PREVALENCE AND DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG IN-SCHOOL ADOLESCENTS IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE

BY

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CERTIFICATION

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DEDICATION

This work is dedicated to the Almighty God for His mercy and unending love and to my parents and family.

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ABSTRACT

Childhood and adolescence are critical periods of life which lay the foundation for behaviors that are later adopted in life. Childhood overweight and obesity are on the rise in developing countries including Nigeria and its determinants are not yet well understood. This study was therefore carried out to determine the prevalence and determinants of overweight and obesity among in-school adolescents in Ikenne Local Government Area, Ogun State.

A cross-sectional school-based study was conducted among 622 secondary school adolescents between the ages of 10 and 19 years. Respondents were selected through a multistage sampling technique. An interviewer-administered, semi-structured questionnaire was distributed, while anthropometric measurements including body weight, height, waist and hip measurements were taken. Overweight and Obesity were defined according to BMI-for-age as classified by 2007 WHO Growth Reference Charts for 5 – 19 years; and WHO sex-specific cut-offs for Waist-Hip Ratio. Data were analyzed using descriptive statistics, chi-square tests, Pearson correlation and binary logistic regression.

The mean age of respondents was 15 years and a standard deviation of 2 years. More than half (58.7%) were females, 63.3% were enrolled in public schools while 26.7% were enrolled in private schools. Overall, the prevalence of overweight and obesity by BMI was 12.7%, and by WHR was 35.1%. Overweight and obesity was highest among early adolescents (10 – 14 years) which peaked at 12 and 13 years respectively using the BMI approach. However, the WHR technique revealed a higher prevalence of overweight and obesity among the late adolescents (15 – 19 years) and peaked at 16 years. Females tended to be more overweight (6.8% versus 3.2%) while obesity was higher in males than females (1.7% versus 0.9%) by BMI while WHR revealed the prevalence of both overweight and obesity to be higher in females than in males. Adolescents between 10 – 14 years were about 58% times less likely to be overweight/obese (OR: 0.42; 95% CI: 0.258 – 0.672) while those who attended public schools were about three times more likely to be overweight/obese (OR: 3.32; 95% CI: 2.04 – 5.41). Adolescents who skipped breakfast and those who had high physical activity level were 41% and 54% times less likely to be overweight/obese (OR: 0.59; 95% CI: 0.36 – 0.99 and OR: 0.46; 95% CI: 0.24 – 0.87 respectively) while those who desired to lose weight were about 3.4 times more likely to be

overweight/obese (OR: 3.39; 95% CI: 1.97 – 5.81). There was a weak positive correlation between BMI and WHR (r = 0.023) and it was not statistically significant.

The prevalence of overweight and obesity among adolescents was high and was associated with age, dietary and physical activity factors. Hence, coordinated school health programs and interventions with emphasis on healthy nutrition and physical activity should be put in place in order to prevent childhood overweight and obesity.

Keywords: Adolescents, Overweight and Obesity, Body Mass Index, Waist-Hip Ratio

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
CDC	Centers for Disease Prevention and Control
IKLG	Ikenne Local Government Area
IOTF	International Obesity Task Force
NCDs	Non communicable Diseases
OR	Odds Ratio
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist-Hip Ratio
WHtR	Waist-to-Height Ratio

CHAPTER ONE

INTRODUCTION

1.1 Background

Overweight refers to increased body weight in relation to height. Obesity is described as an excessively high amount of body fat or adipose tissue in relation to lean body mass (Levi et. al, 2015). Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (WHO, 2003). Obesity can also be referred to as a body mass index greater than the 95th percentile for children of the same age and gender (Dietz, 1998).

Overweight and obesity are a major determinant of non-communicable diseases which in turn are the leading causes of morbidity and mortality globally (Sabageh and Ojofeitimi, 2013). According to World Health Organization, overweight and obesity are said to be the fifth leading cause of mortality worldwide and one of the most serious health issues and risk factors for chronic diseases such as cardiovascular diseases, hypertension, type 2 diabetes, psychosocial problems, stroke, arthritis, certain cancers and musculoskeletal disorders (Muthuri et. al, 2014; Steyn and Mchiza, 2014; Sabageh and Ojofeitimi, 2013).

Until recently, overweight and obesity have been termed as 'disease of affluence,' that is, disease mostly affecting the high-income countries – the so called developed countries (James, 2005), and perceived as increasing public health problems among middle-aged adults and older adults (Poobalan and Aucott, 2016). However, studies have shown that these health conditions now affect even the low- and middle-income countries including Nigeria and have extended to both children and adolescents (childhood obesity) (Ene-Obong et. al, 2012). In fact, overweight and obesity were not considered public health problems in developing countries until late 20th century (Poobalan and Aucott, 2016).

Adolescents constitute about 20% of the world's population with about 85% living in developing countries (Dehne and Riedner, 2001). Studies have shown that overweight/obese children and adolescents are at an increased risk of becoming obese adults compared to their normal counterparts (Must et. al, 1992; Vignerova et. al, 2007). Overweight/obese children and adolescents are about 4 to 7 times more likely to become obese adults (Serdula et. al, 1993).

Studies have shown the dual burden of nutrition-related ill health among children and adolescents in developing countries. This is related to the presence of epidemics of obesity (over-nutrition) and under-nutrition. This term can also be referred to as the 'double burden of malnutrition' (Ene-Obong et. al, 2012; Adeomi et. al, 2015).

Worldwide, some 2.8 million deaths are recorded annually and about 35.8 million disability-adjusted life years are caused by overweight and obesity. Furthermore, about one-quarter of adults from 20 years and above are overweight and less than one-tenth are obese (WHO, 2011).

About 10% of the world's school-aged children have excess body fat, a quarter of which is obese. An estimated 250 million people are termed as being obese (Ahmad, Ahmed and Airede, 2013).

According to Lobstein et. al, (2004), the estimated global prevalence of overweight and obesity in children and adolescents of 5 to 17 years of age is 10%. Moreover, Cole et. al, (2000) and IOTF (2003) showed that in Africa, the prevalence of overweight and obesity are 1.2% and 0.1% for males and 1.4% and 0.3% for females of 5 to 17 years respectively. Owa and Adejuyigbe (1997) showed that 18% of children and adolescents from 5 to 15 years were obese in Nigeria.

Overweight and obesity have been linked to nutrition transition: a shift from a traditional diet (healthy and staple foods) toward a Western diet characterized by high consumption of saturated fat, sugar and sugar-sweetened beverages, animal protein, refined carbohydrates and low fiber intake. All of these are also associated with a sedentary lifestyle as a result of urbanization, technological advancement, socioeconomic transition and low energy expenditure in terms of physical inactivity (Ene-Obong et. al, 2012; Steyn and Mchiza, 2014).

Several risk factors such as physical inactivity, unhealthy dietary habits, prolonged hours of television viewing, high socioeconomic status and area of residence and urbanization, (obesogenic environment), age and gender, traditional beliefs and sociocultural factors and endocrine or genetic factors have been identified as the cause of the rising prevalence of childhood/adolescent overweight and obesity (Popkin et. al, 1998; Popkin, 2002; Gupta et. al, 2012).

Childhood obesity leads to a large number of complications and accelerates the risk of premature illness/disease and death in later years (Dietz, 1998). Although, obesity-related diseases occur more frequently in adults, significant effects as well as antecedents of adult disease occur in obese children and adults. These complications include psychosocial problems such as negative self-image, low self-esteem, behavioral and learning difficulties, and binge-eating disorders; others include early maturation, hyperlipidemia, glucose intolerance, etc.

The key health effects of childhood obesity include medical consequences such as insulin resistance, hypertension, type 2 diabetes mellitus, dyslipidemia, sleep apnea, eating disorders, the metabolic syndrome, etc. and psychosocial consequences such as discrimination, poor body image, low self-esteem, stress, poor learning abilities, etc. (Gupta et. al, 2012).

1.2 Statement of the Problem

Childhood and adolescence are critical periods which lay the foundation for the development of overweight and obesity which shows an imbalance between energy consumption and energy expenditure in form of physical activity (Harding et. al, 2008). Owing to progressive urbanization, economic growth and the associated lifestyle changes, childhood overweight is becoming challenging, yet under-recognized, problem in many developing countries while malnutrition is far from being over (Jafar et. al, 2008).

Many adolescents experience very significant lifestyle changes such as leaving home for hostels, developing relationships, indulging in risky behaviors such as unhealthy diet, sexual risk behavior, physical inactivity and substance use and abuse (Poobalan and Aucott, 2016). The interrelationship between these social, psychological and biological factors that occur during this period may make them susceptible to indulge in many risky behaviors (Tremblay and Frigon, 2005). However, both the positive and negative behaviors that have been formed during the adolescence stage continue into adulthood and later into life. Therefore, it can be concluded that the adolescence stage is indeed a critical period in a person's lifetime.

De Onis et. al, (2010) reported from a total of 450 nationally represented cross-sectional surveys in 144 developing countries that the global prevalence of overweight and obesity among

preschool children increased from 4.2% in 1990 to 6.7% in 2010 and is expected to reach 9.1% in 2020. They also reported that the estimated prevalence of overweight and obesity in Africa was 8.5% in 2010 and is expected to reach about 13% in 2020. This shows that there is an increasing trend of overweight and obesity among preschool children (< 5 years) in Africa including Nigeria, Ghana, Egypt, Senegal, Peru and Dominican Republic.

Furthermore, the prevalence of overweight and obesity among older children and adolescents have also increased at an alarming rate in developing countries. For example, in 2006, the prevalence of overweight and obesity among children between 6 to 13 years in South Africa ranged from 10.9% and 2.4% in males to 17.5% and 4.8% in females respectively (Armstrong et al, 2006). Gupta et. al, (2011) also examined secular trends of overweight and obesity among urban Asian Indian adolescents in New Delhi, North India and found out that there was a significant rise in prevalence of obesity from 9.8% in 2006 to 11.7% in 2009.

Ikenne Local Government Area of Ogun State is a semi-urban area with obesity-promoting avenues such as fast food restaurants, hotels and clubs for leisure activities which promotes eating away from home, and less physical activity during and after school hours. These findings show that childhood overweight and obesity is on the rise in developing countries including Nigeria and its determinants are not well understood.

1.3 Justification of the Study

Until recently, most public health programs and research on adolescents across the nation have focused on undernutrition and its effects on survival, morbidity and mortality (Adeomi et. al, 2015). This may be due to the fact that adolescents are considered as an age group with reduced mortality (Woodruff, 2000). However, based on current knowledge and research in developing countries, an increasing trend in childhood overweight and obesity is being observed (Adeomi et. al, 2015). They possess the greatest need for consideration because they experience significant physical, psychological and biological changes. Their nutritional status/needs and health interventions have not been appropriately considered despite global concerns for adolescent health (WHO, 2005).

Since childhood overweight and obesity have been shown to persist into adulthood with significant related health and psychological implications, there is a crucial need to prevent obesity. The etiology of overweight and obesity is complex and multifaceted and there are various factors from multiple contexts that interact with other. These factors are not yet well understood. Understanding these determinants will form a basis for key strategies on the effective prevention of overweight and obesity among children and adolescents.

Several intervention programs and campaigns have recently been initiated in developing countries in order to increase knowledge on healthy nutrition, diseases and physical activity among children and adolescents. These programs vary according to the targeted age group, activities and budget allocated to implement these programs. Yet, it has been observed that most programs use schools as an important setting for health promotion and education activities (Gupta et. al, 2012). Some of these programs include MARG project in India, the Fat Truth Campaign (United Arab Emirates), School health program and school canteen guidelines (Malaysia), World Heart Federation Campaign (Brazil) and the Community Children's Program (South Africa) to mention a few. These intervention campaigns have shown favorable results in specific study populations, however, they have not yet reduced the overall prevalence of childhood overweight and obesity in developed or developing countries. If these intervention efforts are not properly coordinated both at the school and community levels, childhood overweight and obesity may be far from being prevented.

This study is aimed at bridging the gap in knowledge on the prevalence and risk factors associated with overweight and obesity among adolescents in Nigeria. It is also essential for providing evidence-based information to decision and policy makers and stakeholders such as parents, teachers, Ministry of Health, Ministry of Education and Ministry of Youth Development and Sports for proper planning, development and implementation of feasible public health policy interventions so as to curb the alarming increase in overweight and obesity.

1.4 Research Questions

The following questions were addressed in this study:

1. What is the prevalence of overweight and obesity among in-school adolescents in Ikenne Local Government Area (IKLG)?
2. What is the pattern of overweight and obesity among in-school adolescents in IKLG?
3. What are the determinants of overweight and obesity among in-school adolescents in IKLG?
4. What is the correlation between Body Mass Index and Waist-Hip ratio as two standard methods of measuring overweight and obesity among adolescents?

1.5 Objectives of the Study

1.5.1 Broad Objective: To determine the prevalence and determinants of overweight and obesity among in-school adolescents of IKLG in Ogun State.

1.5.2 Specific Objectives

1. To determine the prevalence of overweight and obesity among in-school adolescents in IKLG.
2. To assess the pattern of overweight and obesity among in-school adolescents in IKLG.
3. To identify the determinants of overweight and obesity among in-school adolescents in IKLG.
4. To determine the correlation between Body Mass Index and Waist-Hip Ratio as two standard methods of measuring overweight and obesity among adolescents of IKLG.

CHAPTER TWO

LITERATURE REVIEW

Adolescence refers to the developmental period between childhood and adulthood (Adesina et. al, 2012). WHO, (1995) defines adolescents as individuals between the ages of 10 and 19 years. Adolescents are said to make up about 20% of the world's population with 85% living in developing countries (Dehne and Riedner, 2001).

Adolescence is the second most critical period of physical growth after the early childhood years. It is a time of enormous physiological, cognitive and psychosocial changes; and sexual development with muscle mass and body fat increase in boys and girls respectively, as a result of hormonal and environmental influences (Adesina et. al, 2012). The demands of this normal physical growth and maturation lead to increased need for nutrients and micronutrients and this places extra nutritional demands on adolescents (WHO, 2000). A combination of the energy demands of the adolescent growth spurt and inadequate diet has contributed immensely to the poor weight status of adolescents.

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (WHO, 2013). Overweight and obesity have been known to mankind since the Middle Ages; during the Renaissance of Europe and the Ancient East Asian Civilization. They were then regarded as a mark of wealth and affluence and were more common among the elites; however, recent reports have shown an increasing trend among the low- and middle-income countries (Ene-Obong et. al, 2012). The rising epidemic shows very serious changes in the society and in the behavioral patterns of communities over recent years. This is reflected in societal changes, worldwide nutrition transition, economic growth, urbanization, modernization and globalization of food markets. Higher incomes and more urban populations give rise to a wider availability of energy-dense and high fat foods; with simultaneous shifts towards less physically demanding work resulting in low levels of physical activity, increased automated transport, technology in the home and more passive leisure pursuits (WHO, 2003). The childhood and adolescent years represent a major 'window of opportunity' and 'teachable moment' for the prevention and effective management of the key behavioral risk factors for chronic diseases – unhealthy diet and low levels of physical activity coupled with sedentary behaviors (Hills et. al, 2014).

2.1 Standards for Measuring Childhood Overweight and Obesity

2.1.1 Body Mass Index (BMI)

The prevalence of overweight and obesity is commonly assessed by using BMI, defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). A BMI of over 25 kg/m^2 is defined as overweight, and a BMI of over 30 kg/m^2 as obese (WHO, 2013).

Centers for Disease Control and Prevention (2000) defines BMI cutoffs as overweight ($25.0 \leq BMI < 30.0$) and obesity (≥ 30.0). Overweight is defined as a BMI at or above the 85^{th} percentile and below the 95^{th} percentile for children and teens of the same age and sex. Obesity is defined as a BMI at or above the 95th percentile for children and teens of the same age and sex. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age. A high BMI can be an indicator of high body fatness. BMI does not measure body fat directly, but research has shown that BMI is correlated with more direct measures of body fat, such as skinfold thickness measurements, bioelectrical impedance, densitometry (underwater weighing), dual energy x-ray absorptiometry (DXA) and other methods (Freedman et. al, 2013; Wohlfahrt-Veje et. al, 2014). BMI can be considered an alternative to direct measures of body fat. In general, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. It also has its limitations such as inability to measure central fat adiposity which has been associated with the risk of cardiovascular and metabolic disease in children (Kawatra et. al, 2013).

Other standards of measuring overweight and obesity include:

2.1.2 Waist Circumference (WC)

WC is a generally acceptable measure of central obesity which is a traditional risk factor for cardiovascular diseases (CVD). Ethnic-specific cut-off values for WC are defined between > 85 cm and > 94cm for men and between > 80 cm and > 90 cm for women in adults. However, for children and adolescents from different ethnicities, no uniform definition of WC cut-offs exist due to their physiological growth and development (Alberti et. al, 2005).

2.1.3 Waist-Hip Ratio (WHR)

The 1997 WHO Expert Consultation on Obesity recognized the importance of abdominal fat mass (referred to as abdominal, central or visceral obesity), which can vary considerably within a

narrow range of total body fat and body mass index (BMI). It also highlighted the need for other indicators to complement the measurement of BMI, to identify individuals at increased risk of obesity-related morbidity due to accumulation of abdominal fat (WHO, 2000). Waist–hip ratio (i.e. ratio of the circumference of the waist to that of the hips) was suggested as an additional measure of body fat distribution. The ratio can be measured more precisely than skin folds, and it provides an index of both subcutaneous and intra-abdominal adipose tissue (Bjorntorp, 1987). Extreme central distribution has a WHR of about 0.5, whilst WHR is 1.0 in the peripheral type. Another classification of WHR is 0.76 – 0.80 which is normal, 0.81 – 0.86 which is moderate obesity, while above 0.86 is severe obesity (Ogunbode et. al, 2011).

2.1.4 Waist-to-Height Ratio (WHtR)

This can be defined as the ratio of the waist circumference to the height. It is a simple, rapid screening tool which has been shown to be more sensitive than BMI as an early warning of health risks, cheaper and easier to measure and calculate (Ashwell and Hsieh, 2005).

WHtR is more strongly correlated with visceral fat-mass (Ashwell et. al, 1996) and clustering of cardiovascular risk factors in children (Savva et. al, 2000) and adults (Hsieh et. al, 2003). It incorporates Waist Circumference as a measure of abdominal adiposity and adjusts for an individual's size by dividing by their height. The use of WHtR has been proposed as it may explain the metabolic consequences of obesity and identify abdominal obesity, particularly in individuals who would not be classified as overweight or obese by BMI (Nambiar et. al, 2009; Reilly et. al, 1995). WHtR has no measurement units and is in close agreement in both males and females in an age-group.

2.2 Burden of Childhood Overweight and Obesity

2.2.1 Global Burden of Overweight and Obesity

Childhood obesity is increasingly being recognized worldwide as a major global public health problem reaching epidemic proportions (Wang and Lobstein, 2006). Childhood obesity is already epidemic in some areas and on the rise in others. Childhood obesity is increasing at an alarming rate particularly in low- and middle-income countries. Global estimates in 2010 suggested that 43 million children (35 million children in developing countries) were overweight or obese, with a significant likelihood that this figure will double by 2020 (De Onis et. al, 2010).

The global evidence of childhood overweight and obesity is observed in the escalation of unhealthy dietary habits and physical activity behaviors. For example, the epidemic of obesity in Asia has been strengthened by the rapid nutrition and physical activity transition with a wide availability of energy-dense and poor quality foods as well as low physical activity levels and sedentary lifestyle (Hills et. al, 2014).

The calculated global prevalence of overweight (including obesity) in children and adolescents aged 5 – 19 years is 10% (Moraes et. al, 2006).

WHO (2012), estimated that about 40 million children under 5 years of age worldwide are overweight. According to the US Surgeon General, in the USA the number of overweight children has doubled and the number of overweight adolescents has tripled since 1980. The prevalence of obese children aged 6-to-11 years has more than doubled since the 1960s. Obesity prevalence in youths aged 12-17 years has increased dramatically from 5% to 13% in boys and from 5% to 9% in girls between 1966-1970 and 1988-1991 in the USA. In 2009 – 2010, the prevalence rose to 16.9% among children and adolescents between 2 and 19 years and remained the same from 2011 to 2012 (Ogden et. al, 2012). The problem is global and increasingly extends into the developing world; for example, in Thailand the prevalence of obesity in 5-to-12 year olds children rose from12.2% to 15.06% in just two years. Obesity accounts for 2-7% of total health care costs in several developed countries (WHO, 2003).

More than 1.9 billion adults, 18 years and older, were overweight of which over 600 million were obese in 2014. Overall, about 13% of the world's adult population (11% of men and 15% of women) was obese. About 39% of adults aged 18 years and over (38% of men and 40% of women) were overweight. The worldwide prevalence of obesity has more than doubled between 1980 and 2014 (WHO, 2014). In 1990, about 4.2% of children were overweight and obese. This increased to 6.7% in 2010 and has been projected to rise to about 9.1% by the year 2020 (De Onis et. al, 2010).

A study conducted by Acharya et. al, (2014) in Kaski District, Nepal, revealed that the prevalence of overweight and obesity among higher secondary school adolescents (16 – 19 years) was 5.8% and 2.3% respectively. Adolescents living in urban areas were found to be about 2.36 times more likely to have a higher BMI compared to their rural counterparts.

