DIETARY PATTERN, NUTRITIONAL STATUS AND BLOOD PRESSURE LEVEL OF IN-SCHOOL ADOLESCENTS IN EDO STATE, NIGERIA

BY

OKOLOSI, JOEL EVIANO

B. Sc. Biochemistry, Delta State University (DELSU), Abraka.

MPH Population and Reproductive Health Nutrition, University of Ibadan (UI)

MATRIC NO.: 152706

A Thesisinthe Department of Human Nutrition, Faculty of Public Health, College of Medicine, University of Ibadan.

Submitted in Partial Fulfilment of the Requirementsfor the Degreeof

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

MARCH 2020

ABSTRACT

Poor eating habit and dietary pattern predispose adolescents to Diet-related Non-Communicable Diseases (DrNCDs) including hypertension. The dietary pattern, nutritional status and blood pressure of adolescents needed to be adequately understood to inform appropriate intervention strategy against DrNCDs. This study was designed to assess the dietary pattern, nutritional status and blood pressure of in-school adolescents in Edo State, Nigeria.

The cross-sectional study included a total of 1440 respondents selected using a three-stage simple random sampling technique. Two hundred and forty respondents were selected from two schools per Local Government Areas (LGAs) in each of the three Senatorial District in the State. A validated, standard interviewer-administered questionnaire was used to obtain information on socio-demographic characteristics, dietary pattern, diversity and anthropometric characteristics of respondents. Dietary pattern was assessed using one-week food frequency questionnaire, while 24-hour recall was used to determine Dietary Diversity (DD) and nutrient intake. The DD was assessed with a 9-point scale categorised as low (1-3), medium (4-5) and high (6-9). Adapted Total Diet Assessment software was used to determine nutrient adequacy, classified as inadequate (<80.0%), adequate (80.0-120.0%) and excess (>120.0%). Weight (kg) and height (m) were assessed and analysed using WHO Anthro-Plus to generate Body Mass Index for Age [BMI/A (kg/m2)] z-score, classified as underweight (<-2SD); normal (-2SD to 1SD); overweight (>1SD to 2SD) and obese (>2SD). Waist Circumference [WC (cm)] was classified as normal (<75th percentile), moderate (≥75th-≤90th percentile) and high (>90th percentile). Validated sphygmomanometer was used to assess Blood Pressure [BP (mmHg)], classified as normal (<90th percentile), pre-hypertension (≥90th-≤95th percentile) and hypertension (>95th percentile). Data were analysed using descriptive statistics and linear regression at α0.05.

Age of respondents was 14.5±1.9 years, 50.0% were female and 77.2% were ethnic minority in Edo State. Consumption pattern included: Staples- rice (52.3%), *eba* (40.7%) and yam (40.1%); Proteins- fish (64.1%), crayfish (53.3%), egg (42.8%) and beans (37.9%); Fruits (30.1%) and vegetables (31.0%). Meal skipping was high particularly lunch (48.7%) and breakfast (42.1%), while 30.9% added extra salt to food. Majority (56.6%) of the respondents had medium DD while 40.7% and 2.7% had

low and high dietary diversity, respectively. Respondents adequately consumed total fat (97.9%), energy (89.6%), protein (87.9%), sodium (87.7%), vitamin A (74.2%) and carbohydrate (77.1%). However, respondents adequately consumed Potassium (1.9%), Calcium (4.1%), vitamin C (4.4%), dietary fibre (13.5%), folate (21.3%) and iron (31.7%). Prevalence of abnormal BMI/A (underweight, overweight and obesity) was 29.6% (9.0%, 18.1% and 2.5%, respectively). More males (45.8%, 6.7%) than females (32.4%, 4.6%) had moderate and high WC, indicative of cardio-metabolic risk. Prevalence of pre-hypertension and hypertension was 34.1% and 11.9%, respectively. Gender, ethnicity, WC and DD significantly predict BMI/A (β= 0.123, β = -0.068, β=0.310 and β= -0.041, respectively). However, the WC, BMI/A and DD were not significant predictors of BP (β=-0.029; β=-0.019 and β=0.030, respectively).

The pattern of regular intake of macronutrient than micronutrient by the adolescents was established while observed Low DD and high WC were associated with malnutrition than hypertension hence corrective nutrition education should be promoted among adolescents.

Keywords: Dietary diversity, Malnutrition, Hypertension, In-school adolescents

Word Count: 496

CERTIFICATION

This is to certify that this study was carried out by OKOLOSI, Joel Eviano under my supervision in the Department of Human Nutrition, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Oyo state, Nigeria.

_____

Supervisor

Grace, T. Fadupin ***Ph.D, NRD, FIDN***

Professor (Clinical Nutrition and Diet Therapy),
Department of Human Nutrition,
Faculty of Public Health,
College of Medicine,
University of Ibadan,
Ibadan, Nigeria

DEDICATION

This project is dedicated to the Almighty God the giver of Wisdom, Knowledge and Understanding.

ACKNOWLEDGEMENT

My unreserved gratitude is to Almighty God who granted me the grace to start and complete this study. It is my desire to express my profound appreciation –Prof. Grace T. Fadupin (Supervisor) for her assistance, correction, patience and support toward the completion of this dissertation. These greatly enhance the quality of this work. It has been worthwhile experience learning from her.

I sincerely appreciatethe Head of Department- Human Nutrition– Dr. O.T. Adepoju, Prof. Tola Atinmo, Prof. Ben Emikpe, Dr. O.E. Oyewole, Prof. R.A. Sanusi, Dr. Folake Samuel, Dr O. Ariyo, Dr. O.O Leshi, Dr. Morenike Ogunkunle, Dr. Shirley Ejoh, Dr. Folasire, Dr. Bamigboye, Dr. Akinsete, Mr. Afolami and Mr. Fabusorofor their love, help and contributions to this course and achievementof this Thesis and throughout this study cannot be quantified. With great pleasure,my appreciation goes to members of staff in the Department of Human Nutrition, who are friendly and always ready to render services with love.

I love to express my gratitude to Prof. Betty O. George, Prof. S.D. Nwajei, Prof. S.O. Asagba, and Prof. N.J. Tunikari – of Delta State University with regards to their encouragement, love and support I am indeed sincerely grateful to my steadfast, consistent and caring parents: Pastor (Dr.) and Deaconess E.E. Okolosi for their unflinching love, care, support and understanding towards my study, God in His infinite mercies will give you long life in good health. I also appreciate my siblings (Mrs. Naomi Agidih, Mrs. Ruth Atorue, Ms. Rebecca Okolosi, Mrs. Esther Ejegreh, Mr. Gideon Okolosi, Ms. Elizabeth Okolosi and Mr. Isaiah Okolosi) and Onome Agbada with respect to their understanding including support.

I cannot but mention the names of my dear friends and colleagues: Dr. Boboye, Dr. Oreva, Dr. Bukola Bamisiaye, Dr. Bayo Kazeem, Dr. J.E. Uba, Mr. Chikodi Ehumadu, Mr. Bright Irhivben, Mr. Francis O, Mr. Faith Odeyemi, Mr. Femi Oyeniyi, Ms. Helen T. Olojede, Mr. Fredrick Anongo, Mr. Wali Musa Dedeh, Mr. Williams Danladi, Mr. Umma Samuel Bem, Dr. Kemi Akintemi, Dr. A. Okekunle, Mr. Kalu Ndukwe, Dr. Adenike Akinyemi, Dr. Tolu Eyinla, Mrs. Doris Anaemene, Mrs. Oghenefego Ofilli, Ms. Omotola Ogundairo, Mr. Tobi Akinremi, Ms. Joy Nwajei, Mrs. Linda, Dr. Akinyemi Tope, Dr. Elijah Akintunde, Mr. Peter Yekeem, Mr. Zachariah Mishelia,

Mrs. Chioma Onwubiko, Mrs. Oluchi, Mrs. Erhies, Ms. Abigail Olomukoro, Ms. Tomi Olaifa, Mr. Ezichi Ogbonnaya, Mr. Jackson Etuk, Mr. Tola Oyebanjo, Mr. Prince Ike Onyemenam, Mr. Adedeji Adebayo, Mr. Nwabueze Ogana, Mr. Olajide Adedeji, Mr Olarinde Johnson, Ms Dorcas Eni, Ms Ucheoma Adanna, Ms Rachael Omoba, Mr. Jean Paul, Mr. Yuji Ogawa, Ms. Tubi Ibukun, Mr. Victor Kolo, Dr. Omolola Ajayi, Mr. Michael Asuelime, Mr. Siji, Mr. Emah Ekere, Mr. Olurotimi O. Oloyede, Ms. Susanna O. Aiyedun, Mr. Wisdom Johnson, Ms. Joy Osoikhia amongst others and my Pastor(s)Ebare, Oki, Joshua Adegbiyi and Adams.

I am delighted to appreciate the Commissioner, Edo State Ministry of Education and Principals in Secondary Schools involved in the study. I also appreciate the household of TACSFON UI Chapter and IVCUPGF for their prayers, encouragement and support saw me through the conduct of the studyand to all who has contributed to the success of this Thesis one way or the others; May God bless you all.

Joel Eviano OKOLOSI

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

FFQ =	Food Frequency Questionnaire
DD =	Dietary Diversity
DrNCD =	Diet Related Non-Communicable Diseases
BMI/A =	Body Mass Index for age
WC =	Waist Circumference
WtHR =	Waist to Height Ratio
PCA =	Principal Component Analysis.
BF =	Body Fat
VF =	Visceral Fat
WHO =	World Health Organisation
UNICEF =	United Nations Children Fund
NCD =	Non-Communicable Diseases
PA =	Physical activities
LS =	Lifestyle

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Adequate nutrition performs a significant in the physical, mental and psychological well-being of individuals.It also assists in the prevention, treatment, controlling premature morbidity resulting from communicable and diet related non-communicable diseases (UNICEF, 2018).Appropriate nutrition and good health condition are crucial and interlinked aspects of human development which interact with socio-demographic and economic variables in important ways (Maiti *et al.,* 2011). Individuals'nutrition and health condition is influenced by nutrient intake and their utilization in the body (Mansur *et al.,* 2015; Singh *et al.,* 2008). Individuals between the ages of 10-19 are referred to as adolescents (Black *et al.,* 2013). In 2012, there were 1.2 billion adolescents in the world (Black *et al.,* 2013), In Nigeria, adolescents make up 21.5% of the population (NDHS, 2013). In 2012, 38 million people died due to Non-communicable disease accounting for 68% of total annual death; and cardiovascular diseases alone were responsible for 17.5 million deaths in the year (Nam *et al.,* 2015; WHO, 2014).

Energy imbalance and nutrient intake in children and adolescents involve both inadequate and excessive energy and nutrients intake; the former leading to malnutrition in the form of wasting, stunting and underweight, and the latter resulting in overweight and obesity" (Caroline *et al.,* 2014). Cognitive, physical, social, and lifestyle changes during adolescence can create profound changes in their eating patterns. Poor eating patterns involving irregular consumption of meals, excessive snacking, eating away from home,eating fast foods with soft drink, dieting (especially among female) and skipping meals] had been reported among adolescents and may lead to health problems {Non-communicable diseases (NCDs)} including obesity, diabetes, cardiovascular diseases, hypertension, cancer as well as osteoporosis at their (Shafiee *et al.,* 2013; Fernandes & Zanesco, 2010, Anector, Ogundele & Oyewole, 2012).

Food habits vary widely between individual adolescents, and exhibit some general trends over time, reflecting sociocultural trends in food availability (Slining, Mathias & Popkin 2013).Poor feeding habits are frequently observed in adolescents from developed and developing countries whose diet were characterized by increased intake of saturated fat and energy dense food, sugar and low intake micronutrient rich fruits and vegetables including dairy products (Prochnik Estima *et al.,* 2009). Low dietary diversity, poor intake of micronutrient rich foods has been reported among adolescents in Ibadan (Sanusi, Yusuf & Ejoh, 2014) and inadequate iron intake was significantly higher in female when compared to males (Ogunkunle & Oludele, 2013) while fruits, vegetables, meat, chicken and dairy products were less likely to be consumed by obese adolescent girls (Musaiger, Al-Mannai & Zagzoog, 2014).

Overweight/obesity has been implicated to increase the risk of cardiovascular diseases among school-attending children and adolescents (Friedemann *et al.,* 2012; Makkes *et al.,* 2013) and low physical activity in adolescents was also reported to be associated with metabolic disorders, including insulin resistance, lipid profile alteration and cardiovascular diseases (Velásquez-Rodríguez *et al.,* 2014). Obesity is an important modifiable risk factor for many NCDs, including hypertension (WHO, 2014). Childhood obesity and hypertension are associated with several adult non-communicable diseases and conditions, such as cardiovascular diseases, diabetes, and premature death (WHO, 2015; Petkeviciene *et al.,* 2015).

Obesity in childhood is not limited to the developed countries alone. A rising prevalence of childhood obesity in both developed and developing countries has been reported (Mustapha & Sanusi, 2013). Dietary pattern and obesity have shown to be significantly associated with the development of hypertension (Lu *et al.,* 2013); with high blood pressure ($\geq 90^{th}$ percentile or >120/80mmHg) (Marrodán Serrano *et al.,* 2013) among children and adolescents. High blood pressure is also becoming an issue for children and adolescents all over the world. Although, it is referred to as a disease of the elderly historically (Magliano *et al.,* 2013). It has been reported as a risk factor for cardiovascular diseases, the leading cause of morbidity and mortality globally (Park *et al.,* 2013).

Body dissatisfaction has been linked to several unhealthy eating disordered behaviours such as dieting, skipping meals, fasting, self-induced vomiting, and use of diet pills or

laxatives, smoking and alcohol consumption are more common in overweight and obese males and females (Ojofietimi *et.al.,* 2011).

There is a need to provide comprehensive information on the dietary pattern, nutritional status and blood pressure level of adolescents in every part of the country to identify unhealthy dietary behaviour early among adolescents. This will help to determine effective intervention programmes which will help in bringing positive changes in dietary habit and to also reduce the occurrence and development of diet-related chronic NCDs among adolescents later in life.

1.2 Statement of the Problem

In recent decades, the prevalence of childhood malnutrition, most especially obesity has become an important global health concern (de Onis *et al.,*2010; de Onis and Blössner, 2000). Poor eating pattern and nutritional status which could lead to overweight/obesity and non-communicable diseases among adolescents have been reported.Studies on the global prevalence of malnutrition among under five (U5) were reported in many parts of Nigeria however, limited information exists on adolescents' dietary pattern and nutritional status in every State in Nigeria.

Trends in the nutritional status of kids under age of five were reported having stunting (42%, 41%, 37%), wasting (11%, 14%, 18%), underweight (24%, 23%, 29%) and overweight (6%, 9%, 4%) for the year (NDHS: 2003, 2008 and 2013) respectively. There is no available data about malnutrition (stunting, underweight, overweight and obesity) among adolescents in the Nigeria Demographic Health Survey (NDHS) of these years.

In Eti-Osa Local Government Area (LGA) of Lagos State, Ben-Bassey *et al.* (2007) recorded general prevalence levels of overweight and obesity in urban and rural communities respectively as 3.7% and 0.4%, and 3.0% and 0.0% among adolescents 10-19.Ansa *et al.* (2008) also reported a prevalence rate of obesity and overweight of 1.7% and 6.8% respectively among students 10-20 years of age in Cross-River state.Incidence of underweight, overweight and obesity among teenagers in Ondo State was observed by Mustapha & Sanusi (2013) as (16.3%, 5.8% and 1.1%) respectively.

Energy imbalance and nutrient intake in children and adolescents involve inadequate and excessive intake; the former leading to malnutrition in the form of wasting, stunting and underweight, and the latter resulting in overweight and obesity" (Caroline *et al.,* 2014).Several reports have been made on adolescents' nutritional status for example, Sanusi, Yusuf & Ejoh, (2014) reported on the dietary diversity of adolescents that majority (62.85%) of the adolescent in Ibadan had medium dietary diversity while (35.64% and 0.51%) had low and high dietary diversity respectively. In addition, adolescents' dietary diversity was low and showed poor consumption of micronutrient rich foods like fruits and milk products.

Ogunkunle and Oludele, (2013) reported that intake of energy was higher in greater proportion (66%) of the adolescents as well as 62% higher in carbohydrate but relatively lower I fat and protein (51% and 42%) respectively. However, reduced intake of iron was significantly higher in female when compared to males ($p<0.05$).

Musaiger, Al-Mannai and Zagzoog, (2014) reported an increased risk (OR= 1.57, OR= 13.5) of obese adolescents that were more likely to consume chocolate and sweet, and fast food more than once a week compared to non-obese adolescents' girls respectively. However, they are less likely to consume micronutrient rich fruits, vegetables and dairy products their non-obese counterparts.

Childhood obesity and hypertension has been reported to be associated with several adult non-communicable diseases and conditions, such as cardiovascular diseases, diabetes, and premature death (WHO, 2015; Petkeviciene *et al.,* 2015). There is limited data available in Nigeria on the incidence of hypertension among teenagers.

Investigation have shown that dietary pattern and obesity were significantly associated with the development of hypertension (Zhang *et al.,* 2012); high blood pressure ($\geq 90^{th}$ percentile or >120/80 mmHg) (Marrodán Serrano *et al.,* 2013) and evidence has been shown that mild numbers of obese children / adolescents will develop as obese adolescents with associated negative health effects including heart disease, hyperlipidemia, hyperinsulinemia, hypertension, angina pectoris, non-insulin-dependent diabetes mellitus (NIDDM) and early atherosclerosis and even increased adult mortality(Dulskine *et al.,* 2014; Amole *et al.,* 2011; Ojofietimi *et al.,* 2011; Sebanjo, 2011). There is need to determine the prevalence of obesity and hypertension among adolescents in Nigeria for appropriate intervention.

1.3 Justification

In 2012, there were 1.2 billion adolescents in the world (Black *et al.,* 2013), In Nigeria, adolescents make up 21.5% of the population (NDHS, 2013). Adolescents have increased nutritional needs and are vulnerable due to poor eating pattern and bad lifestyle. They are also susceptible to environmental influences.Identifying and ensuring healthy eating habits during this phase of life therefore perform a basic role in their adequate growth and development and in their future health (Dulskiene *et al.,* 2014).

Developing dietary habit early in life have reduced risk in developing obesity and its associated diet related non-communicable diseases. Identifying the risk factors associated with poor nutritional habits,obesity as well as its associated chronic diseases that cannot be transmitted at adolescence is essential, so that every effort could be made to prevent and control these factors from adolescence (Dulskiene *et al., 2014*; Ogunkunle and Oludele, 2013).

In Nigeria, information collected on the prevalence of adolescent overweight and obesity are limited (Ojofietimi *et al.,* 2011). There is limited available data about malnutrition (stunting, underweight, overweight and obesity) among adolescents in the Nigeria Demographic Health Survey NDHS: 2003, 2008, and 2013). This study will contribute to the limited available data.

Schools are considered suitable places for the screening and promoting healthy lifestyle to prevent and control overweight/obesity and hypertension among children and adolescents (Nam, 2015). World Health Organization (WHO) has made recommendations of promoting health through schools, including providing education regarding critical health and lifestyle skills (Nam, 2015; WHO, 1998). This study will be conducted within the school environment of the adolescents.

Hypertension is one of the leading sources of NCDs such as heart disease, kidney end-stage disease, and stroke. There have been a few studies investigating the relationship between adolescent overweight, obesity, and prehypertension (Zhang *et al.,* 2012; Ejike *et al.,* 2010).The early detection of risk factors of hypertension in adolescents could be essential for the control of cardiovascular diseases in adulthood.

There is insufficient documentation on dietary pattern, nutritional status and blood pressure among adolescents in Nigeria's southern states.Comprehensive data regardingeating patterns and the nutritional status of adolescents in each state in Nigeria is needed to inform suitable intervention plan to avoid the future development of diet related chronic non-communicable disease such as hypertension. Information obtained from this study could help in developing policy for adolescent health in Nigeria and then give answers to this research study.

1.4 Research Questions

1. What is the dietary pattern of the respondents?
2. What is the dietary habit of the of the respondents?
3. What is the of the dietary diversity of the respondents?
4. What is the nutrient adequacy of the respondents?
5. What is the nutritional status of the respondents?
6. What is the blood pressure level of the respondents?
7. What is the body dissatisfaction of the respondents?
8. What is the level of nutrition knowledge of the respondents?

1.5 General Objective

This study was designed to investigate the dietary pattern, nutritional status and blood pressure of in-school adolescents in Edo State, Nigeria.

1.6.1 Specific Objectives:

The specific objectives of the study are to:

1. Determine the dietary pattern of the respondents
2. Assess the dietary habit of the of the respondents
3. Determine the of the dietary diversity of the respondents
4. Determine the nutrient adequacy of the respondents
5. Assess the nutritional status of the respondents
6. Assess the blood pressure level of the respondents
7. Determine the body dissatisfaction of the respondents
8. Assess the level of nutrition knowledge of the respondents

Hypotheses

1. There is no significant relationship between body composition and nutritional status (BMI/A) of the respondents.
2. There is no significant relationshipbetween body composition and blood pressure of the respondents.
3. There is no significant relationship between body dissatisfaction and dietary pattern of the respondents.
4. There is no significant relationship between body dissatisfaction and nutritional status (BMI/A) of the respondents.
5. There is no significant relationship between the level ofnutrition knowledge and dietary pattern of the respondents.
6. There is no significant relationship between the level of nutrition knowledge and nutritional status (BMI/A) of the respondents.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definitions

2.1.1 Dietary Pattern

Dietary Pattern is defined as the quantity, variety or combination of different foods and beverages in a diet and the frequency with which they are habitually consumed. It is the total usual intake of food combinations by individuals or groups. It may be assessed with validated food frequency questionnaire (FFQ) for the target population or with 24-hour recall (Tucker, 2010). Dietary pattern identified with factor analysis do not explain a large proportion of variability between individuals with respect to their diet, there still remain important dietary habits that account for the considerable proportion between individual variation (Michels and Schulze, 2005).

Dietary Habits are habitual decisions of individuals or group of people regarding what food they eat. Proper dietary choices require the consumption of vitamins, minerals, carbohydrates, proteins and fats. Dietary habits play a significant role in human health (Watson, 2010).

2.1.2 Dietary Diversity

Dietary Diversity is a qualitative measure of consumption that reflects household access to a variety of foods and it is also a proxy for nutrient adequacy of the diet of individuals (FAO, FHI 360, 2016). Individual dietary diversity score aims to reflect nutrient adequacy. Increase in individual dietary diversity score is related to increase in nutrient adequacy of the diet. Dietary diversity scores have been positively correlated with adequate micronutrient density of complementary food for infant and young child (FANTA, 2006), macronutrient and micronutrient adequacy of diet for adolescents (Mirmiran et al., 2004) and adult (Arimond, *et al.,* 2010).

2.1.3 Nutritional Adequacy

Nutritional adequacy is defined as the intake of nutrients at which health is optimal including the prevention of chronic diet related diseases (Castro-Quezada *et al.,* 2014; Matthys *et al.,* 2011). Assessing the quality of a diet is to establish the nutritional recommendations for individuals or populations as priority (Roman-Vinas *et al.,* 2009). Nutrient requirements are traditionally based on the minimum amount of nutrients needed by individuals to avoid deficiency and are defined by the physiological needs of the body (Matthys *et al.,* 2011). Nutritional adequacy can be estimated by the comparison between the nutrient requirements and certain individual's or population intake. This is because neither the real intake nor requirement of individual is known, the assessment can be calculated as the probability of adequacy (Castro-Quezada *et al.,* 2014; Roman-Vinas *et al.,* 2009). Nutritional adequacy can be used to determine the risk of deficiency of nutrients in terms of low intake or high intake e.g. the adverse intake of high level of sodium intake may be applicable to increasing the risk of certain chronic diseases or conditions such as hypertension (Meyers, Hellwig and Otten, 2006).

2.1.4 Nutritional Status

Nutritional Status is defined as the physiological state of an individual which results from the relationship between nutrient intake, requirements and body's ability to digest, absorb and utilize these nutrients. Malnutrition indicates a bad or abnormal nutritional status. It refers to all the deviations from adequate nutrition. Malnutrition refers to imbalance, deficiency or excesses of specific nutrients (e.g. iodine, iron, vitamin A, vitamin C) from undiversified diets (wrong kind or proportion of food) (FAO, 2007). Nutritional Status is expressed as Body Mass Index for Age (BMI/A).

2.1.5 Blood Pressure

The definition of hypertension in children and adolescents is based on the normative distribution of blood pressure in healthy children. Normal blood pressure is defined as the systolic blood pressure (SBP) and diastolic blood pressure (DBP) that is less than 90^{th} percentile (i.e. < 120/80 mmHg) for sex, age and height. Hypertension is defined

as the average SBP or DBP that is greater or equal to 95th percentile (> 120/80 mmHg) for sex, age and height based on at least three separate readings. Average SBP and DBP that is greater than 90th percentile but less than 95th percentile (> 120/80mmHg) is an indication of high risk of developing hypertension even in adulthood. It is also termed prehypertension (National High Blood Pressure Educative Programme, 2005).

2.1.6 Adolescents and Adolescence

Adolescent is described as an individual between 10 and 19 years (Black *et al.,* 2013). World Health Organization (WHO, 1995) reported that adolescence occurs between the ages of ten and nineteen, whereas the definition varies in other countries, for instance in India, as adolescences have been recorded to begin at age 12.Adolescence is a period of transition between childhood and adulthood. Adolescents are far from being a homogeneous group, in terms of development, maturity and lifestyle. They are known to be ambivalent in behaviour. For a given place and age, there is a great deal of diversity depending on personal and environmental factors (Christa *et al.,* 2014).Adolescence is a key period of significant differences characterized by physiological, physical, behavioural and social modifications (Christa *et al.,* 2014). Adolescence is a time of fast physiological, psychological, and social growth that influences nutrient requirements, and providing these nutritional needs is essential. Adolescence may be divided into three developmental stages based on physical, psychological and social changes (WHO, 2003).Adolescence has been reported as period of catch-up growth for all those who did not have the opportunity at the earlier age (Thurnham, 2013).

2.2 Focusing on Adolescents

Adolescence is a unique opportunity to break a range of vicious cycles of structural problems involving poverty, gender discrimination, violence, poor nutrition and health that could be passed from one generation to the next. Children and adolescents are the future generation of any nation.Adolescents make up about 20 percent of the world's population (Burt, 1996). In 2012, there were 1.2 billion adolescents in the world (Black *et al.,* 2013), In Nigeria, adolescent make up 21.5% of the population (NDHS, 2013). Getting ready for the demands of childbearing and breastfeeding and terminating premature pregnancy and its associated risk for both mother and child are timely in adolescent girls. Rapid intervention is particularly critical in adolescent girls

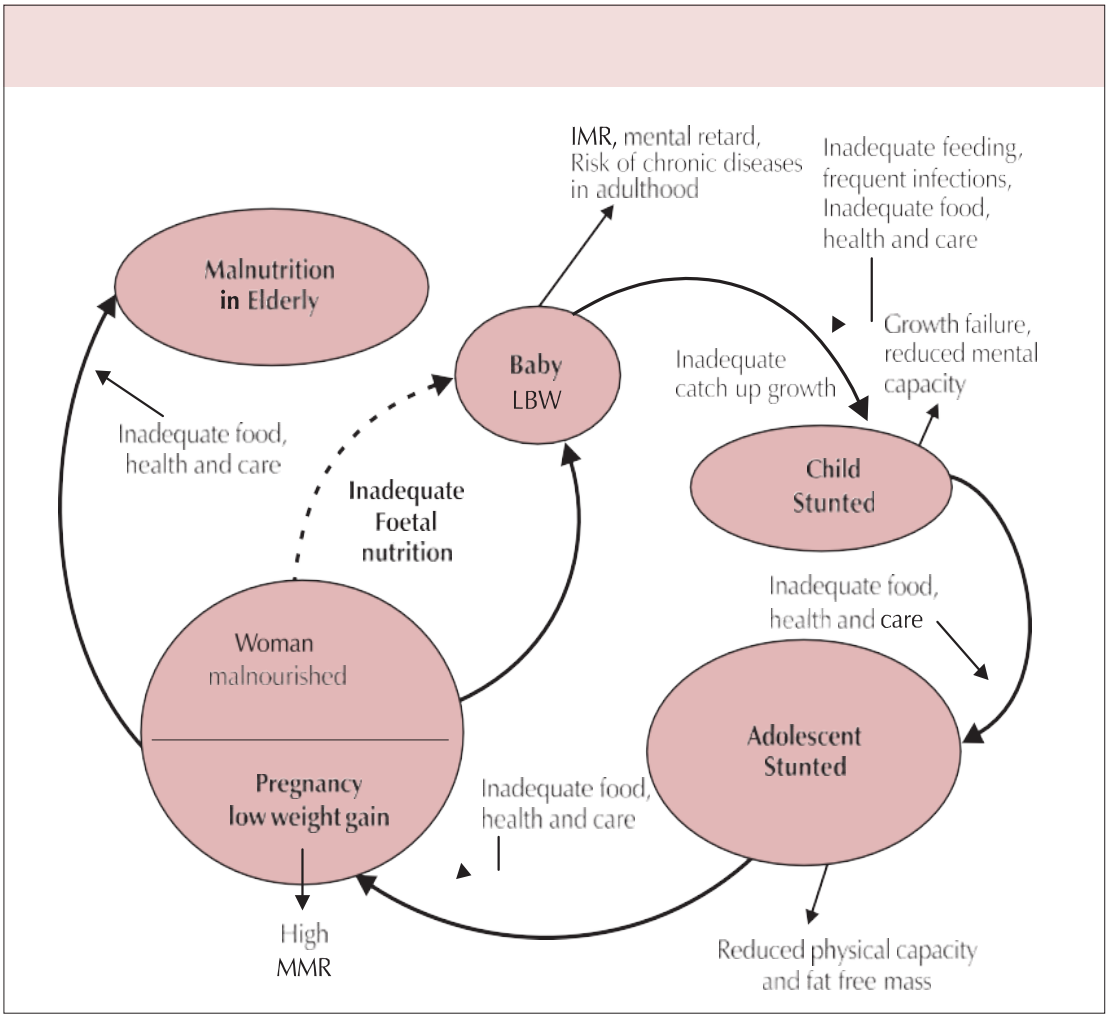
whose nutritional status is marginal to begin with, so that they enter their first pregnancy in a better nutritional state (WHO, 2005). Adolescent girls' concentration will also alter considerably, with the biggest rise occurring in sub-Saharan Africa, where teenage pregnancy is most prevalent, and the rate of contraceptive use is the lowest in the world (UNFPA, 2013a).

Improving adolescent girls' nutrition has the following reproduction-related benefits (WHO, 2005):

- Increased pre-pregnancy weight and body stores of nutrients, contributing to improved future pregnancy and lactation outcome.
- Helps in preserving mother's nutritional status and well-being.
- Improves iron and folate status with reduced risk of anaemia in pregnancy.
- Reduces danger of neural tube defects in the new born and megaloblastic anaemia in pregnancy.
- Prevents low birth weight and maternal morbidity and mortality.
- Enhances work productivity and perhaps linear growth
- Small stature young females are likely to become small women who are more likely to have small babies, particularly if at a young age. Improving adolescent girls' nutrition and delaying their first pregnancy may be a promising intervention point to break this intergenerational cycle of malnutrition (ACC/SCN, 2000; ACC/SCN 1997).

Similarly,intervention has the following advantages for enhancing the nutrition of adolescent boys:

- Proper nutrition encourages the optimum growth and development of adolescent children.
- Appropriate nutrition helps them to develop good bones and muscles, dietary habits and healthy eating.
- Healthy eating helps avoid high cholesterol, high blood pressure and reduces the risk of developing chronic diseases such as cardiovascular disease, cancer, and diabetes.
- Healthy eating helps decrease the likelihood of adolescents developing obesity, osteoporosis, iron deficiency, and dental caries (cavities) (United State Dietary Guidelines Advisory Committee, 2010).



Source: ACC/SCN, 2000.

Figure 2.1: Nutrition intervention in adolescent girls may contribute to breaking the vicious cycle of intergenerational malnutrition, poverty and chronic disease

Table 2.1: Adolescent Stages of Development

Stages of Adolescence	Physical Development	Cognitive Development	Social-Emotional Development	Vitamin Requirement	Mineral Requirement
Early Adolescence **Approximately 10 – 13 years**	• Puberty: grow body hair, increase sweat and oil production in hair and skin, Girls – development of organs containing mammary glands and hip, onset of menstruation, Boys – growth of testicles and penis, wet dreams, deepening of voice	• Growing capacity for abstract thought	• Combat with sense of identity	Vitamin A Thiamin Riboflavin Niacin Vitamin B6 Folate Biotin Choline Vitamin C Vitamin E	Potassium Sodium Chromium Copper Molybdenum Selenium
	• Great physical growth, height and weight gain	• Mostly interested in present with limited thought to the future	•Feel awkward about one's self and body; worry about being natural		
	• Higher sexual interest	• Intellectual interests expand and become more important	• Realize that parents are not ideal; increase conflict with parents		
		• Deeper moral thinking	• Increased peer group influence • Wish for autonomy		

Table 2.1: Adolescent Stages of Development (Continued)

Stages of Adolescence	Physical Development	Cognitive Development	Social-Emotional Development	Vitamin Requirement	Mineral Requirement
			• Likelihood to return to "childish" behaviour, especially when stressed • Moodiness • Testing rules and limitations • Greater interest in privacy protection		
Middle Adolescence **Approximately 14 – 16 years**	• Puberty is finished	• Continued growth of capacity for abstract thought	• Intense self-implication, shifting between elevated expectations and bad self-conception	Vitamin A Thiamin Riboflavin Niacin Vitamin B6 Folate Biotin Choline Vitamin C Vitamin E	Potassium Sodium Chromium Copper Molybdenum Selenium
	• Physical development slows for girls and continues for boys	• Greater capacity for setting goals	• Continued adjustment to change the body, worries about being normal		

Table 2.1: Adolescent Stages of Development (Continued)

Stages of Adolescence	Physical Development	Cognitive Development	Social-Emotional Development	Vitamin Requirement	Mineral Requirement
		• Interest in morality • Think about the significance of life	• Tendency to distance oneself from parents, ongoing motivation for independence • Driven to create friends and rely more on them, popularity can be a significant problem. •Sensations of affection and passion		
Late Adolescence **Approximately 17 – 19 years**	• Young females are typically completely developed	• Ability to think through ideas	• Strong sense of identity	Vitamin A Thiamin Riboflavin Niacin Vitamin B6 Folate Biotin Choline Vitamin C Vitamin E	Potassium Sodium Chromium Copper Iodine Molybdenum Selenium

Table 2.1: Adolescent Stages of Development (Continued)

Stages of Adolescence	Physical Development	Cognitive Development	Social-Emotional Development	Vitamin Requirement	Mineral Requirement
	• Young men continue to increase in height, weight, muscle mass and body hair	• Capacity towards delay gratification	• High emotional stability		
		• Examination of internal experiences • Increased concern about the future	• Increased concern for others • Increased independence and self-reliance • Development of more serious relationships • Social and cultural traditions regain some of their importance		

Source: Sprano, 2004, Atkinson and Koletzko 2007.

