3 (27.3%)	8 (72.7%)		
1	99 (18.8%)	428 (81.2%)	13.66	0.001
2 or more	57 (32.0%)	121 (68.0%)		
How do you regularly transport to school				
Parents drop off	130 (29.4%)	312 (70.6%)	23.64	<0.001
public transport/ walk	78 (16.0%))	399 (84.0%)		

Table 4.9.3b: Association between obesity in children and Physical Activities (PA)

	Obesity			
	Yes	No	X^2	P value
In the past 7days, participated in any activity that made my heart beat fast				
None	13 (7.6%)	158 (92.4%)		
1 - 2 days	25 (7.6%)	302 (92.4%)	0.006	0.997
3 or more days	31 (7.8%)	368 (92.2%)		
In PE class how many minutes did you spend exercising				
I don't take PE	25 (7.5%0	310(92.5%)		
less 30 minutes	11 (6.0%)	171 (94.0%)	0.99	0.608
greater 30 minutes	31 (8.4%)	337 (91.6%)		
How many hours do you spend watching TV or movies in a week				
I don't usually watch TV/Movies	8 (6.3%)	118 (93.7%)		
1 hour	19 (6.7%)	263 (93.3%)	1.19	0.523
2 hours or more	42 (8.6%)	444(91.4%)		
How many hours do you spend on PC in a week				
I don't use Computer	29 (8.3%)	321 (91.7%)		
1 hour	16 (6.6%)	227 (93.4%)	0.64	0.726
2 hours or more	24 (8.1%)	274 (91.9%)		
How many hours do you spend on video games in a week				
I don't play video games	39 (8.4%0	426 (91.6%)		
1 hour	16 (6.8%)	218 (93.2%)	0.52	0.768
2 hours	15 (7.7%0	181 (92.3%)		
How many sports do you regularly engage in at school weekly				
None	2 (18.2%)	9 (81.8%)		
1	38 (7.2%)	489(92.8%)	3.03	0.220
2 or more	18 (10.1%)	160 (89.9%)		
How do you regularly transport to school				
Parents drop off	41 (9.3%)	401 (90.7%)	2.68	0.094
public transport/ walk	30 (6.3%))	445 (93.7%)		

4.9.4 Overweight/Obesity and Perception of body weight, lifestyle and health

Table 4.9.4a and table 4.9.4b, shows that the association between participants' perception of their body weight and rate of overweight and obesity. Results shows that the prevalence of both combined 'overweight /obesity' and obesity alone was significantly higher among children who were not satisfied with their body weight, who didn't feel good about the way they looked, who wanted to lose some weight and who had been bullied /mocked because of their body weight ($p < 0.05$).

Table 4.9.4a: Association between Overweight/Obesity and Perception of body weight, lifestyle and health

		Overweight/Obese			
		Yes	No	X^2	P-Value
Skip meals affect mental ability.					
	Agree	83 (23.5%)	270 (76.5%)		
	Disagree	82 (20.0%)	329 (80.0%)	3.75	0.215
	Neither	36 (27.7%)	94 (72.3%)		
Overweight people are likely to have health Problems					
	True	126 (25.0%)	378 (75.0%)		
	False	24 (19.4%)	100 (80.6%)	4.47	0.345
	I don't know	48 (19.8%)	194 (80.2%)		
Relationship btw PA and Health is Important					
	Yes	187 (22.9%)	629 (77.1%)	0.45	0.500
	No	14 (19.4%)	58 (80.6%)		
I am satisfied with my weight					
	Yes	102 (160%)	535 (84.0%)	58.28	< 0.001
	No	102 (39.7%)	155 (60.3%)		
I want to lose weight					
	Yes	140 (45.5%)	168 (54.5%)	137.1	< 0.001
	No	64 (10.9%)	522 (89.1%)		
I Feel good about way I look					
	Yes	147 (19.1%)	621 (809%)	33.44	< 0.001
	No	52 (42.6%)	70 (57.4%)		
I have Been bullied /mocked because of my weight					
	Yes	127 (31.8%)	273 (68.2%)	34.05	< 0.001
	No	78 (15.4%)	428 (84.6%)		

Table 4.9.4b: Association between Obesity and Perception of body weight, lifestyle and health

		Obesity			
		Yes	No	X^2	P-Value
Skip meals affect mental ability.					
	Agree	23 (6.5%)	330 (93.5%)		
	Disagree	33 (8.0%)	378 (92.0%)	1.72	0.423
	Neither	13 (10.0%)	117 (90.3%)		
Overweight people are likely to have health Problems					
	True	42 (8.3%)	462 (91.7%)		
	False	10 (8.1%)	114 (91.9%)	1.25	0.867
	I don't know	17 (7.0%)	225 (93.0%)		
Relationship btw PA and Health is Important					
	Yes	65 (8.0%)	751 (92.0%)	0.09	0.758
	No	5 (6.9%)	67 (93.1%)		
I am satisfied with my weight					
	Yes	26 (4.1%)	611 (95.9%)	45.16	< 0.001
	No	45 (17.5%)	212 (82.5%)		
I want to lose weight					
	Yes	56 (18.2%)	252 (81.8%)	69.93	< 0.001
	No	14 (2.4%)	572 (97.6%)		
I Feel good about way I look					
	Yes	44 (5.7%)	724 (94.3%)	23.21	< 0.001
	No	22 (18.0%)	100 (82.0%)		
I have Been bullied /mocked because of my weight					
	Yes	55 (13.8%)	345 (86.2%)	36.45	< 0.001
	No	15 (3.0%)	491 (97.0%)		

4.8.5. Association between Overweight/Obesity (BMI) and Systolic blood pressure

Table 4.9.5 shows the correlation between Overweight/Obesity (BMI) and Systolic blood pressure. Results showed that BMI and systolic blood pressure were significantly related, ($r = 0.309$, $N = 925$, $p < 0.01$). The BMI of the children was positively correlated with their systolic blood pressure. A scatter plot of BMI and systolic blood pressure also shows a positive correlation (figure 4.5).