In Brazil, childhood and adolescent overweight/obesity is on the increase especially after the age of five, in all economic classes and in all regions (Nichues et. al, 2014). A review on the

prevalence of overweight and obesity in children and adolescents (2 to 19 years) in Brazil showed that there are variations across all regions. In the South, the rates were approximately 25.7% and 10.4%, respectively among subjects aged 6–18 years. In the Southeast, the prevalence was 13.7% and 15.4% respectively among subjects aged 2–19 years. In the Northeast region, rate of overweight was 15.8% and obesity 4.3% with population aged 6–19 years. In the North, the only study found showed a prevalence of 28.8% overweight with population aged 6–19 years. Similarly, the only study in the Central West region showed a prevalence of overweight of 16.8% and 5.3% obesity in children aged 6–10 years.

In Kuwait, recent studies have shown that overweight and obesity are indeed prevalent with an estimate of 30% – 40% of children and adolescents are either overweight or obese (Musaiger et. al, 2012). Alrashidi et. al, (2015) reported that about one quarter of the children (25.5%) were overweight and over one-third (36.5%) were obese according to the BMI classification.

2.2.2 Burden of Overweight and Obesity in Africa

Over nutrition is an emerging problem in segments of Sub-Saharan African society, particularly where lifestyles become urbanized and westernized (Van der Sande et. al, 2001) and data have accumulated on the adverse health effects of obesity in developed and developing countries. Increased risk for diabetes, dyslipidemia, coronary heart disease, atherosclerosis, hypertension, high blood cholesterol concentration, stroke, certain cancers and arthritis have been reported to be associated with obesity (Ribeiro et. al, 2006). The prevalence of overweight and obesity have increased dramatically over the past few decades in most industrialized countries.

Although more people in developing countries now die from obesity-associated diseases, many people are still under the impression that overweight and obesity affects only the Western world and that lower resource countries continue to struggle with only underweight, malnutrition and infections. This may not be the case because the obesity epidemic is growing faster in developing countries than in the developed world (WHO, 2000). Among people aged 15 years and above, the WHO estimated that the prevalence of overweight and obesity in 2010 was as high as 63.8% and 21.3% respectively, for men, and 73.8% and 43.2% respectively, for women, in some Sub-Saharan Africa countries. Eritrea, Ethiopia, Democratic Republic of the Congo and Central African Republic had the lowest prevalence, while Seychelles, Lesotho, South Africa and Mauritius had the highest prevalence of overweight and obesity in Sub-Sahara Africa (Ono et. al,

2012). In general, the countries with lower prevalence of overweight and obesity tend to be those with low gross domestic product per capita and vice versa, suggesting that socio-economic status may be a determinant of overweight and obesity in some African countries.

The 2002 National Youth Risk Behavior Survey for South Africa indicated that about 17% of children between 13 – 19 years were overweight (Reddy et. al, 2008). In 2010, a study on the prevalence of stunting, overweight and obesity, and metabolic disease risk was conducted among rural South African children. The results showed that the prevalence of combined overweight and obesity, which was almost non-existent in boys, was substantial among adolescent girls, increasing with age and reaching approximately 20-25% in late adolescence. Central obesity was prevalent among adolescent girls, increasing with sexual maturation and reaching a peak of 35%, indicating an increased risk of metabolic disease (Kimani-Murage et. al, 2010).

Monyeki et. al, (2015) conducted a systematic review of articles on the challenges of underweight and overweight in South African children and adolescents and reported the prevalence of overweight to be between 4% and 24.5% using the NCHS/WHO reference. Using the Cole-2007 reference, the prevalence ranged from 5.4% to 32.4% and between 0% and 11% using CDC growth charts. In the same vein, the prevalence of obesity among children in studies that used NCHS/WHO reference ranged from 1% to 6.4%. Cole-2007 reference showed a prevalence of 2.5% to 17.3% and IOTF reference indicated a higher prevalence of 24%.

Muthuri et. al, (2014) showed a trend towards increasing proportions of overweight/obesity over time in school-aged children in Sub-Saharan Africa, as well as a persistent problem of underweight. Weighted averages of overweight/obesity and obesity for the entire time period captured were 10.6% and 2.5% respectively. Body composition measures were found to be higher in girls than boys, and higher in urban living and higher socioeconomic status children compared to rural populations or those of lower socioeconomic status.

Morgre et. al, (2013) noted that the prevalence of overweight/obesity among school-aged children (5 – 14 years) in Tamale, Northern Ghana was 17.4%.

Malete et. al, (2013) examined linkages between obesity, physical activity, and body image dissatisfaction, with consideration of socioeconomic status (SES) and urbanization in adolescents in Botswana. They noted that the prevalence of overweight and obesity was 16.7%. These OW/OB students felt farther from ideal and greater dissatisfaction with their weight and body proportions than optimal weight students. Boys felt greater difference from ideal and more

dissatisfaction with muscle tone, chest size, and strength than girls. Lower SES students and those from rural villages had more minutes of PA than higher SES or urban students.

According to Wolde and Belachew (2014), the combined prevalence of childhood overweight and obesity among preschool children in Hawassa city, South Ethiopia was 10.7%. Children with a high socioeconomic status were about 3.5 times more likely to become overweight/obese compared with those living with low socioeconomic status.

2.2.3 Burden of Overweight and Obesity in Nigeria

There is little or no available data on national surveys on childhood/adolescent overweight and obesity in Nigeria. However, there are relevant findings showing the prevalence of overweight and obesity among children and adolescents across regions in the country.

Kandala and Stranges (2014) stated that the overall prevalence of combined overweight and obesity (body mass index $\geq$ 25) was 20.9%. Higher education, higher wealth index, living in urban settings, and increasing age were all significantly associated with a higher prevalence of overweight/obesity. There was also a striking variation in overweight/obesity prevalence across ethnic groups and state of residence, the highest being in Cross River State, in South-Eastern Nigeria, the lowest in Osun State in South-Western Nigeria.

According to the 2010 WHO survey data on Nigeria, the prevalence of overweight was 26% and 37% in men and women respectively, while the prevalence of obesity was 3% and 8.1% in men and women respectively. Data from the WHO Global InfoBase, based on individuals aged 30 years and above, shows that the prevalence of overweight and obesity together increased by 23% in men and 18% in women, while the prevalence of obesity alone increased by 47% in men and 39% in women, between 2002 and 2010, in Nigeria (Ono et. al, 2012).

A comparative study on the pattern and determinants of the weight-status of school-aged children from rural and urban communities in Osun State revealed that the prevalence of overweight/obesity was 9.7% in the urban community with no occurrence in the rural community (Adeomi et. al, 2015). Sabageh and Ojofeitimi (2013) reported that the prevalence of obesity among adolescents in Ile-Ife, Osun State was 4.2% and was significantly higher in the females than in the males. The prevalence of overweight and obesity among private and public school adolescent females were found to be 4.0% and 1.2%; and 2.3% and 0% respectively (Ojofeitimi et. al, 2011).

Mustapha and Sanusi, (2013) reported that the prevalence of overweight and obesity among in-school adolescents in Ondo State was 5.8% and 1.1% respectively. Furthermore, overweight and obesity were found to be more prevalent in the rural area (7.90% and 1.49% respectively) compared to the urban area (4.70% and 0.96% respectively).

A cross-sectional school-based study in Lagos State reported the prevalence of overweight and obesity to be 13.8% and 9.4% respectively among adolescents (Oduwole et. al, 2012). According to Akinpelu et. al, (2008), the prevalence of overweight and obesity were reported with respect to gender among adolescents (12 – 19 years) in urban Sagamu community. The study showed that the prevalence of overweight was high in both genders (0 – 8.1% and 1.3 – 8.1% in males and females respectively). However, obesity prevalence was quite low (0 – 2.7% and 0 – 1.9% in males and females respectively).

Ayoola et. al, (2009) conducted a study on the relative height and weight among children and adolescents of two rural communities in Southwestern Nigeria and found out that no child or adolescent was overweight based on BMI-for-age.

In the Niger Delta region, Idung et. al, (2014), estimated the prevalence of overweight and obesity among male and female adults to be 39.8%, 28.0%, 31.7% and 52.0% respectively. They reiterated the fact that overweight and obesity is increasing and becoming more common in Nigeria.

Ene-Obong et. al, (2012) estimated the prevalence of overweight and obesity among urban school-aged children and adolescents in Southern Nigeria to be 11.4% and 2.8% respectively which was higher in adolescents (10 – 18 years) than in children (5 – 9 years). In Benue State, 9.7% and 1.8% of the adolescents were overweight and obese respectively. Prevalence of overweight was found to be higher in girls (20.3%) than boys (16.2%), while a higher incidence of obesity was observed in boys (3.5%) (Musa et. al, 2012).

Similarly, Adesina et. al, (2012) reported the prevalence of overweight and obesity to be 6.3% and 1.8% respectively among secondary school adolescents aged 10 – 19 years in Port-Harcourt.

A cross-sectional study conducted in Benin-city, Nigeria revealed that 5.7% of the adolescents were overweight and 52.7% were at risk of overweight (Omuemu and Omuemu, 2010).

2.3 Dual Burden of Malnutrition in Developing Countries

Undernutrition has conventionally been the focus of nutrition issues in low- and middle-income countries (LMICs). The World Health Organization (WHO, 2002) revealed in the World Health Report that undernutrition together with micronutrient deficiencies are the highest risk factors for disease and death, especially among young children. Evidence shows that severe undernutrition kills globally 10.8 million children under-5 years annually (Pelletier & Frongillo, 2003). However, rapid economic development and urbanization have given rise to a nutrition transition, where energy-dense diets replace traditional diets and sedentary lifestyles prevail (Popkin, 1994). This has led to an increase in obesity and diet-related chronic diseases. The coexistence of under- and over nutrition, also known as the "dual burden," poses a huge public health challenge. Presently the growing threat of over nutrition and its health, development, and socioeconomic consequences cannot be ignored as under- and over nutrition live side by side in more households (Jongwook et. al, 2006). Currently, individuals, families, and communities globally are seen making the rapid transition from undernutrition to poor nutrition (Jongwook, 2006). In line with the co-existence of undernutrition and obesity, a protracted-polarized model of epidemiologic transition has been documented in LMICs. In this non-classical model of epidemiologic transition, infectious diseases and undernutrition coexist with non-communicable diseases and persist over prolonged periods of time. On the community level, economic status may influence the extent of the dual burden, with obesity increasingly affecting the already undernourished poor. In a household, shared determinants of poor nutritional status among members can result in disproportionate nutritional status across generations. Within an individual, obesity may co-exist with stunting or anemia due to shared underlying determinants or physiologic links (Tzioumis and Adair, 2014).

Therefore, both undernutrition-related diseases, infectious diseases and obesity-related diseases contribute substantially to the burden of disease in these societies (WHO, 2002).

This phenomenon, referred to as *Nutrition Transition*, may be attributed to the changing nature of globalized food supply, and easier access to technologically processed high fat and sugar foods coupled with more sedentary lifestyles.

2.4 Pattern of Childhood Overweight and Obesity in Developing countries

Jinabhai et. al, (2007) investigated the sex differences in under and over nutrition among school-going black teenagers (13 – 17 years) in South Africa. The socio-demographic and anthropometric profiles of these Black African teenagers revealed that 2,924 (54.9%) were girls who were significantly younger compared with the 2398 boys (45.1%), by an average of approximately 3 months ($P < 0.05$). Teenage girls on average were significantly shorter but were less stunted, weighed more, but had significantly lower weight for age than boys, and for each age group girls had a significantly higher BMI than boys ($P < 0.005$ in all cases). BMI increased with age and there was an increase in height and weight among both boys and girls with age. When considering over nutrition at each age, girls had a significantly higher prevalence of overweight than boys ($P = 0.003$). When considering obesity no statistically significant differences across gender and age groups were found.

Significant sex differences were noted in the prevalence of under and over nutrition, demonstrating a unique and uneven pattern regarding nutritional status among Black teenage boys and girls, with the boys showing signs of under nutrition and the girls, over nutrition. These significant sex differences were found at every age, with fewer girls undernourished and having larger BMIs.

The pattern of weight abnormality was studied among school children and adolescents (2 – 19 years) in Ota, Nigeria by Chinedu et. al, (2012). The study reported that weights and heights of subjects increased with respect to age, indicative of a progressive growth pattern. Abnormal body weights occurred in 22.4% of the respondents (underweight – 9.0%; overweight – 9.1%; obesity – 4.3%). However, weight abnormality reduced with an increase in age. They also noted that underweight occurred most in early childhood (2 – 5 years) while overweight and obesity peaked at middle childhood (6 – 9 years). Weight deficiency was higher in males (10.4%) than in females (7.9%), while weight excess was higher in females (13.9%) than in males (12.6%). The study concluded that weight deficiency and weight excess occurred simultaneously in school children and adolescents in Ota, Nigeria. Consequently, weight deficiency (under nutrition) prevailed in early childhood, whereas, weight excess (over nutrition) prevailed in the older children and adolescents.

2.5 Determinants of Childhood Overweight and Obesity

The causes of obesity are both biological and social and may vary considerably by sex or gender (Yang et. al, 2007). In general, excess weight gain occurs due to energy imbalance. Excessive energy intake, particularly of energy-dense foods [e. g., sugar-sweetened beverages (SSB)], and increased portion sizes, and sedentary activity are often ascribed as the main causes that have led to this pandemic (Lovejoy, 2003).

The increasing international trend for overweight and obesity in childhood is occurring alongside an escalation in poor eating and physical activity behaviors. Energy-dense and often poor quality foods are more widely available and the typical lifestyle of many children is characterized by low levels of physical activity and a predisposition to inactive or sedentary lifestyles (Florentino, 2002). These changes mean that affected children have an increased risk of lifestyle-related, non-communicable diseases (NCDs) including type 2 diabetes, cardiovascular diseases and certain forms of cancer (Ramachandran, et. al, 2012).

Recently, various studies have delved into the behavioral, psychological, environmental, genetic and socioeconomic influences on overweight and obesity among children and adolescents. These factors manifest in form of overeating or unhealthy dietary habits, reduced physical activity, sedentary lifestyle, high socioeconomic status, family history and the mechanisms by which the environment contributes to health.

2.5.1 Sociodemographic Factors

Several studies have shown the association between sociodemographic factors such as age, gender, ethnicity and increased BMI among adolescents. These factors are referred to as the non-modifiable factors that influence childhood overweight and obesity. Overweight and obesity has been on the increase in girls and boys of all ages and ethnic groups (Ogden et. al, 2014). However, variations have been observed in the prevalence of overweight and obesity by sex, age, race and ethnicity. There have been reports of similar prevalence of overweight and obesity among school-aged children (6-11 years old) and adolescents (12-19 years old) (Wang, 2011).

Fonseca and Gaspar de Matos (2005) conducted a survey among Portuguese adolescents to elicit their perception about associated factors associated with adolescent overweight and obesity. The study reported that there were more obese girls compared with boys, however, males who were

overweight were more than their female counterparts. Moreover, overweight and obesity was more common among the younger teens (11 – 13 years) than the older teens (14 – 17 years).

Lifestyle, occupational composition, dietary patterns, and outlooks differ greatly in metropolitan cities compared with nonmetropolitan cities in developing countries. Fascination of urban youth with Western- style food outlets and their willingness to pay for these services make metropolitan cities lucrative targets for most transnational fast-food companies. Limited availability of open spaces and parks, increased rural-to urban migration, and illegal settlements also reduce the scope for physical activity for children in metropolitan cities. In most urban families, working parents have less free time to plan proper nutrition and cook healthy meals for their children; as a result, healthy home-cooked dinners have been widely substituted by T.V. dinners or restaurant dinners, which frequently take place in fast-food restaurants. Working mothers have been particularly known to indulge their children with a fairly constant flow of sweet treats and high-fat snacks (Gupta et. al, 2012).

In Kaski district, Nepal, Acharya et. al, (2014) reported that among the 838 higher secondary school students (16 – 19 years), urban respondents were found to be more overweight/obese than rural respondents (p=0.001, OR=2.360). Adolescents of ethnic/ indigenous group (p<0.001, OR=2.56), fathers with government job (p=0.011, OR=2.08), mothers with teaching job (p=0.038, OR=2.57) were also found to be more overweight and obese. However, other socio-demographic factors like gender (p=0.26), birth order (p=0.404) and parents' education (p=0.121 for fathers' education and p=0.282 for mothers' education) were not significantly associated with overweight and obesity.

2.5.2 Behavioral Factors

Mozaffarian et. al, (2011) and Deshmukh-Taskar (2010) identified several obesity-promoting behaviors include frequent fast food consumption, eating occasions away from home, high consumption of beverages high in sugar, and breakfast omission. In developing countries, students often have easy access to high-caloric, and nutritionally-depleted foods in cafeteria and fast-food shops located around schools. Childhood obesity has been linked to these food choices available in the school cafeteria (Gupta et. al, 2012). Rapid increase in childhood obesity has also been attributed to a shift in the activity patterns from outdoor play to indoor entertainment: television viewing, internet and computer games.

In Kuwait, the rising prevalence of childhood overweight and obesity is a major public health issue. Recent findings show that economic transition has a negative influence on Kuwaiti's population lifestyle and dietary habits. Both children and adults consume more than the recommended energy intake for protein and carbohydrate requirements by about 78 – 100%. There has been an increase in food availability and consumption of foods high in calories and fats due to the high economic state of the country. Moreover, a sedentary lifestyle, such as physical inactivity and long hours of watching television has also been identified as a contributing risk factor to the incidence of childhood overweight and obesity in Kuwait (Musaiger, 2011).

Alrashidi et. al, (2015) using a multiple regression model indicated that age, family history of overweight and obesity, sedentary lifestyle (physical inactivity, prolonged television watching) and regular intake of fast foods from restaurants were contributing factors to overweight and obesity in both male and female children in Kuwait.

Ranjani et. al, (2014) stated that psychological and behavioral factors in form of unhealthy dietary practices and increased sedentary lifestyle are the most important determinants of childhood overweight and obesity. For example, in Punjab, among adolescents who were said to be obese, more than 80% of them were non-vegetarians. Overweight and obesity also was more prevalent among adolescents who ate out outside the home and fed largely on energy-dense, high calorie snacks and drinks (Aggarwal et. al, 2008). Aggarwal et. al, (2008) also reported that more than half of the adolescents' spent 1-4 hours per day viewing TV or sitting at the computer. Physical inactivity was also reported to influence childhood overweight in form of less likelihood to participate in sporting activities, changing mode of transportation (increased motorization), increased mechanization and use of labor-saving devices at home (Goyal et. al, 2010).

Several studies on the association between adolescent overweight/obesity and chronic disease-related health practices have been posited. For example, Farhat et. al, (2010) showed that early adolescent (<15 years) overweight and obese girls were 1.75 and 1.77 times more likely to smoke, respectively, than their normal weight peers, and mid-adolescent (≥ 15 years) obese girls were 2.05 times more likely to smoke. Haug et. al, (2009) showed a negative association

between overweight and obesity and breakfast consumption and physical activity in the Netherlands and Finland during a cross national study.

The Australian Institute of Health and Welfare (2004) identified various causes of overweight and obesity among children and adolescents in Australia. They include:

1. Increasing energy intake – Factors contributing to high fat diets include availability of energy-dense foods, reduced time for cooking and foods eaten away from home including restaurants, eateries, etc.
2. Increased sedentary lifestyles – Many sedentary activities have replaced active physical activities during leisure hours including prolonged hours of watching television, electronic or computer games and videos and internet.
3. Reduced physical activity levels – Increased use of cars and perceptions about roads and local neighborhoods being unsafe have reduced the level of walking or cycling to schools or other public places.
4. Changes in family structures – Changes in family work patterns and parents' busy schedules have reduced sufficient engagement in active physical activity with the children.

A study conducted by Guo et. al, (2013) among adolescents in Northeast China showed that frequent sleep was a protective factor against being overweight or obese. However, not having breakfast everyday conferred higher odds of being overweight or obese.

A 2014 HEAL study by Skouteris et. al, reported a randomized controlled trial addressing the risk factors of overweight and obesity among 118 adolescents in out-of-home care (OOHC) aged 13 – 17 years. Several studies showed that the risk of overweight and obesity for children placed in OOHC has been largely ignored. Children and young people in OOHC experience poorer health conditions than their counterparts in the general community, including lower levels of immunization and attainment of educational objectives, and higher levels of mental health issues, behavioral disorders, risky health behaviors, illnesses and accidents (Skouteris et. al, 2011). Though the study is still in progress, it aims at measuring the effectiveness of the HEAL programme across two major community service organizations that provide OOHC to disadvantaged adolescents in the State of Victoria, Australia – Berry Street and The Salvation Army Westcare. It is hypothesized that the intervention HEAL group adolescents, in comparison with the wait-list group, at the completion of the 6-month intervention programme will:

demonstrate greater consumption of fruit and vegetables, and a decrease in consumption of high-fat, high-sugar cordials, soft-drinks and juices and non-essential, energy-dense snack foods; increase the number of days per week they are physically active for at least 60 minutes per day; demonstrate improved knowledge regarding key aspects of healthy eating, physical activity and sedentary behaviors relevant to the prevention of obesity and improving health and well-being generally; and exhibit lower levels of depressive, anxiety, and stress symptoms, lower body dissatisfaction, and greater self-esteem and quality of life. At 12 months post intervention these significant differences between the intervention and control group adolescents will be sustained, and the intervention group adolescents will also exhibit lower body mass index (BMI)-for-age z-scores.