Table 2.2: Classification of Dietary Diversity Score in groups

Low dietarydiversity	Mediumdietarydiversity	Highdietarydiversity
(≤3foodgroups)	(>3- < 6foodgroups)	(≥6.0 food groups)

Adapted

Source: Kennedy, Ballard and Dop, 2011. Guideline for measuring Household and Individual Dietary Diversity. (C) FAO.

Table 2.3: Dietary Recommended intake of Adolescents

DRIs and AIs: Recommended intakes for Adolescents; Vitamins and Minerals						
	Female (Years)			Male (Years)		
	9-13	14-18	19-30	9-13	14-18	19-30
Energy (kcals/day)	2,071	2,368	2,403[a]	2,279	3,152	3,067
Carbohydrate (g/day)	130	130	130	130	130	130
Total Fiber (g/day)	26	28	25	31	38	38
n-6 Polyunsaturated Fat (g/day)	10	11	12	12	16	17
n-3 Polyunsaturated Fat (g/day)	1.0	1.1	1.1	1.2	1.6	1.6
Protein (g/day)	34	46	46	34	52	56
Vitamins						
Vitamin A (µg/d)	600	700	700	600	900	900
Vitamin C (mg/d)	45	65	75	45	75	90
Vitamin D (µg/d)	5	5	5	5	5	5
Vitamin E (mg/d)	11	15	15	11	15	15
Vitamin K (µg/d)	60	75	90	60	75	120
Thiamin (mg/d)	0.9	1.0	1.1	0.9	1.2	1.2
Riboflavin (mg/d)	0.9	1.0	1.1	0.9	1.3	1.3
Niacin (mg/d)[f]	12	14	14	12	16	16
Vitamin B_6 (mg/d)	1.0	1.2	1.3	1.0	1.3	1.3
Folate (µg/d)[g]	300	400	400	300	400	400
Vitamin B_{12} (µg/d)	1.8	2.4	2.4	1.8	2.4	2.4
Elements						
Calcium (mg/d)	1,300	1,300	1,000	1,300	1,300	1,000
Iodine (µg/d)	120	150	150	120	150	150
Iron (mg/d)	8	15	18	8	11	8
Phosphorus (mg/d)	1,250	1,250	700	1,250	1,250	700
Zinc (mg/d)	8	9	8	8	11	11

Note: This table presents RDAs in bold type and AIs in ordinary type. RDAs and AIs may both be used as goals for individual intake. RDAs are set to meet the needs of almost all (97-98%) individuals in a group.

Source: Data from reports from the Institute of Medicine, Food and Nutrition Board, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes,3-7 © by the National Academy of Sciences, courtesy of the National Academies Press, Washington DC. (http://www.nap.edu/)

Table 2.4: Nutritional Assessment Methods

Variables	Uses	Advantages	Disadvantages
Anthropometric Measurements	It is used to measure both undernutrition and overnutrition.	Objective with high specificity.	Inter-observer measurement error.
	The measured value reflects the current nutritional status and does not distinguish between acute and chronic and chronic changes.	Measure many variables involving height, weight, Body Mass Index for age (BMI-for-age), Mid Upper Arm Circumference, Skin Fold Thickness, Waist Circumference, Hip Circumference, Waist-Hip-Ratio.	Limited diagnosis of nutritional status
	Nutritional indices include: height, weight, Body Mass Index (BMI-for-age).	Readings on growth chats are numerical and gradable	Problems with standards of reference (local and global standards)
	Others anthropometric measurements includes: Mid Upper Arm Circumference, Skin Fold Thickness, Waist Circumference, Hip Circumference, Waist-Hip-Ratio.	Readings can be reproduced. Not expensive and require minimal training.	Arbitrary statistical cut-off levels for what is termed abnormal
Biochemical (Laboratory) Method	Estimation of haemoglobin is the most significant test and helpful index of the overall nutritional status.	Useful in detecting early changes in metabolism and nutrition before appearance of clinical signs	Time consuming
	Besides anaemia, it tells the nutrition of proteins and trace elements.	It is accurate and reproducible.	Expensive
	Stool examination for ovarian and/or intestinal parasites.	Useful for validating data obtained from the dietary method.	Cannot be used on a big scale
	Microscope albumin, blood sugar and urine dipstick.		Needs qualified staff and equipment.

Source: Gibson, 2005.

Table 2.4:Clinical Features of Undernutrition and Micronutrient Deficiency.

Parameters	Clinical features
Skin	• Pallor especially palms (anaemia from iron or folate deficiency) • Ecchymoses (vitamin K deficiency) • Hypo or hyperpigmentation, desquamation, ulceration (zinc or protein deficiency) • Hyperpigmentation exposed areas (niacin deficiency) • Perifollicular hyperkeratosis (vitamin A deficiency)
Eye	• Night blindness, xerotic conjunctivae, xerotic cornea, Bitot's spots, keratomalacia, corneal scars (vitamin A deficiency)
Hair	• Conjunctival pallor (anaemia from iron or folate deficiency) • Depigmentation, easy pluck-ability, sparsity (kwashiorkor)
Nails	• Koilonychia (iron deficiency)
Mouth	• Cheilosis, glossitis, loss of papillae, magenta tongue (riboflavin deficiency)
Subcutaneous tissue	• Glossitis, scarlet tongue (niacin deficiency) • Bleeding gums (vitamin C deficiency) • Reduced subcutaneous tissue and fat (energy • deficiency) • Oedema (sodium and potassium disturbances, hypoal-buminemia)
Muscle bulk	• Muscle wasting, weakness (undernutrition)
Bones	• Craniotabes, prominent costochondral junctions, widening of metaphyses (wrists and ankle), frontal bossing, wide anterior fontanelle, rickety rosary, delayed dentition, bow legs (vitamin D deficiency) • Bony tenderness, pseudoparalysis (vitamin C deficiency) • Inadequate bone mass or osteoperosis (calcium)
Abdomen	• Hepatomegaly (kwashiorkor)
Central nervous	• Apathy (kwashiorkor, iron deficiency) system • Peripheral neuropathy (thiamin or pyridoxine deficiency)
Cardaic	• Cardiac failure or enlargement (thiamin deficiency)
Thyroid	• Goiter (iodine deficiency)

Source: Khoshoo,1997; Wittenberg and Hansen, 1998.

Table 2.4: Dietary Assessment Method

Instrument	Advantages	Disadvantages

Estimates	-Intake quantified.	-High investigator cost.
Food record		
	-Can enhance self-monitoring for weight control or other behaviour change.	-High respondent burden.
	-Does not require recall of foods eaten.	-Extensive training and motivation of the respondent needed.
	-Useful for quantifying food intake in institutions.	-A lot of days are needed to capture individual's usual intake.
		-Affects eating behaviour.
		-Intake often underreported.
		-Informationregarding intake decrease with time.
		-Natural wastage increases with number of daily -records requested.
		-May lead to non-representative sample and subsequent nonresponse bias.
24-hour dietary recall	-Intake quantified.	-High investigator cost.
	-Appropriate for most populations, thus less potential for nonresponse bias.	-Many days needed to capture individual's usual intake.
	-Burden on the respondent is reduced.	-Intake often underreported.
		-Does not affect eating behaviour.
Food frequency questionnaire	-Usual individual consumption requested	-Not quantifiably precise.
	-Total diet information acquired	-Hard cognitive task for respondent.
	-Low cost to the researcher.	-Intake often misreported.
	-Does not influence eating behavior	
Diet history	-Typical individual intake requested.	-Not quantifiably precise.
	-Information on total diet obtained.	-Difficult cognitive task for respondent.
	-Information often available on foods consumed by meal.	-Assessment limited to small number of nutrients/ foods.
	-Reduced cost to the researcher.	-Intake often misreported.
	-Does not affect eating behaviour.	Can have high investigator burden.

Source: Thompson and Subar, 2001.

Table 2.5: Reference for growth of the WHO: use of percentiles and Z-scores for Children and Adolescents

Outcomes	Anthropometric measures and cut points	Indication of growth /nutrition problems
Adolescents (> 10years)		
Stunting	HAZ <-2Zscore	Chronic Malnutrition
Thinness	BMI-for-age < 5^{th} percentile	Underweight
Overweight	BMI-for-age≥85^{th} percentile	Overweight
Obese	BMI-for-age ≥85^{th} percentile and triceps and scapular skinfold thickness-for-age≥90^{th} percentiles	Obesity

Source: WHO, 1995; Cole *et al.,* 2007.

This table summarizes the cut-points of percentiles and Z-scores to define problematic growth status in children and adolescents when using anthropometric measures. These cut-points based on statistical distribution are often adopted by other growth references/standards including the recent new WHO growth standards and references HAZ: Height- or length-for-age Z-score; WHZ: Weight-for-age Z-score; BMI: Body mass index (WHO, 1995; Cole *et al.,* 2007).

Table 2.6: National High Blood Pressure Education Programme(NHBPEP) Classification of Prehypertension and hypertension in Children and Adolescents

Classification	Systolic or Diastolic Blood Pressure*
Normal	< 90th percentile
Prehypertension	90th to < 95th percentile or 120/80 mmHg +
Stage 1 hypertension	95th percentile to < 99th percentile plus 5mmHg
Stage 2 hypertension	>99th percentile plus 5mmHg

NHPEP= National High Blood Pressure Education Programme, 2005.

*- Based on sex, age, height measured on at least 3 separate readings

+- Blood pressure of 120/80 mmHg or greater is prehypertension regardless of whether it is less than the 90th percentile. If 120/80 mmHg is in the 95th percentile or greater, then the patient has hypertension (NHPEP, 2005; Riley & Bluhm, 2012).

Table 2.7: Recommended Blood Pressure Cuff Bladders Dimensions

Age Range	Width (cm)	Length (cm)	Maximum Arm Circumference (cm)*
Small adult (Adolescents)	10	24	26

Source: NHPEP= National High Blood Pressure Education Programme, 2005.

*The recommended dimension of blood pressure curve bladder is calculated so that the largest arm would allow the bladder to encircle the arm by at least 80%. The correct measurement for blood pressure required a cuff that is appropriate to the size of the adolescents' arm. An appropriate cuff size is a cuff with an inflatable bladder width that is at least 40% of the arm circumference. An optimal cuff bladder length should cover 80%-100% of the circumference of the arm. Such requirement demands that the bladder width to length ratio be at least 1:2 (Gomez-Marin, Prineas and Rastam, 1992).

2.3 Dietary Pattern and Sociodemographic Characteristics of Adolescents

Jones *et al.,* 2019 conducted a longitudinal study on adolescent health, nutrition and sexual reproductive health in Ethiopia. The average adolescent lived in moderately food insecure household. Rural adolescents are at greater risk of poor nutrition than urban adolescents while adolescents living in rural areas have limited access to timely information about their reproductive health.

Iheanacho, Onyeke and Ede, 2019 investigated the Dietary pattern and prevalence of overweight and obesity among 656 female undergraduate students 16-29 years of university of Nigeria, Nsukka. The respondents had low intake of fruits and vegetables, legumes, meat and fish but high consumption of high calorie dense foods. Majority (75%) skip meal mostly due to time constraint, 51.4% due to lack of food while 20.7% was due to inadequate fund. About a quarter (25%) were overweight while 10.1% were obese. The prevalence of overweight and obesity was high in 40.4% among 16-19 years than 33.4% in 20-29 years old students.

Chandrashekarappa, Ramakrishnaiah and Manjunath, 2018 investigated the nutritional status in 700 adolescent girls to determine the prevalence of malnutrition andits association with socio-demographic variables. It was reported that about 36.2% of adolescent girls were malnourished, among whom 33.7% wereobese and 66.3% were undernourished.

In a cross-sectional study, Duru*et al.,* 2016 investigated the prevalence and determinants of adolescent malnutrition in Owerri, Imo State, Nigeria. The results revealed that 18.6% and 11.6% of adolescents were underweight and overweight/obese respectively. Most of the respondents (89.6%) had a poor to fair level of knowledge about overweight and obesity.It was further revealed that adolescents aged 14-16 and 17-19 years old, who were first born, female, with orthodox religious background and are senior students in school were significantly more likely to be overweight/obese than underweight. ($p<0.05$).

Pell*et al.,* 2016 conducted a cross sectional study on obesity among adolescents and young adults in Malaysia. The prevalence of overweight was 12.8 % at ages 16–20 and 28.4 % at ages 31–35. Obesity was 7.9 % and 20.9 % atthe same age groups. The main ethnic groups also showed varied patterns of obesity and overweight at thedifferent age groups with Chinese at lowest and Orang Asli at highest risk. Level of education,

employment status,physical activity and frequency of eating out were poor predictors of overweight and obesity.

Rode, 2015 investigated the prevalence of malnutrition among adolescent with respect to the socio-economicissues and challenges in Mumbai metropolitan region in India. It was reported that the incidence of severe malnutrition is higher in male as compare to female. The physical and electronicasset holding is more among adolescent. Pulses, vegetables, fruits eaten is more among the adolescent.The incidence ofmalnutrition is higher among adolescent having parentswith lower educational level.

Uddin, Nag and Sil, (2015) carried out a cross-sectional study on Anthropometric Assessment of Nutritional Status of Adolescents [300 boys and girls (1:1)] of 10-15 years old in Rural School of Unokoti District of Tripura, North-East India. Weight, height, head circumference (HC), mid upper-arm circumference (MUAC),chest circumference (CC) and BMI were assessed.The percentage of malnourished children was discovered to vary from 53 percent to 76 percent based on distinct indicators of nutritional status, socio-economic status, and sex.There is a downward trend in the proportion of undernourished children with growing socio-economic status (SES).

Mbagwu *et al.,*(2015) conducted a cross-sectional study on Anthropometric evaluation of growth variation in urban dwelling 320 apparently healthy adolescent school girls, aged 10-17 years in Nigeria. Body mass, stature, sitting height biacromial breadth (bab), waist circumference, and biceps skin fold. Private school girls had consistently higher values in body mass, stature, sitting height than the public-school girls. Consistent variation pattern in growth exists among the girls indicating the need for adequate health monitoring during adolescence.

In a cross-sectional study conducted by Guedes, Neto and Silva (2014) on anthropometric nutritional in 1,538 adolescents aged 15-18, including 1,036 girls and 502 boys from a region of low economic development in Brazil. Height, Weight, BMI were assessed. High proportion of adolescents had short height (<10th percentile) as well as increasedproportion of overweight/obesity (>90th percentile).

Odaman and Odaman, (2013) conducted a cross-sectional study on Mothers' Socio-economic Background and Feeding Practices of(589) adolescent in Edo Central, Nigeria. Questionnaire was used to collect information.Most of the high school pupils showed risk of poor dietary habit because most of the students did not take the

adequate/balanced diet.Appropriate feeding practices for secondary school students were more common with older parents than their younger counterparts.Food varieties were associated with mothers ' religious denominations and education while earnings status of mothers had a beneficial impact on children's feeding practices.

Guo *et al.,* 2012 conducted a cross-sectional study on the differences in lifestyle behaviours, dietary habits,and familial factors among normal-weight,overweight, and obese Chinese children andadolescents. The prevalence rates of overweight and obesity were 15.3 and 6.4%, respectively. Compared to girls, boys were more overweight (17.5% vs. 12.9%) and obese (9.5% vs. 3.1%). Obese children and adolescents were more likely to be non-snackers [odds ratio (OR): 1.348; 95% confidence interval (CI): 1.039–1.748] and to have a family income of 2000 CNY or more per month (OR: 1.442; 95% CI: 1.045–1.99)and less likely to sleep longer (≥7.5 h) (OR: 0.475; 95% CI: 0.31–0.728) than the normal-weight participants.

Fokeena and Jeewon, 2011 conducted a cross-sectional study on the association between socioeconomic status andbody mass index among 200 adolescents in Mauritius. A negative association was found between socio-economic status and body mass index ($\chi 2 = 8.15\%$, $P < 0.05$). Diet quality, time spent in physical activities at school ($P = 0.000$) were significantly associated with high socio-economic status.Poor diet quality and less time spent in physical activities at school could explain body mass index discrepancies between socio-economic status groups.

In Spain, Bibiloni*et al.,* 2011 conducted a cross-sectional study on Western and Mediterranean dietary patterns among Balearic Islands' adolescents with respect to the socio-economic and lifestyle determinants. The 'Western' dietary pattern was higher among boys than girls and is associated with spending 4hour/day on media screen time, but less prevalent amongthose adolescents who desired a thinner body and those girls who desired toremain the same weight. The 'Mediterranean' dietary pattern was mainly followed by girls, and boys who spent,2 hours/day on media screen time and girls withhigh parental socio-economic status.

2.4 Dietary Pattern Medical History and Lifestyle of Adolescents

Bolajoko, Adesanwo and Akinhanmi, 2019 conducted a cross-sectional study on the contribution of dietary pattern and family history to hypertension among 300 young adults in Abeokuta Local Government Area, Ogun State, Nigeria. Only a few (6.7%) of the respondents consumed fruits daily while 80.7% ate less than 4 servings of fruits and vegetables per week. The family history of hypertension was reported in 17.3% of the respondents while 28.9% were hypertensive. Family history of hypertension and diabetes significantly contributed to the observed 19.4% and 8.9% of hypertension and diabetes in this study.

In a cross-sectional study, Rodrigues*et al.,* 2012 investigated the factors associated with dietary patterns in 1,139 adolescents in Cuiabá,Mato Grosso. “Western”, “traditional” and “mixed” dietarypatterns were identified. Studying in themorning hours and reporting the intake ofalcoholic beverages were associated withgreater adherence to the “Western” pattern.Male low-income students from public schools who had normalbody mass index preferred the “traditional” pattern. The“mixed” pattern was adopted by boys frompublic schools reporting physical activity.

2.5 Dietary Pattern and Diversity of Adolescents

In China, Jiang*et al.,* 2018 conducted a cross-sectional study to investigate if children eat a sufficientlydiverse diet. Positive predictors ofdietary diversity included residing in an urban environment, a higher household expenditure onchildren’s food, and a higher frequency of eating outside. Food-intake differences existed amongthe predictors.

In China, Zhao*et al.,* 2017 conducted a study on dietary diversity scores: an indicator ofmicronutrient inadequacy instead ofobesity for 1,694 Chinese children. The dietary diversity varied with age and place of residence; children livingin rural areas tend to have poorer dietary diversity. The DDS positively correlated withindicators of micronutrient adequacy indicating the lowest risk of micronutrient inadequacy indifferent groups of children. The dietary diversity was not related with obesity.

In Brazil, Cunha *et al.,* 2017 investigated at-home and away-from-home dietary patterns and BMI z-scores in 5,266 Brazilianadolescents. Data from Brazilian National

Demographic Survey 2008-2009 were analysed. In general, mean at-home food intake was greater than away-from-home food intake. Theratios of away-from-home/at-home was greater than 30% for baked and deep-fried snacks, soft drinks, sandwiches, pizza, and desserts, and was lower than 10% for rice and beans. Three main similar dietary patterns were identified both at-home and away-from-home. The "Traditional pattern", "Bread and Butter pattern" and the "Western pattern". Only the "Western pattern" was positively associated with BMI z-scores ($\beta = 0.0006$; $p < 0.001$).

Abiola, 2017 conducted a cross-sectional study on evaluating patterns of snacks consumption, energy nutrientintakes among 78 in-school adolescent students in Ibadan, Nigeria. About (43.8%) of adolescents consumed snacks oncedaily. Most (91%) adolescents reported having snacks during lunch. The snacks commonlyconsumed include fresh fruits, doughnuts, egg rolls, plantain chips, buns, sausage rolls, soft drinks andyoghurts. The most common meal and snack patterns in most of the students composed ofthree main meals plus three snacks daily.

Appannah *et al.,* (2015) performed a cohort study among (1,611 and 1,009) 14-yearand17-year participants, respectively using semi-quantitative FFQ linked to the past 12 months. Height, weight, BMI, WC; insulin, glucose, TG, HDL-c, LDL-c were evaluated. Energetically dense, high in fat, and poor in dietary fibre patterns were observed, respectively.

Karatzi *et al.* (2014) conducted a cross-sectional survey in Greece among (1,912) respondents within the ages of 9-13. Twenty four-hour food record (two days a week and one weekend) was used to obtain food intake. Weight, height, waist circumference, insulin, and glucose were assessed. Fried potatoes, red meat and sweetened beverages; processed meat and cheese; margarine, sweets and savory meals; vegetables and fruits; increased egg consumption and reduced fish consumption pattern were observed, respectively.

Elnein, 2013 conducted a cross-sectional study on the dietary patterns of 300 students of Sennar, Saudi Arabia. Less than half (40%) of students were in critical growth stage, their food was poor in content of nutrients and they showed signs poor nutrition.

In Spain, Biblioni *et al.,* (2013) conducted a cross-sectional study among 219, 12-17 years' respondents using validated semi-quantitative FFQ related to previous 12 months. Weight, height, WC, WtHR, Adiponectin, leptin was tested for and

Mediterranean diet and Western dietary pattern were observed. Western diet score was inversely related to plasma concentrations of adiponectin and IL-6.

Shang *et al.,* (2012) conducted a cross sectional study on eating Pattern and its Association with the Prevalence of Obesity and Related Cardiometabolic Risk Factors among (5,267) Chinese Childrenaged 6–13 years.Dietary intake was assessed with multiple 24-hour dietary recall for three consecutive days.Anthropometric measurements, blood glucose and lipid profiles were obtained.Three mutually exclusive nutritional patterns have been recognized: healthy dietary pattern, transitive dietary pattern, and Western dietary pattern.Obesity was most prevalent among children with the Western dietary pattern (17.1%), followed by the transitive dietary pattern (10.9%) and the healthy dietary pattern (9.2%).Children with the Western dietary pattern had a significantly higher odds of obesity compared with children who followed thehealthy dietary pattern.

In Mexico, Romero-Polvo *et al.,* (2012) conducted a cross-sectional study between (916) 7-18 years using semi-quantitative FFQ related to previous 12 months. Weight, height, BMI, WC, percentage of body fat; glucose, insulin was assessed. Western, Prudent, and High protein/fat consumption pattern respectively were observed.Insulin resistance was associated with the highest consumption quintiles of the Western dietary pattern.

Cheng, Lin and Wong, 2011 conducted a survey on eating disorder–related thoughts, behaviours,and their relationship with food intake and nutritionalstatus in 1605 female high school students in Taiwan. Disturbed eating attitudes and behaviours were found in 17.11% of participants (measured by anEAT-26 score ≥ 20).Disturbed eating attitudes/behaviours weresignificantly associated with overestimation of body weight, unrealistic body weight goal, dissatisfaction withbody weight, and weight loss experiences. The reported intakes of energy, protein, carbohydrate, zinc, andvitamins B6 and B12 were significantly lower in participants with disturbed eating patterns than in participantswithout disturbance issues.Participants with disturbed eating patterns had higher dietary and crudefibre intake than participants without disturbed eating issues.

In Iran, Abedi*et al.,* 2011 investigated the consumption pattern of food and obesity of 116 femalestudents of Mazandaran. Based on body mass index (BMI), 21.1% of the

subjects were underweight, 51.7% normal while 29.3% and 6.9% were overweight obeserespectively. The ratio of waist- to- hip circumferencedemonstrated that 49.1% of students were suffering from abdominal obesity (WHR>0.8).

Dishchekenian *et al.,* (2011) conducted a cross-sectional study in Brazil among (76)14-19-year-old respondents using Four-day food records (three days a week and one weekend). Weight, height, blood pressure, TC, LDL-c, HDL-c, TG, glycemia, insulin was evaluated respectively. Traditional pattern, Transition pattern and Fast food pattern were observed. In Australia, Ambrosini *et al.,* (2010) conducted a cohort cross-sectional study among (1,139) 14 years' respondents using Semi-quantitative FFQ related to previous 12 months. Weight, height, WC, blood pressure, TC, LDL-c, HDL-c, TG, glycemia and insulin were assessed. Western pattern and Healthy pattern were observed respectively.

2.6 Dietary Habit of Adolescents

Ghosh, 2019 conducted a cross-sectional study explaining overweight and obesity in 1,061children and adolescentsof Asian Indian origin with respect to the Calcutta childhood obesity study. About 18% ($R^2 = 0.185$) of total variance of body mass index could be explained by monthly family income,participants think obese, consumption of too much junk foodstuffs, breakfast skip, extra consumption of salt, and computer hours.Sedentary lifestyles, including increasing fast food preferences may be responsible for increasingoccurrence of paediatric and adolescent obesity in this population.

Iyalomhe *et al.,* 2018 conducted a cross-sectional study on the assessment of dietary habits and nutritional status of 400 adolescents in a resource–poor environment in Ekpoma, Edo State Nigeria. Important factors affecting dietaryhabits include parental influence (87%), taste of food (71%), mass media reports (61%) and culture (55%). Prevalence ofunderweight, normal weight, overweight, and obese adolescents were 24%, 72%, 3% and 1%, respectively. Significant association was observed between BMI and monthly household income, $p<0.002$.

In Italy, De Cosmi, Scaglioni and Agostoni, 2017 conducted a review on early taste experiences and later food choices. The role of breastfeeding, of

complementaryfeeding, and the parental and sociocultural factors which contribute to set food preferences early inlife was investigated. Children are predisposed to prefer high-energy, sugar/salt foods and in pre-school age to reject new foods (food-neophobia). While genetically determined individual differences exist,repeated offering of foods can modify innate preferences.

Lateef*et al.,* 2016 conducted a cross-sectional study on breakfast, food consumption pattern and nutritional status of 515 students inpublic secondary schools in Kwara State, Nigeria. Majority (77%) consumed breakfast daily while 52% added (1-2) teaspoonsof sugar daily to beverages. Prevalence of underweight was 29.1%, while (4.7% and 0.2) were overweight and obese. Nutritional status for both boys and girls indicated that underweight was (47.7 and 19.8%), overweight was (0.6 and 6.7%) and obese was (0 and 0.3%) respectively.Relationship between food consumption and nutritional status of participants was positive butnot significant.

In a cross-sectional study, Abdull Hakim, Muniandy and Danish, 2012 investigated the knowledge and practices on food safety among 200 secondary school students in Johor Bahru, Johor, Malaysia. More than half did not meet their RNI for energy, protein, calcium and iron. Male (65.6%) students tend to skip breakfast when compared to female (52.8%) students. Most students consume fruits (male: 65.6%, female 58.3%) and vegetables (male: 45.6%, female 44.5%) in 1-4 times/week. About 33.3% of male and 29.1% female consume fast food several times a week.

In a cross-sectional study based on 4,984 four-year-olds children population-based cohort in the Netherlands; Jansen*et al.,* 2012 investigated the Children's eating behaviour, feeding practices ofparents and weight problems in early childhood: with respect to the data from the population-based Generation RStudy. Thirteen percent of the childrenwere underweight while 8% and 2% were overweight and obese respectively. Higher levels ofchildren’s food responsiveness, enjoyment of food and parental restriction were associated with a higher mean body mass index independent of measured confounders.Emotional under-eating, satiety responsiveness and fussiness ofchildren as well as parents’ pressure to eat were negatively related with children’s body mass index.

2.7 Nutrient intake and adequacy of Adolescents

In Dhaka, Bangladesh, Alam *et al*, 2019 conducted a study on adolescent health, nutrition and sexual and reproductive health among seven hundred and eighty adolescent girls and boy from different households in two slum areas and one low income settlements.Mean intake of protein, iron, vitamin A, thiamine, riboflavin, niacin and vitamin C are below recommended daily allowance. The adolescents' access to sexual and reproductive health services were limited.

Meng*et al.,* 2018 conducted a cross-sectional study to investigate the dietary diversity and food variety in Chinesechildren aged 3–17 years to determine if they are negativelyassociated with dietary micronutrient inadequacy. The dietary diversity score (DDS) and food variety scores (FVS) were positively associated with micronutrient adequacy ratio (MAR) and nutrient adequacy ratio (NAR) ofmost nutrients except sodium ($p < 0.05$).A higher DDS was negatively associated with the prevalenceof inadequate intake of vitamin A, riboflavin, vitamin C, iron, zinc, selenium, niacin, phosphorus,magnesium and OMI. Similar results were found for FVS. Poor dietary diversity and food variety in Chinese children are directly associated with inadequatemicronutrient intake.

In China, Wang *et al.,* 2017 conducted a study to investigate if Chinese children and adolescents 4-17 years get enough micronutrients. Data from China Health and Nutrition Survey was analysed. The average usual daily intakes of all micronutrients increase with age and the intakes of boys were found to be higher than girls in the same age group. The averagecalcium intake increased from 272 mg/day in 4–6 years to 391 mg/day in 14–17 years, but thepercentage of inadequate calcium intake remained very high (>96%). As the requirements ofmicronutrients increased with age, the percentage of children and adolescents with inadequate intake increased in the11–17 years' age groups.

Harika*et al.,* 2017 carried out a systematic review of data from 2005 to 2015 to investigate the micronutrient status and dietary intake of iron,vitamin a, iodine, folate and zinc in women ofreproductive age and pregnant women in Ethiopia,Kenya, Nigeria and South Africa. In pregnant women (PW), the prevalence was higher, and ranged from 32–62%, 19–61%,and 9–47%, respectively. In women of reproductive

age (WRA), prevalence of vitamin A, iodine, zinc and folate deficiencies rangedfrom 4–22%, 22–55%, 34% and 46%, while in PW these ranged from 21–48%, 87%, 46–76% and3–12% respectively. Inadequate intakes of these micronutrients are high and corresponded with theprevalence figures.

In a cross-sectionalstudy by Lateef *et al.,*(2016) on Breakfast, Food Consumption Pattern and Nutritional Status of 515(343 girls and 172 boys) respondents in Public Secondary Schools in Kwara State, Nigeria.Weight and height were assessed. Dietary intake and patterns were assessed with 24-hour recall and Food Frequency Questionnaire (FFQ).Majority (77%) consumed breakfast daily. Few (29.1%, 4.7% and 0.2%) were underweight, overweight and obese, respectively while Many (66.0%) had normal weight.Positive significant relationship was observed between food consumption and nutritional status.However, children's weak remembrance about foods' portion size underestimated their dietary intake.

Sanusi, Yusuf and Ejoh, (2016) performed a cross-sectionalsurvey on Assessment of Dietary Diversity of393 In-School Adolescents aged 10 -19years old in Ibadan, Oyo State, Nigeria.Height, Weight and BMI for age were assessed. Twenty-four-hour dietary recall was used to obtain information on dietary intake and diversity. Most (82.68%) of the participants were normal while(9.82%, 4.9% and 3.1%) overweight, underweight and obese, respectively. Majority (62.85%) had medium dietary diversity but only a few (36.64% and 0.51%) had low and high dietary diversity, respectively. Low dietary diversity was a result of poor consumption of micronutrient rich foods like fruits and milk products.

Ruopeng, (2015), performed a cross-sectional survey on diet quality and physical activity related to childhood obesity in 2818 kids aged 6–17 in the USA. Assessment of dietary intake was with multiple 24-hour dietary recall (weekday and weekend). Weight, height, BMI were evaluated.Physical activities were also assessed.The reported probabilities of overweight and obesity were 19.03 (95 percent confidence interval: 11.31, 26.74) and 15.84 (10.48, 21.21) percentage points greater among children on an unhealthy diet and physically inactive, 16.53 (7.58, 25.48).Using a phone call to perform the second 24-hour nutritional recall, however, could lead to under / over estimation in portion sizes of the food consumed.

Musaiger, Al-Mannai and Zagzoog (2015) performed a cross-sectional survey on the association between food intake frequency and obesity among 512 female students aged 12–19 from schools and colleges in Jeddah, Saudi Arabia. Weight and height were measured.Fruits, vegetables and dairy products were less likely to be consumed by obese girls. They have increased likelihood for chocolate and sweet consumption (OR= 1.57) greater than three times per week.

In a cross-sectional study undertaken by Napier and Oldewage-Theron, (2015) on dietary intake and nutritional status of 523 (156 teenage girls aged 14-18 and 367 females aged 19-28) adolescents and young females in Durban, South Africa; weight, height and BMI were evaluated. WHO Anthro-plus software was used to classify respondents to their nutritional status.Dietary assessment was through multiple twenty-four-hour dietary recall (2 weekdays and 1 weekend). Nutrient intake was determined with Food Finder software. Dietary assessment was conducted through multiple 24-hour dietary recall (2 weekdays and 1 weekend). Less than half (43 percent) of girls had the likelihood of becoming overweight. Few (30.5% and 15%) were overweight and obese respectively. However, average energy intake was low.

Azeredo *et al.,* (2015) conducted a cross-sectional dietary intake study of 109,104 Brazilian adolescents. Validated FFQ was utilised to evaluate dietary intake.Dietary intake was assessed by validated FFQ.Fewer than 30 percent of adolescents consumed raw or cooked vegetables on a regular basis, while more than one-third reported regular intakes of sweets, soft drinks and sweet biscuits. Southern adolescents and the older ones were the ones most exposed to inadequate dietary intake. However, food groups were considered and not portion sizes in determining nutrient adequacy.

Kalkan, Turkmen and Filiz (2015) also execute a cross-sectional study of the dietary habits of 643 Turkish adolescents between the ages of 13 and 16 in Konya, Turkey. Weight, height and BMI were assessed.Dietary habit was with a questionnaire form prepared based on Adolescent Food Habits Checklist (AFHC).Mean age was 15.18±0.57 years, of which 65.2% were males. Evaluation of the body mass index stated that 51.8% of students were underweight, 39.5 % normal and 8.7 % overweight. Mean student AFHC score was calculated as 9.17±3.70. However, the questionnaire considered food groups but did not put into consideration the portion sizes consumed.

Choudhary *et al.,* (2015) conducted a cross-sectional study on the Relationship of Energy Balance and Protein Intake with Nutritional Status of 273 adolescent girls in A Rural Area of Haryana, India. Weight, height and BMI were evaluated. Dietary intake was evaluated with 24-hour dietary recall. Majority (65.57%) were underweight. Aboutone-third (29.67%) suffered from chronic energy deficiency (CED) grade III. Important association was observed between participants ' protein consumption and nutritional status ($P<0.01$).

Bellisle, 2014 conducted a systematic review of articles. In many reports,snacking appears to facilitate the adjustment of energy intake to needs, and to contribute carbohydrates, ratherthan fats, to the diet, in addition to valuable micronutrients. Such results are usually reported in healthy,normal-weight children and adults.By contrast, snacking often appears to contributemuch energy but littlenutrition in the diet of other consumers, particularly obese children and adults.

Azadbakhat, Akbari and Esmillzadeh (2014) performed a cross-sectional survey on diet quality among Iranian 265 children aged 11–13 years in Iran. Weight, height, WC, HC, BMI and blood pressure were evaluated. Overweight and obesity were assessed in line with the rules of the WHO. Dietary intake was evaluated using validated FFQ and diet quality indicators included dietary diversity score (DDS), healthy eating index (HEI) and mean adequacy ratio (MAR) were computed across ten nutrients. The mean nutrient adequacy ratio of all nutrients was above 1 except for vitamin D (0·53 ± 0·51).No significant association between HEI score and BMI, central or abdominal obesity, and blood pressure.However, the FFQ did not quantify intakes in terms of the grams of food eaten by participants but only the intake frequency.