Table 4.9.5: Correlation between Overweight/Obesity (BMI) and Systolic blood pressure

	N	Pearson Correlation (r)	P value
Systolic blood pressure	926		
BMI	925	0.309**	< 0.001

**. Correlation is significant at the 0.01 level (2-tailed).

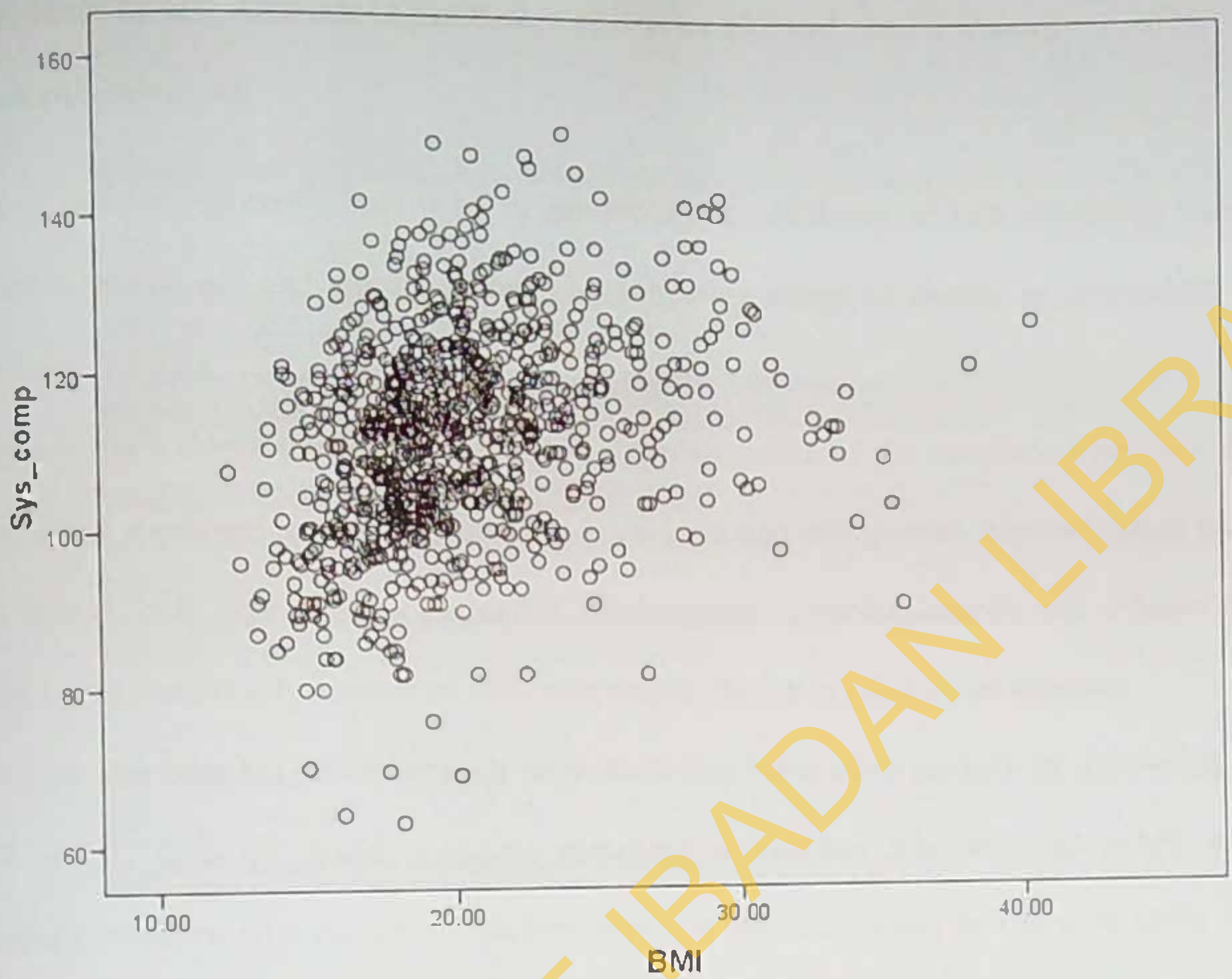


Figure 4.5: Scatter plot showing the association between BMI and systolic blood pressure.

4.10: Multivariate Analysis of predictors of overweight and obesity among children/adolescents

Binary logistic regression was used to determine the predictors of two outcomes: combined 'overweight/obesity' and obesity among children using absent of obesity or overweight as the reference category.

Tables 4.10a/b shows the result of binary logistic regression of the association between 21 risk factors and combined 'overweight/obesity' in children and adolescents. After adjusting for other risk factors, only type of school attended, consumption of confectioneries and a desire to lose weight were statistically associated with overweight/obesity in children/adolescents.

Children who attended private schools were about five times more likely to be overweight/obese (*OR*: 4.651; *95% CI*: 0.091 – 0.506) compared to children who attended public schools. Similarly, children who consumed confectioneries at least once a day before were about 5 times more likely to be overweight/obese compared to those who didn't consume (*OR*: 5.367; *95% CI*: 1.697 - 16.975). These risk factors were statistically significant.