Kleiser et. al, (2009) revealed potential determinants of obesity among 17, 641 children and adolescents aged 0 – 17 years in Germany. The cross sectional KiGGS study showed that there were strong positive associations between obesity and various risk factors. The strongest association with obesity was observed for parental overweight and for low SES (OR = 4.92; 95% CI = 4.1 – 6.0; OR = 2.12; 95% CI = 1.8 – 2.4). Furthermore, a positive association with both overweight (including obesity) and obesity was seen for maternal smoking during pregnancy (OR = 1.68, 95% CI = 1.5 – 1.9; OR = 1.93, 95% CI = 1.6 – 2.4), high weight gain during pregnancy (only for mothers of normal weight) (OR = 1.92, 95% CI = 1.4 – 2.6), high birth weight (OR = 1.87, 95% CI = 1.4 – 2.5), and high media consumption (OR = 2.06, 95% CI = 1.6 – 2.6). In addition, high intakes of meat and sausages, total beverages, water and tea, total food and beverages, as well as energy-providing food and beverages (OR = 1.32, 95% CI = 1.1 – 1.7) were significantly associated with overweight as well as with obesity. Long sleep time was negatively associated with obesity among 3- to 10-year olds (OR = 0.89, 95% CI = 0.8 – 1.0).

An Arab Teens Lifestyle Study (ATLS) conducted in Saudi Arabia examined the lifestyle factors associated with overweight and obesity among 2,906 adolescents aged 14 – 19 years (Al-Hazzaa et. al, 2012). The study evaluated the associations between obesity measures and several lifestyle factors, including physical activity, sedentary behaviors and dietary habits. The major results from the study included reports of less physical activity in terms of vigorous activity and less healthy dietary habits (e.g., lower intake of breakfast, fruits and milk) and less intake of sugar-sweetened beverages, sweets/chocolates among obese adolescents. Logistic regression analysis showed that overweight/obesity (based on BMI categories) or abdominal obesity (based on

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WHtR categories) were significantly and inversely associated with vigorous physical activity levels (aOR for high level = 0.69, 95% CI 0.41–0.92 for BMI and 0.63, 95% CI 0.45–0.89 for WHtR) and frequency of breakfast (aOR for<3 days/week = 1.44; 95% CI 1.20–1.71 for BMI and 1.47; 95% CI 1.22–1.76 for WHtR) and vegetable (aOR for<3 days/week = 1.29; 95% CI 1.03–1.59 for WHtR) intakes, and consumption of sugar-sweetened beverages (aOR for<3 days/week = 1.32; 95% CI 1.08–1.62 for BMI and 1.42; 95% CI 1.16–1.75 for WHtR).

A recent study conducted by Piryani et. al, (2016) assessed the associated risk factors of overweight among urban school adolescents in Nepal. The results showed that the prevalence of overweight among adolescent students was 12.2% (95% CI 8.9 to 15.5). Factors associated with being overweight included gender (being male) (adjusted OR (AOR) 2.64, 95% CI 1.18 to 4.88), type of school (studying in private school) (AOR 2.10, 95% CI 1.03 to 4.28), family's socioeconomic status (AOR 4.77, 95% CI 1.36 to 16.72), watching television for more than 2 h per day (AOR 8.86, 95% CI 3.90 to 20.11), and consuming fruit four times or less per week (AOR 3.13, 95% CI 1.39 to 7.01). However, there was no statistically significant association between adolescent overweight and age, ethnicity, mother's education level, mother's occupation, number of siblings or family type. The study concluded that socioeconomic status, watching television for a longer time and consuming less fruit were major risk factors for overweight among adolescents in Nepal.

In Malaysia, the prevalence of overweight is higher in urban cities compared to rural areas and there are various factors that contribute to increase in body weight status including attitudinal disposition towards food, ethnicity, genetic and environmental issues, sociocultural beliefs, area of residence and family's socioeconomic status (Moy et. al, 2004).

Sakinah et. al, (2012) examined the socio-demographic, dietary and physical activity determinants of adolescent overweight and obesity among 178 secondary school adolescents (13 – 17 years) in Kelantan, Malaysia. They compared the prevalence of overweight and obesity between Kota Bharu district and Bachok district and they found that the prevalence was higher in the former than the latter. This reflected the fact that the household income of the former district was significantly higher than the latter district. The results also showed that there were significant associations between students' residence ($p = 0.004$), household income ($p = 0.005$) frequency of fast food consumption ($p = 0.001$), breakfast skipping ($p = 0.001$) and physical activity ($p = 0.001$) with overweight and obesity prevalence.

Peltzer and Pengpid (2011) reported various factors associated with overweight and obesity among school-aged adolescents in Ghana and Uganda. Among girls, smoking cigarettes (AOR = 1.52, 95% CI 1.17 – 1.98) and loneliness (AOR = 2.26, 95% CI 1.23 – 4.15) were found to be associated with overweight or obesity and among boys, smoking cigarettes (AOR = 1.75, 95% CI 1.11 – 2.76) were found to be associated with overweight or obesity in multivariable analysis. Overweight status was not associated with the intake of fruits, vegetables, and sedentary behavior.

Morgre et. al, (2013) reported television viewing (p = 0.0149) and late bedtimes (p = 0.0375) as factors that were positively associated with overweight and obesity among school-aged children (5 – 14 years) in Tamale, Northern Ghana.

A study on the worldwide association between television viewing and obesity in children and adolescents revealed that television viewing contributes to increased BMI in childhood. Daily television viewing in excess of one hour was reported in 89% of adolescents and 79% of children. Comparing adolescents in the short viewing group as the reference, those in the moderate, long and prolonged groups had significant increase in BMI and were higher in females than in males. The study concluded that increased television viewing hours were positively associated with BMI in both adolescents and children with an apparent dose response effect (Braithwaite et. al, 2013).

2.5.3 Built Environment and Socioeconomic Status (SES)

Multistructural variables such as the physical environment and socioeconomic status have been shown to have a significant influence on energy intake and energy expenditure (Cutler et. al, 2011). Environmental influences consist of the proximity of large supermarkets and malls, the concentration of fast food establishments and restaurants in any given area, the availability of recreational centers for physical activity, and socioeconomic status. In developing countries, affluent children attending private schools have significantly higher prevalence of overweight and obesity than those belonging to lower SES. Children from high SES receive daily allowance (pocket money) to buy lunch and snacks. Because of the brand-building efforts by transnational companies that heavily target this age group, fast foods, easily available in the school cafeteria, become their preferred choice. In addition, due to easy availability of domestic help in developing countries, affluent children may resort to a relatively inactive lifestyle. Although

most children in private schools go to school by bus or car, active commuting either by walking or bicycling is seen more commonly among children in government schools (Gupta et. al, 2012). These may either have a positive or negative influence on dietary habits and physical activity levels (Reed et. al, 2011).

Guo et. al, (2013) showed that a higher monthly family income (2,000–5,000 Chinese yuan (CNY); 1 CNY = 0.163 US dollar) was associated with an increased risk of being overweight or obese as compared with lower incomes.

Alqahtani et. al, (2014) reported socioeconomic determinants of overweight and obesity among Saudi children. The results showed that male adolescents living in households which had a domestic driver were at a significantly higher risk of being obese in both the urban ($p = 0.02$) and rural areas ($p < 0.001$). Urban females living in a medium-income household were at risk of overweight ($p = 0.02$) and obesity ($P < 0.01$). The risk of obesity was almost 11 times higher for females living in households which had a driver ($p = 0.01$). Owning a computer was associated with an increased risk of overweight among urban adolescent females ($p = 0.01$).

Children living with higher SES were 3.5 times more likely to be at risk of being overweight and obese as compared to children living with lower SES (Wolde and Belachew, 2014).

A recent study on the predictors of overweight and obesity in adult women in Nairobi Province of Kenya revealed that urbanization and the nutrition transition were well established in the sample of women studied in the high SE groups. They exhibited a sedentary lifestyle and consumed a diet high in energy, protein, fat, cholesterol, and alcohol and lower in fiber and carbohydrate compared with those in the low SE groups (Mbochi et. al, 2012).

2.5.4 Psychosocial Factors

Adolescent overweight and obesity have also been positively associated with a development of negative body image which is associated with numerous health effects such as impaired mental ability, low self-esteem, depression, sedentary lifestyle, physical inactivity, substance use and abuse (Paxton et. al, 2006).

Nieman and LeBlanc (2012) also noted important psychosocial contributors of adolescent overweight and obesity. They include depression, low self-esteem, bullying and weight bias.

2.5.5 Genetics and Parental Obesity

Several studies have shown that genetics and parental obesity are strong determinants of a child's weight status (Reilly et. al, 2005; Guo et. al, 2013). Parents are largely held accountable for their child's food environment in early life; therefore, separation of the genetic and environmental components of the influence of parental obesity is almost impossible (Parsons et. al, 1999).

A cross-sectional study of 2,385 adolescents aged 11 – 18 years was conducted by Thibault et. al, (2009) in Southwest France between 2004 and 2005. The study examined risk factors of overweight and obesity among French adolescents. The findings showed that the prevalence of overweight and obesity was greater in boys and younger children. The odds ratio (OR) for an adolescent being overweight increased with parents' being overweight (at least one parent overweight, OR 1.97, 1.48–2.62, $P < 0.0001$), low paternal socioeconomic status (OR 1.78, 1.22–2.60, $P < 0.01$) and sedentary behavior (22 h/wk, OR 1.33, 1.02–1.74, $P < 0.05$), and decreased with physical activity of parents (at least one parent active, OR 0.67, 0.51–0.89, $P = 0.01$). The study concluded that parental overweight and low socioeconomic status and adolescents' sedentary behavior are strong risk factors for adolescent overweight and obesity, and that parent's active lifestyle is associated with a lower risk of overweight in their adolescents.

A recent national study conducted among Iranian adolescents revealed that parents' weight status, father's job and parents' education showed significant association with weight status in adolescents. Logistic regression analysis showed that parental overweight and obesity, parental education and father's job were the main parental determinants of overweight and obesity in Iranian adolescents (Doustmohammadian et. al, 2012).

In Bangladesh, Ferdousi and Alamgir (2008) conducted a cross-sectional study among 202 students and found out that the order of birth of the students in family was found significant having more prevalence of overweight among the first child. Also, children overusing computer games, reading excess story book, doing less physical activity and no sports were found to be significantly more among overweight students than others. Types and frequency of snacks were also found to be significantly higher in the overweight than non-overweight students.

A comparative study conducted in Olorunda Local Government, Osun State, Nigeria, showed that there were significant associations between school types and various risk factors for overweight and obesity in adolescent girls. These include: history of obesity in parents ($\chi^2 = 9.52$;

P=0.002), knowledge about obesity (χ^2=50.12; P=0.0001), dietary practice (χ^2=43.48; P=0.0001) and activities/lifestyle (χ^2=41.15; P=0.0001), perception of their body figures (χ^2=4.71; P=0.03), their satisfaction with their figures (χ^2=9.94; P=0.002) and their fear about being overweight or obese (χ^2=4.25; P=0.039). Obesity/overweight in any of the parents or siblings occurred more among public school girls, good knowledge about obesity was demonstrated by private school girls compared to their public school counterparts. However, active lifestyles and healthy dietary practices were demonstrated more among the public school girls. Private school girls expressed more dissatisfaction with their body figures in contrast to the public school girls (Ojofeitimi et. al, 2011). The reasons for these varied results were identified to be due to differences in socioeconomic status, level of education, increased likelihood of practicing Western diets and eating junk foods and engagement in sedentary activities.

2.6 Health Consequences of Childhood Overweight and Obesity

Childhood overweight and obesity poses serious health risks for children's health but medical research in investigating how obesity affects the health of children and adolescents has advanced rather slowly (Daniels, 2006). The immediate and long-term health consequences of childhood overweight and obesity were assessed as follows:

2.6.1 Cardiovascular Problems

In the cardiovascular system, the heart pumps blood and transported throughout the body and back to the heart by the blood vessels. The arteries, which move blood from the heart to all other parts of the body, are a dynamic series of conduits that regulate the flow of blood. As such, they are susceptible to various diseases that can ultimately lead to heart attack and stroke. The heart muscle is also susceptible to mechanisms that can thicken it and reduce its functions.

Studies have shown the association between child and adolescent overweight and obesity and cardiovascular risks. Daniels (2006) reported that the prevalence of hypertension and left ventricular hypertrophy (increased thickness of the heart's main pumping chamber) was about 2 – 4% in pediatric populations. The risk of high blood pressure is about 2.5 to 3.7 times higher among with a BMI at or above the 90th percentile than those with a BMI at or below the 10th percentile. He also noted that atherosclerosis (hardening of the arteries) was a significant consequence of childhood overweight and obesity, even though it was once thought to be

predominantly adult health concerns. Atherosclerosis begins as a fatty streak on the artery's inner lining and progresses into a fibrous plaque (a raised lesion) that ultimately causes a heart attack or a stroke by blocking blood flow to the heart or to the brain. Risk factors that cause this progression in adulthood include smoking, hypertension, high cholesterol, and diabetes.

2.6.2 Metabolic Disorders

The metabolic system is a complex set of interrelated processes that control how the body uses and stores energy. It includes the gastrointestinal tract, which governs absorption of nutrients and energy; the liver, which is the body's major metabolic organ; and a variety of hormonal systems that govern the ebb and flow of nutrients and energy. Many metabolic disorders-among them insulin resistance, the metabolic syndrome, dyslipidemia (abnormal levels of fat in the blood), glucose intolerance and type 2 diabetes mellitus-have been linked with obesity in adulthood. The metabolic syndrome is a constellation of risk factors, including increased waist circumference, elevated blood pressure, in- creased triglyceride and decreased HDL- cholesterol concentrations, and raised blood sugar levels. The underlying risk factors for the metabolic syndrome are abdominal obesity and insulin resistance. The metabolic syndrome is an important risk factor for cardiovascular disease and for the development of type 2 diabetes in adults. Obesity is associated with cholesterol abnormalities, often referred to as atherogenic dyslipidemia, that involve abnormal changes in cholesterol and triglycerides (or fats) in the blood. These abnormalities, which appear to accelerate atherosclerosis, also occur in obese children and adolescents.

A study conducted by Narayan et. al, (2007) in USA revealed that there was a 37% increased lifetime risk of diabetes associated with obesity at age 18 years. However, the rising prevalence of childhood overweight and obesity in recent years has caused an appearance of type 2 diabetes in children as young as 8 years old (Daniels, 2006). The prevalence of type 2 diabetes mellitus has increased dramatically in adolescents-in parallel with the increasing incidence and severity of obesity. In Cincinnati the prevalence of type 2 diabetes in adolescents increased tenfold between 1982 and 1994.

2.6.3 Psychosocial Consequences

The most widespread consequences of childhood obesity are psychosocial. Obese children become targets of early and systematic discrimination. As they mature, the effects of

discrimination become more culture-bound and insidious. Psychosocial issues involve psychological health and the ability to relate to family members and peers. Such issues may have many determinants, which may be genetic or socioeconomic. Childhood obesity is linked with various problems such as depression, low self-esteem, and negative body image perception – especially as a result of discrimination. Depression is a common mental health problem in adolescents. Adolescent-onset depression is often persistent and may be related to longer-term adverse mental health and health outcomes.

2.6.4 Premature Mortality

Child or adolescent overweight and obesity have been found to be linked with an increased risk of premature mortality in adulthood with hazard ratios ranging from 1.4 to 2.9 (Reilly and Kelly, 2011). A cohort study found that a BMI of >25 kg/m^2 at age 18 was associated with significantly increased mortality within 20 years of follow up. By the 32 year follow up, a BMI of greater than or equal to 26 kg/m^2 at age 18 years was associated with significantly increased mortality risk (RR = 1.95, with BMI 19 kg/m^2 as the reference group) (Reilly et. al, 2003).

Other less common consequences may include:

2.6.5 Social and Economic Effects

Of all the economic issues related to obesity, perhaps the most important is the cost of its associated health problems (Daniels, 2006). Evidence shows that obesity in adolescence/ young adulthood has adverse effects on social and economic outcomes in young adulthood (for example, income, and educational attainment). These effects might be more pronounced in women than men. For example, British girls born in 1958 who had BMI > 90th percentile when studied at age 16 had significantly lower income than girls with BMI < 90th percentile (by 7% on average) at age 23, controlled for social class and intelligence quotient (Sargent et. al, 1994).

2.6.6 Polycystic Ovary Syndrome

Polycystic ovary syndrome consists of a constellation of abnormalities, including abnormal menses, such clinical manifestations of androgen excess as acne and excessive hair growth, elevated levels of circulatory androgens, and polycystic ovaries on ultrasound evaluation. Although obesity is generally not considered the cause of the syndrome, it can exacerbate the

associated metabolic derangements, including insulin resistance. The onset of polycystic ovary syndrome is often around the time of menarche, but it can occur after puberty, particularly after excess weight gain. The syndrome is one of the most common female hormonal disorders, with a reported prevalence of 5 to 10 percent (Daniels, 2006).

2.7 Correlation between BMI and WHR

The easiest and cheapest measures of obesity are the body mass index (BMI), waist circumference (WC) and waist to hip ratio (WHR) (Ghazali and Sanusi, 2010). Body mass index (BMI) is a good measure of general adiposity and an elevated BMI value is an established risk factor for ischemic heart disease, stroke and many cancers (Hu, 2008). The diagnosis of obesity is usually based on BMI. However, Waist Hip ratio (WHR) is thought by some to be a more sensitive indicator of Obesity because of the inclusion of abdominal fat deposition in the Syndrome X (WHO, 2005). Studies have shown a positive relationship between BMI and WHR in relation to overweight and obesity, high blood pressure and metabolic syndrome among adults (Sanya et. al, 2009; Zafar et. al, 2007; Abiodun et. al, 2014) but studies regarding this relationship have not been adequately reported in children and adolescents.

CHAPTER THREE

METHODOLOGY

3.1 Description of Study Area

This research study was conducted in Ikenne Local Government Area (IKLG) of Ogun State. This Local Government Area was created in September 1991, from the defunct Remo Local Government. It is a semi-urban settlement, comprising of 5 major towns, namely Iperu, Ilisan, Ogere, Irolu and Ikenne. It has a land area of about 144 sq.km bounded on the west by Obafemi-Owode Local Government, on the south by Sagamu Local Government, on the east and north by Odogbolu Local Government and a population of 118,735 as at the 2006 census. The Remo people are predominant in this area. The people are predominantly farmers and traders, due to the favorable rainforest weather in this area. There is freedom of worship for all. There are Christians, Muslims and traditional worshippers. The Local Government has 27 approved public and private secondary schools and 2 unapproved secondary schools.

3.2 Study Design

The study was a cross-sectional school-based study with adolescents between the ages of 10 and 19 years.

3.3 Study Population

The study population comprised of school-aged adolescents (10 – 19 years) attending public and private secondary schools (JSS 1 to SSS 3) in IKLG.

3.3.1 Inclusion Criteria

The study included adolescents between 10 and 19 years who were enrolled in a public or private school as at the time of the study.

3.3.2 Exclusion Criteria

The study excluded students below 10 years and above 19 years who were still in secondary school; and children suffering from severe illness as at the time of the study.

3.4 Sampling Technique

A multistage sampling technique was used for the selection of the study participants.

Stage 1: Of the 10 wards in IKLG, 3 wards were randomly selected by balloting.

Stage 2: From each ward, one community each was randomly selected by balloting.

Stage 3: From the selected communities, secondary schools were stratified into public and private schools. One private and one public secondary school were selected at random by balloting (a total of 6 schools were selected randomly from the list of all the schools in the communities).

Stage 4: Probability proportional to size sampling was used to select the total number of study participants in each school. This was determined by dividing the total number of students in each school by the total number of students in all the six (6) schools and multiplying by the sample size (N).

Stage 5: Students from each school were stratified into Junior and Secondary sections and probability proportional to size sampling was also used to select study participants from each stratum.

3.5 Sample Size Determination

The minimum sample size (n) was determined by the formula for estimating sample size for single proportion:

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

Where

Z_{α} = value of z at 95% Confidence level (1.96)

p – prevalence of overweight in South-Western Nigeria (22.2%) (Oduwole et. al, 2012)

d = degree of precision (5%)

$q = 1 - (\text{prevalence of overweight and obesity})$

$$n = \frac{1.96^2 \times 0.222 \times 0.778}{0.05^2}$$

$$= 265.4$$

Adjusting for 10% non-response rate = n/(1-r) = 266/0.90 = 296

Adjusting for design effect: of (x2): 296 × 2 = 592

Minimum sample size = 592 participants

3.6 Operational Definition of Terms

Childhood Overweight and Obesity: Abnormal or excessive fat accumulation in the body that may impair health in children and adolescents.

Body Mass Index (BMI): A person's weight in kilograms divided by the square of height in meters. For children and adolescents, BMI is age- and sex-specific and often referred to as BMI-for-age. BMI-for-age was classified based on WHO Growth Reference Charts (2007) for 5 – 19 years.

Overweight: > +1 SD (equivalent to BMI 25kg/m^2 at 19 years)

Obesity: > +2 SD (equivalent to BMI 30kg/m^2 at 19 years)

Waist-Hip Ratio (WHR): The waist circumference divided by the hip circumference. It is an additional measure of body fat distribution. WHR was classified based on WHO sex-specific cut-off points (WHO, 2011). WHR ≥ 0.90 for boys and ≥ 0.85 for girls were considered overweight.

Adolescent: Children between the ages of 10 and 19 years.

3.7 Data Collection Procedure

The major instrument for data collection was a semi-structured, pretested and interviewer-administered questionnaire. The questionnaire contained the following sections:

Section A: Adolescents' sociodemographic characteristics including age, sex, ethnicity, religion, area of residence, parents' highest level of education, parents' occupation, average monthly family income, number of siblings, and position in the family.