Napier and Hlambelo (2014) also performed a cross-sectional study on the Contribution of school lunchboxes to the daily consumption of adolescent girls in Durban, South Africa. Dietary assessment was with two 24-hour multi pass dietary recall (weekday and weekend).Lunch of the participants were weighed. Nutrient intake was determined with Food Finder software based on South African Food Composition Table. Lunchboxes contributed one-third of the children's daily nutrient consumption. The contribution of total fat (34.04 %) to the girls ' complete energy consumption was higher than the 15-30 % recommended intake with respect to World Health Organization.The daily consumption of fruit and vegetables (87.95 g and 83.97 g

according to 24-hour recall and lunchbox analysis, respectively) was inadequate compared to the WHO recommended intake of > 400 g / day.

Shafieea, *et al.,* (2013) conducted a cross-sectional study on the Association of cardio-metabolic risk factors and breakfast intake among Iranian adolescents. Height, weight, WC and BMI were assessed.A standardized mercury sphygmomanometer was used to perform measurements of systolic blood pressure (SBP) and diastolic blood pressure (DBP). Auto-analysers enzymatically measured serum glucose (FBG), total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), and triglycerides (TG). Respondents who skipped breakfast showed increased risk of obesity, elevated TG and LDL-C including HDL-C when compared to those who do not skip breakfast.

Romero-Sandoval *et al.,*(2013) also performed a cross-sectional study on Breakfast Habits and Family Structure Associated with 6964 students in Ecuador. Structured questionnaire, completed in class time asked about breakfast habits, physical activity, type and stage of family. Few (29%) of excess weight were observed among children who skip breakfast when compared to those who had breakfast.

Antony and Bhatti (2013) conducted a cross-sectional study on Empty Calories Food Consumption and Knowledge of its Ill Effects among 208 teenagers aged 13-17 in four English medium schools at Pune District of Maharashtra, India. Structured questionnaire was used to collect information.Of the 66.8 % who consumed junk food, 50 % of teenagers consumed junk food 3-5 times a week and 1-3 bottles of aerated drinks. 46.15 % of adolescents had an average understanding of the ill consequences of junk food. Teenagers ' overall awareness of the ill impacts of junk food is comparatively average or good, but the difficulty is that they do not translate this understanding into good food behaviour. However, the use of purposive, disproportionate random and convenient sampling technique is a restriction and the participants ' nutritional status was not evaluated.

Ogunkunle and Oludele (2013) conducted a cross-sectional study on food intake and meal patterns of 302 public schooladolescents in Ila Orangun, Southwest Nigeria. Information was obtained using questionnaire. Breakfast was skipped by one-third (38%) of the participants while majority consume dinner. The proportion of females who missed breakfast was significantly higher than that of the males (p-value < 0.05).

Onyiriuka, Umoru, and Ibeawuchi (2013) performed a survey on the weight status and eating habits of 2,097 adolescents aged 12 to 19 in urban secondary school girls in Nigeria.Structured anonymous questionnaire was used to collect information. Height, weight and BMI wereassessed.The incidence of both overweight (24.5% v. 13.2%) and obesity (2.5% v. 1.1%) were higher in girls who skipped meals compared with their peers who did not (OR 0.4; 95% CI 0.32 - 0.50).Schoolgirls who skip meals have a higher prevalence of both overweight and obesity.Only adolescent girls were studied thereby making the results did not include male respondents.Second, the results are restricted by the single location, as the respondents were derived from schoolgirls in only one school.

Hallstrom *et al.,* (2012) conducted a cross-sectional survey on Breakfast intake and CVD risk factors in (2,929) European teenagers aged 12–17 years: (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study, Europe.Breakfast consumption was assessed.Weight, height, circumference of the hips, thickness of the skin, blood pressure, total cholesterol (TC), HDL cholesterol (HDL-C), LDL cholesterol (LDL-C), TAG, insulin, glucose and BMI were evaluated. Regular consumption of breakfast was reported to lower body fat. It could also negate the effect of excess adiposity on total cholesterol (TC) including LDL-C in the male adolescents.

In 523 in school adolescents, Thompson-McCormick *et al.* (2012) conducted a cross-sectional on Breakfast skipping as a risk factor of overweight and obesity. Height, weight and BMI wereevaluated. Information sociodemographic and cultural characteristics, dietary pattern and eating pathology were acquired through self-report.BMI was based on WHO classification for adolescent with respect to age, gender, and height. The odds of being overweight with frequent skipping of breakfast. Overweight and obese individuals were significantly more likely to skip breakfast when compared with ideal body weight individuals.

Monika-Arora, *et al.,*(2012) also conducted cross-sectional surveyon the Association of breakfast intake with obesity, dietary and physical activity behaviour among urban (1,814) school-aged adolescents in8th and 10th gradein Delhi, India. Height and weight were assessed.The prevalence of overweight and obesity among adolescents who consume breakfast daily was significantly lower than those that consume sometimes (15.2%) or never (22.9%). Consumption of breakfast daily is associated

with less overweight and obesity involving a dietary pattern and physical activity-related behaviour among participants. However, objective measures to assess food behaviour or physical activity were not used in this study. Self-reported data was relied upon, which has the likelihood to be subject to recall bias. It is important to note that the associations observed here in this cross-sectional study could be bidirectional, with no clear evidence of exposure preceding the outcome.

Tsai *et al.,* 2011 conducted a survey on eating disorders related thoughts, behavioursand dietary intake in 835 female junior high school studentsin Taiwan. The reported intakes of energy, protein, fat, carbohydrate, cholesterol, zinc and vitaminsB-6, B-12, were significantly lower in participants with disturbed eating patterns than in participantswithout disturbed eating. Participants with disturbed eating patterns had higher dietary and crude fibreintake than participates without disturbed eating.

Aounallah-Skhiri *et al.,*(2011) conducted a retrospective cross-sectional survey on Nutrition transition among adolescents of a South-Mediterranean country: dietary patterns, association with socio-economic factors, overweight and blood pressure: A cross-sectional study in Tunisia among 1,019 adolescents 15-19 years.Dietary intake was assessed with semi-quantitative frequency questionnaire (134 items).Diet Quality was with DQI-I. Height, weight, BMI/A, WC as well as blood pressure were assessed. Two dietary patterns were observed among subjects which are modern pattern-characterized by higher white bread, dairy products, sugars, added fats and fruits and decreasing consumption of oils, grains, legumes and vegetables intake;Meat/fish pattern- characterized by higher intakes of meats and fish, and Modern dietary pattern was associated with decreased prevalence of hypertension among females.

Minaker *et al.,* (2011) performed a cross-sectional survey on associations between the perceived presence of vending machines and food and beverage logos in 4,936 school age students and adolescents aged 7–10 (aged 11–17) on diet and weight status in Canada. Weight, height, BMI were assessed. Dietary intake and diet quality were assessed with 24-hour dietary recall and FFQ.Drink-vending machines in schools were associated with the students' weight status.There was, however, a likelihood of misreporting as BMI was computed from self-reported weight and height.

Morales *et al.,*(2011) also conducted a cross-sectionalsurvey on Breakfast quality and its relationship to the prevalence of overweight and obesity in 467 secondary school

adolescents.Data collection was achieved through the 7-day food journal and the Food Frequency Questionnaire. Height, weight, BMI and percentage body fat were assessed.Daily intake of macronutrient especially Energy and carbohydrate for full breakfast eater was (2267.83±523.31, 235.50±62.14), while for not full breakfast eaters was (2589.72±118.93, 257.52±46.62) with $P<0.01$. Breakfast skipping was not an effective way to lose weight. However, weight loss was inversely related to the quality of breakfast.

Henry-Unaeze and Okonkwo (2011) performed a cross-sectional study on Food Consumption Pattern and Calcium Status of 200 adolescents in Nnewi, Anambra State, Nigeria. Height, weight and BMI were assessed. The higher percentage (67.5 %) of participants eat three meals/day and the frequency of dairy intake was very small (17.7 %). Milk intake was considerably influenced by serum calcium concentration (mg/dl). Low serum calcium concentration was ascribed to the reality that the primary calcium sources of the participants were cereals and legumes that mostly contain anti-nutritional factors. However, the questionnaire used was not specified.

Olumakaiye *et al.,* (2010) also performed a cross-sectional study on Nigerian 401 students from 32 secondary schools and the effect on body weight in Osun State, Nigeria.Height, weight and nutritional status was assessed. Majority (66.1%) of adolescents ate 3 meals daily; this percentage was higher among rural (75.4%) than urban (61.4%) children ($P < .001$).About 33.0% consumed snacks daily but to a varying degree, which was higher among urban than rural adolescents. Prevalence of underweight was 20.1%, more common in rural (22.1%) than urban adolescents (18.7%). Underweight prevalence was highest among those who ate 3 meals and no snacks daily (28.6%) and least among those who ate 3 meals and snacks twice daily (15.9%).

Nago *et al.,* (2010) also conducted a cross-sectional study on the contribution of food, energy and macronutrients from outdoors food in (656) school-going adolescents aged 13–19 in Cotonou, Benin.Multiple non-consecutive 24-hour dietary recall was used to evaluate dietary intake.The score for dietary diversity was calculated. Weight and height were assessed. The Out-of-home prepared foods contributed more than 40% of the daily energy, fat, protein, carbohydrate and fibre intakes of the adolescents.Low consumers ate more fruit and vegetables and cereal grain products than high

consumers whereas high consumers consumed more sweet energy-dense foods. Both categories had a diet poor in fruit and vegetables (hardly one-fourth of the recommended 400 g) and high in fat.

Timlin *et al.,* (2008) conducted a 5-year longitudinal study on breakfast eating and weight change in a 5-year prospective study of 2216 adolescents (1007 boys and 1215 girls): Project EAT (Eating Among Teens), USA. Height and weight and BMI were evaluated. Youth and Adolescent Food Frequency Questionnaire (YAQ) evaluated dietary intake. Average age was 14.9±1.6 years and 19.4±1.7 years for male and female respectively. However, there was a significant inverse relationship between breakfast frequency and BMI.

McNaughton *et al.,* (2008) performed a cross-sectional study on adolescent eating patterns and risk of obesity and hypertension in 1,086 adolescents (ages 12 to 18) from the 1995 Australian National Nutrition Survey, Australia.Dietary intake was evaluated with a 108-item FFQ. The BMI and WC were evaluated. Three dietary patterns were discovered among adolescents; A pattern of salad, cereals and fish; a high pattern of fat and sugar; and a pattern of vegetables.The pattern of fruit, salad, cereals and fish was inversely associated with diastolic blood pressure.No significant associations were observed between any of the dietary patterns and systolic blood pressure.

2.8 Nutritional Status of Adolescents

Onifade, Okorie and Otegbayo, 2019 investigated the nutritional status and eating pattern of 220 pre-school children in South-West Nigeria. The prevalence of malnutrition was low with stunting, wasting and underweight as 8.1%, 7.7% and 9.1% respectively. Most (78.2%) of the children ate more than 3 times daily while 96.4% of the children constantly had regular number of specified meals daily.

Haileselassie, Roba and Weldgebreal, 2019 conducted a cross-sectional study to investigate undernutrition and its associated factors among 376children and adolescents aged 2-15 years attendingantiretroviral therapy in Eastern Ethiopia. Few 24.7% (95% CI: 20.7, 29.4) of the children were stunted and 28.2% (95% CI: 23.7, 32.2) were wasted. Household food insecurity, being anaemic, presence of diarrheal during the last 14 days andadvanced WHO clinical stages were significantly associated

with stunting. While being male, low family monthlyincome, medium family monthly income, low (poor and medium) dietary diversity, low food consumption score, andthe presence of diarrhoea during the last 14 days were significantly associated with wasting.

In Democratic Republic of Congo (DRC), Buhendwa*et al.,* 2017 conducted a study on nutritional status and height, weight and BMI percentiles of 7,541 school-aged children and adolescents' 6-18-years from Kinshasa. The prevalenceof short stature (< -2 SD) and thinness (< - 2SD) was higher in boys (9.8% and 12%) than in girls (3.4%and 6.1%), but the prevalence of overweight (> 1 SD) was higher in girls (8.6%) than in boys (4.5%).

Johnson *etal.,*(2016) carried out a cross-sectional study on Obesity in Nigeria children and adolescents (5-19years old)-waistcircumference a more sensitive indicator.Height, weight, waist circumference and BMI were evaluated.Waist-to-hip ratios (WHR) and waist-to-height ratios (WHtR) were calculated. Average ages of males and females were 14.03±2.16years and 9.57±2.17years, respectively. Males were older, bigger, and taller than females. However, females had higher WHR and WtHR ratios.Waist circumference was significantly associated ($p<0.05$) with gender ($\chi2 = 23.762$, $p = 0.001$) and age ($\chi2 = 25.585$, $p = 0.001$), with a greater proportion of males in the obese group.The prevalence of obesity was small, suggesting that WC was the most delicate measure of obesity. Participants were recruited from a homogenous population, and gender distribution was not even for some age groups.

Esimai and Ojofeitimi, (2015) conducted a cross-sectional study on Nutrition and Health Status of adolescents aged 10-16 years in the Armed Force Private Secondary School in Port Harcourt, Nigeria. Weight, height, visual acuity and dental status were also evaluated. Prevalence of underweight, overweight and stunting were (46.2%, 6.6% and 36.3%), respectively. Twenty-three percent had refractive errors and the incidence of dental caries was 24.2%. Significant difference was observed in the mean BMI by gender. Prevalence of underweight in early adolescence and male gender was greater while the prevalence of stunting in early adolescence was greater. Similarly, there was an important relationship between low BMI and gender.

Nto *et al.,*(2015) conducted a cross-sectional study on the Prevalence of nutrition associated ponderal outcomes among 1620 subjects (849 males and 771 females)

school kids and adolescents (5–18 years of age), in Ebonyi State, South-East Nigeria.Height, weight and BMI were calculated. Nutritional status was classified as underweight, overweight and obese respectively, according to the International Obesity Task Force reference.The prevalence of obesity, overweight and underweight were 12.6%, 11.9% and 7.6%, respectively while prevalence of underweight among rural school children and adolescents is high whereas the prevalence of overweight and obesity was higher in urban school children and adolescents.

Mansur *et al.,* (2015) performed a cross-sectional study on the nutritional status of 438 rural school children aged 4-16 in Kavre District, Nepal, from April to July 2014.Height, Weight and BMI were assessed. The prevalence of underweight, stunting and thinness were 30.8%, 24.5% and 10.5% respectively. increased prevalence of underweight, stunting and thinness was noted in males compared to female respondents.However, it is inappropriate to use BMI for school-going children and teenagers aged 4-16 years instead of BMI for age.

Shrestha, 2015 performed a cross sectional study on anthropometrically determined undernutrition among adolescent girls 10-19 years from 16 April to 15 September 2010 in Kathmandu Valley, Nepal. Height, Weight and BMI were evaluated.One-third of the study population was stunted (32 %), one-fourth was underweight (24 %) and one-tenth was thin (9.5 %).During the late adolescence phase ($P<0.001$), both underweight and stunted girls were considerably more. However, the research was conducted in a single place (Kathmandu Valley).

Barbu *et al.,* (2015) explored obesity and eating behaviour in 866 respondents using information from a cross-sectional research schools in Bucharest, Romania. Questionnaire was used to collect information about lifestyle and eating behaviour. Height and weight were evaluated. Prevalence of overweight and obesity alone based on different standards, was 31.6% and 11.4% (WHO), 24.6% and 6.2% respectively (IOTF), 25.2% and 10% (USA-CDC), 22.3% and 12.5% (local standards). Most (95%) participants reported at list one unhealthy eating behaviour but no significant relationship was found with overweight or obesity only.

Wolde, Berham, and Chala (2015) performed a cross-sectional study to assess the determinants of underweight, stunting, and waste among 450 schoolchildren aged 7-14 in Ethiopia. Weight and height were evaluated.Multiple 24-hour dietary recall

(weekdays and weekend) was used for dietary assessment.The prevalence of stunting, wasting and underweight were (10.3%, 14.0% and 19.0%) respectively.Children from food-insecure homes are more likely to be stunted, underweight and wasted than children who live in food-secure homes. However, Children's weak remembrance about foods' portion size could have underestimated the dietary intake using 24 hour-recall method for three days.

Onyiriuka, Ikuren and Onyiriuka, (2015) performed cross-sectional study of (2,159) Nigerian Adolescent Urban Secondary School Girls ' Body Mass Index. Weight, height and BMI were evaluated.BMI-for-age percentile graph was used to classify the participants ' weight status.Average age of 15.3±1.2 years and the prevalence rates of underweight, overweight and obesity were 7.1% (95% CI= 3.0-11.2), 8.3 % (95% CI= 4.3-12.3) and 2.1% (95% CI= 2.0-6.2), respectively.Body mass index values increased directly with age.

Ukegbu and Ukegbu, (2014) conducted a study on Assessment of nutritional and health status of institutionalized adolescent students (38 males and 22 females) aged 14 -19 years all of whom were students of school of the blind, Afaraukwu,in Umuahia, Abia State, Nigeria. Weight, height, MUAC and BMI-for-age were assessed. Nutrient intakewas assessed using weighed inventory technique for 2 days (weekday and weekend). Prevalence of underweight was higher in males (39.5% vs 13.5%), while more females were overweight than males (32.0% vs 5.2%) ($P > 0.05$).Mean weight was significantly higher in females than males (51.41 ± 15.20kg vs 43.32 ± 13.47 kg) ($p < 0.05$) while Energy and nutrient intake were below recommendations for normal adolescents.

Omobuwa, *etal.,* (2014) conducted a cross-sectional study assessing the nutritional status of 93 (29 males and 64 females) randomly selected adolescents aged 13–18 from eight public and two private secondary schools in Ibadan, Nigeria. Weight, and height were assessed. One third (29 %) of subjects were underweight, 59 (63.45) were of normal or healthy weight, 5 (5.4 %) were overweight, and 2 (2.2 %) were obese. However, the use of small sample size is not adequate to make inference regarding larger population.

Nto, *et al.,* (2014) conducted a cross-sectional study on the growth status of 1,620 participants (849 males and 771 females) teenagers from urban and rural populations

in Ebonyi State, Southeast Nigeria.Height, weight and body mass index (BMI) were assessed. Median BMI values of the urban females were higher than the standard; the urban males and rural females were almost identical to the reference chart. In contrast, the median BMI values of the rural males were below the standard.

Abdulkarim *et al.,* 2014 conducted a cross-sectional study among 1700 adolescent girls on malnutrition: prevalence and pattern in Abuja municipal area council, Nigeria. The mean age was14.43±1.94 years. Theprevalence of wasting, stunting,overweight and obesity was documentedas 1.7%, 11.3%, 13.2%, and 2.6%, respectively. Adolescents in urban schools had highermean BMI (20.91±3.22 kg/m^2versus 19.71±2.78 kg/m^2) andheight (160.41±9.14 cm versus 155.32±8.81 cm) than adolescents in rural schools, p values<0.05.

Tzioumis and Adair, 2014 conducted a critical review on Childhood dual burden of under- and overnutrition inlow- and middle-income countries with focus on children from birth to 18 years of age.Global trends indicate decreases in diseasesof undernutrition, while overnutrition is increasing. Onthe community level, economic status may influencethe extent of the dual burden, with obesity increasinglyaffecting the already undernourished poor. In a household,shared determinants of poor nutritional statusamong members can result in disparatenutritional statusacross generations. Within an individual, obesity may co-occurwith stunting or anaemia due to shared underlyingdeterminants or physiologic links.

Nawab *et al.,* 2014 conducted a cross-sectional study on the influence of behavioural determinants on the prevalenceof overweight and obesity among 660 school goingadolescents of Aligarh. India. Prevalence of both overweight and obesitywas higher among males. Statistically significant difference was found in prevalence of overweight and obesity amongaffluent schools (14.8% and 8.2%) and non-affluent schools (4.8% and 1.5%). Important determinants of overweightand obesity were increased consumption of fast food, low physical activity level and watching television for more than 2-hours/day.The prevalence of obesity is high even in small cities. Dietary behaviour and physical activity significantlyaffect weight of adolescent children.

Heshmat *et.al.,* (2014) performed a cross-sectional investigation into the association between body mass index and perceived weight status with self-rated health and life

satisfaction in Iranian adolescents aged 10–18 residing in urban and rural regions of 27 provinces. Weight, height, and BMI were assessed. Forty (40%) of the participants misperceived their body image.Lifestyle and Self-rated health were not association with BMI (P value>0.05).

Chirila *et al.,* (2014) conducted a cross-sectional survey on height difference, body mass index and self-assessment among 185 adolescents aged 14-18 students in Constanta County– a comparison between rural and urban regions in Romania.Weight and height were assessed. WHO Anthro-plus software was used to determine BMI for age.Proportion of overweight and obese students in metropolitan regions was statistically considerably greater relative to high school students in rural regions. However, small sample size was not enough to draw conclusion.

Caroline *et al.,* (2014) conducted a cross-sectional survey on Nutritional Status of 300 School Children 11-14 years in Rural, Semi Urban and Urban Areas of Tamil Nadu, India.Height, Weight, WC, HC, WHR and BMI. Regarding nutrient intake, a 3-day diet history was obtained from the children.Majority (67.33%) were underweight and only a few (6%) were overweight/obese. About one-third (29.6 %) of underweight and (4.67 %) overweight / obese children were from rural regions.Children's mean calorie consumption in rural areas was much smaller than children in urban areas.

Christa *et al.,* (2014) performed a cross-sectional survey on the nutritional status of adolescent girls with reference to BMI among 930 school-going adolescent girls aged 11-16 in Chidambaram, India.Weight, Height and BMI were assessed.Increased BMI was associated with low physical activity.Physical activity influences the development of overweight and obesity in adolescent girls.

Bhattacharyya and Barua, 2013 conducted a cross-sectional study on the nutritional status and factors affectingnutrition among 284 adolescent girls in urbanslums of Dibrugarh, Assam. The prevalence of thinness was 25.70% while theprevalence of stunting was 31.33%. A significant association wasobserved between the nutritional status of adolescents and themother’s literacy level and family size.

Mijinyawa *et al.,*(2014) carried out a cross-sectional study on the Prevalence of thinness among (718) adolescents in from six secondary schools in Kano metropolis,North-western Nigeria. Height, weight and BMI were measured.The total prevalence of thinness was 60.6 %, with a greater prevalence among boys (63.0 %)

compared to girls (58.7 %). Grades-I, II and III thinness were found in 26.0%, 15.5% and 19.1% of the studied subjects respectively. The prevalence of grade III thinness was higher among boys (19.4%) compared with girls (18.8%). The rate of thinness was observed to increase with age up to 16 years after which it starts to fall. increased age was independently associated with thinness among the adolescents.

Maruf *et al.,* (2013) performed a cross-sectional gender influence on the prevalence of overweight and obesity among 9,014 children and teenagers (male=4392; female=4622) aged 2-18 in Nigeria. Height, weight and BMI computed. At 2-6 years of age, males had greater BMI than females, while females had greater BMI than males at 11-14 years of age and 15-18 years of age. Females had a considerably greater prevalence of overweight ($P<0.05$) than males at 11-14 and 15-18 years of age. More female adolescents are at increased risk of obesity than males. However, no information was gathered on other BMI correlates with physical activity level, dietary pattern and socio-economic backgrounds.

Mustapha and Sanusi, (2013) conducted a cross-sectional survey on Overweight and Obesity among 2031 (1126 males and 905 females) In-school Adolescents in Ondo State, Southwest Nigeria. Weight, height and body mass index for age was assessed. Mean age was 14.28± 2.07 years. Majority 1559 (76.8%) were in the normal weight while few [32 (16.3%), 117 (5.8%) and 23 (1.1%)] were underweight, overweight, obese, respectively.Underweight and obese were higher in males while overweight was higher among females ($p<0.05$).

Ahmad, Ahmed and Airede (2013) performed a cross-sectional study on the Body Mass Index among (360) school adolescents aged 10-18 in Sokoto, North-West Nigeria. Weight and height were measured, and BMI computed.The male adolescents ' mean BMI was 18.3 ± 2.7kg/m^2 and the female was 19.3 ± 3.1kg/m^2.Overweight prevalence was 3.3% while obesity was 1.4%.

Abah *et al.,* (2012) carried out a cross-sectional study on the Prevalence of Overweight and Obesity Among 417 students drawn from secondary schools in Nigeria. Height, weight and BMI were assessed.The incidence of overweight and obesity was 8.6% and 1% respectively. Majority (67.5%) of overweight and obese students were from private schools (95% CI = 1.03-4.39 OR=2.11; $\chi 2$= 4.85).Similarly, 11.59% and 1.45% of students in private schools were overweight and obese compared to 5.71% and 0.95%

from public schools, respectively. Majority (68%) of respondents had poor knowledge of the risk factors associated with being overweight or obese.

Maiti *et al.,* (2011) conducted a cross-sectional survey on: A Comparative Study on Nutritional Status of Urban and Rural Early Adolescent School Girls aged 10-14 in West Bengal, India. The W/A, H/A and BMI for age were investigated. In rural teenage girls, the prevalence of stunting (35.5 %, 19.6%) and thinness (26.3 %, 13.6 %) was higher than in urban adolescent girls, and significant health issues among rural early adolescents were due to undernutrition. However, the result obtained cannot be used for both male and female policy or intervention.

Maiti *et al.,* (2011) performed another cross-sectional survey on the Assessment of Nutritional Status of Rural Early Adolescent School Girls (3611) 10-14years in Dantan-Ii Block, Paschim Medinipur District, West Bengal, India.Weight and height were measured. Weights and heights of these girls were below the standard value. Regarding weight for age index, only 28.2% subjects were in the normal category while (12.7%, 30.4%, 13.7% and 1.9%) of the subjects were experiencing Grade I, Grade II, Grade III and Grade IV malnutrition respectively.Few (32.6%) had mild retardation and about 2.2% had poor status. However,the standard used for classification of respondents to their nutritional status was not stated.

Nabag, (2011) carried out comparative survey on the Nutritional Status of Urban and Rural School Girl's Children aged 5-15 Khartoum State, Sudan. Weight, height and skin fold thickness of triceps muscle was assessed.These z-scores of W/A, H/A and SKFT were calculated using WHO references (WHO, 1995). Incidence rates of underweight, stunting and thinness were 41.3%, 21.4% and 2.1%, respectively.The mean nutritional indices (weight for age, height for age and SKFT) were found to be significantly lower among the rural children than urban children ($P < 0.001$).

Maiti *et al.,* 2011 carried out a comparative study on nutritional status of 2,545 urban andrural early adolescent school girls of West Bengal, India. The prevalent rates of underweight, stuntingand thinness were 27.9%, 32.5% and 20.2% respectively. In the rural area these were 35.4%, 35.7% and26.3%, while in the urban they were 19.6%, 29.0% and 13.6% respectively.

Peltzer and Pengpid (2011) performed a cross-sectional investigation of overweight and obesity and associated factors among (5,613) school-age children (aged 13 to 15)

from the Global School-based Health Survey (GSHS) in Ghana and Uganda. Regarding dietary Intake, information onfruit/vegetable intake and hunger rating were obtained.Height and weight were self-reported.Prevalence of overweight was 3.2% among boys and 10.4% among girls, while the prevalence of obesity was 0.5% and 0.9% among boys and girls, respectively.Most girls had fruits or vegetables once a day as compared to boys, and 17 % stated they mostly or always felt hungry. Inadequate fruit intake was associated significantly with overweight/obesity only in boys.

Senbanjo *et al.,* (2011) performed a cross-sectional study on the body composition and nutritional status of 575 children and adolescents aged 5-19 in Abeokuta, Southwest Nigeria. Height, weight and HAZ were assessed.Ninety-nine (17.4%) children were stunted. The significant contributing factor to stunting was low maternal education (odds ratio=2.4; 95% confidence interval 1.20-4.9; p=0.015).

Omuemu and Omuemu, (2010) also carried out a cross-sectional study on the Prevalence of Overweight and its Risk Factors Among 250 adolescents aged 10-19 in an Urban City in Edo State, Nigeria. pre-tested interviewer-administered questionnaire was used to obtain information. Few (5.7%) of the adolescents were overweight while 52.7% were at risk of overweight. Risk factors ofoverweight identified were consumption of snacks (64.3%), soft drinks (85.7%) and physical inactivity. Majority (69.7%). Overweight was significantly associated with consumption of snacks, soft drinks, physicalinactivity and positive family history of obesity ($p<0.05$).

Nasreddine *et al.,* (2009) researched adolescent obesity in Syria: prevalence and related factors using a cross-sectional study among 776 adolescents.Height, weight, waist circumference and BMI were evaluated. Dietary intake was evaluated with 24-hour dietary recall.Overweight and obesity prevalence rates were 18.9% and 8.6% respectively.Carbohydrate and saturated fatty acid intakes were considerably greater in overweight and obese (250.66 and 32.82 g/day, respectively) relative to normal weight adolescents (218.12 and 26.10 g/day, respectively). Obesity was significantly greater amongst adolescent boys than girls ($OR = 2.30$, $P < 0.05$).

2.9 Nutrition and Iron Status of Adolescents

Sjoberg and Hulthen (2015) performed a cross-sectional study on the comparison of food habits, iron consumption and status in (2,285) adolescents from 13 schools before and after the closure of the general iron fortification in Göteborg, Sweden.Weight, height and BMI assessed. Blood samples were obtained for serum ferritin (SF) and diet history was assessed. Iron deficiency increased in girls from 37% -45%in girls while it was stable at 23% in boys. Total iron intake decreases from (15.7- 9.5; 22.5-13.9) mg in girls and boys respectively. However, cereals were the primary source of iron intake.

Bleyere *et al.,*(2014) conducted a longitudinal and descriptive study on Comparison during pregnancy of iron metabolism between 531 pregnant women (112 of Adolescents and 419 of adult)in Côte d'Ivoire. Haematological screening tests were assessed.Many (81.4 %) of adult females were impacted by anaemia compared to 67.9 % of adolescents. Iron deficiency was related to inflammatory anaemia. For iron metabolism components, adolescents during pregnancy were more affected than adult females.

Onabanjo and Balogun (2014) conducted a cross sectional study on Anthropometric and Iron Status of 127Adolescents 10-19 years from selected Secondary Schools in Ogun State, Nigeria.Weight, height, WC, HC, WHR and BMI for age were assessed.Nutrient Intake was through multiple 24-hour dietary recall. The overall prevalence of anaemia was 24.4% while that of iron deficiency 71.0%. Boys had significantly (<0.05) higher mean intake for energy and most nutrients than girls. The dietary iron intake of the adolescents was unsatisfactory with majority(80%) of the respondents failing to meet RNI level.

Moschonis *et al.,* (2013) performed a cross-sectional survey on the Relationship of Iron Depletion with Menstruation and Dietary Intake Indices in (1222) Pubertal Girls aged 9–13 years: Healthy Growth Study, Greece. Weight and height were assessed. Blood samples were obtained for serum ferritin (SF), Serum transferrin receptor (STfR) and C-reactive protein (CRP) tests. Multiple 24-hour dietaryrecall and FFQ were used to assess food intake. Few (33.5%) were found to be iron depleted (defined as serum ferritin < 12 μg/L) when compared to 15.9% out of 948 girls without menses. Iron-depleted girls without menses were found to have reduced consumption of poultry

(P = 0.017), higher fruit intake (P = 0.044) and fast food (P = 0.041) when compared to their peers having normal iron status.

Jildeh *et al.,* (2011) performed a cross-sectional survey on Assessing the Nutritional Status of Palestinian Adolescents (313) 11–16 years.Weight, height and BMI for age were measured. Blood samples for haemoglobin level assessment were collected using an instantly calibrated finger prick Hemocue machine (Hemocue AB, Angelholm, Sweden).Dietary Assessment was through 24-hour dietary recall.Few (4.8%) of the respondents were underweight while (24.3% and 9.9%)were overweight and obese, respectively. The prevalence of anaemia was 23.30%. The mean haemoglobin level was significantly higher in boys (13.35±1.40) than in girls (12.87±1.28) ($p<0.01$).Inadequate protein intake was reported by 15.07% of boys and 43.08% of girls while most of them met <80% of the recommended daily allowances for most micronutrients.

2.10 Anthropometric Characteristics and Body Composition of Adolescents

Klimek-Piotrowska *et al.,*(2015) carried out a cross-sectional study on Anthropometry and Body Composition of 456 boys and 514 girls aged 14-18 years old Adolescents in Cracow, Poland.Weight, height, waist and hip circumference (WC, HC) were measured. Body mass index (BMI), waist-to-hip ratio (WHR), waist-to-height ratio and (WHtR)were computed. Prevalence of overweight and obesity were 10.2% and 4.2%. Weight, height, WC, HC, WHtR, and WHR were considerably higher in males than females while weight, height and HC increased with age. Increased level of adiposity was observed during the last decade.

Sen, Mondal and Ghosh (2015) performed a cross-sectional study on Upper Arm Composition as an indicator of body composition and nutritional status of 964 adolescent boys belonging to the indigenous Rajbanshi population of West Bengal, India. Height, weight, MUAC, TSFand upper arm composition was estimated based on Upper arm composition by total upper arm area (TUA), upper arm muscle area (UMA), upper arm fat area (UFA) and arm fat index (AFI). These are determined from mid-upper-arm circumference (MUAC) and triceps (TSF) skinfold thickness.Age specific means of TUA, UMA and UFA increased with age. The adolescent boys were observed to be well below the 50th percentiles of the reference population in BMI,

TUA, UMA, UFA and AFI. Age and sex-specific smooth percentile curves were derived for height, weight, TSF, BMI, UMA and UFA using the L, M and S modelling approach for further evaluation of body composition.

Senbanjo, Oshikoya and Njokanma, (2015) conducted a cross-sectional survey on upper arm composition and nutritional status of school children and adolescents in Abeokuta, Southwest Nigeria. Weight, height, mid-upper arm circumference (MUAC) and triceps skin fold thickness (TSF) were assessed. Body mass index, upper arm muscle area (UAMA), upper arm fat area (UAFA), fat proportion and UAMAH were derived.At each age group, the TSF, UAFA and fat proportion were considerably greater in females than males. MUAC and UAMA were considerably greater in female children aged 10-14, whereas UAMA was considerably greater in adolescent males aged 15-19. UAMAH's sensitivity and specificity for identifying wasting were 80.8% and 63.9%, respectively.A mixture of poor calorie and protein reserves was identified in the school children studied.

Eke *et al.,* (2015), performed a cross-sectional study on Body Composition of 132 children and adolescents aged 6 to 18 years with Sickle Cell Anaemia in Enugu, Nigeria.Height and weight were assessed. Body composition parameters such as body fat percentage (BFP), visceral fat percentage (VFP), body mass index (BMI), skeletal muscle percentage (SMM), and resting metabolic rate (RMR) were assessed.The participants had lesser parameters of body composition compared to controls. Also, the older male participants aged 10 to 18 years, had lower body composition indices (weight, height, BMI, and BFP) relative to controls.