Results further showed that male children were about twice more likely than females to be overweight/obese (*OR*: 1.529; *95% CI*: 0.801– 2.919); while children who ate fatty/oily products were about four times more likely than those who didn't consume fat/oily products to be overweight/obese (*OR*: 3.910; *95% CI*: 0.836 – 18.290); children who also consumed starchy products had a 2 times odds of being overweight/obesity compared to children who didn't eat (*OR*: 1.637; *95% CI*: 0.843 – 3.179); while the odds of overweight/obesity was about twice higher among those who didn't feel good about their weight compared to children who did (*OR*: 1.859, *95% CI*: 0.774 – 4.466); factors were however not statistically significant

Table 4.10a: Binary logistic regression between risk factors and combined overweight/obesity in children and adolescents.

	OR	95% C.I. for OR		P Value
		Lower	Upper	
Sex				
Male	1.53	0.80	2.92	0.19
Female [a]	-	-	-	-
Age				
9 – 13 Years	1.01	0.39	2.62	0.97
13 – 19 Years [a]	-	-	-	-
Location of school				
Urban	0.97	0.49	1.92	0.92
Semi urban	-	-	-	-
Type of school [b]				
Private	4.65	0.09	0.50	< 0.00
Public [a]	-	-	-	-
Class Category				
Junior Sec	0.88	0.36	2.14	0.78
Senior Sec [a]	-	-	-	-
Religion				
Christianity	1.19	0.55	2.55	0.66
Islam [a]	-	-	-	-
Mother's highest level of Education				
Secondary	0.43	0.06	3.33	0.41
Tertiary	0.38	0.05	2.68	0.33
Pry and less [a]	-	-	-	-
Mother's occupation				
Business	0.15	0.01	1.95	0.14
Civil servant	0.22	0.02	3.13	0.26
Professional	0.14	0.01	1.98	0.14
Artisan [a]	-	-	-	-
Fats and oils products				
Once	3.91	0.84	18.29	0.08
None [a]	-	-	-	-
Soft drinks				
Once	1.27	0.66	2.44	0.47
None [a]	-	-	-	-
Starch foods				
Once	1.64	0.84	3.17	0.14
None [a]	-	-	-	-

Table 4.10a: Binary logistic regression between risk factors and combined overweight/obesity in children and adolescents (cont'd).

Confectionery [b]				
Once	5.37	1.69	16.97	0.004
None [a]	-	-	-	-
Which food do you take the most serving				
Carbohydrates/cereals	1.47	0.74	2.93	0.27
Fat/protein	1.75	0.72	4.24	0.22
Fruits/vegetables	-	-	-	-
Do you usually Skip Breakfast				
Yes	0.74	0.40	1.37	0.35
No [a]	-	-	-	-
How many Hours do you spent on video games				
1 hour	1.26	0.59	2.68	0.54
2 hours/ more	1.09	0.48	2.25	0.83
I don't play video games [a]	-	-	-	-
how many sports do you engage in in school				
One	1.39	0.21	9.43	0.73
2 or more	1.43	0.20	10.17	0.72
None [a]	-	-	-	-
How do you usually transport to school				
Parents drop off	0.61	0.31	1.22	0.16
walk/public transport [a]	-	-	-	-
Do you feel good about way you look				
Yes	1.86	0.77	4.46	0.16
No [a]	-	-	-	-
Do you want to lose weight [b]				
Yes	0.13	0.06	0.25	< 0.01
No [a]	-	-	-	-
Are you satisfied with weight				
Yes	1.07	0.50	2.29	0.86
No [a]	-	-	-	-
Have you been bullied /mocked because of your weight				
Yes	0.79	0.42	1.51	0.48
No [a]	-	-	-	-

a. The reference category.
b. Statistically significant.

Table 4.10b: Binary logistic regression between risk factors and obesity in children and adolescents.

	OR	95% C.I. for OR		P Value
		Lower	Upper	
Sex				
Male	1.53	0.80	2.92	0.198
Female [a]	-	-	-	-
Age				
9 – 13 Years	1.01	0.39	2.62	0.975
13 – 19 Years [a]	-	-	-	-
Location of school				
Urban	0.97	0.48	1.92	0.928
Semi urban	-	-	-	-
Type of school [b]				
Private	0.22	0.09	0.51	< 0.001
Public [a]	-	-	-	-
Class Category				
Junior Sec	0.88	0.36	2.15	0.781
Senior Sec [a]	-	-	-	-
Religion				
Christianity	1.19	0.55	2.55	0.663
Islam [a]	-	-	-	-
Mother's highest level of Education				
Secondary	0.43	0.05	3.33	0.419
Tertiary	0.38	0.05	2.68	0.332
Pry and less [a]	-	-	-	-
Mother's occupation				
Business	0.15	0.01	1.95	0.146
Civil servant	0.22	0.02	3.14	0.265
Professional	0.15	0.01	1.98	0.148
Artisan [a]	-	-	-	-
Fats and oils products				
Once	3.91	0.83	18.29	0.083
None [a]	-	-	-	-
Soft drinks				
Once	1.27	0.66	2.44	0.477
None [a]	-	-	-	-
Starchy foods				
Once	1.64	0.84	3.18	0.145
None [a]	-	-	-	-