Section B: Adolescents' dietary habits including breakfast consumption, and weekly dietary intake.

Section C: Adolescents' physical activity levels/sedentary lifestyle including mode of transportation to and from school, engagement in sporting activities, hours spent on watching television, video games and sleeping hours.

Section D: Respondents' perception of weight status of family members

Section E: Body Image Perception of Respondents

Anthropometric measurements were taken including weight (kg), height (m), waist and hip measurements (cm), to determine the Body Mass Index and Waist-Hip Ratio.

Physical assessments: Body weight of the respondents was measured using a standard portable bathroom scale (Camry Mechanical Personal Scale: Model BR9015B) to the nearest 0.1kg. Each respondent was weighed with light clothing and without shoes and the scale was checked for accuracy after every 10^{th} person. The height of the respondents was measured as the vertical distance from the top of the head to the bottom of the feet with an appropriate height meter to the nearest 0.1cm. The Body Mass Index (BMI) was calculated in kg/m^2. Waist circumference (cm) was measured with a flexible tape between the lowest rib and the superior border of the iliac crest at the level of the umbilical cord in a standing and balanced position. The hip circumference was done using a flexible tape to measure the widest diameter around the greater trochanter. Waist-Hip Ratio (WHR) was calculated to the nearest 0.05.

Ethical approval for this study was obtained from Babcock University Health Research Ethics Committee (BUHREC). The principals of the selected schools were visited by the researcher to discuss the objectives and significance of the study and to obtain their permission to carry out the study. All measurements were taken during free periods or break periods in order not to disrupt academic activities. Two research assistants (a male and a female) were adequately trained on how to measure weight, height, waist and hip measurements of the participants. They were also

trained on how to distribute the questionnaires and its contents for easy understanding to ensure that the participants fill them correctly.

3.8 Study Variables

Dependent/Outcome Variables:

- Overweight – as assessed by Body Mass Index and Waist-Hip Ratio

Independent Variables

- Sociodemographic factors e.g. age, sex, ethnicity, religion, area of residence, parents' highest level of education, parents' occupation, average monthly family income, number of siblings, and position in the family.
- Socioeconomic status: Socioeconomic status of respondents was determined by parents' level of education, occupation, type of school, total family monthly income and possession of some selected home equipment.
- Dietary habits: The frequency of consumption of some selected foods a week before the study was scored. Foods considered healthy such as fruits, vegetables, meat, fish, eggs and starchy foods were scored thus; those who do not take the foods at all – 0, less than 3 times were scored 1, more than 3 times/week were scored 2 and daily/more than once daily were scored 3. For foods considered unhealthy such as fast foods, pastries, soft drinks and sweets; those who do not take these foods at all were scored 3, less than 3 times were scored 2, more than 3 times were scored 1 and daily/more than once daily were scored 0. All these scores were added and the mean was obtained. Those who scored less than the mean were considered as having unhealthy dietary habits and those who scored above the mean were considered as having healthy dietary habits (Adeomi et. al, 2015).
- Physical activity levels: The activity levels of the respondents were also scored. Those who engaged in vigorous sports 3 or more days a week, went to school on foot or bicycle, slept 8 hours or less daily, spent 2 hours or less watching television and computer games were scored 2 each for the activities; those who did not engage in these activities were scored 1. All these scores were added and a mean score were obtained. Those who scored less than the mean were considered as having low physical activity level and those who

scored above the mean were considered as having high physical activity level (Adeomi et. al, 2015).

3.9 Data Management and Analysis

Data gathered from the questionnaires were coded and entered into the computer using Statistical Package for Social Sciences (SPSS), version 20. Data were further cleaned and backed-up to an external hard-drive. Data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations). Cross-tabulations and Chi-square test analysis were used to compute the relationship between variables in order to infer possible explanations.

Logistic regression analysis was used to identify the determinants of overweight among adolescents in IKLG. Odds ratios and 95% confidence interval were obtained for correlations between the dependent and independent variables. Simple linear regression was used to determine the relationship between BMI and WHR.

3.10 Ethical Considerations

1. Approval was obtained from Babcock University Health Research Ethics Committee (BUHREC) and the school authority of the six secondary schools that were included in the study.
2. Written and verbal informed consent was obtained from the participants.
3. Anonymity and confidentiality was maintained. All identifiers were removed from the questionnaires and the research assistants were trained on the importance of confidentiality.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic Characteristics of Respondents

A total of 622 secondary school students participated in the study. The age range of the respondents was between 10 and 19 years. The mean age of the respondents was 15 years and a standard deviation of 2 years. Majority (61.7%) of the respondents were between 15 – 19 years, while more than half (58.7%) of the adolescents were females. A high percentage of the respondents (82.2%) were Yoruba, and practiced Christianity (77.5%). Respondents' father's and mother's highest level of education were secondary education (52.2% and 54.4% respectively). Majority of the respondents had less than 5 siblings each (69.1%) and were within the birth position of 1 – 4 (86.5%). Three hundred and ninety four (63.3%) were enrolled in public schools while 228 (36.7%) were enrolled into private schools. More than half of the respondents were in the senior secondary classes (68.9%). (Table 4.1)

Table 4.1: Socio-demographic Characteristics of Respondents

Variables	Frequency (N = 622)	Percent (%)
Age (years)		
10-14	238	38.3
15-19	384	61.7
Sex		
Male	257	41.3
Female	365	58.7
Type of school		
Public	394	63.3
Private	228	36.7
Ethnicity		
Yoruba	511	82.2
Igbo	84	13.5
Others	27	4.4
Religion		
Christianity	482	77.5
Islam	132	21.2
Others	8	1.3
Father's education		
Primary & less	48	7.8
Secondary	322	52.2
Tertiary	246	40.0
Mother's education		
Primary & less	62	7.0
Secondary	335	54.4
Tertiary	218	35.5
Number of siblings		
1 – 4	428	69.1
More than 4	191	30.9
Birth position		
1 – 4	538	86.5
More than 4	84	13.5
Class		
Junior Secondary	194	31.2
Senior Secondary	428	68.9

4.2 Socio-economic Status of Respondents' Parents

Table 4.2 shows the distribution of respondents' parents' socioeconomic status. Results showed that almost half of the respondents' fathers were business owners (45.0%); others were professionals (24.6%), artisans (19.8%) and civil servants (10.6%). Similarly, the mother's occupations were majorly business owners (67.8%); professionals (13.8%), artisans (11.4%), while a few (6.9%) were civil servants. More than half (59.4%) of the respondents had an average monthly family income of less than ₦100,000. Majority of the respondents possessed television sets (97.7%), generator set (90.5%), car (64.7%), and a house (76.8%). However, more than half of the respondents did not possess computer/video games (53.1%), while 36.4% lived in a rented apartment.

Table 4.2: Socio-economic Status of Respondents' Parents

Variables	Frequency (N = 622)	Percent (%)
Father's occupation		
Artisan	123	19.8
Business	280	45.0
Civil servant	66	10.6
Professional	153	24.6
Mother's occupation		
Artisan	71	11.4
Business	422	67.8
Civil servant	43	6.9
Professional	86	13.8
Average monthly family income		
Less than ₦100,000	353	59.4
₦100,000 - ₦299,999	126	21.2
₦300,000 - ₦499,999	51	8.6
₦500,000 and above	64	10.8
Television set/DVD		
Yes	607	97.7
No	15	2.3
Generator		
Yes	561	90.5
No	61	9.5
Computer/video games		
Yes	291	46.9
No	331	53.1
Car		
Yes	401	64.7
No	221	35.3
Do your parents own a house		
Yes	477	76.8
No	145	23.2
Do you live in a rented apartment		
Yes	226	36.4
No	396	63.6

4.3 Adolescents' Dietary Intake

Table 4.3 shows the distribution of adolescents' dietary intake of various food groups. Results showed that more than half of the respondents occasionally ate fruits (59.5%), vegetables (43.0%), soft drinks (44.4%), fruit drinks (45.1%) and fast foods (35.1%). However, most of the respondents ate meat and poultry products (65.8%), sugar-sweetened beverages (37.8%), water (69.4%), starchy foods (54.4%), snacks (58.4%) and sweets (39.4%) every day.

Table 4.3: Adolescents' Dietary Intake of various food groups based on a weekly recall

Food groups	Frequency(N = 622)	Percent (%)
Fruits		
Not at all	93	15.0
Occasionally	368	59.2
Very often	50	8.0
Everyday	107	17.2
Non-response	4	0.6
Vegetables		
Not at all	87	14.0
Occasionally	266	42.8
Very often	94	15.1
Everyday	171	27.5
Non-response	4	0.6
Soft drinks		
Not at all	79	12.7
Occasionally	275	44.2
Very often	85	13.7
Everyday	180	28.9
Non-response	3	0.5
Fruit drinks		
Not at all	149	24.0
Occasionally	279	44.9
Very often	65	10.5
Everyday	126	20.3
Non-response	3	0.5
Meat/fish/eggs		
Not at all	19	3.1
Occasionally	119	19.1
Very often	74	11.9
Everyday	407	65.4
Non-response	3	0.5
Sugar-sweetened beverages		
Not at all	64	10.3
Occasionally	228	36.7
Very often	94	15.1
Everyday	235	37.8
Non-response	1	0.2
Water (6-8 glasses per day)		
Not at all	32	5.1
Occasionally	105	16.9
Very often	52	8.4
Everyday	429	69.0
Non-response	4	0.6

Not at all: 0 times; *Occasionally*: 1 – 3 times; *Very often*: 4 – 6 times; *Everyday*: Daily

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Not at all	93	15.0
Occasionally	368	59.2
Very often	50	8.0
Everyday	107	17.2
Non-response	4	0.6
Vegetables		
Not at all	87	14.0
Occasionally	266	42.8
Very often	94	15.1
Everyday	171	27.5
Non-response	4	0.6
Soft drinks		
Not at all	79	12.7
Occasionally	275	44.2
Very often	85	13.7
Everyday	180	28.9
Non-response	3	0.5
Fruit drinks		
Not at all	149	24.0
Occasionally	279	44.9
Very often	65	10.5
Everyday	126	20.3
Non-response	3	0.5
Meat/fish/eggs		
Not at all	19	3.1
Occasionally	119	19.1
Very often	74	11.9
Everyday	407	65.4
Non-response	3	0.5
Sugar-sweetened beverages		
Not at all	64	10.3
Occasionally	228	36.7
Very often	94	15.1
Everyday	235	37.8
Non-response	1	0.2
Water (6-8 glasses per day)		
Not at all	32	5.1
Occasionally	105	16.9
Very often	52	8.4
Everyday	429	69.0
Non-response	4	0.6

Not at all: 0 times; *Occasionally:* 1 – 3 times; *Very often*: 4 – 6 times; *Everyday:* Daily

Table 4.3: Adolescents' Dietary Intake of various food groups based on a weekly recall contd...

Food groups	Frequency (N = 622)	Percent (%)
Starchy foods		
Not at all	13	2.1
Occasionally	172	27.7
Very often	98	15.8
Everyday	337	54.2
Non-response	2	0.3
Snacks		
Not at all	30	4.8
Occasionally	147	23.6
Very often	81	13.0
Everyday	362	58.2
Non-response	2	0.3
Sweets		
Not at all	82	13.2
Occasionally	210	33.8
Very often	83	13.3
Everyday	244	39.2
Non-response	3	0.5
Fast foods		
Not at all	148	23.8
Occasionally	218	35.0
Very often	122	19.6
Everyday	133	21.4
Non-response	1	0.2

Not at all: 0 times; *Occasionally:* 1 – 3 times; *Very often*: 4 – 6 times; *Everyday:* Daily

4.4 Adolescents' Dietary Habits

The assessment of dietary intake was based on intake of various food groups using a weekly recall. Table 4.4a shows the dietary habits of the respondents. More than half of the respondents skipped breakfast (53.5%), while over two-thirds (67.3%) took breakfast at home. Over one-third of the respondents took meals from fast food restaurants (41.1%) and soft drinks (42.8%).

Majority of the respondents (80.4%) had unhealthy dietary habits while a few (19.6%) had healthy dietary habits (Table 4.4b).

Table 4.4a: Dietary Habits of Adolescents

Dietary Habits	Frequency (N=622)	Percent (%)
Breakfast omission		
Yes	331	53.2
No	288	46.3
Non-response	3	0.5
Where do you take breakfast		
Home	418	67.2
School canteen	171	27.5
Shop (outside school)	32	5.1
Non-response	1	0.2
Consumption of fast foods		
Yes	255	41.0
No	366	58.8
Non-response	1	0.2
Consumption of soft drinks		
Yes	265	42.6
No	354	56.9
Non-response	3	0.5

Table 4.4b: Composite Dietary Habits of Adolescents

Dietary Habits	Frequency (N=608)	Percent (%)
Healthy	119	19.6
Unhealthy	489	80.4

4.5 Physical Activity Levels of Adolescents

The assessment of physical activity levels was based on a five (5) day recall of activities.

Table 4.5a shows the physical activity levels of the respondents. Results showed that more than one-third of the respondents walked to school as their mode of transportation (41.8%) while nearly two-thirds walked to and from school less than 6 times (out of a total of ten to and from) in the last 5 school days (64.3%). It took more than 30 minutes to walk from home to school for about a third of the respondents (38.6%). Over one-third of the respondents occasionally engaged in vigorous activities (36.0%) such as jogging, football, cycling, etc.

About two-thirds (68.4%) of the respondents had low physical activity level while 31.6% had high physical activity level (Table 4.5b).

Table 4.5a: Physical Activity Levels of Adolescents

Physical Activity Level	Frequency (N = 622)	Percent (%)
Mode of transportation to school		
Walking	259	41.6
Bicycle	14	2.3
School bus	83	13.3
Motorcycle	184	29.6
Private car	80	12.9
Non-response	2	0.4
Frequency of walk to and from school per week		
Less than 6 times	399	64.1
6 – 10 times	222	35.7
Non-response	1	0.2
Duration of walk to school		
Less than 15 minutes	150	24.1
15 – 30 minutes	224	36.0
More than 30 minutes	235	37.8
Non-response	13	2.1
Frequency of vigorous activities per week		
Not at all	219	35.2
Occasionally	223	35.9
Very often	45	7.2
Everyday	133	21.4
Non-response	2	0.3

Not at all: 0 times; *Occasionally:* 1 – 3 times; *Very often*: 4 – 6 times; *Every day:* Daily

Table 4.5b: Composite Physical Activity Levels of Adolescents

Physical Activity Level	Frequency (N=608)	Percent (%)
Low	416	68.4
High	192	31.6

4.6 Sedentary Lifestyle of Adolescents

Table 4.6 shows the sedentary behavior of the respondents. More than half of the respondents (55.6%) reported reading as their leisure time activity, majority spent 2 hours or less watching TV/videos (60.0%) while 72.6% spent 2 hours or less on the internet/computer games. Majority of the respondents reported parents regulating the amount of time spent on watching TV but not very strict limits (37.9%). Over two-thirds reported sleeping 8 hours or less (68.7%).

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Table 4.6a: Sedentary Lifestyle of Adolescents

Sedentary Lifestyle	Frequency (N = 622)	Percent (%)
Leisure time activities		
Sleeping	28	4.5
Watching TV/videos/DVDs	183	29.4
Reading	345	55.5
Playing football	39	6.3
Hanging out with friends	10	1.6
Riding bicycle	5	0.8
Others	11	1.8
Non-response	1	0.2
Hours spent watching TV/videos		
0 – 2 hours	372	59.8
3 – 4 hours	138	22.2
More than 4 hours	110	17.7
Non-response	2	0.3
Parents regulation of spent on watching TV		
No limits	171	27.5
Yes, but not very strict limits	234	37.6
Yes, strict limits	212	34.1
Non-response	5	0.8
Hours spent on internet/computer games		
0 – 2 hours	445	71.5
3 – 4 hours	101	16.2
More than 4 hours	65	10.8
Non-response	9	1.4
Sleeping hours		
8 hours or less	425	68.3
More than 8 hours	194	31.2
Non-response	3	0.5

Table 4.6b: Composite Sedentary Lifestyle of Adolescents

Lifestyle	Frequency (N=608)	Percent (%)
Active	398	65.5
Sedentary	210	34.5

4.7 Adolescents' Perception of Weight Status of Family Members

Table 4.7 shows the distribution of respondents' perception of overweight and obesity among family members. Results showed that most (more than 95%) of the respondents reported no history of overweight and obesity among parents and siblings.

Table 4.7: Respondents' Perception of Weight Status of Family Members

Overweight among family members	Frequency (N = 622)	Percent (%)
Father		
Yes	21	3.4
No	594	95.5
Non-response	7	1.1
Mother		
Yes	22	3.5
No	596	95.8
Non-response	4	0.6
Brother		
Yes	17	2.7
No	579	95.8
Non-response	26	4.2
Sister		
Yes	25	4.0
No	569	91.5
Non-response	28	4.5

4.8 Body Image Perception of Adolescents

Table 4.8 shows the distribution of body image perception of respondents. Results showed that most respondents (89.5%) were satisfied with their body weight, while 74.6% did not desire to lose weight. Half of the respondents (50.3%) did not desire to gain weight but 72.7% agreed to maintaining their current weight. Nearly two-thirds of the respondents (63.4%) agreed that their friends do not make jest of their body shape while 65.9% were scared of becoming fat.

Table 4.8: Perception of Body Image by Study Participants

Body Image Perception	Frequency (N = 622)	Percent (%)
I am satisfied with my body weight		
Agree	552	88.7
Disagree	65	10.5
Non-response	5	0.8
I desire to lose weight		
Agree	149	24.0
Disagree	460	74.0
Indifferent	8	1.3
Non-response	5	0.8
I desire to gain weight		
Agree	295	47.4
Disagree	310	49.8
Indifferent	11	1.8
Non-response	6	1.0
I desire to maintain my current weight		
Agree	449	72.2
Disagree	155	24.9
Indifferent	14	2.3
Non-response	4	0.6
My friends make jest of my body shape		
Agree	217	34.9
Disagree	392	63.0
Indifferent	9	1.4
Non-response	4	0.6
I am scared of becoming fat		
Agree	407	65.4
Disagree	200	32.2
Indifferent	11	1.8
Non-response	4	0.6

4.9 Anthropometric Assessments of Respondents' Weight Status

Anthropometric measurements of the respondents are represented in Table 4.9a and b. The results showed that the prevalence of overweight and obesity were 10.0% and 2.7% respectively. The combined prevalence of overweight and obesity was 12.7%. The mean weight and height of the respondents were 48.92 ± 15.13 kg and 157.01 ± 10.37 cm respectively. Moreover, the mean BMI and WHR of the respondents were 19.81 ± 6.70 kg/m^2 and 0.83 ± 0.05 respectively.

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Table 4.9a: Anthropometric Assessments for Weight Status of Respondents

Anthropometric measurements	Frequency (N = 622)	Percent (%)
Weight status – BMI		
Overweight	62	10.0
Obesity	17	2.7
Combined overweight/obesity	79	12.7
Weight status – WHR		
Combined Overweight/at risk of abdominal obesity	113	35.1
Male	34	13.3
Female	79	21.8

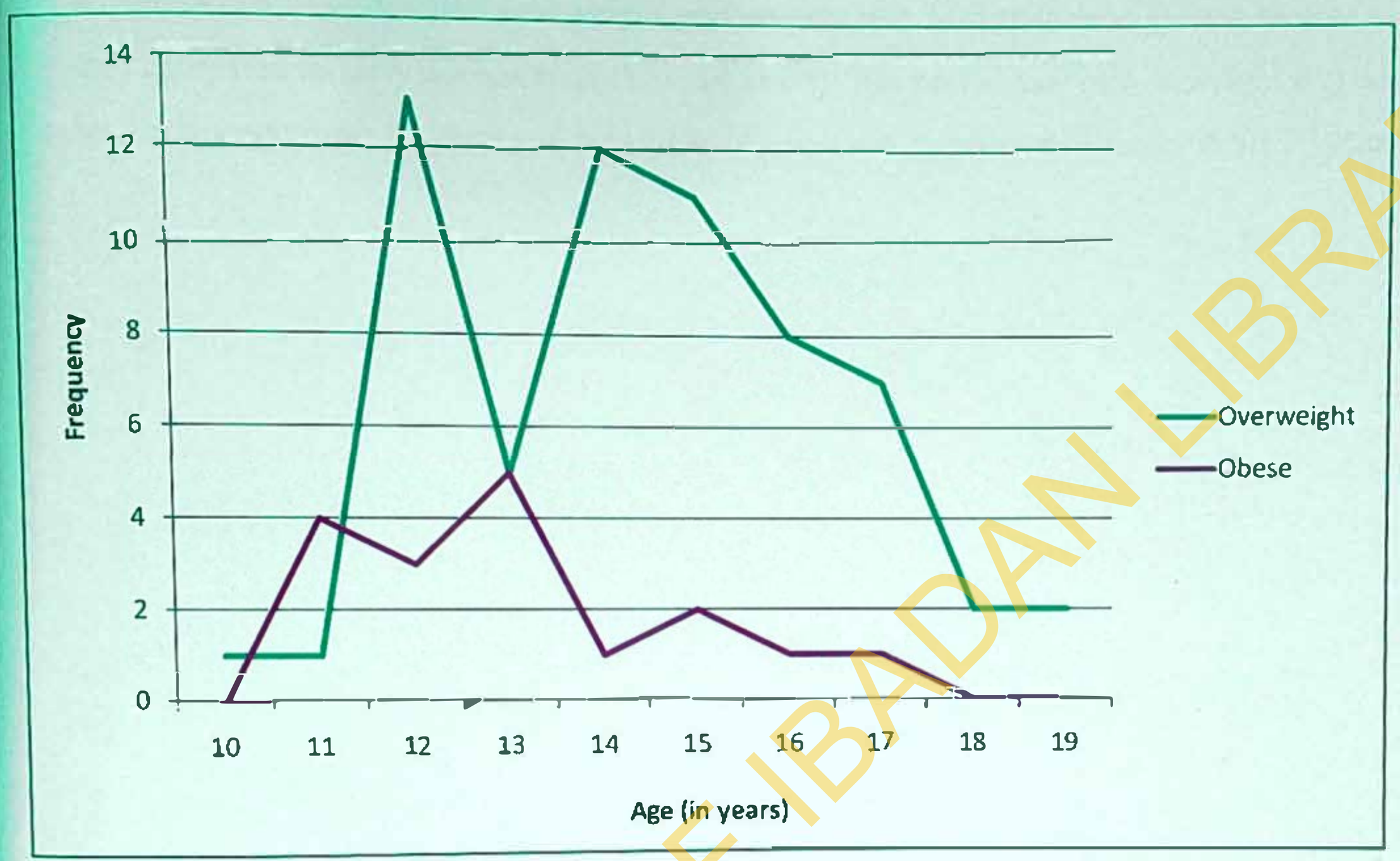
Table 4.9b: Mean and Standard Deviation of Anthropometric Measurements

Anthropometric Measurements	Mean	Standard Deviation
Weight (kg)	48.92	15.13
Height (cm)	157.01	10.37
BMI (kg/m^2)	19.81	6.70
Waist circumference (cm)	70.99	6.91
Hip circumference (cm)	86.12	8.31
WHR	0.83	0.05
WHR for males	0.84	0.05
WHR for females	0.81	0.05

4.9.1a Prevalence of Overweight and Obesity (BMI) by Age

Figure 4.1 shows the prevalence of overweight and obesity by age of the respondents using the BMI technique. The prevalence of overweight and obesity was higher in early adolescence (10 – 14 years) compared to late adolescence (15 – 19 years). The prevalence of overweight was highest at age 12, while the prevalence of obesity was highest at age 13. The prevalence of overweight persisted till age 14 years and started declining afterwards; while obesity peaked at age 13 at started declining till age 17. Obesity was generally absent between 18 and 19 years.