Jaswant and Nitish, (2014) carried out a cross-sectional study on the Use of Upper-Arm Anthropometry as Measure of Body-Composition and Nutritional Assessment in 1545 (770 boys; 775 girls) of (6-20 years) in India. Height, weight, triceps and mid-upper-arm circumference were recorded. The upper-arm composition was assessed using standard equations. Age and sex-specific muscularity were found significantly greater among boys than girls ($p<0.01$), while adiposity was significantly greater among girls ($p<0.01$), particularly when they approached to puberty. Prevalence of wasting was 23.69%. Thinness and UAMAH, and body composition and dietary pattern were observed to be significantly unsatisfactory.

Mushengezi and Chillo, (2014) conducted a cross-sectional study conducted on the Association between body fat composition and blood pressure level among 523 secondary school adolescents in Dar es Salaam, Tanzania. Weight, height, WC, BMI, blood pressure and skin fold thickness were assessed.Obesity was 22.2% while 17.5%, 5.5%, and 4.0% had systolic, diastolic and combined hypertension, respectively. The mean percentage of body fat was favourably associated with diastolic BP and mean arterial pressure (MAP), but not with systolic BP.Body mass index predicts BP levels better than body fat composition and should be used as a measure of increased likelihood of hypertension among adolescents.

Izuora *et.al.,* (2013) conducted a cross-sectional survey on the evaluation of overweight and obesity among 1,235 Nigerian college children and teenagers aged 5–18 using skin-fold thickness and body mass index. Weight, height, triceps SFT and BMI were assessed.Fifty-seven respondents (15 boys and 42 girls) had SFT > 85th percentile with a greater prevalence in girls than boys (6.4% vs. 2.6%, P = 0.001).The prevalence of overweight and obesity among females was also greater (11.9% vs. 5.7%, P < 0.001 and 4.7% vs. 2.2%, P = 0.02, respectively). Greater proportion (82.5%) of respondent with elevated SFT also had high BMI.

2.11 Nutritional Status and Blood Pressure of Adolescents

Adekanmbi*et al.,* 2016 conducted a cross-sectional study on the prevalence of malnutrition and high blood pressure amongst 572 adolescents in semi-urban area of Ogun State South- Western Nigeria. The nutritional status of thesubjects was related to their blood pressure pattern. Wasting and stunting were diagnosed among 26.7% and 24.8% of the subjects respectively. Pre–hypertension was present in 4.2% and 3.9% of the stunted and wasted respectively ($p<0.05$.)while Stage -1 hypertension was observed among adolescents with normal weight. Weight wasstrongly correlated with blood pressure.

Rahmani *et al.,* (2015) performed a cross-sectional study on: Body Mass Index Is Important Blood Pressure Determinant in 694 adolescents aged 12-18 from middle and high schools in 4 districts of Shiraz, Iran. Weight, height, BMI/Aand blood pressure were assessed. Prevalence of overweight/obesity and elevated systolic and diastolic blood pressure was 22.0%, 16.8%, and 13.3%, respectively.Boys had greater rates of

overweight / obesity and increased blood pressure compared to girls. In both sexes, high blood pressure had a positive association with BMI classifications independent of gender; this relationship was noted even in normal versus low BMI classifications.

Xu *et al.,* (2015) performed a cross-sectional study on gender-specific incidence and related risk factors of elevated normal blood pressure and hypertension among 29,997 multi-ethnic Chinese adolescents aged 8-18 in China. Height, weight, waist circumference as well as blood pressure measurements were assessed.The general incidence for hypertension was 4.15% (4.73% for boys and 3.62% for girls) and 29.85 % for elevated normal BP (33.40% for boys and 26.65% for girls).The odds ratios (ORs) improved with age, but the absolute variations in ORs were considerably distinct between boys and girls. Odds ratios (ORs) improved with age, but the absolute variations in ORs were considerably distinct between boys and girls.

Mladenova and Andreenko, (2015) equally conducted across-sectionalstudy on Prevalence of High-Normal Blood Pressure and Hypertension among (873) Bulgarian Children and Adolescents with Various Nutritional Status.weight, height, waist circumference, systolic blood pressure, diastolic blood pressure, body mass index (BMI) and waist to height ratio (WHtR) were assessed.High-normal blood pressure was discovered in an average of 20.3% of children and adolescents, while hypertension was found in 3.4 %.Children with high normal blood pressure and central obesity were 35.4%, and 7.1% with hypertension and central obesity.There are positive important correlations in both sexes between BMI, WHtR and blood pressure. The incidence of children with high-normal blood pressure and hypertension had increased central obesity.

Nam *et al.,*(2015) also conducted cross-sectional study on Obesity and Hypertension among 952 School-going Adolescents from 11 schools in Lima or Callao, Peru, in 2014.Weight, height, and blood pressure (BP) were measured and categorized. Mean age of subjects was 14.6 years. Overweight and obesity prevalence was 20.2% and overall 9.5 % for boys 17.4% and 11.1%, and for girls 22.5% and 8.0%, respectively.The overall prevalence of hypertension was 26.7%, boys 34.8%, and girls 19.6%. The overall prevalence of hypertension was 26.7%, boys 34.8%, and girls 19.6%. while overweight and obesity are strongly associated with adolescent BP status.

In Malaysia, Cheah *et al.,* (2015) performed a cross-sectional study on hypertension and its association with anthropometric indexes among 218 pre-university students. Height, weight, BMI, WC, WHtR, body fat percentage, systolic and diastolic blood pressure wand BMI were assessed.The mean age was 18.2 ± 0.40 years.The prevalence of hypertension was 7.3%, which was greater among males (16.7%). Approximately 22 % of participants were overweight and obese. Most males had a normal waist circumference (WC) (75.9%), but approximately half of the female had an unhealthy category WC value (47.0%). Females had greater conicity indexes and body fat compared with males.

In India, Mahajan and Negi, (2015) conducted cross-sectional study on Hypertension and pre-hypertension among 3385 students with 1665 females and 1720 male students in Shimla, Northern India-Time to awaken.Weight, height, BMI were assessed. Overall mean SBP and DBP increased significantly with age in both the genders. Average SBP (111.60 mmHg ± 11.43) and DBP (72.88mmHg ± 7.41) were higher in males in comparison to females in whom mean SBP and DBP were 109.91 ± 12.04mmHg and 71.84 ± 7.37mmHg, respectively. The prevalence of hypertension in females was more i.e., 13.1% in comparison to males 9.5%. However, the prevalence of pre-hypertension was nearly equal (11.0% in females and 11.3% in males). In both genders, hypertension was significantly associated with BMI for age.

Omisore, Omisore and Abioye-Kuteyi, (2015) carried out a cross sectional study on Gender comparisons of 1000 (510 males and 490 females)adolescents' anthropometry and blood pressure from eight secondary schools, Osun State, South-Western Nigeria.Height, weight, waist circumference as well as blood pressure measurements were assessed.Average age for male participants was 13.83±12.12 years and 13.62±1.96 years for female. Generally, in both males and females, anthropometric indices gradually increased from lower ages to higher ages. The mean weight, BMI and waist circumference were significantly higher in females than in males ($p < 0.05$). The overall "hypertension" prevalence was 4.1%, with more females (70.7%) having "hypertension" than males (29.3%).

In Europe, De Moraes*et al.,* 2015 investigated the dietary protein and amino acids intake and itsrelationship with blood pressure in 1,605adolescents:the HELENA STUDY. In boys, an inverse association was observed between protein (animal and

vegetable) intake and DBP; and a positive association betweenhistidine and SBP. In girls, a positive association was observed among tryptophan, histidine with SBP andmethionine with DBP. An inverse association was also observed between tyrosine and both SBPand DBP levels in girls.

Kuciene and Dulskiene, (2014) carried out a cross-sectional study in Europe on Associations of short sleep duration with prehypertension and hypertension among6,940Lithuanian children and adolescentsaged 12–15 years old. Height, Weight and BMI were assessed. Prevalence of prehypertension and hypertension was 12.6% and 22.5%, respectively.Prehypertension and hypertension were associated with short sleep duration among Lithuanian children and adolescents aged 12 to 15 years.

Dulskiene, *et al.,*(2014) in Europe conducted another study on the Association between obesity and high blood pressure among Lithuanian 7,486 (3,510 boys and 3,976 girls) aged 12–15 years oldadolescents: a cross-sectional study.Weight, height, WC and BMI wereassessed. The general prevalence of overweight, obesity and abdominal obesity was 12.1%, 2.4%, and 9%, respectively.Overweight and obesity were significantly associated with hypertension. Prehypertension including hypertension were associated with overweight, obesity and abdominal obesity.

Tayel, El-Sayed and El-Sayed, (2013) conducted a study on Dietary pattern and blood pressure levels of 300adolescents 12 and 18 years in Sohag, Egypt.Weight, height, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP) and body fat were assessed.Hypertension was identified among 7.7 % of the adolescents while prehypertension was identified among 34% of the adolescents.High BMI and low fruit and vegetable consumption were associated with increased SBP and DBP.High chip consumption was a predictor of increased SBP, whereas daily soft drink consumption was a predictor of increased DBP.

Noronha *et al.,* (2012) also performed a cross-sectional study on elevated blood pressure in 200 children and adolescents between two and 18 years of age in Brazil. Abdominal circumference, blood pressure, weight and height and BMI were assessed. Most children and adolescents (70.5%) had elevated blood pressure: 6% showed only a rise in systolic blood pressure, 33% in diastolic blood pressure and 31.5% in both. Higher systolic blood pressure values were noted in people with severe obesity and

increased waist circumference, as well as those of male sex and adolescent group. High systolic blood pressure was associated with serious obesity among adolescents.

Moselakgomo *et al.,* (2012) conducted a cross-sectional study in South Africa on body mass index, overweight and blood pressure among 1,172 schoolchildren and adolescents aged 10-16 in the province of Limpopo, South Africa.Weight, height, BMI, Body fat, sum of skinfold and blood pressure wereassessed. The incidence of overweight was 5.5% for boys and 4.4% for girls.The overweight prevalence was 5.5% for boys and 4.4% for girls.Blood pressure increased with age in both genders.hypertensioncorrelated favourably with stature, body mass, body mass index, body fat, and skin fold sum.

Zhang *et.al.,* (2012) performed a cross-sectional study on relationship between nutritional status and blood pressure among (5,456) children and adolescents aged 7 to 18 recruited from 10 public schools in South China Province of Hainan between March 2009 and December 2009. Height, weight, BMI, Systolic blood pressure and diastolic blood pressure were assessed. An elevated incidence of thinness was noted in both male and female children and adolescents (34.0% and 34.3%, respectively). Overweight and obesity were 2.7% and 1.3% respectively. Pre-hypertension and hypertension were detected in 3.9% and 3.3% children and adolescents, respectively.Obesity was positively associated with both pre-hypertension and hypertension compared to normal weight students.

In China, Guo *et al.,* (2011) conducted a cross-sectional study on the Association of Sleep Duration and Hypertension Among 4902 Chinese children and adolescents aged 5 to 18 from 12 schools in rural Shenyang, Liaoning Province.Height, body weight, waist circumference, BMI and blood pressure were assessed. Incidence of hypertension and prehypertension was 20.3% and 15% respectively.A brief sleep period (< 9 hours) was correlated with a greater danger of hypertension relative to group sleeping longer (9–10 hours) among children between the ages 11 to 14 years (OR, 1.5; 95 % CI, 1.04–2.15).

Ejike, (2011) conducted a cross sectional study on Blood pressure to height ratios as simple, sensitive and specific diagnostic tools for 1,173 Nigerian adolescents aged 11-17 years oldadolescent (pre)hypertension in Nigeria.Height, Weight, BMIBlood pressure (BP) were assessed.The accuracy of SBPHR and DBPHR in diagnosing

(pre)hypertension in both sexes was > 92%.The ideal thresholds for diagnosing prehypertension were 0.72/0.46 in boys and 0.73/0.48 in girls; 0.75/0.51 in boys and 0.77/0.50 in girls for hypertension.The sensitivity and specificity of this technique was > 96%.

Ejike and Ugwu (2010) performed a cross-sectional survey on the hyperbolic relationship between blood pressure and body mass index in a Nigerian 483 adolescent population formed by Ajaokuta – a low-income semi-urban city in Nigeria. Height, weight, BMI and Blood pressure were assessed.The mean age for the male subjects was 14.8 years (15.0 ± 1.9 years, 14.6 ± 1.8 years and 14.8 ± 1.8 years for hypertensives, normotensives and prehypertensive, respectively); while for the females, it was 15.1 years (15.0 ± 1.8 years, 15.1 ± 1.8 years and 15.3 ± 1.7 years for hypertensives, normotensives and prehypertensive, respectively).Blood pressures correlated positively with BMI only in normotensive subjects. This correlation was attenuated in prehypertensive subjects and literarily disappeared in the hypertensive subjects.

Ejike, Ugwu and Ezeanyika (2010) performed another survey on variation in the incidence of point (pre) hypertension among 843 Nigerian school-going adolescents residing in semi-urban and urban areas.Height, weight and BMI and Blood pressure were assessed. Prevalence of point-prehypertension in the semi-urban area was 22.2% (20.7% for girls and 23.1% for boys) while it was 25.0% (21.8% for girls and 29.2% for boys) in the urban area. The prevalence of point hypertension was 4.6% (4.1% for girls and 4.8% for boys) in the semi-urban area and 17.5% (18.0% for girls and 16.9% for boys) in the urban area.

Gunther *et al.,* (2009) conducted a cross-sectional study on Relationship Between Dietary Approaches to Hypertension Diet and Hypertension in 2,830 adolescents aged 10 to 22 years with Diabetes Mellitus in the USA. The SEARCH FFQ was used to evaluate dietary intake.Diet quality was achieved through DASH score. Both blood pressure and anthropometric measurements were done based on standard procedure. In youth with T1DM, mean DBP decreased across terciles of DASH adherence. The odds of having hypertension among youth in the highest terciles of DASH adherence was 40% lower than in the lowest terciles.

2.12 Body Image Dissatisfaction of Adolescents

In Brazil, Ribeiro-Silva*et al.,* 2017 conducted a cross-sectional study on body image dissatisfaction (BID) and dietary patternsaccording to nutritional status in 1,496 adolescents. BID was identified in 19.5% of the adolescents. Three dietary patterns were identified:(1) the Western pattern was composed of sweets and sugars, soft drinks, typical dishes, pastries,fast food, beef, milk, and dairy products; (2) the Traditional pattern was composed of oils,chicken, fish, eggs, processed meat products, cereals (rice, cassava flour, pasta, etc.), bakedbeans, and bread; and (3) the Restrictive pattern was composed of granola, roots, vegetables,and fruit. Among overweight/obese adolescents, the data indicated a negative association ofslight BID (OR: 0.240 [0.100; 0.576]) and moderate BID (OR: 0.235 [0.086; 0.645]) with theWestern dietary pattern. Additionally, in this group, there was a positive association betweenhigh BID and the Restrictive pattern (OR: 2.794 [1.178; 6.630]).

In Jamaica, Bhatt-Poulose*et al.,* 2016 carried out a cross-sectional study on increased rates of body dissatisfaction, depressive symptoms,and suicide attempts in Jamaican teens with sickle cell disease. Perceived and desired body images were similar for both groups. Adolescents with sickle cell disorder (SCD) had higher levels of "negative body satisfaction" (43.9% vs. 33.9%; P = 0.03), risk for depression(28.7% vs. 19.3%; P = 0.01), and attempted suicide (12.4% vs. 6.6%; P = 0.02) than national sample.Risk of depression was higher in those who perceived themselves to be over or underweight,and lower in those with more friends and attending school. Females and those with body image dissatisfactionwere more likely to have attempted suicide. Within the SCDadolescents, girls were atgreater odds of having mental health issues.

Claro, Santos and Oliveira-Campos, 2014 carried out a study on body image and extreme attitudes towardweight in Brazilian 9th Grade adolescents in public and private school. More than 38% of the adolescentsdid not consider their body image as normal. Over 15% of the adolescents referred to carry out extreme weightcontrol practices, combining practices to lose and gain weight. Adolescents who considered themselves fatpresented frequency of extreme practices for weight loss 92% higher than that shown by individuals whoconsidered themselves normal. Similarly, adolescents who considered themselves thin presented frequency ofextreme attitudes to gain weight (9.7%) higher than that shown by students who considered themselves normal(5.6%).

Santana *et al.,* 2013 conducted a cross-sectional study on the factors associated with body image dissatisfaction among 1,494 adolescentsin public schools' students in Salvador, Brazil. Body image dissatisfaction was present in19.5% of the adolescents, with a prevalence of 26.6%among the girls and 10% among the boys. Prevalence ratio (PR) of body image dissatisfaction washigher among adolescents who were overweight or obese(girls, PR: 1.38, CI: 1.09-1.73 and boys, PR: 2.26, CI:1.08-4.75), higher among those who perceived themselvesas fat (girls, PR: 2.85, CI: 2.07-3.93 and boys, PR: 3.17,CI: 1.39-7.23), and higher among those who had negativeattitudes toward eating (girls, PR: 2.42, CI: 1.91-3.08 andboys, PR: 4.67, CI: 2.85-7.63). A reduction in body imagedissatisfaction was only identified among underweightgirls (PR: 0.12, CI: 0.03-0.49).

Bibiloni*et al.,* 2013 conducted a study on body image and eating patterns amongadolescents inBaleric Island, Spain. Fifty-one percent of boys and sixty percent of girls that wished to be thinner had less than or equalto 3 meals per day. Overweight girls that wish to be thinner skipped breakfast more frequently thannormal-fat girls. Overweight boys and girls that wished a thinner body reported lower consumption of several foodgroups than normal-fat adolescents and overweight boys satisfied with their own body image (i.e. breakfast cereals,pasta, rice dishes, oils and fats, high fat foods, soft drinks and chocolates in boys; and dairy productsand chocolates in girls).A restriction of Western diet foods and energy intake was associated with a wish to bethinner among overweight adolescents. Many overweight boys were satisfied with their body image while practically all overweight girls reportedwishing a thinner body. Meal patterns and food consumption were associated with body dissatisfaction and overweight status among adolescents.

In Dublin-Ireland, Lawler and Nixon, 2009 conducted a study on body dissatisfaction among 239 adolescent boys and girls:the effects of body mass, peer appearance cultureand internalization of appearance ideals. Body mass, appearance conversationswith friends, peer appearance criticism andinternalized appearance ideals emerged as significant predictorsof body dissatisfaction. Gender moderated theeffect of body mass on body dissatisfaction. Internalizationmediated the relationship between peer appearance conversationsand criticism, and body dissatisfaction.

In USA, Bearman *et al.,* 2006 conducted a longitudinal study involving 482 adolescents on the skinny on body dissatisfaction. Body dissatisfactionshowed significant increases for girls and significant decreases for boys during early adolescence. Forboth genders, parental support deficits, negative affectivity, and self-reported dietary restraint showedsignificant relations to future increases in body dissatisfaction.Ideal body internalization and bodymass index did not demonstrate significant relations to future increases in body dissatisfaction; peersupport deficits showed a marginal relation to this outcome. Gender did not moderate these relations,despite adequate power to detect interactive effects.

Weight-based stigmatisation defined as adverse weight-related attitudes and beliefs that are manifested through stereotypes, bias, rejection and prejudice to children and teenagers because they are overweight or obese(Lawler and Nixon 2011, Heinberg *et al*. 2001).Haines and Neumark-Sztainer (2006) indicated that qualitative interviews with overweight adolescent girls showed that overweight adolescents were treated differently than their normal weight colleagues.

Menzel & Levine (2011) indicated that weight-based stigmatization has adverse weight-related attitudes and beliefs that are manifested through stereotypes, bias, rejection, and prejudice to children and adolescents because they are overweight or obese. Furthermore, stigmatization and social marginalization, overweight and obese youth are also at increased danger of weight-related teasing and intimidation (Haines & Neumark-Sztainer, 2006). The teasing of body weight has been related to body image discontent, eating disordered behaviours, low self-esteem, and adverse psychological effects such as depression and suicide (Heinberg *et al.,* 2001; Thompson,Cattarin & Fowler, 1995).

Body image is described as the subjective evaluation of an individual's own appearance (Thompson *et al.,* 2007).Individuals with body image distortion often experience disappointment with their weight and/or body form (Neumark- Sztainer *et al.,* 2006; Heinberg *etal.,* 2001). During adolescence, body dissatisfaction is prevalent. Approximately 70% of teenage girls and 45% of teenage boys want to modify their body weight or shape (Thompson and Grey1995, Thompson*et al.,* 1995).Body

dissatisfaction has been related to several unhealthy eating disordered behaviours such as dieting, skipping meals, fasting, self-induced vomiting, and the use of dietary pills or laxatives (Neumark- Sztainer *et al.,* 2006).Body dissatisfaction is also associated with low self-esteem and depression, particularly in overweight or obese youth (Heinberg *et al.,* 2001).

2.13 Knowledge of Nutrition of Adolescents

In India, Anandand Anuradha, 2019 conducted a study on the impact of nutrition education programme onknowledge, attitude and practice (KAP) about nutritionamong 1300 In-school adolescent girlsin Puttaparthi Mandal ofAnantapur District. Post intervention in the experimental group indicated asignificant ($p<0.01$) improvement in knowledge, attitude and practice (KAP) scores when comparedwith control group.

In Indonesia, Artanti and Febriana, 2019 conducted a cross-sectional study on Identification of young women (14-20 years) nutrition and reproductive health knowledge in making video on community- based learning. The level of nutrition knowledge and reproductive health waspoor. Nutrition education is required to improve nutrition knowledge and reproductive health of adolescents.

In India,Shama *et al.,* 2019 carried out community-based survey on the relationships between nutrition-related knowledge, attitude, and self-efficacy among adolescents. Significant relationships between knowledge, attitude, and self-efficacy scores were reported. Nutrition-related knowledge, attitude, and self-efficacy scores are determinants of dietary behavior and are inter-related.

Abdirahman, Chege, and Kobia, 2019 conducted a study on nutrition knowledge and dietary practices among pregnant adolescentsin Mandera County, Kenya.Majority (47.5%) having fair nutrition knowledge. The nutritionknowledge score was shown to have a significant relationship with dietary diversity score and thenumber of meals

consumed. Fair nutrition knowledge led to poor dietary practices among the adolescents.

Abd El-Kader, Mekhamier and Hegazy, 2019 conducted a cross-sectional study on dietary habits and nutritional knowledge among 300 students aged from 10-12 yearsin Fayoum Governorate. About 45% had fair knowledge while 34% had good knowledge aboutthe nutrition.Most ofthe students had unhealthy dietary habits and unhealthy appearance while around half of them had fairknowledge about nutrition.

Otuneye*et al.,* 2017 conducted a cross sectional study on the relationship between dietaryhabits and nutritional statusamong adolescents in Abujamunicipal area council ofNigeria. Food preferences was basedmainly on good taste in(35.2%), balanced diet (34.2%); and (34.8%) hadgood nutritional knowledge of abalanced diet.Poor dietary habitswere identified among the adolescents.

Ogunsile & Ogundele, 2016 conducted the effect of game-enhanced nutrition education onknowledge, attitude and practice of healthy eatingamong adolescents in Ibadan, Nigeria. Nutrition education had significant effect on adolescents' knowledge,attitude and practice of healthy eating (effect size = 36, 12.1 and 31.3%, respectively). Game-enhanced nutritioneducation is an effective method of improving adolescents' knowledge, attitude andpractice of healthy eating.

Essien*et al.,* 2014 conducted a study on assessment of nutritional status and knowledge of students from selected secondary schools in Sokoto metropolis, Sokoto State, Nigeria. Seventy-one percent performed poorly in the nutrition knowledge assessment rating. However, (5%, 12% and 12%) had excellent, very good and good nutrition knowledge, respectively. The overall performance of the female students was significantly higherthan their male counterparts. The students were deficient in knowledge and understanding of the facts about energy and nutritive values of foods.

Kakkar *et al.*, 2011 conducted a study of anaemia in adolescent school girls of Bhopal. Overall prevalence was 58.4% among adolescent schoolgirls. Prevalence of anaemia was dependent on theknowledge about prevention of anaemia, literacy level, food habits, birth order & also frequency of Iron rich source viz. green leafy vegetable & non vegetariandiet.

Research Gaps

Several studies have been conducted on nutrients intake of adolescents. There are similarities and differences in some of the studies which estimated nutrients intake with a single twenty-four-hour dietary recall using phone call to obtain the information (Roupeng, 2015 and McNaughton *et al.,* 2008). This could lead to under or overestimation of portion sizes of food consumed.

Some studies estimated nutrients intake/adequacy of adolescents with the use of food frequency questionnaire (FFQ) (Musaiger, Al-Manai & Zagzoog, 2015; Azeredo *et al.,* 2015 and Azadbakhat, Akloari & Esmillzadeh, 2014). Since FFQ did not put into consideration the quantities of food consumed, it is inappropriate for determination of nutrient adequacy of the respondents. As questionnaire on food frequency could only be used to determine the dietary pattern of the respondents.

Many studies such as used the formula for Body Mass Index [BMI= weight (kg)/Height^2 (m)] alone to determine the nutritional status of the adolescents without comparing it with any reference standards or using BMI for age (Mansur *et al.,* 2015; Caroline *et al.,* 2014; Maiti *et al.,* 2011; Carista *et al.,* 2014, Kalkan, Turkmen & Feliz, 2015 and Izuora *et al.,* 2015). Some studies used self-reported weight and height in ascertaining the nutritional status of the adolescents without assessing weight and

height (Peltzer and Pengpid, 2011). There could be misreporting of the weight and height of the respondents.

Several studies were carried out with small sample size (Nabag, 2011; Esmai & Ojofeitimi, 2015; Ahmad, Ahmed & Airede, 2013; Omuemu & Omeumu, 2010, Jildeh *et al.,* 2011; Uddin, Nag & Sil, 2015, Eke *et al.,* 2015; Choudhary *et al.,* 2015). Some of the participants were recruited from a homogenous gender population (male or female) alone. The result obtained from these studies could not be generalized for both genders in which the research was conducted.Few studies in Nigeria provided information on blood pressure of adolescents in selected states(Ejike, 2011, Ejike & Ugwu, 2010, Ejike, Ugwu & Ezeanyika, 2010). There is need to provide information on other States of the Country.

Limited studies provided information on the body composition of adolescents (Cheah *et al.,* 2015, Caroline *et al.,* 2014, Nasredine *et al.,* 2009, Klimek-Piotrowska *et al.,* 2015; Mushengezi & Chillos, 2014). They assessed WC and waist height ratio (WHtR) but had the challenges of comparing their findings with other studies because of the limited information on body composition for adolescents.

Educational, clinical and community settings studies tend to assess, treat and prevent overweight/obesity but few researches have emphasized on the strategies to avoid teasing and stigmatization associated with overweight and obesity which contribute several psychological implications involving low self-esteem and adolescent depression.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

This research was a descriptive cross-sectional study. Descriptive study interest is to obtain an estimate of the proportion that possesses or develops a particular health outcome or attributes.

3.2 Study Location

Demographics

Edo is an inland state in south-southern Nigeria. Its capital is Benin City. It is bounded in the north and east by Kogi State, in the south by Delta State and in the west by Ondo State.

Location of Edo State in Nigeria

Coordinates: 6°30′N 6°00′E

Area Total = 17,802 km2 (6,873 sq mi)

Area rank = 22nd of 36

English is the official language of the state. The major tribal languages spoken in the state are Igarra, Edo, Etsako/Afemai, Esan and Okpamheri. Edo State is home to several ethnicities, among them the Edo, Okpe, Esan, Afemai/Etsako, Ora, Akoko-Edo, Igbanke, Emai and Ijaw.

Figure 3.1: Map of Edo State.

Edo State consists of three (3) Senatorial Districts and eighteen (18) Local Government Areas (LGAs).

The Three Senatorial Districts are: Edo North, Edo Central and Edo South.

Edo North Senatorial District Consist of the following LGAs: Akoko-Edo, Etsako Central, Etsako East, Etsako West, Owan East, Owan West.

Edo Central District Consists of the following LGAs: Esan Central, Esan North-East, Esan South-East, Esan West,Igueben.

Edo South Senatorial District consist of the following LGAs: Egor, Ikpoba-Okha, Oredo, Orhionmwon, Ovia North-East, Ovia South-West, Uhunmwonde.

3.3 Study Population

The research was conducted among In-school adolescents from 10-19 years of age in selected Local Government Areas of the 3 Senatorial Districts of Edo State.

3.4 Sampling Procedure:

The Sampling Procedure is indicated below:

A three-stage sampling technique was used to select representative participants.

The First Stage: It involved random selection of 2 Local Government Area (One Urban and one Rural) from LGAs in each of the three senatorial districts (**Edo North Senatorial District**- Estako West and Owan West LGAs; **Edo Central Senatorial District**- Esan North East and Esan South East; **Edo South Senatorial District**- Oredo and Ikpoba Okha) in Edo State making 3 Urban and 3 Rural LGAs.

The Second Stage: It involved random selection of two secondary schools from each of the six selected Local Government Areas of the three senatorial districts in Edo State.

The Third Stage: It involved the random selection of male and female respondents from each class strata from the selected secondary schools.

3.5 Sample Size Determination

The minimum sample size was calculated using the statistical formula:

$N = \underline{Z^2 (p) (q)}$

d^2

Where Z is the Z score value at 95% confidence interval (CI) = 1.96

n = Minimum sample size

Z = 1.96

d = (0.05)

p = 24.5% (0.245) (Prevalence of overweight was from a study by Onyiruka, Umoru and Ibeawuchi, 2013).

q = 1-p (=0.755)

$$n = \frac{1.96^2 (0.245) (0.755)}{(0.05)^2}$$

n = 282.24

Ten percent (10.0 %) of the minimum sample size calculated using the above formula will be introduced to compensate for non-response.

Thus, 10.0% of 282.24 = 28.2

282.24+28.2 = 310.44 Approximately, 310

The sample size was approximated to 310per Senatorial Districts in Edo State making a total of 930 as the sample size.

3.5.1 Inclusion Criteria

Apparently healthy secondary school adolescents aged 10-19 years who have no systemic disease such as sickle cell anaemia and were willing to participate were included in the study.

3.5.2 Exclusion Criteria

All adolescents age 10-19 years not attending the selected secondary school including those who were not willing to participate, were excluded from the study.

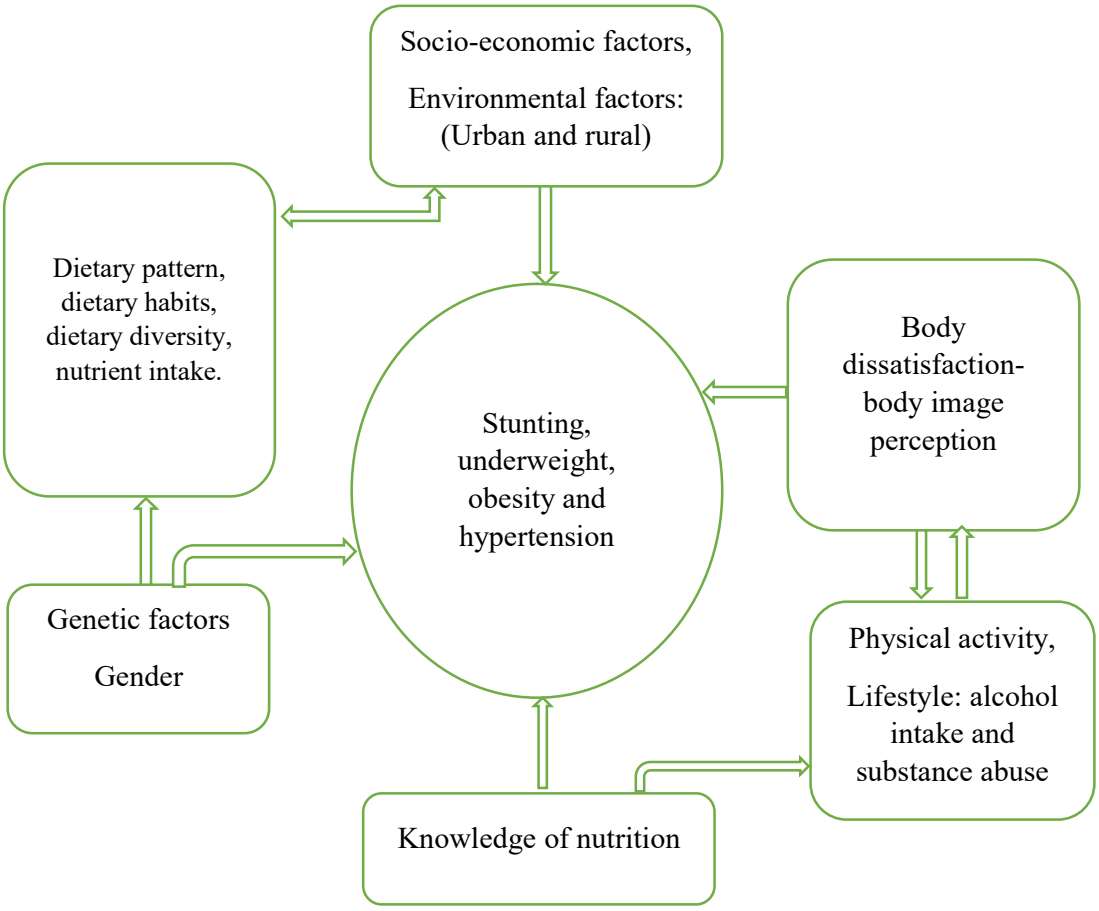


Figure 3.2: Conceptual framework for factors that could affect the health status of adolescents

3.6.1 Data collection:

A validated questionnaire was used to collect information on socio-demographic characteristics, medical history and lifestyle of the respondents.Food frequency questionnaire was used to obtain information on the dietary pattern of the respondents.Twenty-four-hour dietary recall was used to obtain information for determining the nutrient intake and dietary diversity of the respondents. Individual dietary diversity questionnaire was used to assess the dietary diversity of the respondents.Body dissatisfaction of the respondents was assessed.Nutrition knowledge of the respondents was assessed using 18 item questions which was awarded one mark each for correct answers and was classified as poor (Score ≤ 6.0), fair (Score >6.0-12.0) and good (Score >12.0).

Height (m) and weight (kg) of the respondents wasassessed using a portable stadiometer and Omron body composition monitor (BF 511) respectively. Height (H) and weight (W) were measured in metres and kilogram respectively. While WHO Anthro plus was utilized in generating body mass index for age (BMI/A) percentiles. Waist circumference (WC) was measured in centimetres mid-way between the lower rib margin and the iliac crest and classified as normal (< 75^{th} percentile), moderate (75^{th} - < 90^{th} percentile) and high (≥ 90^{th} percentile) according to the cut-off values as defined in the criteria of the Third National Health and Nutrition Examination Survey (NHANES III, 2004). Abdominal obesity was classified as moderate (WC= 75^{th} - < 90^{th} percentile) and high (WC ≥ 90^{th} percentile) (Fernandez *et al.,* 2004). The body fat (percentage) was assessed by Body Composition Monitor (BF 511) to evaluate the total body fat. The test was conducted with the student standing barefooted during the assessment.