Confectionery [b]				
Once	5.37	1.69	16.97	0.004
None [a]	-	-	-	-
Which food do you take the most serving				
carb/cereals	1.47	0.74	2.93	0.270
fat/protein	1.75	0.72	4.24	0.218
fruits/vegs	-	-	-	-
Do you usually Skip Breakfast				
Yes	0.74	0.40	1.38	0.346
No [a]	-	-	-	-
How many Hours do you spent on video games				
1 hour	1.26	0.59	2.68	0.544
2 hours/ more	1.09	0.47	2.51	0.829
I don't play video games [a]	-	-	-	-
how many sports do you engage in in school				
One	1.39	0.20	9.43	0.734
2 or more	1.43	0.20	10.17	0.723
None	-	-	-	-
How do you usually transport to school				
Parents drop off	0.61	0.31	1.22	0.163
walk/public transport [a]	-	-	-	-
Do you feel good about way you look				
Yes	1.86	0.77	4.46	0.166
No [a]	-	-	-	-
Do you want to lose weight [b]				
Yes	0.13	0.06	0.25	<0.001
No [a]	-	-	-	-
Satisfied with your weight				
Yes	1.07	0.50	2.29	0.861
No [a]	-	-	-	-
Ever been bullied/mocked because of your weight				
Yes	0.79	0.41	1.51	0.482
No [a]	-	-	-	-

a The reference category
b Statistically significant

4.11: Multivariate Analysis hypertension and overweight/obesity among children/adolescents

Binary logistic regression was used to determine the association between overweight/obesity and hypertension in children. Results showed that after adjusting for other risk factors, children who were 'overweight/obesity' were 3 times more likely to be hypertensive compared to those who weren't. (*OR*: 2.86; *95% CI*: 1.225 – 6.666).

Other factors that were statistically associated with hypertension in children and adolescents included sedentary lifestyle and mothers' occupation. children who spend two hours or more playing video games had a 0.365 odds of hypertension compared to those didn't play any video game (*OR*: 0.37; *95% CI*: 0.144 – 0.929); similarly the odds of hypertension among children were 0.23 (*95% CI*: 0.074 – 0.706) for children whose mothers were either owned businesses and 0.19 (*95% CI*:0.050 – 0.745) were professionals compared to those whose mothers were artisans.

Table 4.11: Binary logistic regression between Hypertension and obesity in children and adolescents.

	OR	95% C.I. for OR		P Value
		Lower	Upper	
Overweight/Obesity [b]				
Present	2.86	1.225	6.666	0.015
Absent [a]	-	-	-	-
Sex				
Male	1.36	0.70	2.60	0.357
Female [a]	-	-	-	-
Age				
9 – 13 Years	1.60	0.56	4.57	0.379
13 – 19 Years [a]	-	-	-	-
Location of school				
Urban	0.97	0.48	1.90	0.921
Semi urban	-	-	-	-
Type of school				
Private	0.52	0.21	1.26	0.148
Public [a]	-	-	-	-
Class Category				
Junior Sec	0.77	.029	1.97	0.587
Senior Sec [a]	-	-	-	-
Religion				
Christianity	0.83	0.40	1.69	0.603
Islam [a]	-	-	-	-
Mother's highest level of Education				
Secondary	2.9968	0.00	3.56	0.998
Tertiary	2.0968	0.00	4.33	0.998
Pry and less [a]	-	-	-	-
Mother's occupation				
Business	0.23	0.07	0.70	0.010
Civil servant	0.28	0.07	1.02	0.055
Professional	0.19	0.05	0.74	0.017
Artisan [a]	-	-	-	-
Fats and oils products				
Once	1.18	0.12	11.18	0.886
None [a]	-	-	-	-
Soft drinks				
Once	0.90	0.47	1.73	0.763
None [a]	-	-	-	-

Starch foods				
Once	1.75	0.80	3.82	0.161
None [a]	-	-	-	-
Confectionery				
Once	1.09	0.31	3.84	0.889
None [a]	-	-	-	-
Which food do you take the most serving				
Carbohydrates/cereals	1.12	0.49	2.51	0.790
Fat/protein	1.63	0.66	3.99	0.283
Fruits/vegetables	-	-	-	-
Do you usually Skip Breakfast				
Yes	1.20	0.65	2.22	0.558
No [a]	-	-	-	-
How many Hours do you spent on video games				
1 hour	0.84	0.41	1.72	0.637
2 hours/ more	0.37	0.14	0.92	0.035
I don't play video games [a]	-	-	-	-
how many sports do you engage in in school				
One	0.21	0.03	1.33	0.098
2 or more	0.37	0.05	2.44	0.300
None	-	-	-	-
How do you usually transport to school				
Parents drop off	1.21	0.60	2.41	0.589
walk/public transport [a]	-	-	-	-
Do you feel good about way you look				
Yes	1.19	0.43	3.27	0.735
No [a]	-	-	-	-
Do you want to lose weight				
Yes	0.95	0.45	2.01	0.897
No [a]	-	-	-	-
Are you satisfied with weight				
Yes	1.12	0.51	2.44	0.785
No [a]	-	-	-	-
Have you been bullied /mocked because of your weight				
Yes	0.99	0.52	1.88	0.981
No [a]	-	-	-	-