Figure 4.1: Distribution of Overweight and Obesity (BMI) by Age



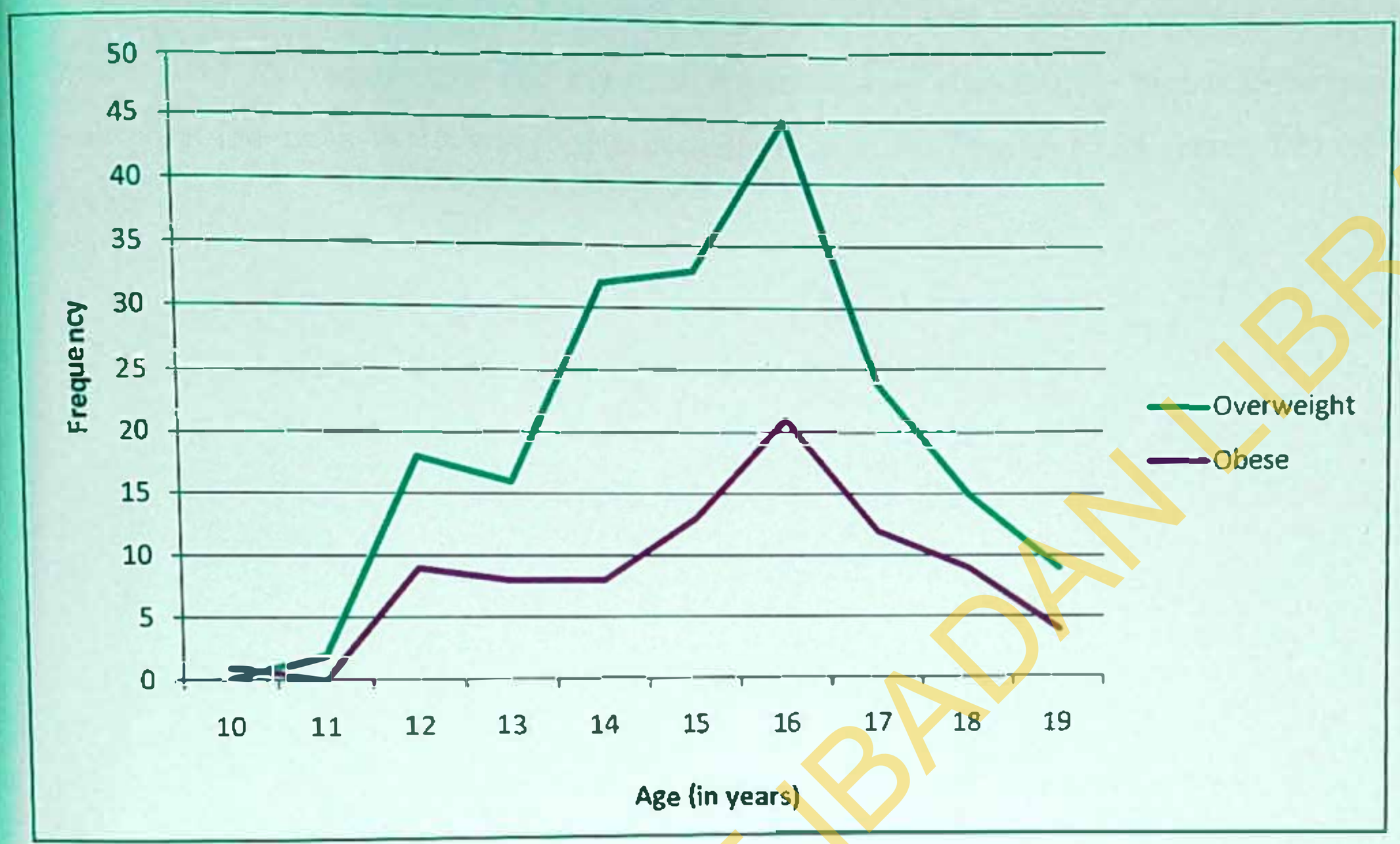
4.9.1b Prevalence of Overweight and Obesity (WHR) by Age

Figure 4.2 shows the prevalence of overweight and obesity by age using the WHR technique. The prevalence of abdominal overweight and obesity was higher in late adolescence (15 – 19 years) compared to early adolescence (10 – 14 years). The prevalence of overweight and obesity increased by age from 10 years and peaked at 16 years and significantly declined till 19 years.

4.9.1b Prevalence of Overweight and Obesity (WHR) by Age

Figure 4.2 shows the prevalence of overweight and obesity by age using the WHR technique. The prevalence of abdominal overweight and obesity was higher in late adolescence (15 – 19 years) compared to early adolescence (10 – 14 years). The prevalence of overweight and obesity increased by age from 10 years and peaked at 16 years and significantly declined till 19 years.

Figure 4.2: Distribution of Overweight and Obesity (WHR) by Age



4.9.2 Weight Status of Respondents by Sex

The mean weight and height (158.10 cm versus 156.24cm; p = 0.039) were significantly higher in males compared to females; however, the mean BMI was higher in females compared to the males. Also, the mean waist and hip measurements were significantly higher in females than in males; but the mean WHR was higher in males than in the females (0.84 versus 0.81; p < 0.001). (Table 4.9.1)

Table 4.9.2: Anthropometric Measurements of Respondents by Sex

Anthropometric measurements	Male	Female	t-test	p-value
Weight (kg)	49.56 ± 20.95	48.47 ± 9.00	0.782	0.435
Height (cm)	158.10 ± 12.42	156.24 ± 8.57	2.069	0.039*
BMI (kg/m^2)	19.80 ± 9.70	19.82 ± 3.20	-0.052	0.958
Waist circumference (cm)	70.47 ± 6.65	71.36 ± 7.07	-1.569	0.117
Hip circumference (cm)	83.62 ± 7.77	87.87 ± 8.24	-6.464	<0.001*
WHR	0.84 ± 0.05	0.81 ± 0.05	-18.362	<0.001*

*Statistically significant

4.9.2a Prevalence of Overweight and Obesity (BMI) by Sex

The prevalence of overweight and obesity by sex of the respondents using the BMI technique is shown in Figure 4.1. The prevalence of overweight was higher among females (6.8%) compared to the males (3.2%), while obesity was higher in males (1.7%) compared to the females (0.9%).

Figure 4.3: Weight Status Distribution by Sex using BMI

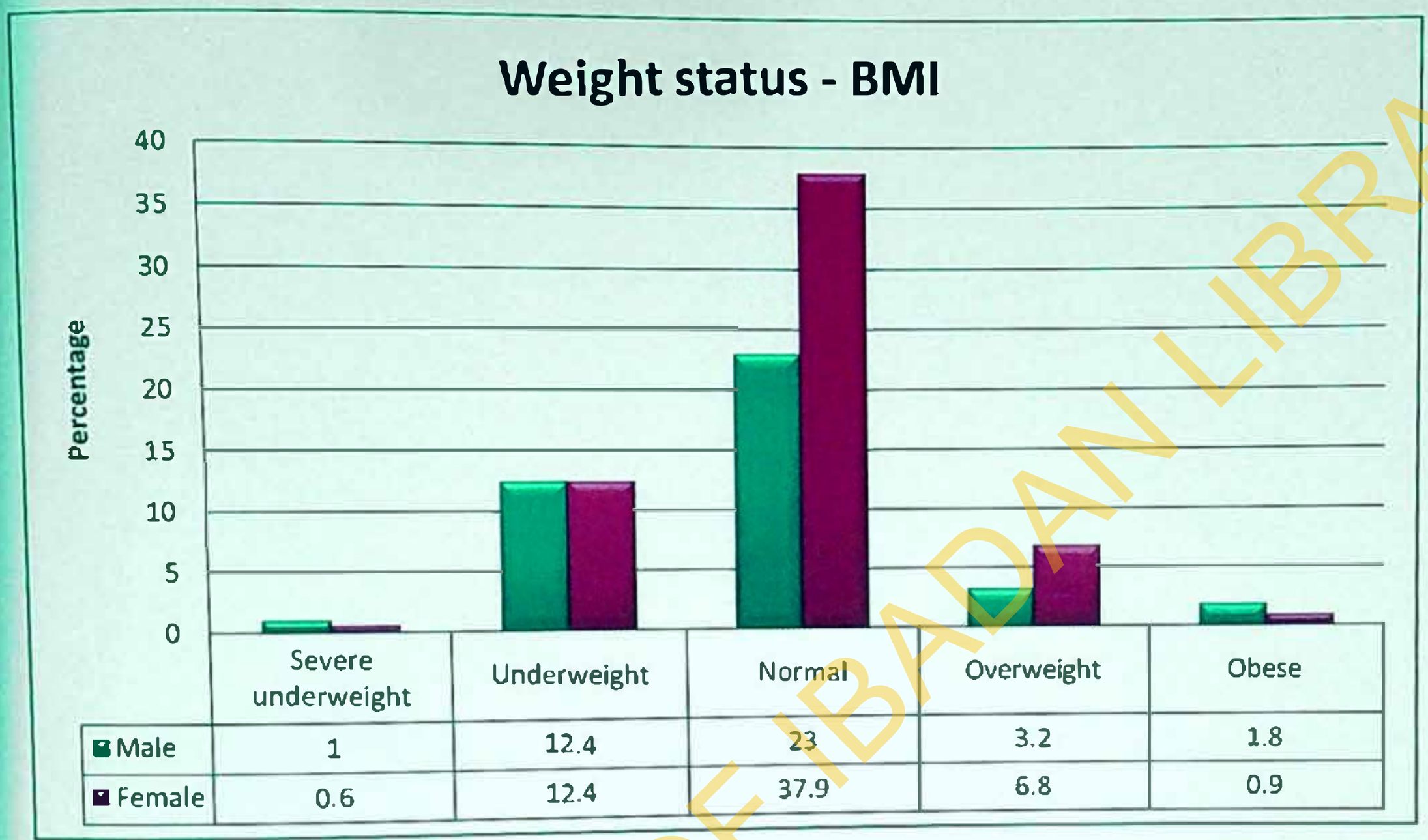
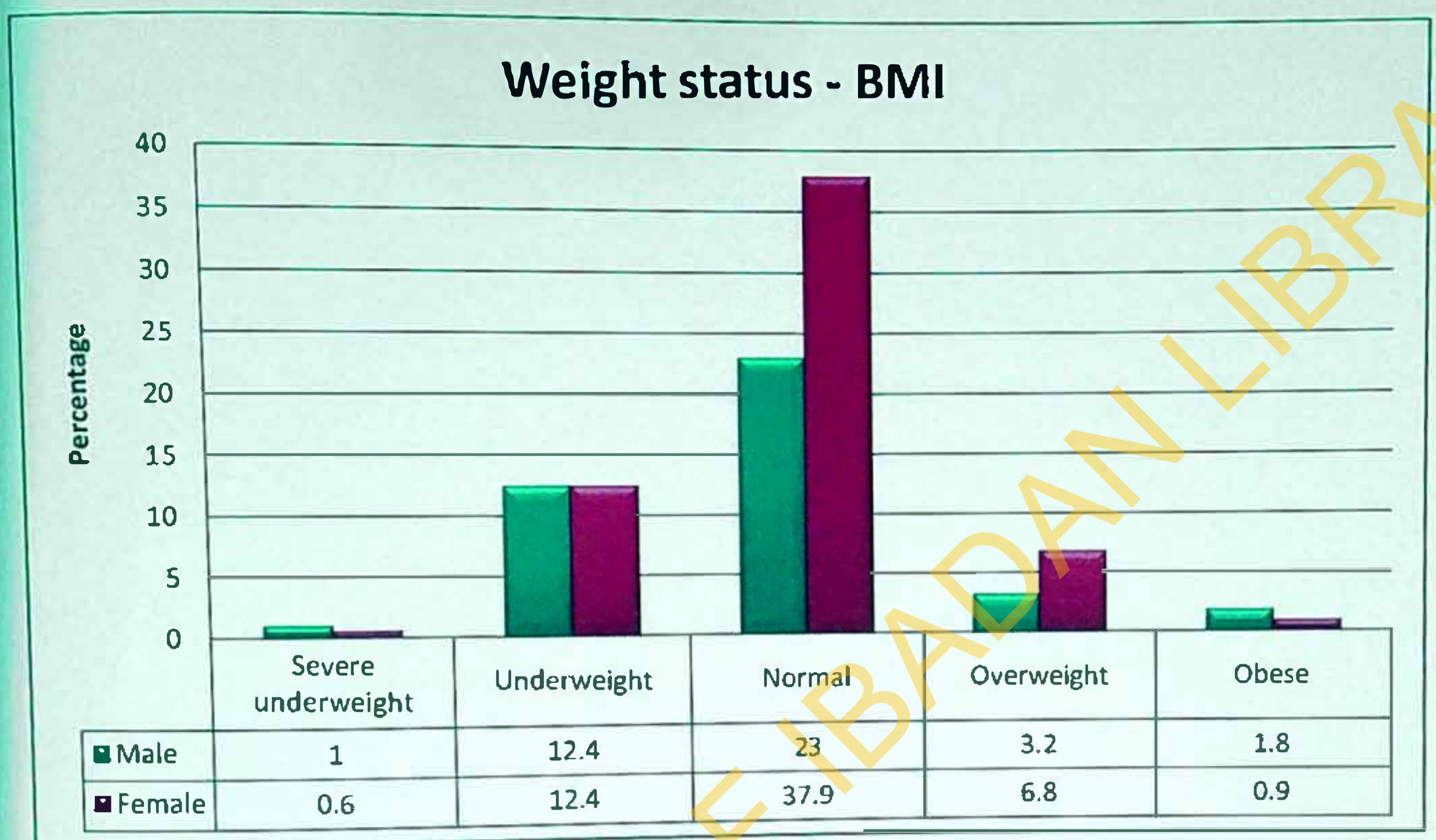


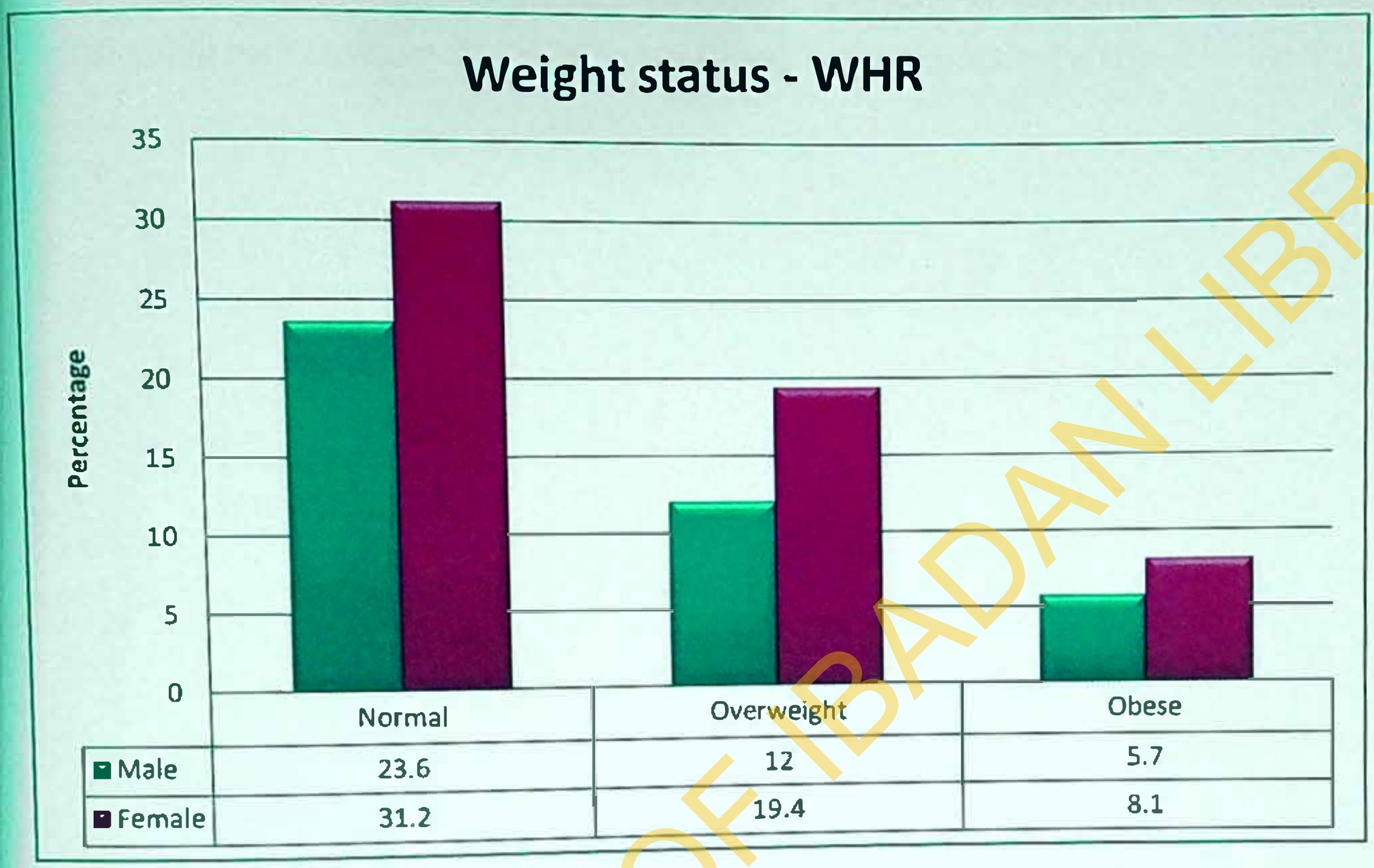
Figure 4.3: Weight Status Distribution by Sex using BMI



4.9.2b Prevalence of Overweight and Obesity (WHR) by Sex

The prevalence of overweight and obesity by sex of the respondents using WHR is shown in Figure 4.2. The prevalence of both overweight and obesity was higher among females (19.4% and 8.1%) compared to the males (12.0% and 5.7%).

Figure 4.4: Weight Status Distribution by Sex using WHR



4.10 Bivariate Analysis

Bivariate analysis was carried out to assess the association between weight status and socio-demographic characteristics, dietary habits, physical activity levels, sedentary lifestyle, family history and body image perception. Correlation analysis was also carried out to explore the relationship between Body Mass Index (BMI) and Waist-Hip Ratio (WHR).

4.10.1 Association between Overweight/Obesity and Socio-demographic Characteristics

Tables 4.10.1a and 4.10.1b show the association between combined overweight/obesity and socio-demographic factors using BMI and WHR. Results showed that combined overweight/obesity varied significantly ($p < 0.05$) according to age, type of school and mother are highest level of education by BMI.

The prevalence of overweight/obesity was significantly higher among adolescents aged between 10 – 14 years (18.91%), who attended private schools (21.49%) and whose mothers had a tertiary education (16.97%). Other factors such as sex, ethnicity, religion, father's occupation, number of siblings, birth position and class category were not significantly associated with overweight/obesity (Table 4.10.1).

Using the WHR technique, the prevalence of overweight/obesity was significantly higher among adolescents aged between 15 – 19 years, who attended public schools, and whose parents had secondary education. However, other factors such as sex, ethnicity, religion, number of siblings, birth position and class category were not statistically associated with overweight/obesity (Table 4.10.1b).