Blood Pressure Assessment of the Respondents

Blood pressure was evaluated using a validated sphygmomanometer by a registered nurse.Blood pressure curve bladders were used for adolescents (young adults). Participants were requested to sit on a chair and rest silently at least 5 minutes before measuring blood pressure and blood pressure was evaluated on the exposed

outstretched arm. During the same visit, blood pressure was evaluated trice with a brief rest in between and the mean of three measurements was recorded. Classifications and definitions of BP levels was defined based on "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents" (National High Blood Pressure Education Program (NHBPEP) Working Group on High Blood Pressure in Children and Adolescents, 2005).

3.7 Reliability test of the questionnaire

Reliability report of the questionnaire was performed in evaluating the internal consistency of the questionnaire. The research instrument (the semi-structured questionnaire) was tested at a selected secondary school, Benin City, Edo State to ensure validity and reliability of the test instrument. Cronbach's alpha and the stability measures were computed with Pearson correlation coefficients for each section at α0.05. Cronbach's alpha values based on each sections of the questionnaires (Socio-economic characteristics= 0.68; Medical history = 0.70; Dietary habits = 0.75; Food frequency questionnaire = 0.93; Dietary diversity questionnaire = 0.71; Body Dissatisfaction questionnaire = 0.82; Knowledge of nutrition = 0.80).

Validity of the questionnaire

To ensure the validity of the test instrument (questionnaire), the original developer selected some items from existing questionnaires (Gracey *et al.,* 1996; Povey *et al.,* 1998; Turconi *et al.,* 2003) while other questions were obtained from selected literatures. The questionnaire was subjected to scrutiny by expert to select items in terms of clarity and interpretability of each items of the questionnaire.

Training of Research Assistants

Training of the research Assistants was conducted, ensuring that the data collected are valid and reliable. Data was collected by the investigator with the trained Research Assistants. Before leaving the research site, all the questionnaires were checked to ensure that they were properly filled.

3.8 Statistical analysis

WHO Anthro-plus was used to calculate BMI for age percentiles. Adapted Total Dietary Assessment Software (TDA) was used to transform food intake into nutrient

intake and adequacy classified as inadequate (<80.0%), adequate (80.0% - 120.0%) and excess (> 120.0%). Analysis were conducted using the Windows version 21.0 of the Statistical Package for Service Solution (SPSS) at α0.05. Categorical variables were displayed as numbers (n) and percentages (%), and the relationship was compared using the Chi-square test, correlation and linear regression. Mean and standard deviations (SD) was presented for normally distributed continuous variables. The principal component assessment as outlined in the multivariate assessment was used to analyse the respondents ' food consumption pattern.

3.9 Ethical Consideration

Approval to collect data was sought from the Department of Human Nutrition, UI/UCH Health and Ethical Review Committee, University of Ibadan and Ministry of Education, Edo State.

The principle of confidentiality, beneficence, non-maleficence and voluntary participation was ensured.

1. **Confidentiality of Data:**we have taken the following steps to ensure that you are safe and the following information you provide is confidential.
    - ✓ Information collected from this research project is kept confidential.
    - ✓ ·The information collected from you is stored in a file that does not have your name on it but will be assigned a number instead.
2. **Beneficence to participants:**Information on the dietary pattern, nutritional status and blood pressure level of the respondents obtained from this study will help decision makers, public health consultants to design and implement specific policies and programme that will prevent the future development of diet related non-communicable disease such as overweight/obesity and hypertension among adolescents in Edo State and Nigeria.
3. **Voluntariness:**Getting involved in this research is voluntary.
4. **Translation of Protocol to the local language:** All participants that will be required in the study are expected to be literate.
5. **Non-maleficence to participants:** Biological sample will not be obtained, although the research may cause some discomfort to the participants due to time consumption.Filling the questionnaire may take up to 45minutes.

3.10 Limitation of the study

The study used questionnaire to obtain information. Questionnaires are believed to be subject to human errors or bias. The study was conducted among in-school adolescents. Out of school adolescents and adolescents in private schools were not included.

CHAPTER FOUR

RESULT

The Socio-demographic Characteristics of the Respondents

Table 4.0 presents the demographic characteristics of the respondents. An equal proportion (33.34%) of the respondents were selected from rural and urban areas of each Senatorial Districts (Edo North, Edo Central and Edo South).

Similarly, an equal proportion (16.68%) of the respondents were selected from six of the Local Government Areas (Oredo, Ikpoba-Okha, Esan North-East, Esan South-West, Estakor West and Owan West). With respect to the schools, equal proportion (8.34%) of respondents were selected from 12 schools (Edokpolor Grammar School, Emotan College, Western Boys High School, Queen Ede College, Esan Grammar School, Our Ladies of Lords Secondary School, Obiaza Grammar School, Our Ladies of Fatima Memorial Grammar School, Jattu Grammar School, Inu Umoru Memorial Grammar School I and Inu Umoru Memorial Grammar School II). About the Class of the respondents, an equal proportion (16.68%) of respondents were selected from each class strata (JSS1, JSS2, JSS3, SS1, SS2 and SS3). Equal proportion (50.0%) of male and female respondents were selected for the study. The age of the respondents ranged from 10-19 years with a mean age of 14.5±1.9 years. About 50.6% of the respondents within the ages of 10-14 years and 49.4% within the ages of 15-19 years. A high proportion (77.2%) of the respondents were ethnic minority (Edo, Esan, Urhobo, Isoko etc.) while only a few (1.6%, 4.4% and 16.7%) were from Hausa, Yoruba and Ibo, respectively. Majority (80.1%) were Christians.

Table 4.0: Socio-demographic Characteristics of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)
Senatorial District			
Edo North	240 (33.34)	240 (33.34)	480 (33.34)
Edo Central	240 (33.34)	240 (33.34)	480 (33.34)
Edo South	240 (33.34)	240 (33.34)	480 (33.34)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
Local Government Area			
Oredo	240 (33.34)	0 (0.00)	240 (16.68)
Ikpoba-Okha	0 (0.00)	240 (33.34)	240 (16.68)
Esan North East	240 (33.34)	0 (0.00)	240 (16.68)
Esan South East	0 (0.00)	240 (33.34)	240 (16.68)
Estakor West	240 (33.34)	0 (0.00)	240 (16.68)
Owan East	0 (0.00)	240 (33.34)	240 (16.68)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
School			
Edokpolor Grammar school	120 (16.68)	0 (0.00)	120 (8.34)
Emotan College	120 (16.68)	0 (0.00)	120 (8.34)
Western Boys High School	0 (0.00)	120 (16.68)	120 (8.34)
Queen Ede College	0 (0.00)	120 (16.68)	120 (8.34)
Esan Grammar School	120 (16.68)	0 (0.00)	120 (8.34)
Our Ladies of Lords Secondary School	120 (16.68)	0 (0.00)	120 (8.34)
St. John Bosco Secondary School	0 (0.00)	120 (16.68)	120 (8.34)
Obiaza Girls Grammar School	0 (0.00)	120 (16.68)	120 (8.34)
Our Ladies of Fatima Memorial Grammar School	120 (16.68)	0 (0.00)	120 (8.34)
Jattu Grammar School	120 (16.68)	0 (0.00)	120 (8.34)
Inu-Umoru Grammar School I	0 (0.00)	120 (16.68)	120 (8.34)
Inu-Umoru Grammar School II	0 (0.00)	120 (16.68)	120 (8.34)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
Class			
JSS1	120 (16.68)	120 (16.68)	240 (16.68)
JSS2	120 (16.68)	120 (16.68)	240 (16.68)
JSS3	120 (16.68)	120 (16.68)	240 (16.68)
SS1	120 (16.68)	120 (16.68)	240 (16.68)
SS2	120 (16.68)	120 (16.68)	240 (16.68)
SS3	120 (16.68)	120 (16.68)	240 (16.68)
Total	720 (100.0)	720 (100.0)	1440 (100.0)

Table 4.0: Socio-demographic Characteristics of the Respondents Continued

Variable	Urban N (%)	Rural N (%)	Total N (%)
Sex			
Male	360 (50.0)	360 (50.0)	720 (50.0)
Female	360 (50.0)	360 (50.0)	720 (50.0)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
Age in group (years)			
10-14	356 (49.4)	372 (51.7)	728 (50.6)
15-19	364 (50.6)	348 (48.3)	712 (49.4)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
Ethnicity			
Hausa	11 (1.5)	12 (1.7)	23 (1.6)
Yoruba	38 (5.3)	26 (3.5)	64 (4.4)
Ibo	111 (15.4)	130 (18.1)	241 (16.7)
Others (Edo, Esan, Urhobo, Isoko etc)	560 (77.8)	552 (76.7)	1112 (77.3)
Total	720 (100.0)	720 (100.0)	1440 (100.0)
Religion			
Christianity	639 (88.7)	515 (71.6)	1154 (80.1)
Islam	77 (10.7)	204 (28.3)	281 (19.5)
Traditional	4 (0.6)	1 (0.1)	5 (0.4)
Total	720 (100.0)	720 (100.0)	1440 (100.0)

Table 4.1: The Socioeconomic Characteristics of the Respondents

Majority (68.2%) of the respondents were from monogamous family while about a third (31.8%) were from polygamous family. About half (52.4%) of the respondents were from a family size of more than 6 persons while 39.9% and 7.7% were from a family size of 4-6 and 3 individuals respectively the family type of the respondents from urban and rural LGAs were not significantly different ($p>0.05$).A high proportion (84.0%) of respondents' fathers had secondary and tertiary education as their highest level of education.Only a few (6.3% and 9.0%) had no formal training and primary education respectively.Similarly, (80.7%) of the respondents' mothers had either secondary or tertiary education as their most eminent form of education while (13.9%) had or primary education.Less than half (41.1%) of the respondent's father were business owners while 31.6%, 17.7% and 6.3% were civil servants, farmers and artisans respectively.

About half (51.3%) of the respondent's mother were business women. However, 15.7%, 21.5% and 7.1% were civil servants, petty tradersand farmers respectively. About a third (32.7%) of the respondent's father estimated monthly income was greater than ₦120, 000 while only a few (6.7%) had < ₦30, 000. However, about a quarter (23.6%) had no idea of the estimated monthly income of their father. About a fifth (20.6%) of the respondents' mother estimated monthly income was greater than ₦120, 000 Naira and only a few (14.0%) received less than ₦30, 000.Similarly, 19.5% had no idea of their mother estimated monthly income. Majority (71.1%) of respondents had their father as the bread winner of the family. Only 9.9% had their relatives as breadwinner. About two third(65.6%) resided with both parents while only a few (4.4%) reside with the father alone. However, 16.9% and 13.0% lived with mother alone and relatives respectively.

A great proportion (80.6%) of the respondents used electricity as a source of energy for lightning while (10.9%, 5.1% and 1.8%) used generator, lantern/candle/wick and solar energy respectively. Only a few (1.5%) used both electricity and generator as a source of energy for lighting. Majority (64.2%) lived in houses built with cement (blocks) while only a few (11.0%) lived in mud houses. Less than half (48.1%) lived in houses owned by their parents. Many (74.6%) of the respondents used water closet

(WC) as a medium for disposing their waste while 20.8% and 4.3% used the latrine (pit toilet) and bush systems respectively.

More than half (57.1%) respondents used borehole as a source of drinking water while about a quarter (29.2%) used tap water, only a few (5.3%, 2.4% and 6.0%) used well, stream and sachet/table water respectively. About a third (39.4%) used sachet/table water as a source of drinking water at school while 4.3%, 26.0% and 29.2% used well, tap and borehole respectively. Above a quarter (37.5%) of the respondents used gas as a source of cooking fuel while (2.0%, 28.0%, 29.8% and 2.7%) used electricity, kerosene, firewood and coal pot/sawdust respectively.

Generally, the socio-economic status of the parents of the adolescents was not low. Significant difference was observed between the socioeconomic variables of the urban and rural respondents ($p<0.05$) except for family type and type of housing ($p>0.05$).

The socio-economic characteristics of the adolescents in this study also revealed that majority (68.2%) of the respondents were from monogamous family with an average family size of majority (92.1%) being between 4-6 persons. The respondents' father had either secondary (44.0%) or tertiary (40.8%) education. Similarly, the respondents' mother had either secondary (48.5%) or tertiary (32.2%) education and were mostly earning more than 120,000 naira per month.

Table 4.1: Socioeconomic Characteristics of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Family type					
Monogamous	493 (68.5)	489 (67.9)	982 (68.2)	0.531	0.821
Polygamous	227 (31.5)	231 (32.1)	458 (31.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Family size					
≤ 3	60 (8.3)	51 (7.1)	111 (7.7)	8.184	0.042
4-6	276 (38.3)	299 (41.5)	575 (39.9)		
≥ 6	384 (53.4)	370 (51.4)	754 (52.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Fathers highest level of education					
No formal education	30 (4.2)	60 (8.3)	90 (6.2)	18.727	0.000
Primary	66 (9.2)	64 (8.9)	130 (9.0)		
Secondary	299 (41.5)	334 (46.4)	633 (44.0)		
Tertiary	325 (45.1)	262 (36.4)	587 (40.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Mothers highest level of education					
No formal education	21 (2.9)	56 (7.8)	77 (5.4)	25.673	0.000
Primary	97 (13.5)	103 (14.3)	200 (13.9)		
Secondary	338 (46.9)	361 (50.1)	699 (48.5)		
Tertiary	264 (36.7)	200 (27.8)	464 (32.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Fathers occupation					
Farmer	102 (14.2)	153 (21.2)	255 (17.7)	55.986	0.003
Petty trader	16 (2.2)	31 (4.3)	47 (3.3)		
Artisan	23 (3.2)	68 (9.4)	91 (6.3)		
Civil servants	254 (35.3)	201 (28.0)	455 (31.6)		
Business	325 (45.1)	267 (37.1)	592 (41.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Mothers occupation					
Farmer	33 (4.6)	69 (9.6)	102 (7.1)	22.008	0.001
Petty trader	151 (21.0)	158 (21.9)	309 (21.5)		
Artisan	25 (3.5)	38 (5.3)	63 (4.4)		
Civil servants	119 (17.8)	98 (13.6)	227 (15.7)		
Business	382 (53.1)	357 (49.6)	739 (**51.3**)		

Total	720 (100.0)	720 (100.0)	1440 (100.0)

Table 4.1: Socioeconomic Characteristics of the Respondents Continued

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Fathers estimated monthly income (₦)					
≤ 30, 000	43 (6.0)	53 (7.3)	96 (6.7)	45.455	0.000
31, 000 – 60, 000	44 (6.1)	74 (10.3)	118 (8.2)		
61, 000 – 90, 000	64 (8.9)	107 (14.9)	171 (11.8)		
91, 000 – 120, 000	103 (14.2)	143 (19.8)	246 (17.1)		
>120, 000	264 (36.7)	205 (28.5)	469 (32.6)		
I don't know	202 (28.1)	138 (19.2)	340 (23.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Mothers estimated monthly income (₦)					
≤ 30, 000	84 (11.7)	117 (16.3)	201 (14.0)	29.000	0.000
31, 000 – 60, 000	100 (13.9)	146 (20.3)	246 (17.1)		
61, 000 – 90, 000	105 (14.5)	87 (12.1)	192 (13.2)		
91, 000 – 120, 000	120 (16.7)	104 (14.4)	224 (15.6)		
>120, 000	141 (19.6)	155 (21.5)	296 (20.6)		
I don't know	170 (23.6)	111 (15.4)	281 (19.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Bread winner of the family					
Father	537 (74.6)	487 (67.6)	1024 (71.1)	32.811	0.000
Mother	144 (20.0)	129 (17.9)	273 (19.0)		
Others (Relatives)	39 (5.4)	104 (14.5)	143 (9.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Respondent live with:					
Both parents	505 (70.1)	440 (61.1)	945 (65.6)	14.668	0.005
Mother alone	106 (14.8)	138 (19.2)	244 (16.9)		
Father alone	29 (4.0)	34 (4.7)	63 (4.5)		
Relatives	80 (11.1)	108 (15.0)	188 (13.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Source of energy for lightning					
Electricity	581 (80.8)	580 (80.6)	1161 (80.6)	10.629	0.031
Generator	80 (11.1)	77 (10.7)	157 (10.9)		
Solar energy	19 (2.6)	7 (1.0)	26 (1.9)		
Others (Lantern/electricity & Generator)	40 (5.5)	56 (7.7)	96 (6.6)		

Total	720 (100.0)	720 (100.0)	1440 (100.0)

Table 4.1: Socioeconomic Characteristics of the Respondents Continued

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Housing type					
Mud	51 (7.1)	108 (15.5)	159 (11.0)	23.426	0.000
Brick	483 (67.1)	441 (60.7)	924 (**64.2**)		
Concrete	186 (25.8)	171 (23.8)	357 (24.8)		
Respondent live in a house built by your parents:					
Yes	331 (46.0)	361 (50.1)	692 (48.1)	2.504	0.114
No	389 (54.0)	359 (49.9)	748 (51.9)		
Type of toilet used at home:					
Latrine (Pit toilet)	144 (20.0)	155 (21.6)	299 (20.8)	13.941	0.003
Water closet (WC)	551 (76.5)	523 (72.6)	1074 (74.6)		
Bush	25 (3.5)	42 (5.8)	67 (4.6)		
Source of drinking water at home:					
Public Tap	193 (26.8)	228 (31.5)	421 (29.2)		
Bore hole	404 (56.1)	418 (58.1)	822 (57.1)		
Well	36 (5.0)	40 (5.6)	76 (5.3)	34.829	0.000
Stream	18 (2.5)	17 (2.4)	35 (2.4)		
Others (Sachet/Table)	69 (9.6)	17 (2.4)	86 (6.0)		
Source of drinking water at school:					
Public Tap	145 (20.1)	229 (31.8)	374 (26.0)		
Bore hole	184 (25.6)	237 (32.9)	421 (29.3)		
Well	36 (5.1)	41 (5.7)	77 (5.3)	62.671	0.000
Others (Sachet/Table)	355 (49.3)	213 (29.6)	568 (39.4)		
Source of cooking fuel:					
Electricity	17 (2.4)	12 (1.7)	29 (2.0)	40.278	0.000
Gas	309 (42.8)	231 (32.0)	540 (37.5)		
Kerosene	215 (29.9)	188 (26.1)	403 (28.0)		
Firewood	162 (22.5)	267 (37.1)	429 (29.8)		
Others (Coal pot/Saw dust etc.)	17 (2.4)	22 (3.1)	39 (2.7)		
Total	720 (100)	720 (100)	1440 (100)		

Table 4.2: Personal and Family Medical History of the Respondents

The personal and family medical history of the respondents is shown in table 4.2.Majority (93.5%) of the respondents had no prolonged or recurrent illness. More than a third (37.4%) had ever been admitted in the Hospital / Health facility. Majority (80.6%) had never measured their blood pressure before while only a few (19.4%) had theirs measured. Above a quarter (29.5%) of respondent who had their blood pressure measured, reported having a high blood pressure while the majority (70.5%) had normal blood pressure. Almost a quarter (24.7%) of respondents reported that their parents had high blood pressure. About a third (30.6%) reported the presence of hypertension in their father while hypertension was present 26.7%, 16.3% and 26.4% of both parents, mother and grandparents respectively.

The majority (79.0%) of the respondents had not been on any special medication in the past one year. A greater proportion (71.7%) had malaria as frequent ailment while 18.7%, 4.9% and 4.7% had typhoid, diarrhoea and other troubles such as eye problem respectively. Less than half (41.2%) of the respondents had their treatment in the Hospital while 26.4%, 24.2% and 8.2% received treatment in the Clinic, Home and Pharmacy/Chemist respectively. A few (8.8%) of the respondents reported heart trouble as family history of illness while 7.2%, 4.2%, 29.7%, 3.2% and 6.9% reported family history of diabetes, obesity, high blood pressure, sickle cell anaemia and eye problem respectively.

No significant difference was observed between the respondents residing in urban and rural areas with respect to their recurrent ailment, use of special medication and history of family ailment ($p>0.05$).

About a quarter of the respondents' family members had hypertension and the respondent's main health problem was malaria which was mainly treated at the hospital.

Table 4.2: Personal and Family Medical History of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Respondent had any prolong or recurrent illness:					
Yes	50 (6.9)	43 (6.0)	93 (6.5)	0.563	0.453
No	670 (93.1)	677 (94.0)	1347 (93.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Ever been admitted in hospital/ health facility					
Yes	289 (40.1)	249 (34.6)	538 (37.4)	4.748	0.029
No	431 (59.9)	471 (65.4)	902 (62.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Ever had BP measured before:					
Yes	127 (17.6)	153 (21.3)	280 (19.4)	2.0997	0.083
No	593 (82.4)	567 (78.8)	1160 (80.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Respondent had ever had high BP:					
Yes	24 (18.6)	59 (38.8)	83 (29.5)	13.695[a]	0.000
No	104 (81.4)	93 (61.2)	197 (70.5)		
Total	128 (100.0)	152 (100.0)	280 (100.0)		
Respondent parents had high BP:					
Yes	154 (21.4)	202 (21.8)	356 (24.7)	8.597	0.003
No	566 (78.6)	518 (71.9)	1084 (75.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
If yes, Who					
Father	36 (23.4)	73 (36.1)	109 (30.6)	6.839	0.077
Mother	44 (28.6)	51 (25.2)	95 (26.7)		
Both parents	28 (18.2)	30 (14.9)	58 (16.3)		
Grand parents	46 (29.9)	48 (23.8)	94 (26.4)		
Total	154 (100.0)	202 (100.0)	356 (100.0)		
Respondents on any special medication in the last one year:					
Yes	160 (22.2)	142 (19.7)	302 (21.0)	1.358	0.244
No	560 (77.8)	578 (80.3)	1138 (79.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Common ailment of the respondent:					
Malaria	521 (72.4)	512 (71.1)	1033 (71.7)	39.874	0.000
Typhoid	105 (14.6)	164 (22.8)	269 (18.7)		
Diarrhoea	39 (5.4)	31 (4.3)	70 (4.9)		
Others (Eye problems)	55 (7.6)	13 (1.8)	68 (4.7)		
Total	720 (100.0)	720 (100.0)	720 (100.0)		

Table 4.2: Personal and Family Medical History of the Respondents Continued

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Place of treatment					
Hospital	315 (48.3)	278 (38.6)	593 (41.2)	15.400	0.002
Clinic	177 (24.6)	203 (28.2)	380 (26.4)		
Home	186 (25.8)	163 (22.6)	349 (24.2)		
Others (Pharmacy/Chemist)	42 (5.8)	76 (10.6)	118 (8.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
History of family illness:					
Obesity					
Yes	25 (3.5)	36 (5.0)	61 (4.2)	2.071	0.150
No	695 (96.5)	684 (95.0)	1379 (95.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Heart trouble					
Yes	54 (7.5)	72 (10.0)	126 (8.8)	2.818	0.093
No	666 (92.5)	648 (90.0)	1314 (91.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Diabetes					
Yes	43 (6.0)	61 (8.5)	104 (7.2)	3.358	0.067
No	677 (94.0)	659 (91.5)	1336 (92.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Hypertension					
Yes	189 (26.3)	239 (33.2)	428 (29.7)	8.311	0.004
No	531 (73.8)	481 (66.8)	1012 (70.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Sickle Cell Anaemia					
Yes	14 (1.9)	32 (4.4)	46 (3.2)	7.276	0.007
No	706 (98.1)	688 (95.6)	1394 (96.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Others (Eye problem)					
Yes	55 (7.6)	44 (6.1)	99 (6.9)	1.312	0.252
No	665 (92.4)	676 (93.9)	1341 (93.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.3 Lifestyle of the Respondents

Table 4.3 represents the lifestyle of the respondents. The majority (99.1%) reported that they were involved in regular physical activity (PA). About a half (42.4%) were involved in football while 12.7%, 33.2%, 4.2% and 7.4% were walking/matching, running, playing volley ball and jogging/rugby respectively. More than half (54.3%) had physical activity for less than an hour while 23.7%, 13.1% and 9.0% in 1-2 hours, 3-4 hours and > 4 hours per week respectively. About a half (56.0%) spent their leisure time reading story book/novel or literature while 27.6%, 10.7% and 5.8% used their leisure time for watching TV/listening to music, playing games with computers and playing cards/Ludo respectively. A greater proportion (59.4%) of the respondents spent about 2 hours on the computer / TV daily.

A high proportion (95.9%) had never smoked any tobacco product, but a few (4.1%) had smoked tobacco product. Majority (75.3%) had taken wine (Palm wine) while only a few (15.7% and 9.0%) had taken beer and hard liquor (Ogogoro) respectively. No significant difference was observed between the respondents residing in urban or rural areas concerning their engagement in regular activities, their activities during leisure time and intake of alcohol ($p>0.05$).

Majority of the adolescents reported that they were regularly taking exercise such as playing of football or running for less than 1-2 hours per week. However, the respondents mostly spend their leisure time reading story book, watching television or playing games with computer for 1-2 hours per day. Majority of the adolescents in this study were not smoking cigarette. However, half of them had ever taken wine occasionally.

Table 4.3 Lifestyle of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Respondents engaged in regular physical (PA) activities at school					
Yes	711 (98.8)	716 (99.4)	1427 (99.1)	1.914	0.164
No	9 (1.3)	4 (0.6)	13 (0.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Type of PA					
Walking	105 (14.6)	78 (10.8)	183 (12.7)	26.246	0.000
Running	223 (31.0)	255 (35.4)	478 (33.2)		
Football	295 (41.0)	316 (43.9)	611 (42.4)		
Volley Ball	23 (3.2)	38 (5.3)	61 (4.2)		
Others (specify)	74 (10.3)	33 (4.6)	107 (7.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Hours of PA/week					
< 1 hour	400 (55.6)	382 (53.1)	782 (54.3)	8.807	0.032
1-2 hours	170 (23.6)	171 (23.8)	341 (23.7)		
3-4 hours	77 (10.7)	111 (15.4)	188 (13.1)		
>4 hours	73 (10.1)	56 (7.8)	129 (9.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Activity during leisure time					
Watching TV /listening to music	219 (30.4)	178 (24.7)	397 (27.6)	6.386	0.095
Playing game with computer	74 (10.3)	80 (11.1)	154 (10.7)		
Reading story book /novel/literature	384 (53.3)	422 (58.6)	806 (56.0)		
Others	43 (6.0)	40 (5.6)	83 (5.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Hours spent on computer/ TV					
1-2 hours/day	417 (57.9)	438 (60.8)	855 (59.4)	22.832	0.000
3-4 hours/day	141 (19.6)	177 (24.6)	318 (22.1)		
5-6 hours/day	61 (8.5)	56 (7.8)	117 (8.1)		
>6 hours/day	101 (14.0)	49 (6.8)	150 (10.4)		
Total	720	720 (100.0)	1440		

	(100.0)	(100.0)	

Table 4.3: Lifestyle of the respondents (continued)

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Ever smoked cigarette or tobacco products					
Yes	11 (1.5)	48 (6.7)	59 (4.1)	24.195	0.000
No	709 (98.5)	672 (93.3)	1381 (95.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
If yes, frequency of smoking					
Daily	4 (36.4)	10 (20.8)	14 (23.7)	4.602	0.100
Occasionally	4 (36.4)	8 (16.7)	12 (20.3)		
Rarely	3 (27.3)	30 (62.5)	33 (55.9)		
Total	11 (100.0)	48 (100.0)	59 (100.0)		
Had ever taken alcohol					
Yes	334 (46.4)	353 (49.0)	687 (47.7)	1.005	0.316
No	386 (53.6)	367 (51.0)	753 (52.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
If yes, type of alcohol taken					
Beer	55 (16.4)	53 (15.0)	108 (15.7)	2.014	0.365
Wine	254 (76.1)	263 (74.5)	517 (75.3)		
Hard liquor (Ogogoro)	25 (7.5)	37 (10.5)	62 (9.0)		
Total	334 (100.0)	353 (100.0)	687 (100.0)		

Table 4.4: Frequency of Food Consumption of the Respondents:

Table 4.4 Represents Frequency of food intake of the Respondents. About a quarter (27.7%) of the respondents consumed maize either as (boiled/cooked, roasted/pop) occasionally. Only a few (18.7%) consumed Pap/Ogi/Koko occasionally. Furthermore, about a half (47.8% and 40.3%) of the respondents rarely consumes *Eko/Agidi a*nd millet respectively. While a greater proportion (71.1%, 66.9% and 62.5%) had never consumed *Tunwo mansara*, sorghum, and *Tunwo shinkafa* respectively. Less than half (42.8%) had never consumed oatmeal. In addition, less than a quarter (21.3% and 24.6%) occasionally consumed whole wheat bread and white bread respectively. Less than half (37.2% and 32.4%) of the respondents regularly consumed rice either as (boiled/cooked/fried) and biscuit respectively. Rice, white-bread and biscuits were regularly consumed by 52.3%,28.0% and 55.6% of respondents respectively.

A greater proportion (55.5%) of the respondents had never consumed *Lafun* while 32.4% rarely consumed *Fufu*. However, 24.9% and 27.4% regularly consumed Garri and yam (boiled/fried/roasted) respectively. Water yam (39.7%) and yam flour (*Amala*) (39.4%) were rarely consumed by the respondents. Although, above a quarter (27.9% and 27.4%) occasionally consumed pounded yam and yam pottage respectively. About 22.6% consumed sweet potato (cooked/fried) regularly while only a few (7.4%) consumed cocoyam (cooked/fried) on a daily base. Garri (*eba*), yam and sweet potatoes were regularly consumed by 40.7%, 40.1% and 31.0% of the respondents respectively.

Less than half (41.3%) of the respondents rarely consumed soya beans. Above a quarter (25.1% and 26.0%) occasionally consumed bean pudding (*monimoin*) and bean cake (*Akara*) respectively. Similarly, 26.4% consumed beans (boiled/cooked) regularly, but only a few (11.5%) consumed beans (boiled/cooked) daily. Only cowpea (beans) was regularly consumed by 37.9% of the respondents.

Less than half (35.1%, 37.8%, 40.9% and 40.3%) of the respondents rarely consumed peanut/groundnut (boiled/roasted); cashew, seeds and nuts; oil palm seeds and nuts; and coconut and walnuts respectively. Notwithstanding, less than a quarter (20.0% and

16.2%) consumed peanut/groundnut (boiled/roasted) and coconut and walnuts regularly respectively.

About meat, fish and poultry; more than a fourth (30.4%) of the respondents rarely consumed sheep meat (mutton) while 21.0% and 25.9% consumed cow meat (beef) and goat meat (chevron) occasionally respectively. In addition, a greater proportion (53.5%, 62.8%, 54.9% and 48.9%) had never consumed pork, duck, shrimps and crabs respectively. Although, less than half (33.2% and 33.3%) rarely consumed turkey and sardine respectively while 34.5% consumed chicken occasionally. However, more than a quarter (29.4% and 26.5%) regularly consumed crayfish and eggs respectively. Similarly, 32.0% and 16.3% consumed fish and egg daily, respectively. Beef, fish, crayfish and eggs were regularly consumed by 34.6%, 64.1%, 53.3% and 42.8% of the respondents respectively.

About milk and milk products, less than half (34.2%) of the respondents had never consumed local cheese while (37.9%, 36.3% and 30.4%) rarely consumed fresh (powdered milk), tinned (evaporated milk) and yoghurt/ice cream, respectively. Also, 26.0% had tinned (evaporated milk) occasionally.However, nearly a fourth (22.4%) consumed yoghurt/ice cream regularly while only a few (13.8%) consumed yoghurt on an everyday base.

Considering Tea, Beverages and Alcohol, about a half (40.5%) of the respondents had never consumed wine/beer while (35.5% and 35.1%) rarely consumed tea (Lipton/top) and Juice respectively. In addition, more than a fourth (28.5%) occasionally consumed beverages (Milo, Bournvita, Richchoco etc.); While nearly a quarter (20.3% and 22.6%) regularly consumed the beverages (Milo, Bournvita, Richchoco etc.) and soft drinks respectively.

Regarding fruits and vegetables, less than half (38.1%, 39.4%, 43.6%, 37.8%, 39.7% and 41.7%) of the respondents rarely consumed mangoes, pawpaw, guava, pineapple/apple, cashew and pear respectively but 36.1% of the respondents rarely consumed non-leafy green (Okra). Likewise, a quarter (26.4%, 26.3%, 25.9% and 25.7%) occasionally consumed mangoes, pineapple/apple, watermelon and carrots respectively. Although, about a quarter (23.0%, 20.0%, 19.2%, 25.6%, 24.6% and 25.4%) of the respondents consumed oranges/tangerine/lemon, pineapple/apple, watermelon, banana, plantain and tomatoes/pepper regularly respectively. In addition,

only a few (14.0%, 16.2%, 15.9% and 15.9%) of respondents consumed oranges/tangerine/lemon; banana, plantain and tomatoes/pepper daily respectively.

Regarding miscellaneous, more than a fourth (38.1%) of the respondents rarely consumed curry/thyme/magi/ginger, but exclusively a few (17.4%) had consumed curry/thyme/magi/ginger regularly.