CHAPTER FIVE

DISCUSSION

5.1. *Prevalence of overweight and obesity.*

This study provides a comprehensive snapshot of the weight status and related behavior of school-aged children across Ibadan metropolis. Results from this study shows that the prevalence of overweight (14.3%) and obesity (7.7%) was far higher than 2.3% overweight prevalence previously reported by Omigbodun et.al,(2010) for school aged children in Ibadan. Several studies conducted in Southern Nigeria have estimated the prevalence and epidemiological characteristics of overweight and obesity among school-aged children. Prevalence rates reported for rural Lagos, Sagamu, and Uyo showed a near absence of obesity (less than 1%) among the population studied [Ben-Bassey *et al.*(2007); Fetuga *et al*, (2011); Opara *et al*, (2010)], while estimates of less than 2% has also been reported for Abeokuta, Benue and Port Harcourt, [Sebanjo and Oshikoya (2010); Musa *et al*,(2012); Adesina *et al*, (2012)]. Studies conducted by Ene-Obong *et al*, (2012) in four Nigerian towns– Aba, Nsukka, Lagos and Port Harcourt, showed that the prevalence of overweight and obesity was less than 13% and 3% respectively in three of the towns (excluding Lagos). Other studies conducted among children in Lagos (Oduwole *et al*, 2012) and Ota (Chinedu *et al*, 2012) southern Nigeria, has also shown a comparable or slightly higher prevalence rates than those obtained from this study.

We estimated the combined prevalence of overweight and obesity as 21.8%; this was higher than estimates reported for both Africa (< 5%) [Lobstein, (2004); Cole, (2000)] and global prevalence (10%) reported by the International Obesity Task Force (IOTF, 2012).

Studies on the prevalence of overweight and obesity conducted across several developed countries including the US, Europe and Asia. While most estimates from the US and Europe including USA (Lobstein and Jackson-Leach, 2007), Canada (Shield, 2005), and Mexico (Rio-Navarro *et al*, 2004), England (Whelton *et al*, 2007), Italy (Lobstein and Jackson-Leach, 2007) and Cyprus (Savva *et al*, 2004) showed much higher prevalence than those observed from this study with estimates ranging between 26% - 36% (overweight) and 7% - 13% (obesity), estimates of combined overweight/obesity (between 6.5% - 18%) obtained from Sweden (Lobstein and Jackson-Leach, 2007), Netherlands (Lobstein and Jackson-Leach, 2007), Brazil(Popkin *et al*, 2006) and some Asian countries – China (Li *et al, 2008*) and India (Chhatwa *et al*, 2004) are very similar or lower than to those obtained from this study.

Our study also showed a significant difference in prevalence of overweight and obesity for both gender and type of school attended, although this difference was not statistically significant at multivariate analysis. The prevalence of both overweight and obesity was higher among female compared to males, although after multivariate analysis, was not statistically significant. A higher prevalence of both overweight and obesity in female children compared to males have also been observed from studies conducted in Nigeria (Omigbodun *et al*., 2007; Odenigbo *et al* 2010; Ene-Obong *et al*., 2012) as well as globally (Cole, 2000; IOTF, 2012). The difference in the prevalence of overweight and obesity between the genders may result from differences in energy expenditure between males and females during school hours. Moreover, we observed that most of the schools surveyed did not have a play ground or sporting centre, and where available, were dominated by male children while most female children reclined in groups for discussions and chats. Hence, female children tend to be less physically active during school periods which could last between six (6) to nine (9) hours daily depending on the type of school

strengthened by a significantly higher prevalence of both overweight and obesity among urban/private school children compared to their semi-urban/public school counterparts.

Adediran et al (2012), has observed that the higher prevalence of obesity in the urban area compared to rural area could be attributed to rapid and unplanned urbanization, changes from local dietary pattern to western style diet which is driven by the proliferation of fast food outlets in major cities and more sedentary lifestyle.

Although there was no rural-urban difference observed from our study at multivariate analysis, we observed however, that children from urban schools also generally had parents who were well educated, and whose occupation was professionals (including doctors, nurses, engineers e.t.c) and since they often represented children of parents from higher socio economic class who can afford the exorbitant private school fees as well as provide better nutritional diets. It is also important to note that most private school surveyed from our study, implemented feeding programs where children were offered lunch daily.

Maternal level of education was significantly associated with overweight and obesity among children. Although we observed a high literacy rate among the parents of our study participants with majority of them (approximately 70%) having tertiary education, there are several possible reasons for this finding, ranging from lack of time with children due to the nature of most mothers' occupation to overindulging children. For example, while almost half of our study participants (42%) skipped breakfasts, we noticed (from personal observation of children surveyed, however data not captured nor analyzed) that they are given a large amount of money to get themselves lunch during school hours thus, exposing them to unnecessary large amounts of junk foods. Furthermore, mothers tend to overindulge their children with special take away

from fast food restaurants at weekends to compensate for their unavailability during most week days.

Our study findings thus provides evidence of an increasing prevalence of both overweight and obesity among school aged children in growing cities across Nigeria, comparable with most estimates from Asia and some developed countries in Europe. This has serious economic and public health implications, since body weight has been associated with academic performance with resultant effect on the economic potentials of these children later in life but also the risk of several non communicable diseases in later adulthood.

5.2. Dietary risk factors

The prevalence of overweight and obesity was significantly higher among children eat fatty/oily foods, soft-drinks, starchy foods, and confectioneries. We also found a significantly association between skipping breakfast and overweight/obese; while daily breakfast consumption was influenced by the type of school and marital status of the parents. Children who skipped breakfast were significantly higher among those attending private schools and children who lived with their parents. Such habits consequently encouraged regular consumption of snacks and soft drinks later in schools.

Snacking and consumption of soft drinks has been shown to be significantly associated with overweight and obesity in children (Omuemu and Omuemu, 2010). Our study therefore, supports a dietary pattern shift from the more traditional meals to away-from-home food intake and snacking among children in Ibadan. Although our study found no significant association between having take-away/snacks from fast food restaurants, the prevalence of overweight children was however higher among this group than others. This further suggests that away-from-home meals

and snacks which are often energy-dense and sweeter than traditional meals are becoming more affordable and therefore within reach of the average child in most developing countries like Nigeria.