Table 4:10.1a: Bivariate Analysis between Overweight/Obesity (BMI) and Socio-demographic Characteristics

Socio-demographic characteristics	Overweight/Obesity			
	Yes	No	χ^2	p-value
Age (years)			13.39	< 0.001*
10 – 14	45 (18.91%)	193 (81.09%)		
15 – 19	34 (8.85%)	350 (91.15%)		
Sex			0.16	0.688
Male	31 (12.06%)	226 (87.94%)		
Female	48 (13.15%)	317 (86.85%)		
Type of school			25.08	<0.001*
Public	30 (7.61%)	364 (92.38%)		
Private	49 (21.49%)	179 (78.51%)		
Ethnicity			0.00	0.975
Yoruba	65 (12.72%)	446 (87.28%)		
Others	14 (12.61%)	97 (83.39%)		
Religion			0.12	0.725
Christianity	60 (12.45%)	422 (87.55%)		
Non-Christians	19 (13.57%)	121 (86.43%)		
Father's education			5.43	0.066
Primary & less	4 (8.33%)	44 (91.67%)		
Secondary	33 (10.25%)	289 (89.75%)		
Tertiary	40 (16.26%)	206 (83.74%)		
Mother's education			6.85	0.033*
Primary & less	5 (8.06%)	57 (91.94%)		
Secondary	34 (10.15%)	301 (89.85%)		
Tertiary	37 (16.97%)	181 (83.03%)		
Number of siblings			1.97	0.161
1 – 4	60 (14.02%)	368 (85.98%)		
More than 4	19 (9.95%)	172 (90.05%)		
Birth position			0.014	0.907
1 – 4	68 (12.64%)	470 (87.36%)		
More than 4	11 (13.10%)	73 (86.90%)		
Class			3.66	0.056
Junior secondary	32 (16.49%)	162 (83.51%)		
Senior secondary	47 (10.98%)	381 (89.02%)		

*Statistically significant at $p < 0.05$

Table 4.10.1b: Bivariate Analysis between Overweight/Obesity (WHR) and Socio-demographic Characteristics

Socio-demographic characteristics	Overweight/Obesity			
	Yes	No	χ^2	p-value
Age (years)			4.67	0.031*
10 – 14	94 (39.66%)	143 (60.34%)		
15 – 19	185 (48.56%)	196 (51.44%)		
Sex			1.01	0.315
Male	109 (42.75%)	146 (57.25%)		
Female	170 (46.83%)	193 (53.17%)		
Type of school			155.97	<0.001*
Public	251 (64.19%)	140 (35.81%)		
Private	28 (12.33%)	199 (87.67%)		
Ethnicity			0.03	0.872
Yoruba	231 (45.29%)	279 (54.71%)		
Others	48 (44.44%)	60 (55.56%)		
Religion			1.03	0.310
Christianity	211 (44.05%)	268 (55.95%)		
Non-Christians	68 (48.92%)	71 (51.08%)		
Father's education			27.58	<0.001*
Primary & less	21 (45.65%)	25 (54.35%)		
Secondary	176 (54.83%)	145 (45.17%)		
Tertiary	80 (32.65%)	165 (67.35%)		
Mother's education			16.70	<0.001*
Primary & less	30 (50.00%)	30 (50.00%)		
Secondary	172 (51.50%)	162 (48.50%)		
Tertiary	74 (34.10%)	143 (65.90%)		
Number of siblings			1.04	0.309
1 – 4	187 (44.00%)	238 (56.00%)		
More than 4	92 (48.42%)	98 (51.58%)		
Birth position			2.79	0.095
1 – 4	234 (43.82%)	300 (56.18%)		
More than 4	45 (53.57%)	39 (46.43%)		
Class			0.41	0.520
Junior secondary	83 (43.23%)	109 (56.77%)		
Senior secondary	196 (46.01%)	230 (53.99%)		

*Statistically significant at $p < 0.05$

4.10.2 Association between Overweight/Obesity and Socio-economic Status of Respondents

Bivariate analysis between overweight/obesity and socio-economic status of respondents showed that the prevalence of overweight/obesity varied significantly according to the possession of a car ($p < 0.05$) by BMI.

The prevalence of overweight/obesity was significantly higher among those who possessed a car compared to those who did not [14.71% versus 9.13%; $p < 0.05$]. However, other factors such as father's occupation, mother's occupation, average monthly family income, possession of TV set/DVD, generator, computer/video games, parents' ownership of a house and those who live in a rented apartment were not significantly associated with overweight/obesity (Table 4.10.2a).

Employing the WHR technique, overweight/obesity was significantly associated with father's occupation ($\chi^2 = 16.52$, $p = 0.001$), mother's occupation ($\chi^2 = 17.73$, $p = 0.001$), average monthly family income ($\chi^2 = 24.29$, $p = <0.001$), possession of generator ($\chi^2 = 4.59$, $p = 0.032$), possession of computer/video games ($\chi^2 = 6.68$, $p = 0.012$), possession of car ($\chi^2 = 11.77$, $p = 0.001$), and parents' ownership of a house ($\chi^2 = 5.13$, $p = 0.023$). However, other factors such as possession of Television set/DVD and living in a rented apartment were not statistically associated with overweight/obesity (Table 4.10.2b).

Table 4.10.2a: Bivariate Analysis between Overweight/Obesity (BMI) and Socio-economic Status

Socio-economic status	Overweight/Obesity			
	Yes	No	χ^2	p-value
Father's occupation			1.37	0.713
Artisan	14 (11.38%)	109 (88.62%)		
Business	39 (13.93%)	241 (86.07%)		
Civil servant	6 (9.09%)	60 (90.91%)		
Professional	20 (13.07%)	133 (86.93%)		
Mother's occupation			1.02	0.797
Artisan	7 (9.86%)	64 (90.14%)		
Business	54 (12.80%)	368 (87.20%)		
Civil servant	7 (16.28%)	36 (83.72%)		
Professional	11 (12.79%)	75 (87.21%)		
Average monthly family income			7.34	0.062
Less than ₦100,000	34 (9.63%)	319 (90.37%)		
₦100,000 - ₦299,999	21 (16.67%)	105 (83.33%)		
₦300,000 - ₦499,999	8 (15.69%)	43 (84.31%)		
₦500,000 and above	12 (18.75%)	52 (81.25%)		
Television set/DVD			0.98	0.323
Yes	76 (12.52%)	531 (87.48%)		
No	3 (21.43%)	11 (78.57%)		
Generator			0.05	0.832
Yes	72 (12.83%)	489 (87.17%)		
No	7 (11.86%)	52 (88.14%)		
Computer/video games			2.79	0.095
Yes	44 (15.12%)	247 (84.88%)		
No	35 (10.64%)	294 (89.36%)		
Car			3.97	0.046*
Yes	59 (14.71%)	342 (85.29%)		
No	20 (9.13)	199 (90.87%)		
Do your parents own a house			2.30	0.129
Yes	66 (13.84%)	411 (86.16%)		
No	13 (9.03%)	131 (90.97%)		
Do you live in a rented apartment			0.192	0.661
Yes	27 (11.95%)	199 (88.05%)		
No	52 (13.16%)	343 (86.84%)		

*Statistically significant at $p < 0.05$

Table 4.10.2b: Bivariate Analysis between Overweight/Obesity (WHR) and Socio-economic Status

Socio-economic status	Overweight/Obesity			
	Yes	No	χ^2	p-value
Father's occupation			16.52	0.001*
Artisan	54 (44.63%)	67 (55.37%)		
Business	147 (52.88%)	131 (47.12%)		
Civil servant	28 (42.42%)	38 (57.58%)		
Professional	50 (32.68%)	103 (67.32%)		
Mother's occupation			17.73	0.001*
Artisan	35 (49.30%)	36 (50.70%)		
Business	205 (48.93%)	214 (51.07%)		
Civil servant	8 (18.60%)	35 (81.40%)		
Professional	31 (36.47%)	54 (63.53%)		
Average monthly family income			24.29	<0.001*
Less than ₦100,000	186 (52.99%)	165 (47.01%)		
₦100,000 - ₦299,999	43 (34.13%)	83 (65.87%)		
₦300,000 - ₦499,999	25 (51.02%)	24 (48.98%)		
₦500,000 and above	17 (26.56%)	47 (73.44%)		
Television set/DVD			0.82	0.365
Yes	271 (44.94%)	332 (55.06%)		
No	8 (57.14%)	6 (42.86%)		
Generator			4.59	0.032*
Yes	245 (43.91%)	313 (56.09%)		
No	34 (58.62%)	24 (41.38%)		
Computer/video games			6.68	0.012*
Yes	115 (39.93%)	173 (60.07%)		
No	164 (50.00%)	164 (50.00%)		
Car			11.77	0.001*
Yes	160 (40.20%)	238 (59.80%)		
No	119 (54.59%)	99 (45.41%)		
Do your parents own a house			5.13	0.023*
Yes	203 (42.74%)	272 (57.26%)		
No	76 (53.52%)	66 (46.48%)		
Do you live in a rented apartment			2.93	0.087
Yes	111 (49.78%)	112 (50.22%)		
No	168 (42.64%)	226 (57.36%)		

*Statistically significant at $p < 0.05$

4.10.3: Association between Overweight/Obesity and Dietary Habits

Table 4.10.3a shows the association between overweight/obesity and dietary habits by BMI. Results showed that the prevalence of overweight/obesity was higher among those who do not usually skip breakfast compared to those who usually skip breakfast (15.28% versus 10.57%; $p > 0.05$). Those who usually took breakfast at school canteens were more overweight/obese than those who took breakfast at home and shop (outside school) [15.20% versus 11.72% and 12.50%; $p > 0.05$). The prevalence of overweight/obesity was also higher among those who do not take meals from fast food restaurants and those who do not usually take soft drinks [(13.39% and 14.97% respectively); $p > 0.05$].

WHR technique showed that there was a statistically significant association between overweight/obesity and breakfast omission ($\chi^2 = 4.65$, $p = 0.031$). Other factors were not statistically significant (Table 4.10.3b).

4.10.3: Association between Overweight/Obesity and Dietary Habits

Table 4.10.3a shows the association between overweight/obesity and dietary habits by BMI. Results showed that the prevalence of overweight/obesity was higher among those who do not usually skip breakfast compared to those who usually skip breakfast (15.28% versus 10.57%; $p > 0.05$). Those who usually took breakfast at school canteens were more overweight/obese than those who took breakfast at home and shop (outside school) [15.20% versus 11.72% and 12.50%; $p > 0.05$). The prevalence of overweight/obesity was also higher among those who do not take meals from fast food restaurants and those who do not usually take soft drinks [(13.39% and 14.97% respectively); $p > 0.05$].

WHR technique showed that there was a statistically significant association between overweight/obesity and breakfast omission ($\chi^2 = 4.65$, $p = 0.031$). Other factors were not statistically significant (Table 4.10.3b).

Table 4.10.3a: Bivariate Analysis between Overweight/Obesity (BMI) and Dietary Habits

Dietary Habits	Overweight/Obesity			
	Yes	No	χ^2	p-value
Breakfast omission			3.06	0.080
Yes	35 (10.57%)	296 (89.43%)		
No	44 (15.28%)	244 (84.72%)		
Where do you take breakfast			1.33	0.515
Home	49 (11.72%)	369 (88.28%)		
School canteen	26 (15.20%)	145 (84.80%)		
Shop (outside school)	4 (12.50%)	28 (87.50%)		
Consumption of fast foods			0.36	0.550
Yes	30 (11.76%)	225 (88.24%)		
No	49 (13.39%)	317 (86.61%)		
Consumption of soft drinks			3.63	0.057
Yes	26 (9.81%)	239 (90.19%)		
No	53 (14.97%)	301 (85.03%)		
Dietary Habits			0.93	0.334
Healthy	18 (15.1%)	101 (84.9%)		
Unhealthy	58 (11.9%)	431 (88.1%)		

Table 4.10.3b: Bivariate Analysis between Overweight/Obesity (WHR) and Dietary Habits

Dietary Habits	Overweight/Obesity			
	Yes	No	χ^2	p-value
Breakfast omission			4.65	0.031*
Yes	162 (49.24%)	167 (50.76%)		
No	116 (40.56%)	170 (59.44%)		
Where do you take breakfast			3.91	0.142
Home	191 (46.02%)	224 (53.98%)		
School canteen	78 (45.88%)	92 (54.12%)		
Shop (outside school)	9 (28.13%)	23 (71.87%)		
Consumption of fast foods			0.09	0.760
Yes	113 (44.49%)	141 (55.51%)		
No	166 (45.73%)	197 (54.27%)		
Consumption of soft drinks			3.63	0.843
Yes	121 (45.66%)	144 (54.34%)		
No	157 (44.86%)	193 (55.14%)		
Dietary Habits			0.17	0.679
Healthy	55 (47.4%)	61 (52.6%)		
Unhealthy	221 (45.3%)	267 (54.7%)		

*Statistically significant at $p < 0.05$

4.10.4: Association between Overweight/Obesity and Physical Activity Level/Sedentary Lifestyle

Table 4.10.4a shows the association between overweight/obesity and physical activity level and sedentary lifestyle using the BMI technique. Results showed that the prevalence of overweight/obesity was significantly higher among those who had school bus and private car as their mode of transportation to school, walking to and from school more than 6 times/week, distance from home to school on foot and engagement in vigorous activities. Sedentary lifestyle factors such as leisure time activities, hours spent on watching TV/videos, regulation of time spent on watching TV, hours spent on internet/computer games and sleeping hours were not statistically associated with overweight/obesity.

WHR technique showed that only mode of transportation to school ($\chi^2 = 82.52$, $p = <0.001$) and walking to and from school more than 6 times in a week ($\chi^2 = 34.95$, $p = <0.001$) were significantly associated with overweight/obesity (Table 4.10.4b).

4.10.4: Association between Overweight/Obesity and Physical Activity Level/Sedentary Lifestyle

Table 4.10.4a shows the association between overweight/obesity and physical activity level and sedentary lifestyle using the BMI technique. Results showed that the prevalence of overweight/obesity was significantly higher among those who had school bus and private car as their mode of transportation to school, walking to and from school more than 6 times/week, distance from home to school on foot and engagement in vigorous activities. Sedentary lifestyle factors such as leisure time activities, hours spent on watching TV/videos, regulation of time spent on watching TV, hours spent on internet/computer games and sleeping hours were not statistically associated with overweight/obesity.

WHR technique showed that only mode of transportation to school ($\chi^2 = 82.52$, $p = <0.001$) and walking to and from school more than 6 times in a week ($\chi^2 = 34.95$, $p = <0.001$) were significantly associated with overweight/obesity (Table 4.10.4b).

Table 4:10.4a: Bivariate Analysis between Overweight/Obesity (BMI) and Physical Activity/Sedentary Lifestyle

Physical activity and Sedentary Lifestyle factors	Overweight/Obesity			
	Yes	No	χ^2	p-value
Mode of transportation to school			21.68	<0.001*
Walking	23 (8.88%)	236 (91.12%)		
Bicycle	3 (21.43%)	11 (78.57%)		
School bus	19 (22.89%)	64 (77.11%)		
Motorcycle	16(8.70%)	168 (91.30%)		
Private car	18 (22.5%)	62 (77.50%)		
Frequency of walk to and from school per week			7.98	0.005*
Less than 6 times	62 (15.54%)	337 (84.46%)		
6 – 10 times	17 (7.66%)	205 (92.34%)		
Duration of walk to school			6.47	0.039*
Less than 15 minutes	12 (8.00%)	138 (92.00%)		
15 – 30 minutes	26 (11.61%)	198 (88.39%)		
More than 30 minutes	39 (16.60%)	196 (83.40%)		
Frequency of vigorous activities per week			12.78	0.005*
Not at all	25 (11.42%)	194 (88.58%)		
Occasionally	40 (17.94%)	183 (82.06%)		
Very often	5 (11.11%)	40 (88.89%)		
Everyday	7 (5.26%)	126 (94.74%)		
Leisure time activities			6.21	0.400
Sleeping	5 (17.86%)	23 (82.14%)		
Watching TV/videos/DVDs	23 (12.57%)	160 (87.43%)		
Reading	39 (11.30%)	306 (88.70%)		
Playing football	7 (17.95%)	32 (82.05%)		
Hanging out with friends	2 (20.00%)	8 (80.00%)		
Riding bicycle	2 (40%)	3 (60.00%)		
Others	1 (9.09%)	10 (90.91%)		
Hours spent on watching TV/videos			4.50	0.105
0 – 2 hours	39 (10.48%)	333 (89.52%)		
3 – 4 hours	24 (17.39%)	114 (82.61%)		
More than 4 hours	15 (13.64%)	95 (86.36%)		
Parents regulation of time spent on watching TV			0.02	0.990
No limits	21 (12.28%)	150 (87.72%)		
Yes, but not very strict limits	29 (12.39%)	205 (87.61%)		
Yes, strict limits	27 (12.74%)	185 (87.26%)		

Table 4:10.4a: Bivariate Analysis between Overweight/Obesity (BMI) and Physical Activity/Sedentary Lifestyle contd…

Physical activity and Sedentary Lifestyle factors	Overweight and Obesity		χ^2	p-value
	Yes	No		
Hours spent on internet/computer games			0.31	0.858
0 – 2 hours	57 (12.81%)	388 (87.19%)		
3 – 4 hours	13 (12.87%)	88 (87.13%)		
More than 4 hours	7 (10.45%)	60 (89.55%)		
Sleeping hours			0.41	0.523
8 hours or less	56 (13.18%)	369 (86.82%)		
More than 8 hours	22 (11.34%)	172 (88.66%)		
Physical Activity Level			11.76	0.001*
Low	65 (15.6%)	351 (84.4%)		
High	11 (5.7%)	181 (94.3%)		
Lifestyle			0.004	0.949
Active	50 (12.6%)	348 (87.4%)		
Sedentary	26 (12.4%)	184 (87.6%)		

*Statistically significant at $p < 0.05$

Table 4:10.4b: Bivariate Analysis between Overweight/Obesity (WHR) and Physical Activity/Sedentary Lifestyle

Physical Activity and Sedentary Lifestyle factors	Overweight/Obesity			
	Yes	No	χ^2	p-value
Mode of transportation to school			82.52	<0.001*
Walking	148 (57.81%)	108 (42.19%)		
Bicycle	9 (64.29%)	5 (35.71%)		
School bus	6 (7.23%)	77 (92.77%)		
Motorcycle	95 (51.63%)	89 (48.37%)		
Private car	20 (25.32%)	59 (74.68%)		
Frequency of walk to and from school per week			34.95	<0.001*
Less than 6 times	145 (36.43%)	253 (63.57%)		
6 – 10 times	134 (61.19%)	85 (38.81%)		
Duration of walk to school			2.10	0.349
Less than 15 minutes	68 (45.64%)	81 (54.36%)		
15 – 30 minutes	109 (49.32%)	112 (50.68%)		
More than 30 minutes	100 (42.55%)	135 (57.45%)		
Frequency of vigorous activities per week			3.42	0.332
Not at all	94 (43.32%)	123 (56.68%)		
Occasionally	107 (48.20%)	115 (51.80%)		
Very often	15 (34.09%)	29 (65.91%)		
Everyday	62 (46.62%)	71 (53.38%)		
Leisure time activities			10.34	0.111
Sleeping	9 (32.14%)	19 (67.86%)		
Watching TV/videos/DVDs	77 (42.08%)	106 (57.92%)		
Reading	166 (48.54%)	176 (51.46%)		
Playing football	20 (51.28%)	19 (48.72%)		
Hanging out with friends	2 (20.00%)	8 (80.00%)		
Riding bicycle	3 (60.00%)	2 (40.00%)		
Others	2 (20.00%)	8 (80.00%)		
Hours spent on watching TV/videos			2.59	0.274
0 – 2 hours	167 (45.38%)	201 (54.62%)		
3 – 4 hours	68 (49.28%)	70 (50.72%)		
More than 4 hours	43 (39.09%)	67 (60.91%)		
Parents regulation of time spent on watching TV			1.55	0.461
No limits	72 (42.35%)	98 (57.65%)		
Yes, but not very strict limits	112 (48.28%)	120 (51.72%)		
Yes, strict limits	93 (44.08%)	118 (55.92%)		

Table 4:10.4b: Bivariate Analysis between Overweight/Obesity (WHR) and Physical Activity/Sedentary Lifestyle contd...

Physical activity and Sedentary Lifestyle factors	Overweight and Obesity		χ^2	p-value
	Yes	No		
Hours spent on internet/computer games			0.31	0.858
0 – 2 hours	204 (46.05%)	239 (53.95%)		
3 – 4 hours	43 (43.00%)	57 (57.00%)		
More than 4 hours	30 (45.45%)	36 (54.55%)		
Sleeping hours			1.60	0.206
8 hours or less	198 (46.92%)	224 (53.08%)		
More than 8 hours	80 (41.45%)	113 (58.55%)		
Physical Activity Level			11.38	0.001*
Low	170 (41.1%)	244 (58.9%)		
High	106 (55.8%)	84 (44.2%)		
Lifestyle			3.90	0.048*
Active	192 (48.6%)	203 (51.4%)		
Sedentary	84 (40.2%)	125 (59.8%)		

*Statistically significant at $p < 0.05$

4.10.5: Association between Overweight/Obesity and Overweight among Family Members/Body Image Perception

Table 4.10.5a shows that there was no significant association between overweight/obesity and family history using both the BMI approach. Although, the prevalence of overweight/obesity was higher among those whose parents (father/mother) and siblings (brother/sister) were overweight compared to those whose parents and siblings were not overweight/obese.