In summary, the major staple foods were cereals and grains, roots and tubers. Rice (boiled/jollof/fried) and bread were the major cereals and grains consumed in regularly by the respondents. The major seeds and nuts consumed regularly were coconuts and walnuts. Beef, goatmeat, shrimps and crayfish were the main source of animal protein which was consumed occasionally or regularly by the respondents. Beverages (Milo, Bournvita, Tea) were consumed occasionally by the respondents. However, some soft drinks were consumed more frequently than other beverages. Fruits and vegetables were consumed occasionally. The main fruits consumed were pineapple, watermelon and banana

Table 4.4: Frequency of Food Consumption of the Respondents per week

Food Groups	Never 0x (1)	Rarely 1x (2)	Occasionally 2-3x(3)	Regularly 4-6x (4)	Daily 7x
A. Cereals & Grains					
Ogi/Pap/Koko	410 (28.5)	664 (46.1)	269 (18.7)	68 (4.7)	29 (2.0)
Eko/Agidi	538 (37.4)	680 (47.2)	179 (12.4)	32 (2.2)	11 (0.8)
Tunwo masara	1032 (71.7)	273 (19.0)	79 (5.5)	38 (2.6)	18 (1.3)
Maize grain (Cooked/roasted/pop)	230 (16.0)	605 (42.0)	399 (27.7)	135 (9.4)	71 (4.9)
Sorghum	963 (66.9)	332 (23.1)	99 (6.9)	25 (1.7)	21 (1.5)
Millet	570 (39.6)	581 (40.3)	187 (13.0)	69 (4.8)	33 (2.3)
Oat meal	616 (42.8)	416 (28.9)	251 (17.4)	106 (7.4)	51 (3.5)
Rice (cooked/fried/jollof)	116 (8.1)	291 (20.2)	280 (19.4)	536 (37.2)	217 (15.1)
Tunwo shinkafa	900 (62.5)	288 (20.0)	106 (7.4)	107 (7.4)	39 (2.7)
Whole wheat bread	298 (20.7)	574 (39.9)	307 (21.3)	171 (11.9)	90 (6.3)
White bread	204 (14.2)	479 (33.3)	354 (24.6)	246 (17.1)	157 (10.9)
Biscuits	79 (5.5)	298 (20.7)	263 (18.3)	467 (32.4)	333 (23.1)
B. Roots & Tubers					
Garri	187 (13.0)	396 (27.5)	271 (18.8)	358 (24.9)	228 (15.8)
Lafun	799 (55.5)	296 (20.6)	173 (12.0)	106 (7.4)	66 (4.6)
Fufu	247 (17.2)	466 (32.4)	347 (24.1)	279 (19.4)	101 (7.0)
Yam (Roasted/Boiled/fried)	133 (9.2)	396 (27.5)	333 (23.1)	395 (27.4)	183 (12.7)
Water yam	294 (20.4)	572 (39.7)	259 (18.0)	204 (14.2)	111 (7.7)
Yam flour (Amala)	362 (25.1)	567 (39.4)	301 (20.9)	131 (9.1)	79 (5.5)
Pounded Yam	179 (12.4)	496 (34.4)	402 (27.9)	252 (17.5)	111 (7.7)
Yam pottage	167 (11.6)	501 (34.8)	395 (27.4)	269 (18.7)	108 (7.5)
Cocoyam (Cooked/fried)	225 (15.6)	574 (39.9)	313 (21.7)	222 (15.4)	106 (7.4)
Sweet potatoes (cooked/fried)	131 (9.1)	517 (35.9)	345 (24.0)	325 (22.6)	122 (8.5)
C. Legume					
Beans (Cooked/Boiled)	91 (6.3)	423 (29.4)	380 (26.4)	381 (26.4)	165 (11.5)
Bean pudding (Moinmoin)	250 (17.4)	528 (36.7)	361 (25.1)	214 (14.9)	87 (6.0)
Bean cake (Akara)	209 (14.5)	522 (36.3)	375 (26.0)	220 (15.3)	114 (7.9)
Soya beans	390 (27.1)	594 (41.3)	216 (15.0)	160 (11.1)	80 (5.6)
D. Nuts & Seeds					
Peanut/groundnut (Boiled/Roasted)	209 (14.5)	505 (35.1)	294 (20.4)	288 (20.0)	144 (10.0)
Cashew seeds and nuts	360 (25.0)	545 (37.8)	305 (21.2)	144 (10.0)	86 (6.0)
Oil palm seeds and nuts	342 (23.8)	589 (40.9)	291 (20.2)	143 (9.9)	75 (5.2)
Coconuts/ walnut	253 (17.6)	581 (40.3)	289 (20.1)	233 (16.2)	84 (5.8)
E. Meat, fish and poultry					
Beef	222 (15.4)	418 (29.0)	302 (21.0)	283 (19.7)	215 (14.9)
Goat meat	186 (12.9)	505 (35.1)	373 (25.9)	214 (14.9)	162 (11.3)

Sheep meat	470 (32.6)	489 (34.0)	256 (17.8)	137 (9.5)	88 (6.1)

Table 4.4: Frequency of Food Consumption of the Respondents per week Continued

Food Groups	Never 0x (1)	Rarely 1x (2)	Occasionally 2-3x (3)	Regularly 4-6x (4)	Daily 7x
Pork	770 (53.5)	394 (27.4)	179 (12.4)	41 (2.8)	56 (3.9)
Chicken	78 (5.4)	467 (32.4)	497 (34.5)	252 (17.5)	146 (10.1)
Turkey	225 (15.6)	478 (33.2)	412 (28.6)	215 (14.9)	110 (7.6)
Duck	905 (62.8)	302 (21.0)	123 (8.5)	57 (4.0)	53 (3.7)
Fish	62 (4.3)	269 (18.7)	186 (12.9)	462 (32.1)	461 (32.0)
Cray fish	151 (10.5)	281 (19.5)	241 (16.7)	423 (29.4)	344 (23.9)
Shrimps	791 (54.9)	306 (21.3)	177 (12.3)	106 (7.4)	60 (4.2)
Crabs	704 (48.9)	382 (26.5)	212 (14.7)	95 (6.6)	47 (3.3)
Sardine	394 (27.4)	480 (33.3)	298 (20.7)	170 (11.8)	98 (6.8)
Egg	76 (5.3)	384 (26.7)	364 (25.3)	382 (26.5)	234 (16.3)
F. Milk and milk products					
Fresh Milk (Powered)	209 (14.5)	546 (37.9)	319 (22.2)	221 (15.3)	145 (10.1)
Tinned milk (Liquid)	253 (17.6)	523 (36.3)	374 (26.0)	195 (13.5)	95 (6.6)
Local Cheese	493 (34.2)	474 (32.9)	252 (17.5)	153 (10.6)	68 (4.7)
Yoghurt /Ice cream	127 (8.8)	438 (30.4)	354 (24.6)	322 (22.4)	199 (13.8)
G. Tea and Beverages/ Alcohol					
Tea (lipton, top, etc)	162 (11.3)	508 (35.5)	355 (24.7)	263 (18.3)	152 (10.6)
Beverages (Milo, bournvita, richoco etc)	215 (14.9)	433 (30.1)	372 (28.5)	293 (20.3)	127 (8.8)
Beer /wine	583 (40.5)	435 (30.2)	253 (17.6)	123 (8.5)	46 (3.2)
Juice	133 (9.2)	506 (35.1)	420 (29.2)	255 (17.7)	126 (8.8)
Soft drinks	75 (5.2)	486 (33.8)	383 (26.6)	326 (22.6)	170 (11.8)
H. Fruits & Vegetables					
Orange/tangerine/lem	114 (7.9)	457 (31.7)	336 (23.3)	331 (23.0)	202 (14.0)
Mangoes	100 (6.9)	549 (38.1)	380 (26.4)	253 (17.6)	158 (11.0)
Pawpaw	115 (8.0)	568 (39.4)	357 (24.8)	239 (16.6)	161 (11.2)
Guava	160 (11.1)	628 (43.6)	317 (22.0)	115 (8.0)	115 (8.0)
Pineapple/apple	96 (6.7)	544 (37.8)	379 (26.3)	288 (20.0)	133 (9.2)
Water melon	153 (10.6)	504 (35.0)	373 (25.9)	277 (19.2)	133 (9.2)
Cashew	225 (15.6)	572 (39.7)	354 (24.6)	203 (14.1)	86 (6.0)
Pear	176 (12.2)	600 (41.7)	330 (22.9)	214 (14.9)	120 (8.3)
Carrot	144 (10.0)	507 (35.2)	370 (25.7)	269 (18.7)	150 (10.4)
Banana	71 (4.9)	409 (28.4)	359 (24.9)	368 (25.6)	233 (16.2)
Plantain	101 (7.0)	455 (30.9)	311 (21.6)	354 (24.6)	229 (15.9)
Leafy green (Ugwu, water)	222 (15.4)	477 (33.1)	343 (23.8)	244 (16.9)	154 (10.7)
Non-leafy green (Okro)	218 (15.1)	520 (36.1)	333 (23.1)	250 (17.4)	119 (8.3)

Tomatoes/pepper	100 (6.9)	419 (29.1)	326 (22.6)	366 (25.4)	229 (15.9)
Miscellaneous					
Curry/tyme/maggi/gin	179 (12.4)	548 (38.1)	233 (16.2)	251 (17.4)	229 (15.9)

From the tables 4.5; 4.6 and figures 4.10; 4.11, the first two principal component accounted for 19.925% and 4.794% of the variance experienced based on their initial eigenvalues of 13.350 and 3.211. The cumulative variance of the first and second principal components is 24.718%.

The pattern matrix, table and figure were used to investigate the factors or items that align together in order of magnitude. All the food items with approximately 0.5 and above drives the pattern of food consumption by the respondents in a week.

Fruits were mostly taken by the respondents as snacks. Fruits such as banana, orange/tangerine, mango, pawpaw, pineapple/apple etc.; staples- roots and tuber such as yam pottage, pounded yam, sweet potato and plantain; and meat fish and poultry-fish/crayfish, chicken and turkey accounted for 19.925% variance in the first principal component while cereals-such as tuwo shinkafa, tunwo mansara and sorghum accounted for the 4.794% of the variance in the second principal component.

In summary, fruits taken as snacks, staples-roots and tuber and meat, fish and poultry accounted for the variance in the first principal component while cereals accounted for the variance experienced in the second principal component. The consumption pattern of the respondents indicated that more of African diet – increased consumption of staples and proteins.

Table 4.5: Total Variance Explained

	Initial Eigenvalues			**Extraction of Sum of Squared loadings**			**Rotation Sums of Squared Loadings**
Component	Total	% of Variance	Cumulative %	Total	% of variance	Cumulative %	Total
1	13.350	19.925	19.925	13.350	19.925	19.925	13.111
2	3.211	4.793	24.718	3.211	4.794	24.718	4.717
3	1.970	2.941	27.659				
4	1.938	2.892	30.551				
5	1.838	2.744	33.295				
6	1.713	2.557	35.852				
7	1.550	2.314	38.116				
8	1.453	2.169	40.334				
9	1.353	2.020	42.354				
10	1.319	1.969	44.323				
11	1.243	1.855	46.178				
12	1.197	1.786	47.964				
13	1.138	1.698	49.662				
14	1.135	1.693	51.356				
15	1.062	1.586	52.941				
16	1.057	1.577	54.519				
17	1.053	1.571	56.090				
18	1.007	1.503	57.593				
19	.996	1.487	59.080				
20	.958	1.430	60.510				
21	.950	1.419	61.929				
22	.942	1.406	63.334				
23	.913	1.362	64.696				
24	.870	1.299	65.995				
25	.860	1.284	67.279				
26	.826	1.233	68.513				
27	.814	1.214	69.727				
28	.803	1.199	70.926				
29	.779	1.162	72.088				
30	.746	1.113	73.201				
31	.736	1.098	74.299				
32	.711	1.061	75.360				
33	.708	1.057	76.417				
34	.701	1.046	77.463				
35	.678	1.011	78.474				
36	.669	.999	79.474				
37	.653	.975	80.448				

38	.627	.936	81.384
39	.610	.910	82.294
40	.603	.900	83.194

Table 4.5: Total Variance Explained (Continued)

	Initial Eigenvalues			**Extraction of Sum of Squared loadings**			**Rotation Sums of Squared Loadings**
Component	Total	% of Variance	Cumulative %	Total	% of variance	Cumulative %	Total
41	.591	.882	84.076				
42	.577	.862	84.938				
43	.555	.829	85.767				
44	.554	.811	86.578				
45	.527	.787	87.365				
46	.526	.785	88.150				
47	.499	.745	88.895				
48	.491	.733	89.628				
49	.463	.692	90.320				
50	.458	.684	91.004				
51	.453	.676	91.680				
52	.452	.645	92.325				
53	.417	.623	92.948				
54	.414	.618	93.566				
55	.407	.608	94.173				
56	.392	.585	94.758				
57	.375	.560	95.318				
58	.372	.555	95.878				
59	.361	.539	96.413				
60	.345	.515	96.928				
61	.335	.500	97.428				
62	.320	.477	97.905				
63	.306	.457	98.362				
64	.296	.442	98.804				
65	.280	.419	99.223				
66	.271	.404	99.627				
67	.250	.373	100.000				

Extraction method: Principal Component Analysis

a. when components are correlated, sums of squared loadings cannot be added to obtain a total variance.

b. **KMO and Bartlett's Test:**Kaiser-Meyer-Olkin Measure of Sampling Adequacy =0.910; Bartlett's Test of Spericity Approx. Chi-Square = 30652.386; df= 2211; Sig.=0.000.

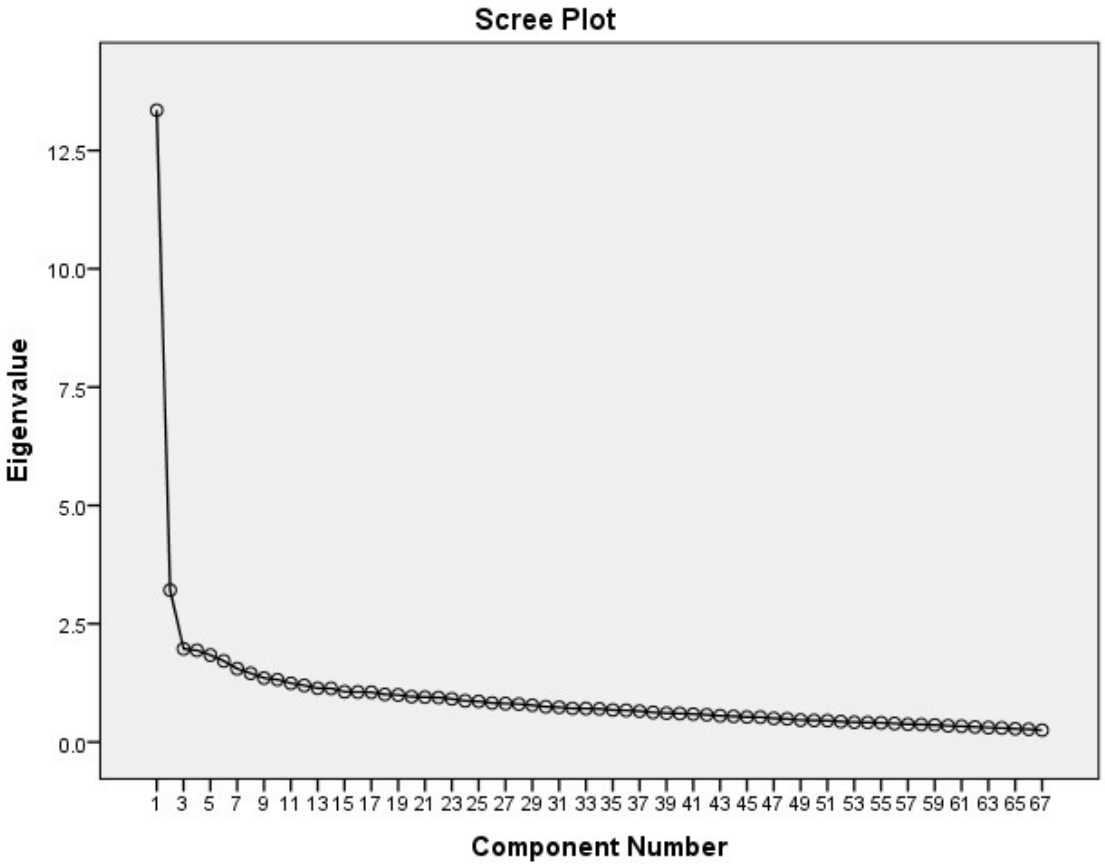


Figure 4.10: Scree plot showing the principal components.

Table 4.6: Pattern Matrix Showing First (C1) and Second (C2) components

SN	Food items	C 1	C 2	SN	Food items	C 1	C 2
1	Egg	.626	-.082	**38**	Sardine	.048	.288
2	Orange/lemon	.621	-.036	**39**	Coconut/walnut	.392	.092
3	Rice	.621	-.040	**40**	Garri /Eba	.392	-.163
4	Plantain	.618	-.174	**41**	Spices-maggi,	.386	-.142
5	Fish	.613	-.283	**42**	Cashew nuts	.371	.252
6	Beans	.602	.073	**43**	Akpu/fufu	.362	.067
7	Chicken	.586	.064	**44**	Okro	.360	-.037
8	Crayfish	.581	.064	**45**	Maize grains	.334	.101
9	Mangoes	.581	.027	**46**	Water yam	.321	.209
10	Yam	.578	.158	**47**	Leafy green	.304	.035
11	Soft drinks	.567	-.068	**48**	White bread	.267	.126
12	Tomato/Pepper	.564	-.229	**49**	Wheat bread	.216	.181
13	Pawpaw	.562	.068	**50**	Pap /Ogi	.199	.060
14	Pineapple/Apple	.559	.021	**51**	Tunwo shinkafa	-.113	.549
15	Beverages	.554	-.113	**52**	Duck	-.068	.545
16	Banana	.550	.129	**53**	Tunwo mansara	-.106	.498
17	Watermelon	.550	-.122	**54**	Sorghum	-.157	.479
18	Ice cream	.550	.032	**55**	Crabs	.146	.455
19	Carrot	.548	-.230	**56**	Lafun	-.044	.445
20	Potatoes	.547	.040	**57**	Shrimps	.085	.426
21	Fruit juice	.541	.150	**58**	Oatmeal	.048	.367
22	Guava	.536	-.347	**59**	Mutton	.223	.346
23	Tea	.532	-.049	**60**	Millet	.164	.339
24	Milk -powdered	.510	.061	**61**	Pork	.129	.336
25	Biscuit	.495	-.270	**62**	Amala	.184	.326
26	Pear	.492	.159	**63**	Beer/Wine	.206	.287
27	Cashew	.486	.224	**64**	Soya beans	.258	.282
28	Yam pottage	.482	.108	**65**	Palm nuts	.241	.273
29	Turkey	.471	.225	**66**	Local cheese	.246	.250
30	Groundnut	.466	-.026	**67**	Agidi /Eko	.092	.138
31	Chevon	.464	.140				
32	Pounded yam	.458	.077				
33	Akara	.453	.075				
34	Cocoyam	.449	.221				
35	Milk- liquid	.438	.102				
36	Beef	.433	.023				
37	Moinmoin	.427	.043				

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 8 iterations.

b. **Component Correlation Matrix:** Component (1= 1.000, 0.239; 2= 0.239, 1.000). Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.

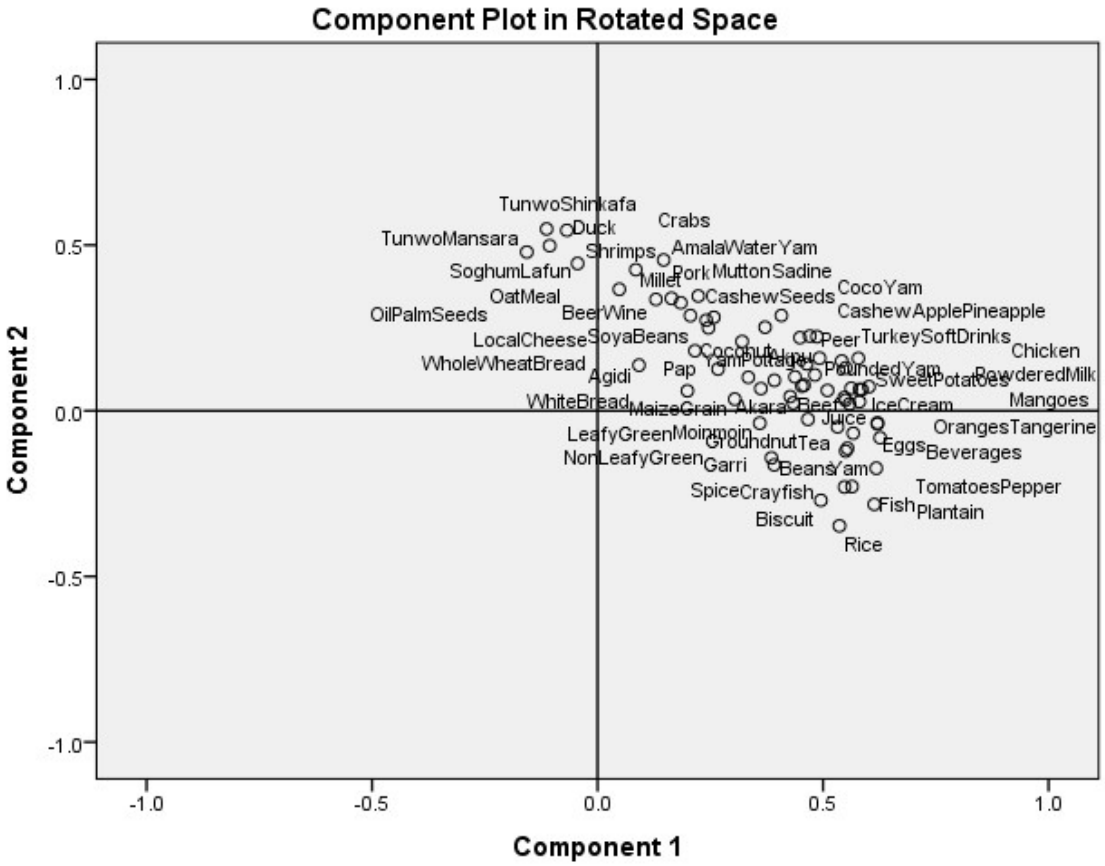


Figure 4.11: Food items based on the first two principal components.

Table 4.7: The Dietary (Food) habit of the respondents.

The dietary (food) habits of the respondents are shown in table 4.7. Majority (64.5%) of the respondents reported consuming breakfast always while (7.4%, 27.6% and 0.4%) consumed breakfast often, sometimes and never respectively. Most (95.3%) of the respondents' food were mostly prepared at home, but only a few (4.7%) bought food from food vendors. Many (78.1%) of respondents consumed three meals per day. However, less than a quarter (21.9%) consumed less than three meals per day. Almost a half (48.7%) of those who skipped meal skipped lunch while (42.1% and 9.2%) skipped breakfast and dinner respectively.A greater proportion (62.1%) gave the reason for skipping meals as lifestyle, while (22.7%) admitted that their parents could not afford it, but only a few (15.1%) said that they were not hungry. Many (39.4%) mostly skipped dinner while (34.3% and 26.3%) mostly skip breakfast and lunch respectively.

Most (63.7%) of the respondents sometimes consume snacks between meals while (12.1% and 9.9%) often and always consume snacks between meals respectively. Yet, just a few (14.3%) never eat snacks between meals. More than half (57.7%) of the respondents do consume fast food sometimes while (14.4% and 10.4%) always and often consume fast food respectively. Less than half (44.6%) of the respondents consume salty food sometimes while (15.4% and 9.2%) consume salty food always and often respectively. Many (51.3%) of the respondents sometimes reported consuming chips. However, about a quarter (21.9% and 13.4%) consumed chips often and always respectively. Less than half (39.7%) consumed coffee sometimes while quite a few (12.0% and 9.5%) consume coffee always and often respectively. No significant difference was observed between eating of breakfast, eating of three meals among the rural and urban adolescents.

Less than half (44.1%) of respondents consume tea sometimes while more than a fourth (27.9%) consume tea always. A quarter (25.5%) of the respondents admitted consumption of soft drink thrice daily while 20.7% reported the addition of extra sugar in food. Similarly, more than a quarter (30.9%) admitted addition of extra salt to food. More than half (55.0%) consume fruits sometimes. Yet, less than a quarter (15.6% and 18.0%) had fruits always and often respectively. Many (55.8) reported that vegetable is sometimes present in their daily meal while less than a quarter (24.2% and 15.8%) had

vegetable in daily meals respectively. More than a quarter (38.9% and 38.5%) of respondents reported that their diet is different daily and different sometimes in a week respectively.

Few (5.3%) reported that their diet is only different at weekend while 17.3% acknowledged that their diet is almost the same every day.More than a fourth (36.0%) reported that their bite is based on biscuit/cracker/bread while 29.3% was based on fruit/fruit juice/milk/yogurt.Just a few (17.8%, 5.6% and 11.4%) snack is based on a plantain chip/popcorn/peanut; soft drink/coffee drink and cake respectively.Many (66.2%) reported using up of a glass of milk/cup of yoghurt daily, sometimes while 11.9% consumed it always daily. Most (81.9%) reported taking water in between meals while 14.2% had a soft drink. However, only a few (3.9%) had fruit/juice in between meals. Less than half (41.6%) of the respondents reported consuming 3-4 sachet of water per day while 31.3% consumed > 4 sachet of water per day. Many (65.8%) of the respondents reported consumption of food supplements.About half (41.1%) of respondent took a nutrient supplement daily while only a few (15.0%) took a nutrient supplement more than twice weekly.

Table 4.7: The dietary (food) habit of the respondents.

Variable	Urban	Rural	Total	X^2	P-value
	N (%)	N (%)	N (%)		
Frequency of eating breakfast:					
Always	448 (62.2)	481 (66.8)	929 (64.5)	6.093	0.107
Often	51 (7.1)	56 (7.8)	107 (7.4)		
Sometimes	219 (30.4)	179 (24.9)	398 (27.6)		
Never	2 (0.3)	4 (0.6)	6 (0.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Source of food of respondents:					
Food prepared at home	678 (94.2)	695 (96.5)	1373 (95.3)	4.524[a]	0.033
Food bought from food vendors	42 (5.8)	25 (3.5)	67 (4.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Respondents ate three meals per day					
Yes	549 (76.3)	575 (79.9)	1124 (78.1)	2.741[a]	0.098
No	171 (23.8)	145 (20.1)	316 (21.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
If no, meal mostly skipped					
Breakfast	75 (43.9)	58 (40.0)	133 (42.1)	4.261[a]	0.119
Lunch	76 (44.4)	78 (53.8)	154 (48.7)		
Dinner	20 (11.7)	9 (6.2)	29 (9.2)		
Total	171 (100.0)	145 (100.0)	316 (100.0)		
Reason for skipping meal					
My parents could not afford it	28 (16.4)	44 (30.1)	72 (22.7)	10.180[a]	0.006
That is my lifestyle	119 (69.6)	77 (53.4)	196 (62.1)		
Others (Not hungry)	24 (14.0)	24 (16.4)	48 (15.1)		
Total	171 (100.0)	145 (100.0)	316 (100.0)		
Meal mostly taken					
Breakfast	248 (34.4)	246 (34.2)	494 (34.3)	1.111[a]	0.574
Lunch	197 (27.4)	182 (25.3)	379 (26.3)		
Dinner	275 (38.2)	292 (40.6)	567 (39.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.7: The dietary (food) habit of the respondents (continued)

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Pattern of taking snacks between meals					
Always	89 (12.4)	85 (11.8)	174 (12.1)	4.026[a]	0.259
Often	68 (9.4)	75 (10.4)	143 (9.9)		
Sometimes	472 (65.6)	445 (61.8)	917 (63.7)		
Never	91 (12.6)	115 (16.0)	206 (14.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Fast food consumption					
Always	102 (14.2)	105 (14.6)	207 (14.4)	2.934[a]	0.402
Often	68 (9.4)	82 (11.4)	150 (10.4)		
Sometimes	430 (59.7)	401 (55.7)	831 (57.7)		
Never	120 (16.7)	132 (18.3)	252 (17.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Frequency of taking coffee					
Always	80 (11.1)	93 (12.9)	173 (12.0)	6.470[a]	0.091
Often	81 (11.3)	56 (7.8)	137 (9.5)		
Sometimes	290 (40.3)	281 (39.0)	571 (39.7)		
Never	269 (37.4)	290 (40.3)	559 (38.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Frequency of taking tea					
Always	193 (26.8)	209 (29.0)	402 (27.9)	2.676[a]	0.444
Often	110 (15.3)	124 (17.2)	234 (16.3)		
Sometimes	331 (46.0)	304 (42.2)	635 (44.1)		
Never	86 (11.9)	83 (11.5)	169 (11.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.7: The dietary (food) habit of the Respondents (Continued)

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Consumption of soft drinks more than a bottle daily					
Yes	167 (23.2)	200 (27.8)	367 (25.5)	3.982[a]	0.046
No	553 (76.8)	520 (72.2)	1073 (74.5)		
Addition of sugar to food					
Yes	140 (19.4)	158 (21.9)	298 (20.7)	1.371[a]	0.242
No	580 (80.6)	562 (78.1)	1142 (79.3)		
Addition of extra salt to food					
Yes	209 (29.0)	236 (32.8)	445 (30.9)	2.371[a]	0.124
No	511 (71.0)	484 (67.2)	995 (69.1)		
Consumption up to 2 types of fruits/day					
Always	107 (14.9)	117 (16.3)	224 (15.6)	16.280[a]	0.001
Often	121 (16.8)	138 (19.2)	259 (18.0)		
Sometimes	429 (**59.6**)	363 (50.4)	792 (55.0)		
Never	63 (8.8)	102 (14.2)	165 (11.5)		
Consume vegetables in meals					
Always	155 (21.5)	194 (26.9)	349 (24.2)	6.513[a]	0.089
Often	112 (15.6)	115 (16.0)	227 (15.8)		
Sometimes	420 (**58.3**)	383 (53.2)	803 (55.8)		
Never	33 (4.6)	28 (3.9)	61 (4.2)		
How different/vary is your diet					
Different per meal	313 (43.5)	247 (34.3)	560 (38.9)	16.541[a]	0.001
Different sometimes in a week	264 (36.7)	290 (40.3)	554 (38.5)		
More different only at weekends	40 (5.6)	37 (5.1)	77 (5.3)		
Almost the same daily	103 (14.3)	146 (20.3)	249 (17.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.7: The dietary (food) habit of the Respondents(Continued).

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Type of snack is mostly taken					
Fruit/ fruit juice/ milk /yoghurt	199 (27.6)	223 (31.0)	422 (29.3)	3.519[a]	0.475
Biscuit / cracker/ bread	257 (35.7)	261 (36.3)	518 (36.0)		
Plantain chip/ popcorn/ peanut	134 (18.6)	122 (16.9)	256 (17.8)		
Soft drinks/ chocolate drinks	40 (5.6)	40 (5.6)	80 (5.6)		
Cakes	90 (12.5)	74 (10.3)	164 (11.4)		
Consumption of glass of milk/ cup of yoghurt daily					
Always	79 (11.0)	92 (12.8)	171 (11.9)	5.777[a]	0.054
Sometimes	498 (69.2)	455 (63.2)	953 (66.2)		
Never	143 (19.9)	173 (24.0)	316 (21.9)		
Drinks mostly taken between meals					
Water	585 (81.3)	595 (82.6)	1180 (81.9)	0.575[a]	0.750
Soft drinks (Cola, soda, tea etc.)	107 (14.9)	97 (13.5)	204 (14.2)		
Fruit/juice/fruit and milk shakes	28 (3.9)	28 (3.9)	56 (3.9)		
Number of sachet water intake daily					
<2	205 (28.5)	185 (25.7)	390 (27.1)	7.565[a]	0.049
3-4	274 (38.1)	325 (45.1)	599 (41.6)		
>4	241 (33.5)	210 (29.3)	451 (31.3)		
Intake of nutrient supplement					
Yes	452 (62.8)	495 (68.8)	947 (65.8)	5.703[a]	0.017
No	268 (37.2)	225 (31.3)	493 (34.2)		
If yes, how often					
Once daily	187 (41.4)	202 (40.8)	389 (41.1)	6.060[a]	0.109
Twice daily	111 (24.6)	136 (27.5)	247 (26.1)		
Twice weekly	74 (16.4)	95 (19.2)	169 (17.8)		
More than 2 times weekly	80 (17.7)	62 (12.5)	142 (15.0)		
Total	452 (100.0)	495 (100.0)	947 (100.0)		

Table 4.8: The Dietary Diversity of the Respondents

As presented in table 4.8, most (99.4%) of the respondents consumed starchy staples. Majority (65.9%) did not eat vitamin A rich fruits and vegetables. Half (50.8%) of the respondents had other fruits and vegetables while 49.2% did not eat other fruits and vegetables. High proportion (79.4%) of the respondents had meat and fish as sources of animal protein while less than a quarter did not. Many (85.4%) of the respondents did not consume dark green leafy vegetables. Similarly, majority (71.2%) of the respondents did not consume milk and milk products. In addition, more than half (60.3%) of the respondents did not consume legume, seeds and nuts.Most (90.6%) of the respondents did not consume organ meat, but only a few (9.4%) did. Also, a greater proportion (80.6%) of the respondents did not consume eggs.

Table 4.8: The Dietary Diversity of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Starchy Staples					
No	5 (0.7)	4 (0.6)	9 (0.6)	0.112a	0.738
Yes	715 (99.3)	716 (99.4)	1431 (99.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Vitamin A rich fruits and vegetables					
No	473 (65.7)	476 (66.1)	949 (65.9)	0.028[a]	0.868
Yes	247 (34.3)	244 (33.9)	491 (34.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Other fruits and vegetables					
No	361 (50.1)	347 (48.2)	708 (49.2)	0.545[a]	0.461
Yes	359 (49.9)	373 (51.8)	732 (50.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Meat and fish					
No	167 (23.2)	130 (18.1)	297 (20.6)	5.807[a]	0.016
Yes	553 (76.8)	590 (81.9)	1143 (79.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Dark green leafy-vegetables					
No	605 (84.0)	625 (86.8)	1230 (85.4)	2.230[a]	0.135
Yes	115 (16.0)	95 (13.2)	210 (14.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Milk and milk products					
No	504 (70.0)	521 (72.4)	1025 (71.2)	0.978[a]	0.323
Yes	216 (30.0)	199 (27.6)	415 (28.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Legume, seed and nuts					
No	444 (61.7)	425 (59.0)	869 (60.3)	1.048[a]	0.306
Yes	276 (38.3)	295 (41.0)	571 (39.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Organ meat					
No	655 (91.0)	650 (90.3)	1305 (90.6)	0.204[a]	0.651
Yes	65 (9.0)	70 (9.7)	135 (9.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Egg					
No	568 (78.9)	593 (82.4)	1161 (80.6)	2.778[a]	0.096
Yes	152 (21.1)	127 (17.6)	279 (19.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

In table 4.9: The dietary diversity score of the respondents ranges from one (1) to seven (7). Less than half (38.3%) had a score of four (4.0). Majority (56.6%) of the respondents had medium dietary diversity score (Score= 4-5) while 40.7%) had a low dietary diversity score (Score ≤ 3.0). Yet, just a few (2.7%) experienced a high dietary diversity score (Score ≥ 6.0).

Table 4.9: The Dietary Diversity Score of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Dietary Diversity Score					
1	8 (1.1)	4 (0.6)	12 (0.8)	8.722	0.181
2	60 (8.3)	41 (5.7)	101 (7.0)		
3	232 (32.2)	241 (33.5)	473 (32.8)		
4	260 (36.1)	292 (40.6)	552 (38.3)		
5	138 (19.2)	125 (17.4)	263 (18.3)		
6	19 (2.6)	16 (2.2)	35 (2.4)		
7	3 (0.4)	1 (0.1)	4 (0.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Dietary Diversity Score Classified					
Low Dietary Diversity (Score= 0-3)	300 (41.7)	286 (39.7)	586 (40.7)	1.417	0.491
Medium Dietary Diversity (Score = 4-5)	398 (55.3)	417 (57.9)	815 (56.6)		
High Dietary Diversity (Score ≥ 6)	22 (3.1)	17 (2.4)	39 (2.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.10: Minimum Dietary Diversity of the Respondents

The minimum dietary diversity of the respondents is shown in the table 4.10 and figure 1-5. Most (99.3% and 99.4%) of the respondents in urban and rural areas consumed grains, white root and tuber; and plantain respectively. Likewise, less than half (38.3% and 41.0%) of respondents consumed pulses (beans, peas and lentils) in urban and rural areas respectively. Similarly, (31.1% and 32.8%; 30.0% and 27.6%) of the respondents took nuts and seeds; and dairy products in urban and rural area respectively. Majority (80.6% and 86.4%) of the respondents consumed meat, fish and poultry in urban and rural areas respectively while less than a quarter (21.1% and 17.6%) consumed eggs in both urban and rural areas respectively.