Our study also showed that eating confectioneries was independently associated with overweight and obesity at the multivariable analysis level. This is supported by a large school based (SPAN) survey conducted in New South Wales in Australia, which purchasing soft drink from the school canteen or school vending machine among other factors, such as parents offering sweets to children as a reward for good behavior, negatively influenced weight gain (Hardy LL *et al.* 2010). Although only a few of our study participants reported ever being rewarded with sweets for good behavior by parents, they tended to be less overweight and obese, compared to those who never did. A plausible explanation for this observation is that majority of these school children are able to purchase these confectioneries for themselves and didn't need to wait to be rewarded by their parents.

5.3. Physical Activity

The prevalence of obesity were significantly higher among children who were less physically active (including children whose parents dropped them off at school in their cars compared to those who either walked or took public transport to school and children who didn't take part in any form of sporting activity). This supports popular view of less physical activity as a major factor for the risk of obesity in children (Omuemu and Omuemu, 2010).

Many developing countries are currently grappling with transition in the level of physical activities among their populations. This is further worsened with the proliferation of electronic

gadgets and smart devices coupled with less leisure-time and fewer opportunities for recreational exercise; thus making high energy expenditure patterns become less common (WHO, 2000).

In China for example, such transition has been marked by changes in types of occupations, levels of activity at each occupation, and shifts in the mode of transportation – from active to more passive (Paeratakul S *et al*, 1998; Bell AC *et al*, 2001; Bell AC *et al*, 2002].

Studies (Levine *et al*, 2005; Popkin, 1994) has also suggested that major shifts in levels of physical activities can be linked with the use of more modern technologies particularly at home, preference for watching of television and playing of television/computer games instead of outdoor recreational activities. thus resulting in a much more sedentary lifestyle with reduced energy expenditure.

The interacting effects between television watching and physical activity among children have been reported (Pérez A *et al*, 2001). Our study showed that obese children spent more time watching TV than their healthier counterparts; besides, about 42% of our study participants also reported having TV-sets in their rooms, suggesting an increasing sedentary lifestyle among young adolescents. Although the association between TV watching and physical activity was not statistically significant, other studies have also reported similar findings. Reilly JJ *et al* (2005), in their study, found an independent association between television viewing and risk of obesity in children. Television viewing may confer risk through a reduction in energy expenditure because watching television is associated with dietary intake, or because large amounts of sedentary time may contribute to impairment of the regulation of energy balance by uncoupling food intake from energy expenditure [Robinson TN et al. 1990; Gortmaker SL. 1999].

We observed that 32.0% of children who participated in two or more sporting activities were 'overweight/obesity' compared to those who participated none (27.3 %). We also observed

from our study that most overweight and obese male children particularly from private schools engaged more in physical activities and several outdoor sporting events. This inverse association observed between sporting activities and overweight, may be explained by the fact that increased physical activity may be part of weight loss program or an attempt to keep a more healthy body weight. Besides, about 46% of our study participants said they wanted to lose weight

5.4. Profile of blood pressure among school children in Ibadan

The prevalence of high blood pressure (HBP) was 12.0% while 16.7% of the study participants were pre-hypertensive (pre-HBP). High blood pressure was significantly among children who were overweight or obese compared to those with normal weight.

Results from this study, show an increase in the prevalence of hypertension among school aged children/adolescents and estimates falls within the 1-13% documented prevalence rate of hypertension among Nigerian adolescents [Obong *et al*, (1991), Obidike and Ibe (1997), Akinkugbe *et al* ,(1999), Ejike *et* al (2008), Mijinyawa *eta al*, (2008)]. Although similar findings were obtained by Ujunwa *et al*, (2013) in Enugu, estimates from this study are higher than prevalence of 4.1% and 6.0% reported in Ilorin (Olaitan, 2001), and Lagos (Oduwole *et al*, 2012) respectively.

A positive correlation was also found between BMI of the children was and their systolic blood pressure. This is similar with findings by Moser *et al*, (2013), who reported positive correlations among all the anthropometric parameters and systolic and diastolic levels. Results showed that after adjusting for other risk factors, children who were 'overweight/obesity' were 3 times more likely to be hypertensive compared to those who were not. Moser *et al*, (2013) has also reported similar findings.

The high prevalence of HBP and pre-HBP in children and adolescents, coupled with the positive correlation between high blood pressure and body mass index (BMI) in this study suggests the predictive role of body weight in the prevalence of juvenile hypertension. This finding has implications for the cardiovascular disease public health burden, particularly the risk of a new cardiovascular disease transition in most developing countries including Nigeria.

5.5. Study limitations

This study was limited by a number of factors. Firstly, the dietary assessment was based on a 24 hour food frequency questionnaire, which only estimates adequacy of dietary intake rather than establish association with prolonged dietary outcome such as obesity. Secondly, although parental obesity may increase the risk of obesity through genetic mechanisms or by shared familial characteristics in the environment, we however, did not capture information on genetic predisposition to obesity. Thirdly, our study participants seems to have well educated parents with about 70% of both parents having tertiary education, which may likely translate into high/medium income earners. Hence, caution should be taken in generalizing estimates to children who may have some form of genetic predisposition to overweight and/or obesity.