However, the prevalence of overweight/obesity was significantly higher among those who were satisfied with their body weight, those who desired to lose weight and those who desired to gain weight ($p < 0.05$). Other body image perception factors such as desiring to maintain current weight, friends making jest of body shape and being scared of becoming fat were not statistically associated with overweight/obesity.

Similarly, the WHR technique showed that there was no statistically significant association between overweight/obesity and family history. Desire to lose weight by the adolescents was the only significant body image perception factor associated with overweight/obesity ($p < 0.05$) (Table 4.10.5b).

Table 4.10.5a: Bivariate Analysis between Overweight/Obesity (BMI) and Respondents' Perception of Overweight among Family Members and Body Image Perception

Family History and Body Image Perception	Overweight/Obesity			
	Yes	No	χ^2	p-value
Father			0.18	0.673
Yes	75 (12.63%)	519 (87.37%)		
No	2 (9.52%)	19 (90.48%)		
Mother			2.11	0.146
Yes	73 (12.25%)	523 (87.75%)		
No	5 (22.73%)	17 (77.27%)		
Brother			0.71	0.398
Yes	74 (12.78%)	505 (87.22%)		
No	1 (5.88%)	16 (94.12%)		
Sister			1.36	0.243
Yes	69 (12.13%)	500 (87.87%)		
No	5 (20.00%)	20 (80.00%)		
I am satisfied with my body weight			12.44	<0.001*
Agree	60 (10.87%)	492 (89.13%)		
Disagree	17 (26.15%)	48 (73.85%)		
I desire to lose weight			37.58	<0.001*
Agree	40 (26.85%)	109 (73.15%)		
Disagree	37 (8.04%)	423 (91.96%)		
Indifferent	0 (0.00%)	8 (100.00%)		
I desire to gain weight			19.00	<0.001*
Agree	19 (6.44%)	276 (93.56%)		
Disagree	56 (18.06%)	254 (81.94%)		
Indifferent	2 (18.18%)	9 (81.82%)		
I desire to maintain my current weight			4.84	0.089
Agree	49 (10.91%)	400 (89.09%)		
Disagree	27 (17.42%)	128 (82.58%)		
Indifferent	1 (7.14%)	13 (92.86%)		
My friends make jest of my body shape			0.09	0.955
Agree	26 (11.98%)	191 (88.02%)		
Disagree	50 (12.76%)	342 (87.24%)		
Indifferent	1 (11.11%)	8 (88.89%)		
I am scared of becoming fat			0.84	0.657
Agree	53 (13.02%)	354 (86.98%)		
Disagree	22 (11.00%)	178 (89.00%)		
Indifferent	2 (18.18%)	9 (81.82%)		

*Statistically significant at $p < 0.05$

Table 4.10.5a: Bivariate Analysis between Overweight/Obesity (BMI) and Respondents' Perception of Overweight among Family Members and Body Image Perception

Family History and Body Image Perception	Overweight/Obesity			
	Yes	No	χ^2	p-value
Father			0.18	0.673
Yes	75 (12.63%)	519 (87.37%)		
No	2 (9.52%)	19 (90.48%)		
Mother			2.11	0.146
Yes	73 (12.25%)	523 (87.75%)		
No	5 (22.73%)	17 (77.27%)		
Brother			0.71	0.398
Yes	74 (12.78%)	505 (87.22%)		
No	1 (5.88%)	16 (94.12%)		
Sister			1.36	0.243
Yes	69 (12.13%)	500 (87.87%)		
No	5 (20.00%)	20 (80.00%)		
I am satisfied with my body weight			12.44	<0.001*
Agree	60 (10.87%)	492 (89.13%)		
Disagree	17 (26.15%)	48 (73.85%)		
I desire to lose weight			37.58	<0.001*
Agree	40 (26.85%)	109 (73.15%)		
Disagree	37 (8.04%)	423 (91.96%)		
Indifferent	0 (0.00%)	8 (100.00%)		
I desire to gain weight			19.00	<0.001*
Agree	19 (6.44%)	276 (93.56%)		
Disagree	56 (18.06%)	254 (81.94%)		
Indifferent	2 (18.18%)	9 (81.82%)		
I desire to maintain my current weight			4.84	0.089
Agree	49 (10.91%)	400 (89.09%)		
Disagree	27 (17.42%)	128 (82.58%)		
Indifferent	1 (7.14%)	13 (92.86%)		
My friends make jest of my body shape			0.09	0.955
Agree	26 (11.98%)	191 (88.02%)		
Disagree	50 (12.76%)	342 (87.24%)		
Indifferent	1 (11.11%)	8 (88.89%)		
I am scared of becoming fat			0.84	0.657
Agree	53 (13.02%)	354 (86.98%)		
Disagree	22 (11.00%)	178 (89.00%)		
Indifferent	2 (18.18%)	9 (81.82%)		

*Statistically significant at $p < 0.05$

Table 4.10.5b: Bivariate analysis between Overweight/Obesity (WHR) and Respondents' Perception of Overweight among Family Members and Body Image Perception

Overweight among family members and Body Image Perception	Overweight/Obesity			
	Yes	No	χ^2	p-value
Father			2.41	0.121
Yes	13 (61.90%)	8 (38.10%)		
No	264 (44.75%)	326 (55.25%)		
Mother			1.80	0.180
Yes	13 (59.09%)	9 (40.91%)		
No	264 (44.59%)	328 (55.41%)		
Brother			0.01	0.926
Yes	8 (47.06%)	9 (52.94%)		
No	264 (45.91%)	311 (54.09%)		
Sister			0.03	0.870
Yes	11 (44.00%)	14 (56.00%)		
No	258 (45.66%)	307 (54.34%)		
I am satisfied with my body weight			0.01	0.944
Agree	247 (45.07%)	301 (54.93%)		
Disagree	29 (44.61%)	36 (55.39%)		
I desire to lose weight			11.02	0.004*
Agree	78 (52.70%)	70 (47.30%)		
Disagree	192 (42.01%)	265 (57.99%)		
Indifferent	7 (87.50%)	1 (12.5%)		
I desire to gain weight			0.38	0.826
Agree	130 (44.07%)	165 (55.93%)		
Disagree	142 (46.25%)	165 (53.75%)		
Indifferent	5 (50.00%)	5 (50.00%)		
I desire to maintain my current weight			2.79	0.247
Agree	204 (45.64%)	243 (54.36%)		
Disagree	64 (41.83%)	89 (58.17%)		
Indifferent	9 (64.29%)	5 (35.71%)		
My fricnds make jest of my body shape			0.75	0.689
Agree	101 (46.54%)	116 (53.46%)		
Disagree	171 (44.07%)	217 (55.93%)		
Indifferent	5 (55.56%)	4 (44.44%)		
I am scared of becoming fat			1.89	0.388
Agree	178 (43.95%)	227 (56.05%)		
Disagree	92 (46.46%)	106 (53.54%)		
Indifferent	7 (63.64%)	4 (36.36%)		

*Statistically significant at $p < 0.05$

4.11: Multivariate Analysis of Determinants of Overweight and Obesity among Adolescents

Binary logistic regression was used to determine the predictors of overweight and obesity among adolescents.

Table 4.11a shows the result of binary logistic regression of the association between risk factors investigated in this study and combined overweight and obesity in adolescents.

Sociodemographic risk factors that were statistically associated with overweight and obesity in adolescents were respondents' age, type of school, father's secondary education, and mother's secondary education (Table 4.11a).

Adolescents between the ages of 10 – 14 years were about 0.4 times less likely to be overweight/obese (OR: 0.417; 95% CI: 0.258 – 0.672) compared to adolescents between ages 15 – 19 years. Similarly, adolescents who attended public schools were about three times more likely to be overweight/obese (OR: 3.321; 95% CI: 2.038 – 5.413) compared to those who attended private schools. Adolescents whose parents (father and mother) had secondary education were about two times more likely to be overweight/obese in relation to those who had tertiary education (OR: 1.701; 95% CI: 1.037 – 2.788 and OR: 1.810; 95% CI: 1.097 – 2.986 respectively).

Results further showed that male adolescents were about 1.1 times more likely than females to be overweight/obese (OR: 1.104; 95% CI: 0.681 – 1.789); those who lived in rural areas had a 4 times odds of being overweight/obese (OR: 4.048; 95% CI: 0.850 – 19.278) while those who lived in semi-urban areas were about 2.5 times more likely to be overweight/obese in relation to those who lived in urban areas (OR: 2.490; 95% CI: 0.870 – 7.122). Adolescents in junior secondary classes were about 0.6 times less likely to be overweight/obese compared to the senior secondary school counterparts (OR: 0.625; 95% CI: 0.384 – 1.015). However, these factors were not statistically significant.

Table 4.11a: Binary Logistic Regression between Socio-demographic Risk Factors and Combined Overweight/Obesity in Adolescents

	OR	95% CI for OR		p-value
		Lower	Upper	
Age group				
10 – 14	0.417	0.258	0.672	<0.001*
15 – 19 (ref)	-	-	-	-
Sex				
Male	1.104	0.681	1.789	0.688
Female (ref)	-	-	-	-
Type of school				
Public	3.321	2.038	5.413	<0.001*
Private (ref)	-	-	-	-
Area of residence				
Rural	4.048	0.850	19.278	0.079
Semi-urban	2.490	0.870	7.122	0.089
Urban (ref)	-	-	-	-
Ethnicity				
Others	1.010	0.544	1.873	0.975
Yoruba (ref)	-	-	-	-
Religion				
Non-Christians	0.905	0.520	1.576	0.725
Christians (ref)	-	-	-	-
Father's education				
Primary & less	2.136	0.727	6.278	0.168
Secondary	1.701	1.037	2.788	0.035*
Tertiary (ref)	-	-	-	-
Mother's education				
Primary & less	2.330	0.874	6.210	0.091
Secondary	1.810	1.097	2.986	0.020*
Tertiary (ref)	-	-	-	-
Number of siblings				
1 – 4	0.678	0.392	1.171	0.163
More than 4 (ref)	-	-	-	-
Birth position				
1 – 4	1.041	0.526	2.062	0.907
More than 4 (ref)	-	-	-	-
Class category				
Junior	0.625	0.384	1.015	0.057
Senior (ref)	-	-	-	-

*Statistically significant at $p < 0.05$

Table 4.11b shows the association between socio-economic status and overweight/obesity in adolescents. Results showed that average monthly family income of less than ₦100,000 and possession of car was statistically associated with overweight/obesity. The odds of overweight/obesity among adolescents whose average monthly family income was less than ₦100,000 was twice higher than those with average monthly family income of ₦500,000 and above. Similarly, adolescents whose parents did not own a car were about two times more likely to be overweight/obese compared to those whose parents possessed a vehicle.

Results further showed that those whose mothers were civil servants were about 0.8 times less likely than those who were professionals to be overweight/obese (OR: 0.754; 95% CI: 0.270 – 2.108); while those did not possess a TV set/DVD were about 0.5 times less likely to be overweight/obese than those who did (OR: 0.525; 95% CI: 0.143 – 1.924). Those who lived in a rented apartment were about 0.9 times less likely to be overweight/obese compared to those who not (OR: 0.895; 95% CI: 0.545 – 1.471). However, these factors were not significant.

Table 4.11b: Binary Logistic Regression between Socio-economic Status and Combined Overweight/Obesity in Adolescents

	OR	95% CI for OR		p-value
		Lower	Upper	
Father's occupation				
Artisan	1.171	0.565	2.426	0.671
Business	0.929	0.521	1.658	0.804
Civil servant	1.504	0.575	3.935	0.406
Professional (ref)	-	-	-	-
Mother's occupation				
Artisan	1.341	0.491	3.662	0.567
Business	1.000	0.499	2.001	0.999
Civil servant	0.754	0.270	2.108	0.591
Professional (ref)	-	-	-	-
Average monthly family income				
Less than ₦100,000	2.165	1.053	4.450	0.036*
₦100,000 - ₦299,999	1.154	0.527	2.525	0.720
₦300,000 - ₦499,999	1.240	0.465	3.310	0.667
₦500,000 and above (ref)	-	-	-	-
Television set/DVD				
No	0.525	0.143	1.924	0.331
Yes (ref)	-	-	-	-
Generator				
No	1.094	0.478	2.501	0.832
Yes (ref)	-	-	-	-
Computer/video games				
No	1.496	0.931	2.406	0.096
Yes (ref)	-	-	-	-
Car				
No	1.717	1.004	2.935	0.048*
Yes (ref)	-	-	-	-
Do your parents own a house				
No	1.618	0.865	3.027	0.132
Yes (ref)	-	-	-	-
Do you live in a rented apartment				
No	0.895	0.545	1.471	0.661
Yes (ref)	-	-	-	-

*Statistically significant at $p < 0.05$

Table 4.11c shows the binary logistic regression of the association between dietary, physical activity, family history and body image perception risk factors and combined overweight/obesity.

After adjusting for other risk factors, results showed that adolescents who usually skipped breakfast had a 0.6 odds of being overweight/obese (OR: 0.597; 95% CI: 0.359 – 0.992); while those who had a high physical activity level were 0.5 times less likely than those with low physical activity to be overweight/obese (OR: 0.458; 95% CI: 0.240 – 0.873). Similarly, those who spent 3 – 4 hours watching TV/videos had a 0.6 odds of overweight/obesity compared to those who spent 0 – 2 hours (OR: 0.563; 95% CI: 0.320 – 0.993), while adolescents whose mothers had normal weight were about 8 times more likely of being overweight/obese compared to those whose mothers were slim (OR: 7.866; 95% CI: 1.324 – 46.739). Those who were satisfied with their body weight were about 0.5 times less likely to be overweight/obese compared to those who were not satisfied (OR: 0.474; 95% CI: 0.227 – 0.990), while those who desired to lose weight were about 3.4 times more likely to be overweight/obese (OR: 3.386; 95% CI: 1.972 – 5.814). Those who desired to gain weight had a 0.4 times odds of being overweight/obese in relation to those who did desire to gain weight (OR: 0.398; 95% CI: 0.222 – 0.712). These risk factors were statistically significant.

Results further showed that those who had healthy dietary habits were about 0.8 times less likely to be overweight/obese in relation to those who had an unhealthy dietary habit (OR: 0.759; 95% CI: 0.418 – 1.377),while those who spent more than 4 hours playing internet/computer games were 1.2 times more likely to be overweight/obese (OR: 1.208; 95% CI: 0.515 – 2.837); those who slept more than 8 hours were about 1.4 times more likely of being overweight/obese compared to those who slept for 8 hours or less (OR: 1.384; 95% CI: 0.794 – 2.412); those who desired to maintain their current weight, those whose friends made jest of their body shape and those who were scared of becoming fat were about 0.9 times less likely to be overweight/obese [(OR: 0.989; 95% CI: 0.543 – 1.801); (OR: 0.882; 95% CI: 0.503 – 1.546); (OR: 0.868; 95% CI: 0.501 – 1.507)] respectively.

Table 4.11c: Binary Logistic Regression between Dietary Habits, Physical Activity, Overweight among Family Members and Body Image Perception and Combined Overweight/Obesity

Risk factors	Adjusted OR	95% CI for OR Lower	Upper	p-value
Dietary habits				
Unhealthy (ref)	-	-	-	-
Healthy	0.759	0.418	1.377	0.364
Breakfast omission				
No (ref)	-	-	-	-
Yes	0.597	0.359	0.992	0.046*
Physical activity level				
High	0.458	0.240	0.873	0.018*
Low (ref)	-	-	-	-
Hours spent watching TV/videos				
0 – 2 hours (ref)	-	-	-	-
3 – 4 hours	0.563	0.320	0.993	0.047*
More than 4 hours	0.769	0.386	1.531	0.455
Hours spent playing internet/computer games				
0 – 2 hours (ref)	-	-	-	-
3 – 4 hours	1.010	0.521	1.960	0.976
More than 4 hours	1.208	0.515	2.837	0.664
Sleeping hours				
8 hours or less (ref)	-	-	-	-
More than 8 hours	1.384	0.794	2.412	0.251
Family history – Father				
Slim (ref)	-	-	-	-
Normal weight	0.712	0.135	3.752	0.688
Overweight	0.620	0.131	2.927	0.546
Family history – Mother				
Slim (ref)	-	-	-	-
Normal weight	7.866	1.324	46.739	0.023*
Overweight	1.994	0.647	6.143	0.229
Family history – Brother				
Slim (ref)	-	-	-	-
Normal weight	0.199	0.022	1.789	0.150
Overweight	0.295	0.033	2.610	0.272
Family history – Sister				
Slim (ref)	-	-	-	-
Normal weight	3.049	0.856	10.864	0.085
Overweight	2.245	0.684	7.365	0.182

*Statistically significant at $p < 0.05$

Table 4.11c: Binary Logistic Regression between Dietary Habits, Physical Activity, Overweight among Family Members and Body Image Perception and Combined Overweight/Obesity contd...

Risk Factors	Adjusted OR	95% CI for OR		p-value
		Lower	Upper	
I am satisfied with my body weight				
Agree	0.474	0.227	0.990	0.047*
Disagree (ref)	-	-	-	-
I desire to lose weight				
Agree	3.386	1.972	5.814	<0.001*
Disagree (ref)	-	-	-	-
I desire to gain weight				
Agree	0.398	0.222	0.712	0.002*
Disagree (ref)	-	-	-	-
I desire to maintain my current weight				
Agree	0.989	0.543	1.801	0.971
Disagree (ref)	-	-		-
My friends make jest of me				
Agree	0.882	0.503	1.546	0.661
Disagree (ref)	-	-	-	-
I am scared of becoming fat				
Agree	0.868	0.501	1.507	0.616
Disagree (ref)	-	-	-	-

*Statistically significant at $p < 0.05$

4.12: Correlation between Overweight/Obesity (BMI) and Waist-Hip Ratio (WHR)

Table 4.12 shows the correlation between Overweight/Obesity (BMI) and Waist-Hip Ratio (WHR). Pearson-product correlation showed that there was a weak positive correlation between BMI and WHR and it was not statistically significant ($r = 0.023$, $N = 618$, $p = 0.573$).

Table 4.12: Correlation between Overweight/Obesity (BMI) and Waist-Hip Ratio (WHR)

	N	Pearson-correlation (r)	p-value
Overweight/Obesity (BMI)	622		
		0.023	0.573
WHR	618		

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Prevalence of Overweight and Obesity

This study gives a comprehensive report of the weight status and its related determinants among secondary school adolescents using both the BMI and WHR techniques in Ikenne Local Government Area, Ogun State. Results from this study reveals that the prevalence of overweight (10%) and obesity (2.7%) by BMI was significantly higher than 5.8% overweight and 1.1% obesity prevalence previously reported by Mustapha and Sanusi, (2013) among in-school adolescents in Ondo State.

Furthermore, several studies have reported prevalence of overweight and obesity in various regions in Nigeria among adolescents. Prevalence rates of combined overweight and obesity reported in Osun State (Adeomi et. al, 2015), Ile-Ife (Sabageh and Ojofeitimi, 2013), Sagamu, (Akinpelu et. al, 2008), Benue (Musa et. al, 2012), Port-Harcourt (Adesina et. al, 2012), Benin-city (Omuemu and Omuemu, 2010), Ekpoma, Edo State (Abah et. al, 2012) and Sokoto (Ahmad et. al, 2013) were significantly less than 10% among the population studied.

However, studies conducted by Ene-Obong et. al, (2012) among school-aged children and adolescents in urban Southern Nigeria revealed that the prevalence of overweight (11.4%) and obesity (2.8%) was slightly higher than what was found in this study. Other studies also reveal a higher prevalence of overweight and obesity than those obtained from this study (Oduwole et. al, 2012; Chinedu et. al, 2012; Owa and Adejuyigbe, 1999).

It was observed that the estimated prevalence of combined overweight and obesity in this study (12.7%) was significantly higher than the prevalence reported by Cole et. al, (2000) and IOTF (2003) in Africa which was less than 5%. In contrast, studies in South Africa, Ghana, and Botswana showed a significantly higher prevalence of overweight and obesity to be more than 15% (Reddy et. al, 2008; Kimani-Murage et. al, 2010; Monyeki et. al, 2015; Mogre et. al, 2013; Malete et. al, 2013).

Estimates of the prevalence of overweight and obesity in this study was found to be higher than the global prevalence of 10% as reported by Lobstein et. al, (2004). Several studies in developed

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Furthermore, several studies have reported prevalence of overweight and obesity in various regions in Nigeria among adolescents. Prevalence rates of combined overweight and obesity reported in Osun State (Adeomi et. al, 2015), Ile-Ife (Sabageh and Ojofeitimi, 2013), Sagamu, (Akinpelu et. al, 2008), Benue (Musa et. al, 2012), Port-Harcourt (Adesina et. al, 2012), Benin-city (Omuemu and Omuemu, 2010), Ekpoma, Edo State (Abah et. al, 2012) and Sokoto (Ahmad et. al, 2013) were significantly less than 10% among the population studied.

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Estimates of the prevalence of overweight and obesity in this study was found to be higher than the global prevalence of 10% as reported by Lobstein et. al, (2004). Several studies in developed

countries reveal a higher prevalence of overweight and obesity among adolescents. For example, in the USA (Ogden et. al, 2012), Nepal (Archaya et. al, 2014), Brazil (Niehues et. al, 2014) and Kuwait (Alrashidi et. al, 2015), estimates of prevalence of combined overweight and obesity were found to be between 15% and 62%. A plausible explanation for these variations in prevalence across the globe is the rural-urban differences i.e. some studies were conducted in urban areas where it is generally assumed that urban children have a better nutritional status than their rural counterparts (Oninla et. al, 2007).