Likewise, less than fourth (16.0% and 13.2%) of respondents eat dark green leafy vegetables in urban and rural areas respectively while more than a quarter (34.3% and 33.9%) of the respondents consumed vitamin A rich fruits and vegetables in urban and rural areas respectively. Although, about a half (45.4% and 48.1%) of the respondents consumed other vegetables in urban and rural areas respectively, only a few (6.7% and 6.0%) consumed other fruits in urban and rural areas respectively.

Table 4.10: Minimum Dietary Diversity of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Grains, white roots & tuber; and plantain					
No	5 (0.7)	4 (0.6)	9 (0.6)	0.112[a]	0.738
Yes	715 (99.3)	716 (99.4)	1431 (99.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Pulses (beans, peas & lentils)					
No	444 (61.7)	425 (59.0)	869 (60.3)	1.048[a]	0.306
Yes	276 (38.3)	295 (41.0)	571 (39.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Nuts & seeds					
No	496 (68.9)	484 (67.2)	980 (68.1)	0.460[a]	0.498
Yes	224 (31.1)	236 (32.8)	460 (31.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Dairy					
No	504 (70.0)	521 (72.4)	1025 (71.2)	0.978[a]	0.323
Yes	216 (30.0)	199 (27.6)	415 (28.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Meat, fish & Poultry					
No	140 (19.4)	98 (13.6)	238 (16.5)	8.879[a]	0.003
Yes	580 (80.6)	622 (86.4)	1202 (83.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Eggs					
No	568 (78.9)	593 (82.4)	1161 (80.6)	2.778[a]	0.096
Yes	152 (21.1)	127 (17.6)	279 (19.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Dark green leafy vegetables					
No	605 (84.0)	625 (68.8)	1230 (85.4)	2.230[a]	0.135
Yes	115 (16.0)	95 (13.2)	210 (14.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Other vitamin A rich fruits and vegetables					
No	473 (65.7)	476 (66.1)	949 (65.9)	0.028[a]	0.868
Yes	247 (34.3)	244 (33.9)	491 (34.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Other vegetables					
No	393 (54.6)	374 (51.9)	767 (53.3)	1.007[a]	0.316
Yes	327 (45.4)	346 (48.1)	673 (46.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Other fruits					
No	672 (93.3)	677 (94.0)	1349 (93.7)	0.293[a]	0.588
Yes	48 (6.7)	43 (6.0)	91 (6.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.11: The dietary diversity score of the respondents ranged from 1 to 7. About a half (41.2%) of the respondents had a dietary diversity score of 4, while more than a quarter (23.9% and 23.9%) of the respondents had a core 3 and 5 respectively. Although, only a few (0.1%, 4.5%, 6.7% and 0.3%) had dietary diversity score of 1, 6 and 7 respectively. More (44.0% and 24.4%) of the rural respondents had score of 4 and 5 than their urban counterpart (38.3% and 21.9%) respectively. The adolescents mean dietary diversity score of 4.04±0.98. However, there is no significant difference between the mean dietary diversity score (4.03±1.02, .06±0.94) of the respondents in urban and rural area P=0.573. Considering the mean number of fruits/vegetable groups out of the four groups, the mean fruit/vegetable group was 1.21±0.43. No significant difference was observed in the mean (1.22±0.44, 1.20±0.43) number of fruit/ vegetable group of the respondents respectively.

Regarding the minimum dietary diversity (table 4.20) of the respondents, greater proportion (69.7%) had a low minimum dietary diversity score of < 5.0 food groups while more than a quarter (30.3%) had a high dietary diversity score of ≥ 5.0 food groups.

Table 4.11:Minimum Dietary Diversity Score of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Dietary Diversity Score					
1	2 (0.3)	0 (0.0)	2 (0.1)	13.931	0.021
2	31 (4.3)	34 (4.7)	65 (4.5)		
3	193 (26.8)	151 (21.0)	344 (23.9)		
4	276 (38.3)	317 (44.0)	593 (41.2)		
5	158 (21.9)	176 (24.4)	334 (23.9)		
6	57 (7.9)	40 (5.6)	97 (6.7)		
7	3 (0.4)	2 (0.3)	5 (0.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Mean Dietary Diversity score	**N (720) Mean±SD**	**N (720) Mean±SD**	**N (1440) Mean±SD**	**T-test**	
	4.03±1.02	4.06±0.94	4.04±0.98	-0.617	0.537
Mean±SD of number of fruit/vegetable group out of 4 groups	**N (720) Mean±SD**	**N (720) Mean±SD**	**N (1440) Mean±SD**	**T-test**	
	1.22±0.44	1.20±0.43	1.21±0.43	0.851	0.395
Minimum Dietary Diversity Score Classified	**Urban N (%)**	**Rural N (%)**	**Total N (%)**	**X^2**	**P-value**
Low Dietary Diversity (Score < 5.0)	502 (69.7)	502 (69.7)	1004 (69.7)	0.000[a]	1.000
High Dietary Diversity (Score ≥ 5.0)	218 (30.3)	218 (30.3)	436 (**30.3**)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

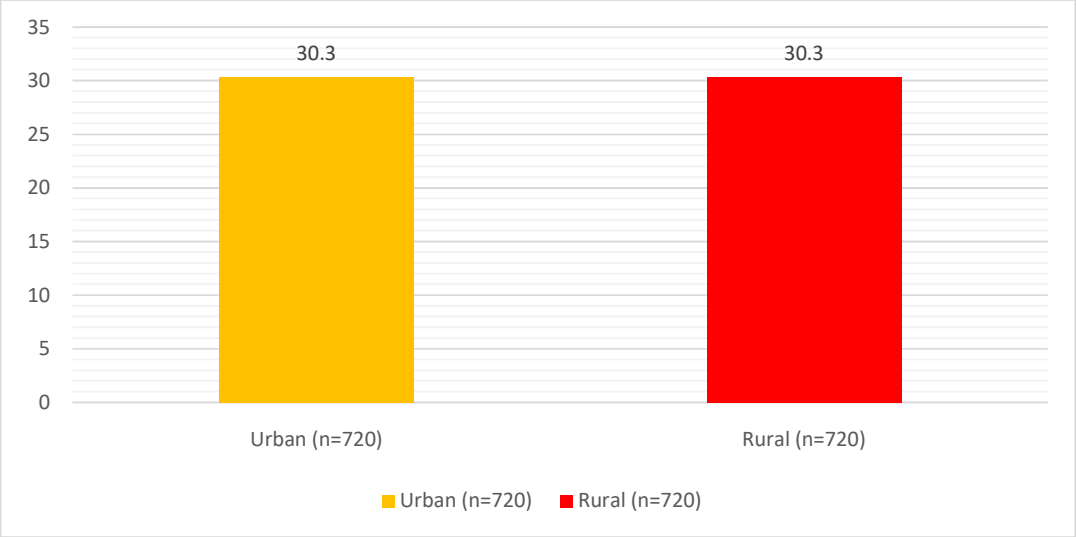


Figure 4.12: Proportion of Respondents who satisfied minimum dietary diversity (≥ 5 food groups)

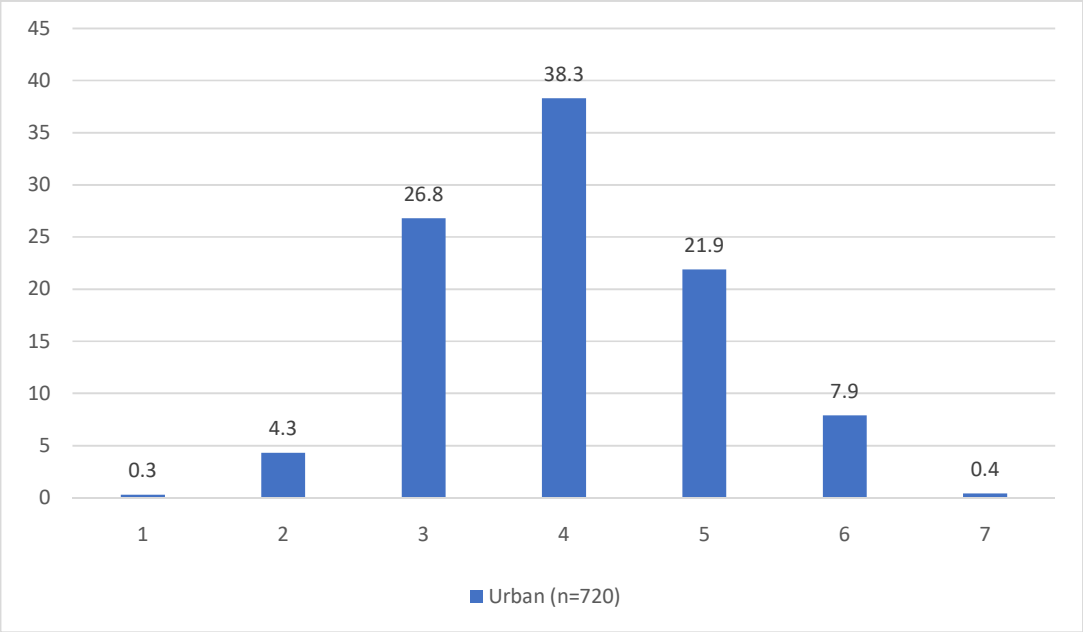


Figure 4.13a: Number of food groups consumed by the Respondents

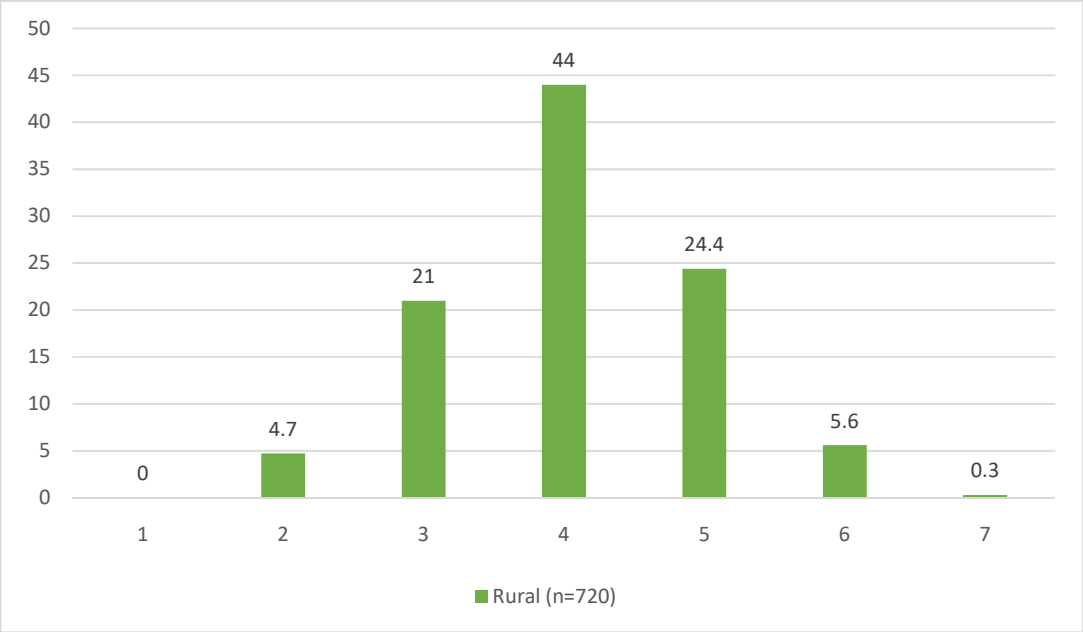


Figure 4.13b: Number of food groups consumed by the Respondents

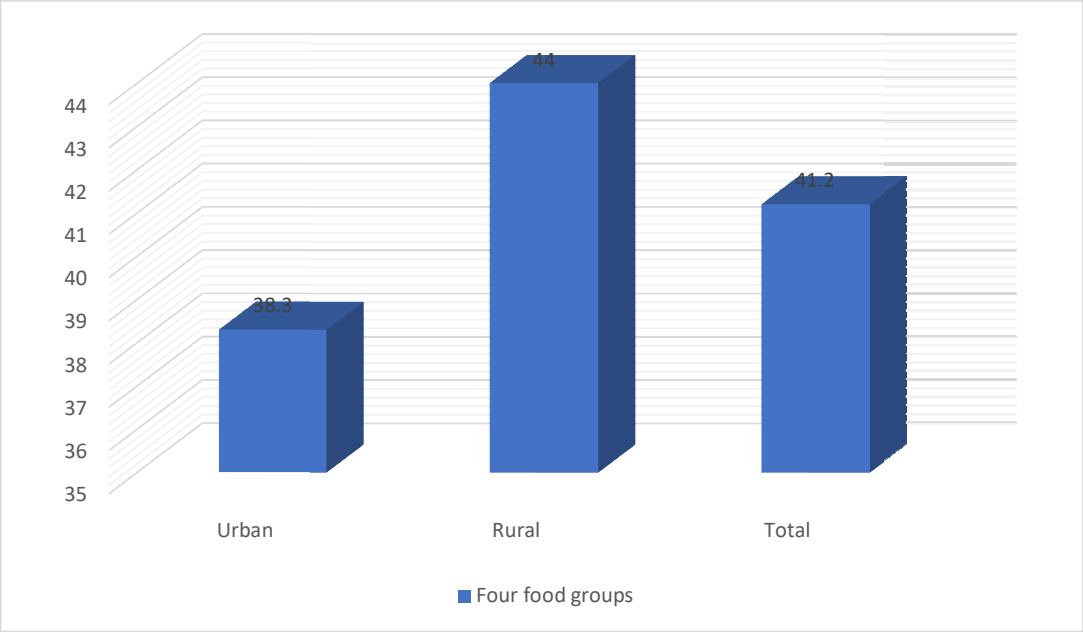
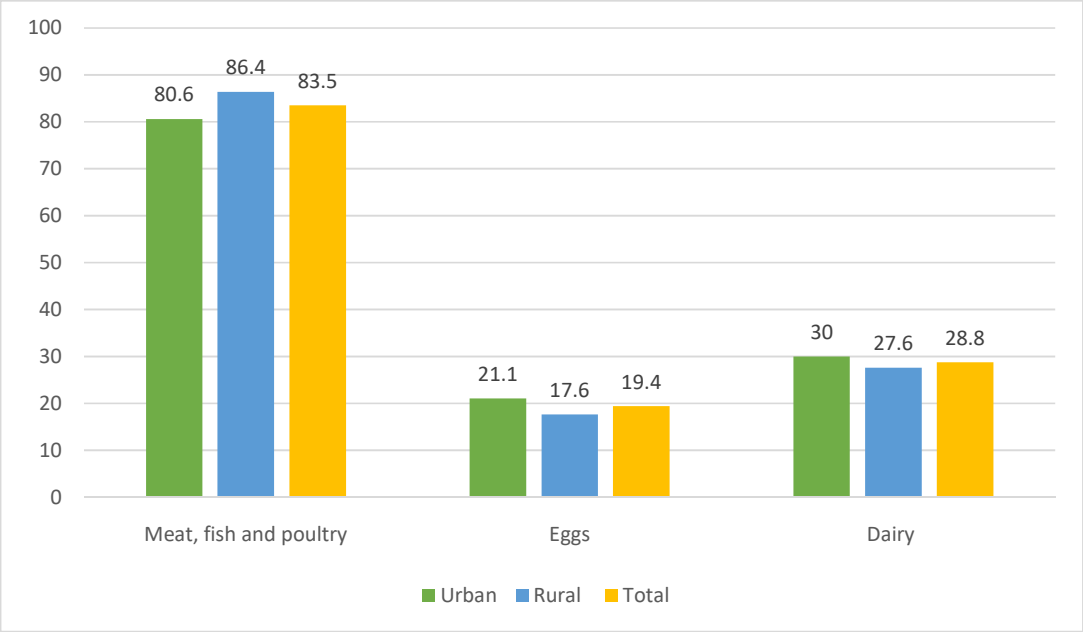
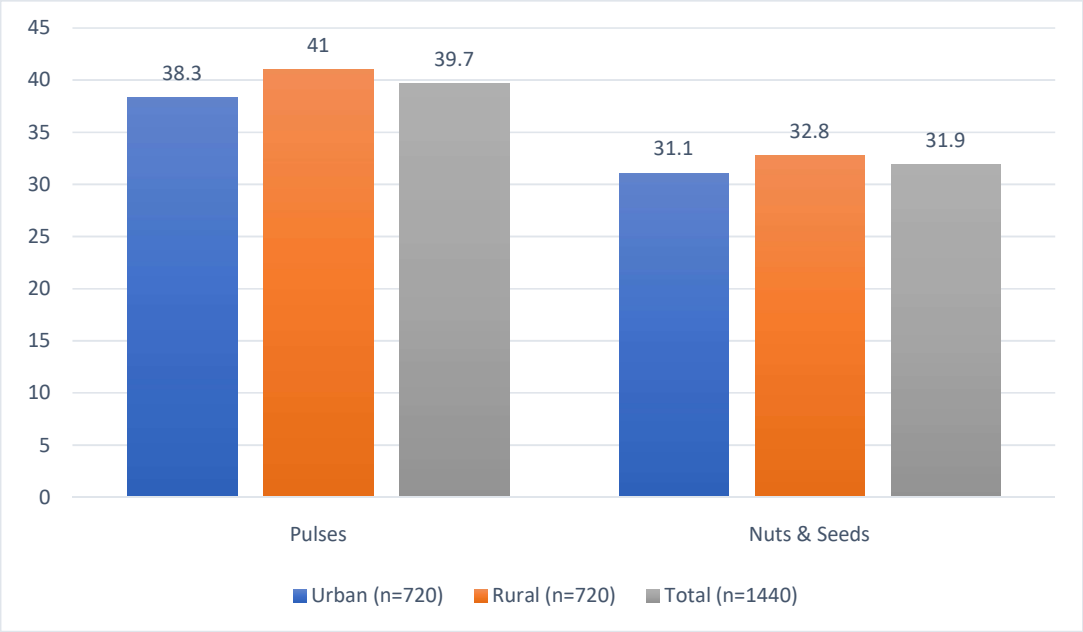


Figure 4.14. Proportion of respondents that consumed four (4) food groups

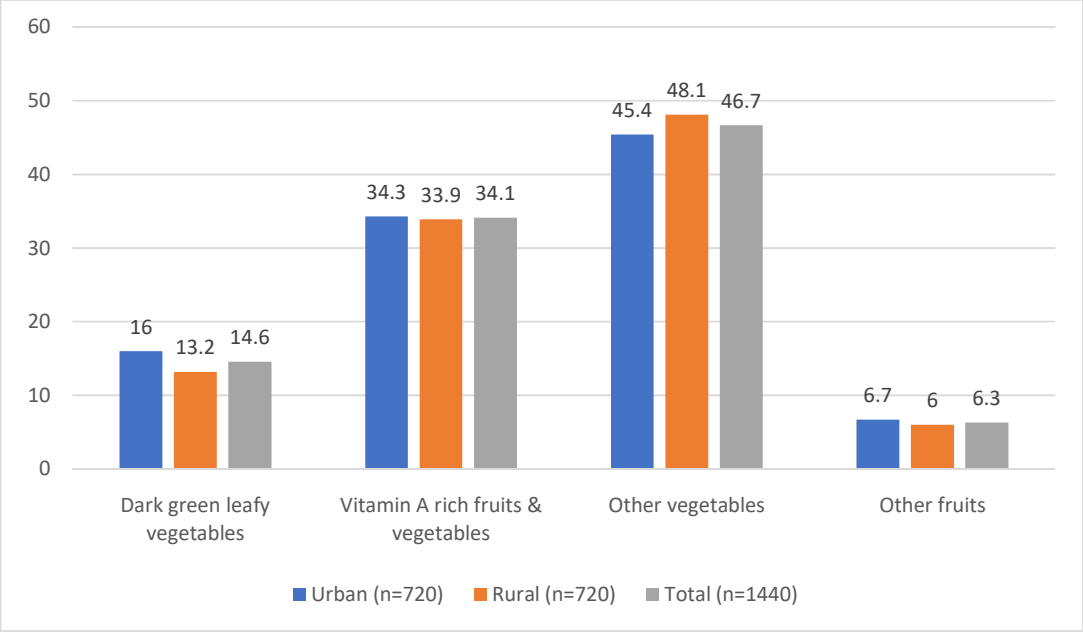


Proportion of Respondents who consumed nutrient rich food

Figure 4.15a: Animal foods sources.



4.15b. Pulses, nuts and seeds



4.15c. Fruits and vegetables

Table 4.12: Nutrient intake and Adequacy of the respondents

The energy and nutrient intake of the respondents is shown in table 4.12. Regarding calorie intake, most (89.6%) of the respondents had an adequate calorie intake while only a few (5.8% and 4.6%) had inadequate and excess calorie intake respectively.Majority (87.9%) of the respondents had adequate protein intake but only a few (5.4% and 6.7%) had inadequate and excess protein intake respectively. A greater proportion (77.1%) of the respondents had adequate carbohydrate intake while only a few (14.8% and 8.1%) had inadequate and excess carbohydrate intake respectively. Similarly, a high proportion (97.9%) of the respondents had adequate fat intake. No significant difference was observed between the energy (calorie) intake of the male and female respondents. The fibre intake of the respondents was observed to be inadequate. A higher proportion (85.6%) of males than female (82.5%) had inadequate intake of fibre. The fibre intake of male and female was significantly different ($p<0.05$).

A high proportion (74.2%) of the respondents had adequate vitamin A intake while a few (5.8% and 10.0%) had inadequate and excess vitamin A intake respectively. With regards to vitamin C, most (95.0%) of the respondents had inadequate vitamin C intake. The respondent's folate intake was mostly inadequate (69.0%). Higher proportion (70.0%) of males than female (67.9%) had inadequate intake of folate.

With respect to mineral intake, a high proportion (95.9%)of the respondents had an inadequate calcium intake. Majority (87.7%) of the respondents had the adequate sodium intake while only a few (5.4% and 6.9%) had inadequate and excess sodium intake respectively. Regarding potassium intake, the greater proportion (98.1%) of the respondents had an inadequate potassium intake. About a half (49.6%) of the respondents had an inadequate iron intake while more than one fourth (31.7%) had an adequate iron intake. High proportion of male (52.9%) compared to female (40.3%) had inadequate intake of iron. However, less than one quarter (18.8%) had the excess iron intake.

Table 4.12: Nutrient intake and Adequacy of the Respondents

Variable	Male N (%)	Female N (%)	Total N (%)	Fishers' Exact test	P-value
Calorie (Kcal)					
Inadequate	39 (5.4)	45 (6.3)	84 (5.8)	5.779	0.057
Adequate	657 (91.3)	633 (87.9)	1290 (89.6)		
Excess	24 (3.3)	42 (5.8)	66 (4.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Protein (g)					
Inadequate	24 (3.3)	54 (7.5)	78 (5.4)	18.089	0.001
Adequate	651 (90.4)	615 (85.4)	1266 (87.9)		
Excess	45(6.3)	51 (7.1)	96 (6.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Carbohydrate (g)					
Inadequate	75 (10.4)	138 (19.2)	213 (14.8)	26.224	0.000
Adequate	594 (82.5)	516 (71.7)	1110 (77.1)		
Excess	51 (7.1)	66 (9.2)	117 (8.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Total fat (g)					
Inadequate	6 (0.8)	21 (2.9)	27 (1.9)	11.325	0.002
Adequate	714 (99.2)	696 (96.7)	1410 (97.9)		
Excess	0 (0.0)	3 (0.4)	3 (0.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Dietary fibre (g)					
Inadequate	618 (85.8)	594 (82.5)	1212 (84.2)	7.537	0.023
Adequate	99 (13.8)	96 (13.3)	195 (13.5)		
Excess	3 (0.4)	30 (4.2)	33 (2.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Vitamin A (µg)					
Inadequate	42 (5.8)	42 (5.8)	84 (5.8)	34.777	0.000
Adequate	639 (88.8)	573 (79.6)	1212 (74.2)		
Excess	39 (5.4)	105 (14.6)	144 (10.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Vitamin C (mg)					
Inadequate	27 (95.0)	36 (95.0)	63 (95.0)	11.106	0.003
Adequate	684 (3.8)	684 (5.0)	1368 (4.4)		
Excess	9 (1.3)	0 (0.0)	9 (0.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.12: Nutrient intake Adequacy of the Respondents(Continued)

Variable	Male N (%)	Female N (%)	Total N (%)	Fishers' Exact test	P-value
Folate (mcg)					
Inadequate	504 (70.0)	489 (67.9)	993 (69.0)	0.764	0.687
Adequate	147 (20.4)	159 (22.1)	306 (21.3)		
Excess	69 (9.6)	72 (10.0)	141 (9.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Calcium (mg)					
Inadequate	693 (96.2)	689 (95.7)	1382 (95.9)	5.347[a]	0.052
Adequate	27 (3.8)	31 (4.3)	58 (4.1)		
Excess	0 (0.0)	0 (0.0)	0 (0.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Sodium (mg)					
Inadequate	33 (4.6)	45 (6.3)	78 (5.4)	3.001	0.227
Adequate	642 (89.2)	621 (86.3)	1263 (87.7)		
Excess	45 (6.3)	54 (7.5)	99 (6.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Potassium (mg)					
Inadequate	708 (98.3)	705 (97.9)	1413 (98.1)	0.113	0.736
Adequate	12 (1.7)	15 (2.1)	27 (1.9)		
Excess	0 (0.0)	0 (0.0)	0 (0.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Iron (mg)					
Inadequate	381 (52.9)	333 (46.3)	714 (49.6)	8.279	0.016
Adequate	204 (28.3)	252 (35.0)	456 (31.7)		
Excess	135 (18.8)	135 (18.8)	270 (18.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

4.13 Nutritional Status of the Respondents

Table 4.13 presents the nutritional status of the respondents. Very few (0.6%) of the respondents were severely stunted, 5.4% were moderately stunted, 92.0% had normal height for age while 1.9% were above normal height for their age.

In classifying the nutritional status of the respondents based on their body mass index for age, 9.9% were underweight, 70.4% had normal weight, 18.1% were overweight while 2.1% were obese. Overweight and obesity were more prevalent among the urban respondents when compared to the rural respondents. In summary, the body mass index for age of the urban and rural respondents were significantly different ($p<0.05$).

Table 4.13: Nutritional Status of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Height for age (HA)					
Severely stunted (Score < -3)	4 (0.6)	5 (0.7)	9 (0.6)	8.058	0.041
Moderately stunted (Score = -3 to -2)	27 (3.8)	51 (7.1)	78 (5.4)		
Normal (Score = -2 to +2)	675 (93.8)	650 (90.3)	1325 (92.0)		
Above normal (Score > +2)	14 (1.9)	14 (1.9)	28 (1.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Body Mass Index for Age (BMIA)					
Underweight (BMIA< -2)	69 (9.6)	60 (8.3)	129 (9.0)	21.956[a]	0.000
Normal (BMIA= -2 to 1)	484 (67.2)	530 (73.6)	1014 (70.4)		
Overweight (BMIA >1 to <2)	136 (18.9)	125 (17.4)	261 (18.1)		
Obese (BMIA>2)	31 (4.3)	5 (0.7)	36 (2.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

4.14 Body Composition of the Respondents

Table 4.14 represents the visceral fat and Waist-Height-Ratio of the respondents. The visceral fat of the respondents ranges from zero (0) to nine (9). All (100.0%) the respondents had normal visceral fat, while no respondents had high or very high visceral fat. However, the visceral fat of the rural and urban respondents was significantly different ($p<0.05$).

The classification of the waist-height ratio is also presented in table 4.40. Majority (97.8%) of the respondents had normal waist -height ratio while 2.2% had high waist -height ratio which was not significantly different between the rural and urban respondents ($p>0.05$).

Table 4.14 Visceral Fat and Waist-Height-Ratio of the respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Visceral fat					
0	659 (91.5)	670 (93.1)	1329 (92.3)	32.736	0.000
1	32 (4.4)	6 (0.8)	38 (2.6)		
2	8 (1.1)	10 (1.4)	18 (1.3)		
3	12 (1.7)	18 (2.5)	30 (2.1)		
4	2 (0.3)	10 (1.4)	12 (0.8)		
5	4 (0.6)	2 (0.3)	6 (0.4)		
6	0 (0.0)	0 (0.0)	0 (0.0)		
7	3 (0.4)	0 (0.0)	3 (0.2)		
8	0 (0.0)	0 (0.0)	0 (0.0)		
9	0 (0.0)	4 (0.6)	4 (0.3)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Visceral fat classified					
Normal (0-9)	720 (100.0)	720 (100.0)	1440 (100.0)		
High (10-14)	0 (0.0)	0 (0.0)	0 (0.0)		
Very High (>14.0)	0 (0.0)	0 (0.0)	0 (0.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Waist-Height-Ratio (WHtR)					
Normal (WHtR < 0.5)	698 (96.9)	710 (98.6)	1408 (97.8)	4.602[a]	0.032
High (WHtR >0.5)	22 (3.1)	10 (1.4)	32 (2.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

4.15 The Body Composition of the Female Respondents.

The body fat of the female respondents age 10-14 years indicated thatmore than half (58.6%) of the female respondents had normal body fat while 38.9% had low body fat. However, only a few (1.7% and 0.8%) had high and very high body fat respectively.

Among female respondents age (15-19 years), half (50.8%) had low body fat while (46.7%) of had normal body fat. Only a few (2.2% and 0.3%) had high and very high body fat respectively. The body fat of the urban and rural female respondents age 10-14 years was significantly different ($p<0.05$) while the body fat of the urban and rural female respondents (age 15-19) was not significantly different ($p>0.05$).

Waist-Hip-Ratio

The waist-hip ratio of the female respondents showed that 5.6% had normalwaist hip ratio while 65.0% and 29.4%had low health risk and high health risk respectively which is not significantly different among the urban and the rural respondents ($p>0.05$).

Waist Circumference

The waist circumference of female respondents indicated that majority (63.1%) had normal waist circumference while 32.4% and 4.6% had moderate and high health risk respectively. The waist circumference of the rural and urban respondents was significantly different ($p<0.05$).

Table 4.15:Body composition of the Female Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Body fat (10-14 years)					
Low (< 16.0%)	124 (34.4)	156 (43.3)	280 (38.9)	12.163	0.005
Normal (16.0-33.1%)	222 (61.7)	200 (55.6)	422 (58.6)		
High + (33.2-36.0%)	8 (2.2)	4 (1.1)	12 (1.7)		
Very high ++ (≥ 36.1%)	6 (1.7)	0 (0.0)	6 (0.8)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		
Body Fat (15-19 years)					
Low (< 18.5%)	177 (49.2)	189 (52.5)	366 (50.8)	5.978	0.084
Normal (18.5-33.6%)	169 (46.9)	167 (46.4)	336 (46.7)		
High + (33.7-37.9%)	12 (3.3)	4 (1.1)	16 (2.2)		
Very high ++ (≥ 38.0%)	2 (0.6)	0 (0.0)	2 (0.3)		
Total	360 (100.0)	260 (100.0)	720 (100.0)		
Waist Hip Ratio					
Normal (WHR < 0.75)	14 (3.9)	26 (7.2)	40 (5.6)	5.969	0.051
Low health risk (WHR= 0.75-0.85)	247 (68.6)	221 (61.4)	468 (65.0)		
High health risk (WHR > 0.85	99 (27.5)	113 (31.4)	212 (29.4)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		
Waist Circumference (WC)					
Normal (<75th %)	207 (57.5)	247 (68.6)	454 (63.1)	23.429	0.000
Moderate risk (75th %- < 90th %)	124 (34.4)	109 (30.3)	233 (32.4)		
High risk (> 94th %)	29 (8.1)	4 (1.1)	33 (4.6)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		

4.16 The Body Composition of the Male Respondents.

Body fat (10-14) years: More than half (63.8%) of the male respondents within the ages of 10-14 years had low body fat while more than a fourth (36.0%) had normal body fat but only a few (0.3%) had very high body fat.

Similarly, a majority (57.2%) of the respondents within the ages of 15-19 years had normal body fat while less than half (41.0%) had low body fat but only a few (1.5% and 0.3%) had high and very high body fat respectively.

Waist-Hip-Ratio

The majority (56.7%) of the male respondents had low health risk while 7.5% had high health risk. However, more than a fourth (35.8%) of the respondents had normal waist-hip-ratio.

Waist Circumference

About a half (47.5%) of the male respondents had normal waist circumference while less than half (45.8%) had moderate risk. However, only a few (6.7%) of the respondents had high risk.

The body fat of urban and rural 10-14 years as well as 15-19 years' male respondents were not significantly different ($p>0.05$). Similarly, the waist hip ratio of the urban and rural respondents was not significantly different. However, only the waist circumference was significantly different.

Table 4.16: Body Composition of the Male Respondents

Variable	Urban	Rural	Total	Fishers'	P-value

	N (%)	N (%)	N (%)	Exact test	
Body fat (10-14 years)					
Low (< 12.0%)	220 (61.1)	239 (66.4)	459 (63.8)	4.113	0.082
Normal (12.0-27.2%)	140 (38.9)	119 (33.1)	259 (36.0)		
High + (27.3.2-30.9%)	0 (0.0)	0 (0.0)	0 (0.0)		
Very high ++ (≥ 31.0%)	0 (0.0)	2 (0.6)	2 (0.3)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		
Body Fat (15-19 years)					
Low (< 9.4%)	138 (38.3)	157 (43.6)	295 (41.0)	4.152	0.210
Normal (9.4-22.7%)	217 (60.3)	195 (54.2)	412 (57.2)		
High + (22.8-26.7%)	5 (1.4)	6 (1.7)	11 (1.5)		
Very high ++ (≥ 26.8%)	0 (0.0)	2 (0.6)	2 (0.3)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		
Waist Hip Ratio					
Normal (WHR < 0.85)	125 (34.7)	133 (36.9)	258 (35.8)	0.584[a]	0.747
Low health risk (WHR= 0.85-0.95)	206 (57.2)	202 (56.1)	480 (56.7)		
High health risk (WHR > 0.95	29 (8.1)	25 (6.9)	54 (7.5)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		
Waist Circumference (WC)					
Normal (<75th %)	163 (45.3)	179 (49.7)	342 (47.5)	9.130[a]	0.010
Moderate risk (75th %- < 90th %)	163 (45.3)	167 (46.4)	330 (45.8)		
High risk (> 94th %)	34 (9.4)	14 (3.9)	48 (6.7)		
Total	360 (100.0)	360 (100.0)	720 (100.0)		

Table 4.17. Descriptive summary of the Respondents. The age of the respondents ranges from 10-19. Mean age of 14.48±1.9 years. No significant difference was observed in the mean age of respondents living in urban and rural areas respectively p=0.641. Likewise, the height of the respondents ranges from 128-190 cm with an

average height of 159±10.2 cm. Also, the weight of the respondents ranged from 25.4-87.8 kg with a mean weight of 46.83±10.7kg. About the body fat of the respondents, it ranged from 5.0-38.8% with a mean body fat of 15.07±6.7% while the waist circumference ranged from 50.8-114.30cm with a mean waist circumference of 67.32±6.6cm. The hip circumference ranged from 58.13-118.22 with a mean hip circumference of 78.32±7.6cm. The waist hip ratio of the respondents ranged from 0.60-0.89 with a mean WHR of 0.87±0.4. The waist-height-ratio of the respondents ranged from 0.32-0.71 with a mean WHtR of 0.42±0.04. With respect to the systolic blood pressure (SBP); it ranged from 74.67-163.6 mmHg with a mean SBP of 112.3±11.1 mmHg while their diastolic blood pressure (DBP) ranged from 51-95 mmHg with a mean DBP of 73.6±10.2 mmHg. In addition, the dietary diversity score of the respondents ranged from 1-7 with a mean score of 3.75±0.9.