5.6. *Conclusion*

The concept of the nutrition transition which focuses on large shifts in dietary and physical activity patterns is evidenced from this study, although few dietary factors were significantly associated with obesity in children, physical activity was more readily linked as a risk factor in the prevalence of overweight and obesity. A plausible reason to explain this observation is that imbalance between energy intake and expenditure among overweight and obese children may be more tilted towards energy expenditure (through physical activities) compared to its intake via diet. Furthermore, we observed an inverse relationship between sporting activities and overweight; this may likely be due to the fact that people who were more physically active tends to eat more than the less physically active children to regain energy lost through these physical exercises.

Hence, there may still exist, a cluster of risk factors apart from the traditional risk factors (of diet and PA) which may explain the prevalence of overweight and obesity in growing cities across developing countries like Nigeria, therefore the need for multiple strategies and coordinated efforts.

5.7. *Recommendations*

We recommend therefore that in tackling the growing menace of overweight and obesity in developing countries, we recommend the following:

1. Targeted efforts to prevent a rise in the prevalence of overweight should be channeled towards promoting healthier diet and eating habits among school children particularly during school periods, while encouraging more physical activities through sports and physical exercises.
2. Weight loss program particularly in private schools where overweight and obesity is most prevalent, should be encouraged and supported by management of schools, ministries of education and ministries of health.
3. Efforts to promote healthier living among children to counter the socio-cultural beliefs of associating overweight with higher socio economic status, must be much more holistic and approach broadened beyond the traditional views to include the families, schools and larger community.
4. Establishing recreational centers especially within urban cities to promote healthier living through physical exercises.

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Appendix A

Prevalence and determinants of obesity among school age children in Ibadan, Nigeria.

Student Assent form

Your name _____

School _____

- In this study you are being asked to answer questions about your food choices and physical activity. An adult will take your weight and height, and write the results on the questionnaire.
- Taking part in this project is voluntary. Your choice about taking part will not affect your grades in school or your ability to take part in any school activities.
- You can skip a question if you do not want to answer it.
- After you complete the survey and are measured for height and weight, this page with your name on it will be removed. Your name will never be used after that.
- By signing below, you agree to take part in this project.

_____ _____

Signature/Thumbprint of Participant Interview Date

QUESTIONNAIRE

The following questions are about what students your age eat, what they know about nutrition, and their physical act (exercise). Your answers will help us learn about students in Ibadan and will be used to design better health programs Read each question carefully and pick the answer that is true for you. Tick (√) your answer in the box provided. ***This is a test and there is no right or wrong answer. Your answers will be kept private.***

Serial No_____ Date_____

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Sex: (1) Male ☐ (2) Female ☐
2. In what month and year were you born (Date of Birth)? ☐☐ ☐☐ ☐☐☐☐

☐☐

3. How old are you (at last birthday):

4. What class/form are you in? [ ]

5. Your ethnicity is: (a) Hausa ☐ (b) Igbo ☐ (c) Yoruba ☐ (d) Others _____

6. Your religion is? (a) Christianity ☐ (b) Islam ☐ (c) Traditional ☐ (d) Others (Specify)_____

7. Who do you presently live with? (a) Both parents ☐ (b) Father alone ☐ (c) Mother alone ☐ (d) Siblings (All your Brother/Sister) ☐ (d) Other relatives ☐ (e) Other *(please specify)*.....

8. What is your birth position? (a) First ☐ (b) Second ☐ (c) Third ☐ (d) Fourth ☐ (d) Other *(please specify_____)*

9. How many brother/sisters do you have (a) One ☐ (b) Two ☐ (c) Three ☐ (d) Four ☐ (e) Other *(please specify)*

10. Occupation of mother _____

11. Father's highest level of education (a) No formal education ☐ (b) Primary School ☐ (c) Junior Secondary ☐ (d) Senior Secondary ☐ (d) Tertiary/University ☐

12. Mother's highest level of education (a) No formal education ☐ (b) Primary School ☐ (c) Junior Secondary ☐ (d) Senior Secondary ☐ (e) Tertiary/University ☐

13. Father's Occupation_____

14. My parents are currently (a) Living together ☐ (b) Divorced ☐ (c) Separated ☐ (d)Widowed ☐

SECTION B: INFORMATION ABOUT DIET

	Questions about your diet yesterday	Tick (√) your response				
		0 None Times	1 Time	2 Times	3 Times	>3
15	Yesterday, how many times did you eat meat with your meal?					
16	Yesterday, how many times did you eat fish (fresh/died) with your meal?					
17	Yesterday, how many times did you eat chicken/turkey with your meal?					
18	Yesterday, how many times did you eat eggs?					
19	Yesterday, how many times did you eat food made with oil, fat or butter?					