Results from this study also showed estimates of prevalence of overweight and obesity by WHR to be 35.1%. This finding is fairly comparable with a study conducted by Sabageh and Ojofeitimi (2013) who found the prevalence of overweight and obesity to be 37.1% using the WHR technique. A study by Sukhpal and Indarjit (2007) revealed a lesser prevalence of 30.12% compared to the findings in this study.

5.2 Pattern of Overweight and Obesity among Adolescents

Findings from this study revealed that the prevalence of overweight and obesity was significantly associated with adolescents' age, type of school attended and maternal education.

The prevalence of overweight and obesity was higher among adolescents who were between the ages of 10 and 14 years (early adolescence) than those who were between 15 and 19 years (late adolescence) by BMI but the reverse was the case when WHR was used. A sharp decline in the prevalence of overweight (BMI) was observed from age 17 years and obesity was completely absent from age 18 years. This is supported by findings from Chinedu et. al, (2012). However, Ene-Obong et. al, (2012) reported a rising prevalence at the age of 18 years. A valid explanation for these findings may be due to the fact that adolescence is a transition period from childhood into adulthood with older adolescents becoming more conscious of their body weight and body shape, since there is development of secondary sexual characteristics and behavioral patterns, which include eating patterns and self-care. At this time, personal preferences take precedence over eating habits learned at home as children progressively take control over what they eat and where and how they eat.

Results further showed that the prevalence of both overweight and obesity using both BMI and WHR techniques was higher among females compared to males, although, this was not statistically significant. A higher prevalence of both overweight and obesity in female adolescents compared to male adolescents have also been observed from studies conducted in Nigeria (Ene-Obong et. al, 2012; Ahmad et. al, 2013; Musa et. al, 2012). It is however largely unclear what the reason for this association could be but a plausible explanation for these findings may be as a result of the physical activity levels in relation to energy expenditure during and after school hours and cultural reasons. Playgrounds in schools studied were mainly dominated by the male adolescents while the females barely sit down in groups during their break periods for discussions and chats. Therefore, it can be inferred that female adolescents are less physically active during and after school hours.

Increased rates of overweight and obesity were observed among adolescents who attended private schools in comparison with those who attended public schools using the BMI approach. However, adolescents who attended public schools were more at risk of abdominal obesity compared to their private school counterparts. It was statistically significant at multivariate analysis level. This finding corroborates with a study conducted among private and public school adolescents in Ekpoma, Edo State (Abah et. al, 2012). This may be as a result of medium and high socio-economic status of private school adolescents who also have access to adequate and better diet.

Other variables such as ethnicity, religion, number of siblings, birth position and class category were not significantly associated with the prevalence of overweight and obesity. In contrast, previous findings reported a significant relationship between ethnicity (Acharya et. al, 2014; Piryani et. al, 2016), religion (Morgre et. al, 2013), number of siblings and birth position (Ojofeitimi et. al, 2011; Acharya et. al, 2014; Piryani et. al, 2016) and weight status among adolescents.

Maternal level of education was significantly associated with overweight and obesity among adolescents. Those whose mothers had tertiary education were more at risk of being overweight/obese compared to those whose mothers had a secondary or primary education using the BMI technique and they were more likely to attend private schools. This finding corroborates with a study conducted by Piryani et. al, (2016) in Nepal. However, a study conducted by

Mustapha and Sanusi (2013) reported a contrary observation among adolescents' maternal level of education in Ondo State, Nigeria. Majority of mothers who had tertiary education were professionals and into business. However, it was observed that those whose mothers had secondary education were more at risk of abdominal obesity using the WHR technique and they were more likely to attend public schools. More of business women fell into the category of SSCE holders. Reasons for these findings may be due to lack of time with children to prepare healthy meals and provision of junk foods because of the nature of the mothers' occupation.

All the variables used to measure socio-economic status of adolescents were not significantly associated with their weight status using the BMI technique except parents' possession of car(s). Those whose parents possessed at least one car were about three times more likely to be overweight or obese compared to those who did not. Moreover, adolescents whose parents were either business owners or professionals were more likely to be overweight/obese than those whose parents were artisans or civil servants. Those whose average monthly family income was less than ₦100,000, who possessed television set/DVDs, generator, computer/video games and those whose parents owned a house, were also more likely to be overweight/obese, although, these associations were not statistically significant. These findings are contrary to previous findings as reported by Adeomi et. al, (2015) and De Onis et. al, (2000).

However, the WHR technique found a statistically significant association between parents' occupation, average monthly family income, possession of computer/video games, generator, car and house ownership. Adolescents whose parents were business owners and artisans, who had an average monthly family income of less than ₦100,000, who possessed generator, car (s), computer/video games and owned a house were more likely to be overweight/obese than their counterparts. It can be inferred from these findings that WHR technique which measures abdominal obesity is a better measure for detecting a significant relationship between weight status of adolescents and their socio-economic status.

5.3 Determinants of Overweight and Obesity among Adolescents

The risk factors for overweight and obesity investigated in this study include: dietary habits, physical activity/sedentary lifestyle, family history of overweight and obesity and body image perception.

5.3.1 Dietary Habits

The prevalence of overweight and obesity was higher among adolescents who ate fast foods, soft drinks, sugar-sweetened beverages, snacks and starchy foods. However, the results were not statistically significant. Results also showed that the dietary habits of adolescents were not statistically associated with overweight and obesity by BMI. Those who did not skip breakfast and those who did not take meals from fast food restaurants were more likely to be overweight/obese than those who did. Adolescents who skipped breakfast were significantly higher among those attending public schools. These findings are contrary to what was reported in previous findings showing that breakfast omission, high intake of sugar-sweetened beverages, high intake of meat and sausage and regular eating from fast food restaurants were dietary risk factors for overweight and obesity among adolescents (Alrashidi et. al, 2015; Ojofeitimi et. al, 2011; Al-Hazzaa et. al, 2012; Sakinah et. al, 2012; Kleiser et. al, 2009). A possible explanation for these findings may be as a result of the cooking pattern of foods rich in fatty oils and meat consumed by those who did not skip breakfast or consume meals from fast food restaurants. Regular consumption of fatty foods could predispose an individual to being overweight or obese. Another possible explanation may be as a result of genetic factors/family history of overweight/obesity since the risk factors of overweight and obesity among adolescents are multi-faceted.

Interestingly, the prevalence of both overweight and obesity was significantly associated with breakfast omission by WHR. Adolescents who skipped breakfast were significantly higher and more likely to be overweight/obese than those who did not.

5.3.2 Physical Activity/Sedentary Lifestyle

Findings from this study revealed that there was a significant relationship between physical activity level and weight status among adolescents. Those who walked or cycled to school every day were less likely to be overweight or obese compared to those whose mode of transportation was school bus, motorcycle or private car. Those who also walked more than 6 times in a week to and from school and those who engaged in vigorous activities during and after school hours frequently were less likely to be overweight or obese compared to their counterparts. Previous studies show similar findings (Al-Hazzaa et. al, 2012; Sakinah et. al, 2012; Peltzer and Pengpid, 2011).

However, variables measuring sedentary behavior of adolescents were not significantly associated with overweight and obesity. There was no significant difference in weight status of adolescents who spent less than 2 hours and those who spent more than 2 hours watching TV. This finding is contrary to previous findings that reported a significant relationship between hours spent watching TV and overweight and obesity in Nepal (Piryani et. al, 2016), China (Guo et. al, 2013), Northeast Brazil (Marine de Moraes et. al, 2011) and Ghana (Peltzer and Pengpid, 2011).

It was also observed that those who played internet/computer games for more than 4 hours and those who slept for more than 8 hours were about 1.2 times and 1.4 times more likely to be overweight and obese respectively. This finding is supported by a previous study conducted in China (Guo et. al, 2013).

5.3.3 Perception of Overweight among Family Members

This study did not detect a significant association between respondents' perception of overweight among family members and adolescents' status. Previous studies in contrast, found significant relationship between family history and weight status of adolescents among French adolescents (Thibault et. al, 2009), China (Guo et. al, 2013), Iran (Doustmohammadian et. al, 2011), India (Ranjani et. al, 2014), Germany (Kleiser et. al, 2009), and Osun State, Nigeria (Ojofeitimi et. al,

2011). However, it is interesting to note that adolescents whose parents and siblings were either overweight or obese were more likely to be overweight or obese.

5.3.4 Body Image Perception

Findings from this study revealed that adolescents who were satisfied with their body weight were 0.5 times likely to be overweight or obese. This corroborates with a study conducted by Ojofeitimi et. al, (2011) in Olorunda local government, Osun State, Nigeria. In addition, adolescents who desired to lose weight were about 3.4 times more likely to be overweight or obese; while those who desired to gain weight were 0.4 times less likely to be overweight or obese. These were all statistically significant at the multivariate level of analysis.

However, adolescents who desired to maintain their current weight, those whose friends made jest of their body shape and those who were scared of becoming fat were about 0.9 times less likely to be overweight or obese. These findings were not statistically significant. Ojofeitimi et. al, (2011) reported that those who were scared of being overweight or obese were more likely to be overweight or obese which shows a contrary finding.

5.4 Correlation between BMI and WHR

This study revealed that there was a weak positive correlation between BMI and WHR of adolescents but it was not statistically significant. A study was conducted among adolescents in Ile-Ife, Osun State and there was a weak positive correlation between BMI and WHR and it was statistically significant (Sabageh and Ojofeitimi, 2013).

It was observed that there were variations in the prevalence and determinants of overweight and obesity among adolescents in the two techniques. A plausible explanation for these disparities is that WHR has been found to be more sensitive than BMI in the detection of abdominal obesity. This was observed in a study conducted among women in a university community whereby WHR gave a higher percentage of excess body weight than BMI (Ojofeitimi et. al, 2007). These variations might also be due to environmental and genetic factors.

5.5 Limitations of the Study

This study was limited by a number of factors. First of all, the dietary assessment and physical activity levels of adolescents were based on questions that required a weekly recall. This could result in recall bias since most of them might not have been able to adequately recall their dietary intake and physical activity levels the previous week before the study was conducted. Secondly, the study did not make provision for measuring adequately the weight status of adolescents' parents. Studies have shown a significant relationship between parents' weight status and adolescents' risk of being overweight or obese. However, questions asked to address this aspect were not sufficient enough to detect a significant relationship between parental weight status and risk of overweight and obesity in adolescents. Thirdly, the study was conducted in a semi-urban local government of Nigeria; hence, rural-urban differences in measuring overweight and obesity among adolescents were not examined.

5.6 Conclusion

The prevalence of overweight and obesity among adolescents as evidenced from this study indicates that childhood overweight and obesity is still a major public health problem globally and even locally especially in developing countries like Nigeria. In addition, this study supports the fact that there are varying risk factors of overweight and obesity among children and adolescents ranging from unhealthy dietary habits, physical inactivity/sedentary lifestyle, genetic factors to environmental factors and body image perception. Although, there were few significant associations between dietary habits and childhood overweight and obesity, other risk factors such as physical activity levels and body image perception showed significant relationships with overweight and obesity. This does not however, nullify the fact that unhealthy dietary habits are important risk factors of childhood overweight and obesity. It only indicates that the determinants of overweight and obesity in children and adolescents are dynamic, complex and multi-faceted.

The study also concludes that even though Body Mass Index is the generally acceptable standard for measuring weight status in individuals, there are more sensitive measures that can detect abdominal and central obesity such as Waist-Hip Ratio. Hence, the use of other standard measures alongside BMI should be encouraged in order to provide a better and more adequate representation of childhood overweight and obesity.

5.7 Recommendations

Based on the results of this study, the following recommendations could be considered:

1. Coordinated school health programs and interventions with emphasis on healthy nutrition and physical activity should be put in place in order to ensure that adolescents adopt a healthy dietary pattern and high physical activity levels.
2. Since schools serve as an important setting for improving the health of adolescents, physical education classes should be strengthened with activities that can boost their health and academic performance.
3. School canteen guidelines should be given by health authorities to cooks and food vendors in ensuring that the daily dietary requirements of adolescents are adequately met.
4. Recreational centers should be established in schools where there is none and adequate provision of sporting facilities should be made available for female students to participate in order to be physically active.
5. Enlightenment programs on overweight and obesity should be targeted at adolescents in both public and private schools by putting into consideration their socio-economic backgrounds and socio-cultural beliefs.
6. Parents and teachers should be encouraged to promote healthy lifestyle for adolescents by limiting amount of hours spent watching television or other activities that might create an imbalance between their energy intake and energy expenditure.

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INFORMED CONSENT FORM

This research work is titled PREVALENCE AND DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG IN-SCHOOL ADOLESCENTS IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE.

My name is Oduyoye Omobola Oyebola, (07039330182, omobola.oduyoye@yahoo.com) an MPH student at the Department of Epidemiology and Medical Statistics, University of Ibadan, Oyo State. This study is aimed at bridging the gap in knowledge on the prevalence and risk factors associated with overweight and obesity among adolescents in Nigeria.

The outcome of this research will be essential for providing evidence-based information to decision and policy makers and stakeholders such as parents, teachers, Ministry of Health, Ministry of Education and Ministry of Youth Development and Sports for proper planning, development and implementation of feasible public health policy interventions so as to curb the alarming increase in overweight and obesity.

The study is a quantitative design. A cross-sectional method of research will be used and anthropometric measurements including body weight, height, waist and hip measurements will be carried out. Should you decide not to continue with the research for any reason, be rest assured that you would not be penalized. You are free to withdraw at any stage of the research provided that reason(s) are given. After the research is over, research participants go back to their normal way of life without any harm or risk. The researcher declares no conflict of interest. The information is required for research purpose only and it will be treated with utmost confidentiality.

Please bear with me as there will be no tangible reward or compensation for your participation in this research work.

Thank you.

If you agree with these terms, please write your name and sign this consent form on the spaces provided below:

Name of researcher: _____ Sign&Date: _____

Name of participant: _____ Sign&Date: _____

Name of witness: _____ Sign&Date: _____

PREVALENCE AND DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG IN-SCHOOL ADOLESCENTS IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE

Dear respondent,

I am an MPH Field Epidemiology student of the Department of Epidemiology and Medical Statistics, University of Ibadan conducting a research on "**Prevalence and Determinants of Overweight and Obesity among In-School Adolescents in Ikenne Local Government Area, Ogun State,**" as a basic requirement for the award of the Master of Public Health (MPH) Degree in Field Epidemiology. The information is required for research purpose only and it will be treated with utmost confidentiality.

Type of School: _____ Study ID: _____

SECTION A: Sociodemographic characteristics

1. Age as at last birthday: _____
2. What is your Date of Birth? Day ____ Month _____ Year _____
3. Sex: Male ( ) Female ( )
4. Ethnicity: Yoruba ( ) Igbo ( ) Hausa ( ) Others, please specify _____
5. Religion: Christianity ( ) Islam ( ) African Traditional ( )
6. Where do you reside (Name of town or city please): _____
7. Father's highest level of education: No formal education ( ) Primary ( ) Secondary ( ) Technical ( ) Tertiary (BSc or HND) ( ) Tertiary (MSc or PhD) ( )
8. Mother's highest level of education: No formal education ( ) Primary ( ) Secondary ( ) Technical ( ) Tertiary (BSc or HND) ( ) Tertiary (MSc or PhD) ( )
9. Father's occupation: _____
10. Mother's occupation: _____
11. Average monthly family income (mother's plus father's income/salary):

    Less than ₦100,000 ( ) ₦100,000 - ₦299,999 ( ) ₦300,000 - ₦499,999 ( ) ₦500,000 and above ( )
12. How many siblings (brother/sister) do you have? _____
13. What is your position among your siblings? _____
14. Class: _____
15. Weight: _____ Height: _____ Waist mm: _____ Hip mm: _____

Instruction: Please indicate if you possess the following household equipment/workers (√)

	Items	Yes	No
16.	Television set/DVD		
17.	Generator		
18.	Computer/Video games		
19.	Car		
20.	Do your parents own a house?		
21.	Do you live in a rented apartment		

SECTION B: Adolescents' Dietary habits

22. On school days, where do you usually get your breakfast? (√)

Home ( ) School canteen ( ) Shop (outside school) ( ) From friends ( )

I don't eat breakfast ( )

23. In the last 5 school days, on how many days did you take breakfast before school started?

0 days ( ) 1 day ( ) 2 days ( ) 3 days ( ) 4 days ( ) 5 days ( )

Indicate the number of times you took these foods in the last one week (√).

		Not at all	1 – 3 times	4 – 6 times	Every day
24.	Fruits (apple, banana, orange, water melon, pineapple, etc.)				
25.	Vegetables (fresh vegetables, salad, cucumber, carrot, tomatoes, etc.)				
26.	Soft drinks (Coke, Sprite, Fanta, Pepsi, Mirinda, etc.)				
27.	Fruit drinks (Ribena, 5-alive, Chivita, Happy hour, etc.)				
28.	Meat/fish/eggs				
29.	Sugar-sweetened beverages e.g. tea, milo, bournvita, lipton, etc.				
30.	Water (6 – 8 glasses per day)				
31.	Starchy foods e.g. yam, bread, rice				
32.	Snacks e.g. biscuit, cake, doughnut, potato or plantain chips, chin-chin, meat pie, egg roll, puff-puff, fish pie, etc.				
33.	Sweets, chewing gum, chocolates, lolly-pop, ice cream, yoghurt				
34.	Fast foods in takeaway packs e.g. indomie, pizza, barbeque, fried chicken, etc.				

SECTION C: Physical Activity levels/Lifestyle

35. In the last one week, what was your mode of transportation to school? Walking ( ) Bicycle ( ) School bus ( ) Motorcycle ( ) Private car ( )

36. In the last 5 school days, how many times did you walk to and from school? (Walking from home to school and back on 1 day is 2 times; walking to school and taking bus or motorcycle home is 1 time) _____

37. How long does it take you to walk from home to your school?
Less than 15 minutes ( ) 15 – 30 minutes ( ) More than 30 minutes ( )

38. What do you do during your leisure time?

Sleeping ( ) Watching television/videos/DVDs ( ) Reading ( ) Playing football ( ) Hanging out with friends ( ) Riding bicycle ( ) Others, please specify _____

39. How many times did you engage in vigorous activities (football, jogging or running, skipping) in the last one week? Not at all ( ) 1 – 3 times ( ) 4 – 6 times ( ) Every day ( )

40. How many hours per day did you spend watching TV/videos/DVDs in the last one week?
0 – 2 hours ( ) 3 – 4 hours ( ) more than 4 hours ( )

41. During the school week, do your parents (or caregivers) regulate the amount of time you spend watching TV? (Including videos and DVDs)?
No limits, I can watch anything ( ) Yes, but not very strict limits ( ) Yes, strict limits ( )

42. How many hours per day did you spend playing internet and computer games in the last one week? 0 – 2 hours ( ) 3 – 4 hours ( ) more than 4 hours ( )

43. When do you normally sleep at night? _____

44. When do you normally wake up in the morning? _____

SECTION D: Family History

Kindly classify your parents and siblings under the following weight status categories

		Slim	Normal weight	Overweight
45.	Father			
46.	Mother			
47.	Brother (s)			
48.	Sister (s)			

SECTION E: Body Image Perception

		Agree	Disagree	Indifferent
49.	I am satisfied with my BODY WEIGHT			
50.	I am happy with my BODY SHAPE			
51.	I desire to lose weight			
52.	I desire to gain weight			
53.	I desire to maintain my current weight			
54.	I don't want to do anything about my weight			
55.	My friends make jest of my body shape			
56.	I am scared of becoming fat			

Thank you.

37. How long does it take you to walk from home to your school?
Less than 15 minutes ( ) 15 – 30 minutes ( ) More than 30 minutes ( )

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Sleeping ( ) Watching television/videos/DVDs ( ) Reading ( ) Playing football ( ) Hanging out with friends ( ) Riding bicycle ( ) Others, please specify _____

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56.	I am scared of becoming fat			

Thank you.

BABCOCK UNIVERSITY
HEALTH RESEARCH ETHICS COMMITTEE

Our Ref. NHREC/17/12/2013 Your Ref. BUHREC463/16 Date: Sept 28, 2016

NAME OF PRINCIPAL INVESTIGATOR: ODUYOYE OMOBOLA O.

TITLE OF STUDY: PREVALENCE AND DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG IN-SCHOOL ADOLESCENTS IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE.

RESEARCH LOCATION: OGUN STATE, NIGERIA.

NOTIFICATION FOR ETHICAL APPROVAL

Babcock University Health Research Ethics Committee has approved your research proposal and other related materials after the necessary reviews and corrections.

The National code for Health Research Ethics requires that you comply with all institutional guidelines, rules and regulations. All forms and questionnaire must carry the assigned BUHREC number. No changes are permitted in the research without prior approval by the committee.

Please, note that the committee will monitor the research study. You are expected to give a progress report of the investigation and submit a final copy of the research to the committee.

Thank you.

Sign... Date 12/10/16

Professor D.O. Akinboye
Chairman, Babcock University Health Research Ethics Committee

Your Ref: BUHREC405/16 Date: Sept 28, 2016

NAME OF PRINCIPAL INVESTIGATOR: ODUYOYE OMOBOLA O.

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Thank you.

BABCOCK UNIVERSITY HEALTH RESEARCH ETHICS COMMITTEE
Sign.....
Date 29/09/16

Professor D.O. Akinboye
Chairman, Babcock University Health Research Ethics Committee

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