20	Yesterday, how many times did you take stew made with oil in your food?					
21	Yesterday, how many times did you eat with melon (Egusi) or Ogbono Soup?					
22	Yesterday, how many times did you drink any kind of sweet, sugar, chocolate, candy, or cake?					
23	Yesterday, how many times did you take a milk yogurt drink? *Include* milk on cereal, and drinks made with milk					
24	Yesterday, how many times did you eat rice, corn/maize, macaroni, spaghetti, or noodles?					
25	Yesterday, how many times did you eat cereal? Cornflakes, Golden morn					
26	Yesterday, how many times did you eat Irish/white potatoes, yams, cassava, cocoyam, or any other foods made from roots?					
27	Yesterday, how many times did you eat any food made from Garri (Eba), Amala, Semo, or pounded yam?					
28	Yesterday, how many times did you eat any food made from beans, moimoi, akara?					
29	Yesterday, how many times did you eat green leafy vegetables? Include all cooked and uncooked vegetables or salad.					
30	Yesterday, how many times did you eat fruit? [Oranges, water melon, pineapple, bananas, apples, green beans, pear]					
31	Yesterday, how many times did you drink fruit juice? Fruit juice is a 100% juice drink like orange juice, apple juice, or grape juice.					
32	Yesterday, how many times did you drink any soft drinks or mineral? (*E.g Fanta, Coke, Sprite, 7-up e.t.c)*					
33	Yesterday, how many times did you drink any *Malt* drinks?					
34	Yesterday, how many times did you eat bread, buns, sausage rolls, doughnuts, pies or cakes?					
35	Yesterday, how many times did you eat any chocolate or chocolate candy?					
36	Yesterday, how many times did you eat food from any type of restaurant? (Restaurants include fast food, Mr Biggs, and Tantalizers).					
37	Yesterday, how many times did you eat or drink a snack? A *snack* is any food or beverage that you eat or drink before, after, or between main meals.					
38	Yesterday, how many times did you take *sweets*?					
39	Yesterday, how many meals did you eat?					

Now these set of questions are about your diet on a regular day of the week

40 Do you usually eat or drink something for breakfast?
☐ Always ☐ Sometimes ☐ Never

41 How often do you have soft drinks or malt (like coke, fanta, 7-up, maltina e.t.c) at home
☐ Always ☐ Sometimes ☐ Never

42 How often do you take soft drink or malt (like coke, fanta, 7-up, maltina e.t.c) with your meals at home or lunch in school? ☐ Always ☐ Sometimes ☐ Never

43 How often do you usually eat dinner in front of the TV? ☐ Always ☐ Sometimes ☐ Never

44	How often do you eat-out or have takeaway meals or snacks from places like MR Biggs, Tantalizers, or other fast-food outlets? ☐ Always ☐ Sometimes ☐ Never
45	How often does your parents/family offer you sweet/snack as a reward for good behavior? ☐ Always ☐ Sometimes ☐ Never
46	Skipping meals such as breakfast or lunch affects my ability to do well in my classes. ☐ Agree ☐ Disagree ☐ Neither agree nor disagree
47	From which food group should you eat the ***most*** servings each day? Choose only ***one*** group. ☐ Breads, cereals, rice, pasta ☐ Dairy products (milk, cheese, yogurt) ☐ Don't know ☐ Fats, oils, sweets ☐ Fruits ☐ Meats, fish, poultry, beans, eggs ☐ Vegetables
48	People who are overweight are more likely to have a higher risk of health problems like hypertension or heart disease than people who are not overweight. ☐ True ☐ False ☐ I don't know

SECTION C: INFORMATION ABOUT PHYSICAL ACTIVITIES

49	In the past 7 days did you exercise or take part in physical activity that made your heart beat fast and made you breathe hard for *at least 20 minutes*? (For example: basketball, soccer, running or jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities)	Response	Tick (√)
		0 days	
		1 day	
		2 days	
		3 days	
		4 days	
		5 days	
		6 days	
		7 days	
50	In an average week when you are in school, on how many days do you go to physical (health) education (PE) classes?	0 days	
		1 day	
		2 days	
		3 days	
		4 days	
		5 days	
51	During an average physical education (PE) class, how many minutes do you spend actually exercising or playing sports?	Dont take PE	
		< 10 Mins	
		< 30 Mins	
		> 30 Mins	
		> 60 Mins	
52	How many hours ***per day*** do you ***usually*** watch TV or video movies away from school?	I don't watch TV/ video movies	
		1 hour	
		2 hours	
		3 hours	
		4 hours	
		5 hours or more	
53	How many hours *per day* do you *usually* spend on the computer away from school? (Time on	I don't use the computer	
		1 hour	

	the computer includes time spent surfing the Internet and instant messaging).	2 hours 3 hours 4 hours 5 hours
S4	How many hours ***per day*** do you ***usually*** spend playing video games like Nintendo®, Sega®, PlayStation®, Xbox®, GameBoy® or arcade games away from school?	I don't play video games 1 hour 2 hours 3 hours 4 hours

S5	During the past 12 months, on how many sports teams ***run by your school*** did you play (do not include PE classes)? (Tick all the Sports teams that apply)		
	☐ Football	☐ Basketball	☐ Baseballs
	☐ Volleyball	☐ Swimming	☐ Gymnastics
56	How often do your parents set rules on the amount of TV or computer games you can watch/play?		
	☐ Always	☐ Sometimes	☐ Never
57	How do you usually transport to school?		
	☐ Public transport	☐ I walk to school	
	☐ My Parents drop me off in their car	☐ I enter public transport and walk	

58	Do you have a TV in your bedroom?	Yes	No
59	Do you currently participate in any other organized physical activities or take lessons, such as martial arts, dance, gymnastics, or tennis?		
60	I think that learning about the relationship between physical activity and health is important for students my age to know.		
61	Are you happy or satisfied about your body weight/size?		
62	Do you want to lose weight or are you currently in a weight loss program?		
63	Do you want to add/gain more weight		
64	I feel good about the way I look and what I can do physically.		
65	Have you ever been bullied or mocked because of your weight/size by classmates in school, people at home or any other place?		

SECTION D: ANTHROMETRIC MEASUREMENTS (Please do not write/tick anything in these boxes)

		Measurements
1	Weight (Kg)	
2	Height (cm)	
3	Systolic Blood pressure (mmHg)	
4	Diastolic Blood pressure (mmHg)	

Thank you very much for your help!