Table 4.17. Descriptive of the Respondents

Variable	N	Range Minimum-Maximum	Urban X±SD	Rural X±SD	Total X±SD	t-test	P-value
Age (years)	1440	10-19	14.45±1.97	14.50±1.98	14.48±1.9	-0.466	0.641
Height (cm)	1440	128.0-190.0	159.99±10.1	158.93±10.13	159±10.2	1.988	0.047
Weight (Kg)	1440	25.4-87.8	47.50±10.91	46.16±10.47	46.83±10.7	2.384	0.017
Visceral Fat	1440	0.0-9.0	0.19±0.77	0.23±0.99	0.208±0.9	-0.981	0.327
Body Fat (%)	1440	5.0-38.8	15.62±6.73	14.53±6.40	15.07±6.7	3.173	0.002
Waist Circumference (cm)	1440	50.80-114.30	68.12±7.49	66.52±5.47	67.32±6.6	4.617	0.000
Hip Circumference (cm)	1440	58.13-118.22	78.68±9.27	80.05±10.28	78.38±7.9	2.643	0.008
Waist Hip Ratio	1440	0.60-0.89	0.86±0.08	0.89±0.57	0.87±0.4	-1.526	0.127
Waist Height Ratio	1440	0.32-0.71	0.43±0.04	0.42±0.03	0.42±0.04	3.870	0.000
Systolic Blood Pressure	1440	99-147	118.11±9.3	118.07±9.8	118.09±9.6	0.069	0.945
Diastolic Blood Pressure	1440	59-93	72.90±9.4	73.17±9.5	73.03±9.5	-0.541	0.589
MinimumDietary Diversity Score	1440	1-7	4.03±1.02	4.06±0.94	4.04±0.9	-0.617	0.537

Table 4.18a: Association between body composition and nutritional status (BMI/A) of the respondents

Correlation between body composition and nutritional status (BMI/A) of the respondents. Table 4.18a shows that there is a significant relationship between BMI/A and Waist Circumference ($r = 0.493$, $p<0.05$), BMI/A and Waist Height Ratio ($r = 0.450$, $p<0.05$), BMI/A and Visceral ($r = 0.190$, $p<0.05$), BMI/A and Body Fat ($r = 0.492$, $p<0.05$). There is no significant relationship between BMI/A and Waist Hip Ratio ($r = -0.050$, $p>0.05$), BMI/A and Dietary diversity ($r = -0.039$, $p>0.05$).

Table 4.18a: Correlation matrix of independent and dependent variables

	DV	X_1	X_2	X_3	X_4	X_5	X_6
DV	1.000						
X_1	.493**	1.000					
X_2	-0.050	0.041	1.000				
X_3	.450**	.764**	.060*	1.000			
X_4	.190**	.292**	-0.005	.195**	1.000		
X_5	.492**	.503**	-.062*	.561**	.086**	1.000	
X_6	-0.039	-0.021	.110**	-0.044	-0.049	-0.020	1.000
Mean	2.14	67.32	0.87	0.42	0.21	15.07	3.75
STD	0.59	6.60	0.35	0.04	0.89	6.59	0.96

KEY: DV= BMI/A

X_1= Waist Circumference; X_2= Waist Hip Ratio; X_3= Waist Height Ratio; X_4= Visceral Fat; X_5= Body Fat; X_6= Dietary diversity

Table 4.18b shows the effect of the independent variables (X_1= Waist Circumference; X_2= Waist Hip Ratio; X_3= Waist Height Ratio; X_4= Visceral Fat; X_5= Body Fat; X_6= Dietary diversity) on dietary pattern of the respondents. The multiple regression yielded a coefficient of F= 15.247, R= 0.245, R^2= 0.060 and adjusted R^2= 0.056 which accounted for 5.6% of the total variation in the respondents' dietary pattern. This indicated that the joint contribution of the independent variables was significant and other variables not included in the model could have accounted for the remaining variance.

The table also revealed that "body fat" was the most significant predictor of dietary pattern (β= 0.316, t= 11.864, $p<0.05$) followed by "waist-circumference" (β= 0.310, t= 7.983, $p<0.05$), "visceral fat" (β= 0.071, t= 3.136, $p<0.05$), "dietary diversity" (β= -0.041, t= -1.895, $p<0.05$) and "waist-hip-ratio" (β= -0.043, t= -1.939, $p<0.05$).

Table 4.18b: Regression model summary of independent and dependent variables and relative contribution of the independent variables to predict the dependent variable.

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	
1	.575[a]	.331	.328	.486	
Source of Variance	Sum of Squares	df	Mean square	F	Sig.
Regression	167.029	6	27.838	117.999	.000[b]
Residual	338.071	1433	0.236		
Total	505.100	1439			
Variables	Regression weight B	Std error	Standard. Coef. (β)	t-value	Sig.
(Constant)	-.220	.184		-1.195	.232
Waist Circumference	.028	.003	.310	7.983	.000*
Waist Hip Ratio	-.071	.037	-.043	-1.939	.053*
Waist Height Ratio	.824	.597	.049	1.380	.168
Visceral Fat	.048	.015	.071	3.136	.002*
Body Fat	.028	.002	.316	11.864	.000*
Dietary diversity	-.045	.024	-.041	-.1.895	.051*

Table 4.19: Blood Pressure of the Respondents

The blood pressure of the respondents is presented in Table 4.19. Only 54.0% of the respondents had normal blood pressure, 34.1% of the respondents had pre-hypertension while 11.9% had hypertension stage 1.

Table 4.19: Blood Pressure of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Blood Pressure					
Normal (<90th %)	392 (54.4)	368 (53.6)	778 (54.0)	4.853[a]	0.088
Pre-hypertension (>90th % ≤ 95th %)	231 (32.1)	260 (36.1)	491 (34.1)		
Hypertension Stage 1 (>95th % ≤ 99th %)	97 (13.5)	74 (10.3)	171 (11.9)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.20: The Body Dissatisfaction of the Respondents.

The body dissatisfaction of the male and female respondents is presented in table 4.20. Less than half (39.0%) of the respondents reported they had been sometimes worried about their body shape and felt the need to diet. However, more females (11.4%) than males (9.2%) had always been worried about their body shape and felt they need to diet. Similarly, more females (33.9%) than males (32.4%) reported that they sometimes noticed the shape of other adolescents and felt their body shape compared unfavourably to that of other adolescents. More females (21.9%) than males (17.9%) reported that they sometimes felt overweight when naked to take their bath. Similarly, more females (28.6%) than males (22.6%) reported that eating sweets, cakes and other high calorie foods could make them overweight. Likewise, more females (18.9%) than males (14.9%) sometimes felt excessively being overweight or obese while only a few females (3.5%) and males (2.9%) very often felt ashamed of their body shape. More females (24.9%) than males (22.5%) reported that seeing their reflection in a mirror sometimes gave them bad feelings about their body shape. Also, more females (29.2%) than males (23.6%) had sometimes been particularly self-conscious about their body shape when in the company of other adolescents. Similarly, more females (28.9%) than males (23.6%) adolescents sometimes find themselves brooding about their body shape. Observing other thin male/female adolescents, more females (21.5%) than males (20.0%) adolescents sometimes felt bad about their body shape.

In summary, female adolescents are more worried their body size and shape than adolescent boys and would desire to go through dieting to maintain normal/ideal body size and shape.

Table 4.20: Body Dissatisfaction of the Respondents

Variable	Male n (%)	Female n (%)	Total n (%)	X^2	P-value
Ever worried about you shape and have been feeling you ought to diet?					
Always	66 (9.2)	82 (11.4)	148 (10.3)	17.851[a]	0.003
Very often	45 (6.3)	22 (3.1)	67 (4.7)		
Often	35 (4.9)	32 (4.4)	67 (4.7)		
Sometimes	291 (40.4)	271 (37.6)	562 (39.0)		
Rarely	33 (4.6)	59 (8.2)	92 (6.4)		
Never	250 (34.7)	254 (35.3)	504 (35.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Ever noticed the shape of other adolescents and felt your own shape compared unfavourably?					
Always	98 (13.6)	69 (9.6)	167 (11.6)	22.739[a]	0.000
Very often	53 (7.4)	55 (7.6)	108 (7.5)		
Often	62 (8.6)	63 (8.8)	125 (8.7)		
Sometimes	233 (32.4)	244 (33.9)	477 (33.1)		
Rarely	16 (2.2)	49 (6.8)	65 (4.5)		
Never	258 (35.8)	240 (33.3)	498 (34.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
While Being naked do you have you have a feeling of being overweight?					
Always	79 (11.0)	60 (8.3)	139 (9.7)	11.233[a]	0.047
Very often	3 (0.4)	9 (1.3)	12 (0.8)		
Often	34 (4.7)	27 (3.8)	61 (4.2)		
Sometimes	129 (17.9)	158 (21.9)	287 (19.9)		
Rarely	73 (10.1)	87 (12.1)	160 (11.1)		
Never	402 (55.8)	379 (52.6)	781 (54.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Does eating sweet, cake and other high calorie food make you feel overweight?					
Always	74 (10.3)	40 (5.6)	114 (7.9)	19.156[a]	0.002
Very often	16 (2.2)	18 (2.5)	34 (2.4)		
Often	30 (4.2)	23 (3.2)	53 (3.7)		
Sometimes	163 (22.6)	206 (28.6)	369 (25.6)		
Rarely	72 (10.0)	91 (12.6)	163 (11.3)		
Never	365 (50.7)	342 (47.5)	707 (49.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.20: Body Dissatisfaction of the Respondent (Continued)

Variable	Male n (%)	Female n (%)	Total N (%)	X^2	P-value
Do you ever feel overweight or obese?					
Always	61 (8.5)	47 (6.5)	108 (7.5)	14.226[a]	0.014
Very often	58 (8.1)	40 (5.6)	98 (6.8)		
Often	57 (7.9)	48 (6.7)	105 (7.3)		
Sometimes	107 (14.9)	136 (18.9)	243 (16.9)		
Rarely	40 (5.6)	62 (8.6)	102 (7.1)		
Never	397 (55.1)	387 (53.8)	784 (54.4)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Ever felt ashamed of your body shape?					
Always	71 (9.9)	41 (5.7)	112 (7.8)	17.419[a]	0.004
Very often	21 (2.9)	25 (3.5)	46 (3.2)		
Often	44 (6.1)	31 (4.3)	75 (5.2)		
Sometimes	140 (19.4)	116 (16.1)	256 (17.8)		
Rarely	50 (6.9)	51 (7.1)	101 (7.0)		
Never	394 (54.7)	456 (63.3)	850 (59.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Has seeing your reflection in mirror make you feel bad about your shape?					
Always	76 (10.6)	51 (7.1)	127 (8.8)	9.384[a]	0.095
Very often	24 (3.3)	16 (2.2)	40 (2.8)		
Often	28 (3.9)	35 (4.9)	63 (4.4)		
Sometimes	162 (22.5)	179 (24.9)	341 (23.7)		
Rarely	72 (10.0)	62 (8.6)	134 (9.3)		
Never	358 (49.7)	377 (54.2)	735 (51.0)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Ever been particularly self-conscious about your shape when in the company of other people?					
Always	72 (10.0)	46 (6.4)	118 (8.2)	21.156[a]	0.000
Very often	42 (5.8)	26 (3.6)	68 (4.7)		
Often	46 (6.4)	19 (2.6)	65 (4.5)		
Sometimes	170 (23.6)	210 (29.2)	380 (26.4)		
Rarely	77 (10.7)	88 (12.2)	165 (11.5)		
Never	313 (43.5)	331 (46.0)	644 (44.7)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.20: Body Dissatisfaction of the Respondents (Continued)

Variable	Male N (%)	Female N (%)	Total N (%)	X^2	P-value
Ever found yourself brooding about your shape?					
Always	62 (8.6)	37 (5.1)	99 (6.9)	14.354[a]	0.014
Very often	28 (3.9)	25 (3.5)	53 (3.7)		
Often	16 (2.2)	17 (2.4)	33 (2.3)		
Sometimes	170 (23.6)	208 (28.9)	378 (26.3)		
Rarely	64 (8.9)	84 (11.7)	148 (10.3)		
Never	380 (52.8)	349 (48.5)	729 (50.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Seeing thin adolescents (male/female), does it make you feel bad about your own shape?					
Always	46 (6.4)	29 (4.0)	75 (5.2)	7.977[a]	0.158
Very often	31 (4.3)	19 (2.6)	50 (3.5)		
Often	29 (4.0)	29 (4.0)	58 (4.0)		
Sometimes	144 (20.0)	155 (21.5)	299 (20.8)		
Rarely	63 (8.8)	58 (8.1)	121 (8.4)		
Never	407 (56.5)	430 (59.7)	837 (58.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.21a: Association between the body dissatisfaction and dietary pattern of the respondents.

The table 4.21a shows that there is a significant association between dietary pattern and body dissatisfaction ($r= -0.054$, $p<0.05$).

Table 4.21a: Correlation matrix of independent and dependent variable

	Dietary Pattern	**Body Dissatisfaction**
Dietary Pattern	1.000	
Body Dissatisfaction	-.054*	1.000

Table 4.21b shows the effect of the independent variable (Body Dissatisfaction) on the dependent variable (Dietary pattern) of the respondents was significant. The regression also yielded a coefficient of F= 4.140, R= 0.054, R^2= 0.003 and an adjusted R^2 of 0.002 which accounted for 0.2% of the total variation on dietary pattern.

It is evident that body dissatisfaction was a significant predictor of dietary pattern (β= 0.054, t= -2.035, $p<0.05$) of the respondents.

Table 4.21b: Regression model summary of independent and dependent variable and relative contribution of the independent variable to predict the dependent variable.

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	
1	.054[a]	.003	.002	.99891060	
Source of Variance	**Sum of Squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	4.131	1	4.131	4.140	.042[b]
Residual	1434.896	1438	0.998		
Total	1439.000	1439			
Variables	**Regression weight B**	**Std error**	**Standard. Coef. (β)**	**t-value**	**Sig.**
(Constant)	0.128	0.068		1.878	0.061
Body Dissatisfaction	-0.006	0.003	-0.054	-2.035	0.042

Table 4.22a:Association between the body dissatisfaction and body mass index for age of the respondents.

The table 4.22a shows that there is a significant association between body mass index for age and body dissatisfaction ($r= -0.052$, $p<0.05$).

Table 4.22a: Correlation matrix of independent and dependent variable

	BMI/A	**Body Dissatisfaction**
BMI/A	1.000	
Body Dissatisfaction	0.052*	1.000

Table 4.22b shows the effect of the independent variable (Body Dissatisfaction) on the dependent variable (Body mass index for age) of the respondents was significant. The regression also yielded a coefficient of F= 43.437, R= 0.052, R^2= 0.003 and an adjusted R^2 of 0.003 which accounted for 0.3% of the total variation on dietary pattern.

It is evident that body dissatisfaction was a significant predictor of body mass index for age (β= 0.059, t= 2.230, $p<0.05$) of the respondents.

Table 4.22b: Regression model summary of independent and dependent variable and relative contribution of the independent variable to predict the dependent variable.

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	
1	.059[a]	.003	.003	.592	
Source of Variance	**Sum of Squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	1.741	1	1.741	4.975	.026[b]
Residual	503.359	1438	0.350		
Total	505.100	1439			
Variables	**Regression weight B**	**Std error**	**Standard. Coef. (β)**	**t-value**	**Sig.**
(Constant)	2.058	0.040		50.840	0.000
Body Dissatisfaction	0.004	0.002	0.059	2.230	0.026

Table 4.23: Nutrition Knowledge of the Respondents

The knowledge of nutrition of the respondents is shown in table 4.23.Majority (79.3%) of the respondents reported they have received one form of nutrition education. Many (85.3%) reported that yam contains carbohydrate and greater proportion (73.9%) reported that the function of carbohydrate isfor provision of energy. More than two-third (68.8%) were aware that soft drinks contain lots of sugar. Just a few (19.9%) reported that vegetables contain fibre.The majority (65.5%) reported that fruit is low in fat, but only a few (11.0%) reported that butter is low in fat. Many (79.7%) of the respondents were aware that cowpeasare a rich source of protein. More than half (62.4%) reported the function of protein to be adequate growth while (26.0% and 6.0%) said protein provide energy and prevent disease respectively.

Only a few (5.5%) reported protein helps in providing energy. A greater proportion (64.4%) reported that carbohydrate contains more energy, but only a few (3.8%) reported fat to contain more energy. Majority (74.4%) reported that fruits as a high source of vitamins. Many (87.4%) agreed that eating fruits and vegetables daily is necessary. Majority (97.0%) agreed that intake of water is important for maintenance of good health, 89.4% reported that an adequate diet contribute to good health. Many (52.8%) of the respondents were aware that an adequate diet is a diet rich in different food groups. Only a few (6.9%) indicated that an adequate diet is a diet without fat.

Many (87.4%) of the respondents reported that short attention and low concentration are the consequences of not eating breakfast to school. Only a few (10.6%) indicated that consumption of breakfast does not have any consequences on students. In addition, less than half (44.5%) of respondents reported that someone who is not having adequate food can be identified by lack of energy/weakness. Others (22.9%, 6.0%, 25.8% and 7.0%) affirmed that the students will not work, study or play well; become ill easily; have loss of weight/thinness and; the students will not be able to grow as they should respectively. In table 4.24, majority (73.6%) reported that being overweight and obese is bad. Majority (66.4%) of the respondents had fair knowledge, 28.2% had good knowledge and only 5.4% had poor knowledge of nutrition.

Table 4.23: Nutrition Knowledge of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Respondents ever had any nutrition education					
Yes	545 (75.7)	597 (82.9)	1142 (79.3)	11442	0.001
No	172 (24.3)	123 (17.1)	298 (20.7)		
Indicate food which contains carbohydrate					
Meat	59 (8.2)	53 (7.4)	112 (7.8)	3.204	0.361
Palm oil	18 (2.5)	29 (4.0)	47 (3.3)		
Yam	615 (85.4)	614 (85.3)	1229 (85.3)		
Milk	28 (3.9)	24 (3.3)	52 (3.6)		
Function of carbohydrate					
Ensure adequate growth	131 (18.2)	134 (18.6)	265 (18.4)	1.202	0.752
Provide energy	536 (74.4)	528 (73.3)	1064 (73.9)		
Prevent disease	20 (2.8)	17 (2.4)	37 (2.6)		
1&3	33 (4.6)	41 (5.7)	74 (5.1)		
Soft drink contains a lot of sugar					
Yes	498 (69.2)	493 (68.5)	991 (68.8)	0.081	0.776
No	222 (30.8)	227 (31.5)	449 (31.2)		
Which of these foodsis rich in fibre					
Whole wheat bread	248 (34.1)	224 (31.1)	472 (32.8)	24.288	0.000
Beans	219 (30.4)	159 (22.1)	378 (26.3)		
Vegetables	115 (16.0)	171 (23.8)	286 (19.9)		
Meat	138 (19.2)	166 (23.1)	304 (21.1)		
Which of these foods is lowest in fat					
Milk	91 (12.6)	118 (16.4)	209 (14.5)	4.944	0.176
Butter	81 (11.3)	78 (10.8)	159 (11.0)		
Meat	61 (8.5)	68 (9.4)	129 (9.0)		
Fruits	487 (67.6)	456 (63.3)	943 (65.5)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

4.23:Nutrition Knowledge of the respondents(continued)

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Which of these foods is rich in protein					
Cowpea	590 (81.9)	558 (77.5)	1148 (79.7)	11.421	0.010
Vegetables	109 (15.1)	119 (16.5)	228 (15.8)		
Indomie	9 (1.3)	28 (3.9)	37 (2.6)		
Apples	12 (1.7)	15 (2.1)	27 (1.9)		
Function of protein					
Enhance growth	473 (65.7)	426 (59.2)	899 (62.4)	12.334	0.006
Provide energy	163 (22.6)	212 (29.4)	375 (26.0)		
Prevent disease	50 (6.9)	37 (5.1)	87 (6.0)		
2 &3	34 (4.7)	45 (6.3)	79 (5.5)		
Food substance which contain more energy is:					
Protein	220 (30.6)	223 (31.0)	443 (30.8)	0.838	0.840
Carbohydrate	466 (64.7)	466 (64.7)	932 (64.7)		
Fat	27 (3.8)	27 (3.8)	54 (3.8)		
Alcohol	7 (1.0)	4 (0.6)	11 (0.8)		
Food substance rich in vitamins is:					
Bread	70 (9.7)	93 (12.9)	163 (11.3)	8.637	0.035
Margarine	60 (8.3)	82 (11.4)	142 (9.9)		
Sausage	35 (4.9)	29 (4.0)	64 (4.4)		
Fruits	555 (77.1)	516 (71.7)	1071 (74.4)		
Is it necessary to eat fruits and vegetables daily?					
Yes	630 (87.5)	628 (87.2)	1258 (87.4)	0.025	0.874
No	90 (12.5)	92 (12.8)	182 (12.6)		
The following is not a mineral element:					
Iron	259 (36.0)	279 (38.8)	538 (37.4)	1.830	0.608
Calcium	67 (9.3)	72 (10.0)	139 (9.7)		
Sodium	77 (10.7)	69 (9.6)	146 (10.1)		
Water	317 (44.0)	300 (41.7)	617 (42.8)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

4.23:Nutrition Knowledge of the respondents(continued)

Variable	Urban N (%)	Rural N (%)	Total N (%)	X^2	P-value
Is it important to take water for good health?					
Yes	689 (96.9)	699 (97.1)	1397 (97.0)	0.024	0.877
No	22 (3.1)	21 (2.9)	43 (3.0)		
Eating adequate diet contribute to good health:					
Yes	659 (91.5)	629 (87.4)	1288 (89.4)	6.620	0.010
No	61 (8.5)	91 (12.6)	152 (10.6)		
An adequate diet is:					
Diet rich in different food groups	409 (56.8)	351 (48.8)	760 (52.8)	10.464	0.015
Food rich in protein (meat, fish, egg etc.)	249 (34.6)	290 (40.3)	539 (37.4)		
Diet without fat	41 (5.7)	58 (8.1)	99 (6.9)		
Eating fish often	21 (2.9)	21 (2.9)	42 (2.9)		
The consequences of not eating breakfast to school					
Short attention and low concentration	638 (88.6)	620 (86.1)	1258 (87.4)	4.012	0.135
Does not cause any harm	72 (10.0)	80 (11.1)	152 (10.6)		
I do not know	10 (1.4)	20 (2.4)	30 (2.1)		
Consequences of not having adequate food:					
Lack of energy/ weakness	344 (47.8)	297 (41.3)	641 (44.5)	14.762	0.005
Cannot work, study or play as normal	138 (19.2)	192 (26.7)	330 (22.9)		
Become ill easily	38 (5.3)	49 (6.8)	87 (6.0)		
Loss of weight	194 (26.9)	178 (24.7)	372 (25.8)		
Inadequate growth	6 (0.8)	4 (0.6)	10 (0.7)		
All the above	0 (0.0)	0 (0.0)	0 (0.0)		
Is it good to be fat (overweight / obese)					
Yes	159 (22.1)	221 (30.7)	380 (26.4)	13.742	0.000
No	561 (77.9)	499 (69.3)	1060 (73.6)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.24:Nutrition Knowledge Score of the Respondents

Variable	Urban N (%)	Rural N (%)	Total N (%)	Fishers' Exact test	P-value
Knowledge Score					
1	1 (0.0)	0 (0.0)	1 (0.1)	29.652	0.007
2	0 (0.0)	0 (0.0)	0 (0.0)		
3	0 (0.0)	2 (0.3)	2 (0.1)		
4	6 (0.8)	4 (0.6)	10 (0.7)		
5	5 (0.7)	14 (1.9)	19 (1.3)		
6	25 (3.5)	21 (2.9)	46 (3.2)		
7	26 (3.6)	53 (7.4)	79 (5.5)		
8	35 (4.9)	46 (6.4)	81 (5.6)		
9	62 (8.6)	67 (9.3)	129 (9.0)		
10	103 (14.3)	81 (11.3)	184 (12.8)		
11	118 (16.4)	109 (15.1)	227 (15.8)		
12	122 (16.9)	134 (18.6)	256 (17.8)		
13	124 (17.2)	115 (16.0)	239 (16.6)		
14	78 (10.8)	52 (7.2)	130 (9.0)		
15	13 (1.8)	22 (3.1)	35 (2.4)		
16	2 (0.3)	0 (0.0)	2 (0.1)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		
Knowledge Score classified					
Poor (1-6)	37 (5.1)	41 (5.7)	78 (5.4)	2.740	0.256
Fair (>6 - 12)	466 (64.7)	490 (68.1)	956 (66.4)		
Good (> 12)	217 (30.1)	189 (26.3)	406 (28.2)		
Total	720 (100.0)	720 (100.0)	1440 (100.0)		

Table 4.25a:Association between the nutrition knowledge and dietary pattern of the respondents.

The table 4.25a shows that there is a significant relationship dietary pattern and nutrition knowledge ($r= 0.171$, $p<0.05$).

Table 4.25a: Correlation matrix of independent and dependent variable

	Dietary Pattern	**Nutrition Knowledge**
Dietary Pattern	1.000	
Nutrition Knowledge	.171**	1.000

Table 4.25b shows the effect of the independent variable (nutrition knowledge) on the dependent variable (Dietary pattern) of the respondents was significant. The regression also yielded a coefficient of F= 43.437, R= 0.171, R^2= 0.029 and an adjusted R^2 of 0.029 which accounted for 2.9% of the total variation on dietary pattern.

It is evident that nutrition knowledge was a significant predictor of dietary pattern (β= 0.171, t= 6.591, $p<0.05$) of the respondents.

Table 4.25b: Regression model summary of independent and dependent variable and relative contribution of the independent variable to predict the dependent variable.

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	
1	.171[a]	.029	.029	.98557307	
Source of Variance	**Sum of Squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	42.193	1	42.193	43.437	.000[b]
Residual	1396.807	1438	0.971		
Total	1439.000	1439			
Variables	**Regression weight B**	**Std error**	**Standard. Coef. (β)**	**t-value**	**Sig.**
(Constant)	-0.780	0.121		-6.437	0.000
Nutrition Knowledge	0.072	0.011	0.171	6.591	0.000

Table 4.26a:Association between the nutrition knowledge and nutritional status(BMI/A) of the respondents.

The table 4.26a shows that there is a significant relationship nutritional status (BMI/A) and nutrition knowledge ($r= 0.159$, $p<0.05$) of the respondents.

Table 4.26a: Correlation matrix of independent and dependent variable

	BMI/A	**Nutrition Knowledge**
BMI/A	1.000	
Nutrition Knowledge	0.159**	1.000

Table 4.26b shows the effect of the independent variable (nutrition knowledge) on the dependent variable (BMI/A) of the respondents was significant. The regression also yielded a coefficient of F= 37.516, R= 0.159 R^2= 0.025 and an adjusted R^2 of 0.025 which accounted for 2.5% of the total variation on BMI/A.

It is evident that nutrition knowledge was a significant predictor of nutritional status (β= 0.159, t= 6.125, $p<0.05$) of the respondents.

Table 4.26b: Regression model summary of independent and dependent variable and relative contribution of the independent variables to predict the dependent variable.

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	
1	0.159[a]	0.025	0.025	0.92071	
Source of Variance	**Sum of Squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	31.802	1	31.802	37.516	.000[b]
Residual	1218.995	1438	0.848		
Total	1250.797	1439			
Variables	**Regression weight B**	**Std error**	**Standard. Coef. (β)**	**t-value**	**Sig.**
(Constant)	-1.387	0.113		-12.259	0.000
Nutrition Knowledge	0.062	0.010	0.159	6.125	0.000

CHAPTER FIVE

5.1 DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1.1 Dietary Pattern and Socio-demographic Characteristics of the Respondents

Adolescence is a period requiring optimal intake of nutrients to satisfy the rapid growth generally occurring at this phase of their lives. The socioeconomic and demographic characteristics of individuals is known to influence dietary pattern and nutritional status of individuals (Haileselassie, Roba and Weldgebreal, 2019). The socio-demographic characteristics of the adolescents in this study revealed no significant difference between the adolescents selected from the senatorial districts, class strata, sex, age and ethnicity in the urban and rural areas, respectively ($p>0.05$). However, the class, sex and ethnicity significantly influence the nutritional status of the adolescents ($p<0.05$).

The socio-economic characteristics of the adolescents in this study also revealed that majority of the adolescents were from monogamous family with an average family size of 4-6 persons. The respondents' father and mother had either secondary or tertiary education and were mostly earning more than 120,000 naira per month. This observation indicates that the socio-economic status of the parents of the in-school adolescents involved in this study was not low. According to the report of Haileselassie, Roba and Weldgebreal, (2019), socioeconomic and demographic characteristics such as being male, low family size and monthly income were significantly associated with and nutritional status of the adolescents in Eastern Ethiopia. Gosh, 2019 also reported that variance of nutritional status (BMI for age) among the adolescents could be explained by monthly family income. Similarly, in this study, significant relationship was observed between mother's level of education, mother and father estimated monthly income, type of housing, source of drinking water and cooking fuel, with the nutritional status (body mass index for age) of the adolescents ($p<0.05$). This information explains that the level of socio-economic status of the parents of the adolescents could influence their nutritional status.

5.1.2 Dietary Pattern andPersonal and Family Medical History of the Respondents

Family history of high blood pressure contributed to the prevalence of hypertension. Instudies such as (Bolajoko, Adesanwo and Akinhanmi, 2019) has shown that the high blood pressure in parents increases the risk of hypertension in their offspring.Bolajoko, Adesanwo and Akinhanmi, 2019 reported that family history of diabetes contributes significantly to hypertension and increases the risk of chronic disease in Ondo State while Akinbodewa *et al.,* 2017) indicating that genetic predisposition is a very strong risk factor for hypertension in Nigeria.

With regards to the personal and family medical history and lifestyle of the adolescents, most of the adolescents had no medical history of recurrent illness and only about a third had ever been admitted to the health clinic or hospital. About a third reported that at least one of their parents were having high blood pressure and a quarter also reported ever been told they had elevated blood pressure by a doctor. However, the most common ailment of the adolescents was malaria, which was mostly treated at the hospital, health clinic or at home. According to the report of the adolescents, non-communicable diseases such as obesity, heart disease, diabetes and sickle cell anaemia were lesser problems than hypertension in the family. No significant relationship was observed between the medical history of the urban and rural residence of the adolescents ($p>0.05$). However, reported presence of high blood pressure was significantly associated with parents residing areas (urban and rural) ($p<0.05$). Presence of prolonged illness, respondents ever had their blood pressure measured before was observed to be significantly related to the respondent's nutritional status ($p<0.05$)

5.1.3 Dietary Pattern andLifestyle of the Respondents

The report of Ghosh, (2019) indicated that sedentary lifestyle may be responsible for adolescent obesity. In this study, majority of the adolescents reported that they were regularly taking exercise such as playing of football or running for less than 1-2 hours per week. However, the respondents mostly spent their leisure time reading story book, watching television or playing games with computer for 1-2 hours per day. This indicates that the adolescents were not very active which could pre-dispose them to

overweight and obesity. Majority of the adolescents in this study were not smoking cigarette. However, half of them had ever taken palm wine occasionally. This indicates that the habits of taking cigarette and alcohol was not a common practice among the adolescents but their involvement in regular physical exercise was inadequate.

5.1.4 Dietary Pattern of the respondents.

Dietary pattern is known to influence intake and other nutritional status of individuals (Abiola, 2017). Low consumption of fruits and vegetables and high consumption of high calorie foods (pastries and sweetened beverage drinks) wasobserved among the adolescents (Abedi *et al.,* 2011). Low intake of fruits and vegetables were reported by the adolescents and snacks consumed by the adolescents were doughnuts, plantain chips, buns and sausage rolls. These are energy dense, nutrient deficient snacks which should not be encouraged. In this study, the major staple foods consumed by the adolescents were cereals and grains, roots and tubers. Rice (boiled/jollof/fried) and bread were the major cereals and grains consumed regularly by the adolescents. The major seeds and nuts consumed regularly were coconuts and walnuts. Beef, goatmeat, shrimps and crayfish were the main source of animal protein which was consumed occasionally or regularly by the respondents. Beverages (Milo, Bournvita, Tea) were consumed occasionally by the respondents. However, sugar sweetened (soft) drinks were consumed more frequently than other beverages while fruits and vegetables were consumed occasionally. The main fruits consumed were pineapple, watermelon and banana.

5.1.5 Dietary Habits of the Respondents

Majority of the adolescents involved in this study were regularly taking breakfast and their food were prepared at home. However, a few sometimes purchase food from vendors. A high proportion of adolescents were taking three meals per day however, lunch and breakfast was sometimes skipped by the adolescents. The report of Lateef *et al.,* (2016) on food habits and nutritional of students in public schools in Kwara State, Nigeria also indicated that a high proportion of the adolescents also consumed breakfast which also indicates that adolescents mostly take breakfast in some other

parts of the country. Taking breakfast among adolescents should be encouraged to keep them active and for them to benefit maximally from the school lessons. Financial constraint was the reason given for skipping a meal. Skipping meal due to lack of food and money was in line with the well-established fact that socio-economic status determines purchasing power and influences the quality and quantity of the adolescents' diet (Lateef *et al.,* 2016).

Most of the adolescents in this study consume biscuits, plantain chips, popcorn and peanut as snacks. Abiola, (2017) in Ogun State, Nigeria also reported commonly consumed snacks among adolescents included doughnuts, plantain chips, buns and soft-drinks. These types of snacks need to be discouraged being energy dense nutrient deficient foods which can negatively impact on the nutritional status of the adolescents. In this study, about a quarter of adolescents were taking soft-drink frequently (more than a bottle daily) and adding extra salt to their foods. Soft drinks are energy dense low nutrient drink which when consumed often can predispose the adolescents to overweight and obesity. Regular intake of soft drinks needs to be discouraged among adolescents for their present and future health.

Blood pressure has been reported to increase with increase salt intake. Addition of extra salt to food can predispose adolescents to hypertension which indicates the need for nutrition education for the adolescents to improve on their food choice and food intake, especially concerning eating of meals regularly and taking appropriate snacks. Fruits which the adolescents required as source of micronutrients were rarely consumed by the adolescents. The reports of Iheanacho, Onyeke and Ede, (2019) also indicated low intake of fruits among adolescents in Nsukka. In this study, drinks mostly taken between meals was water which is a good practice to be encouraged since water is mostly needed for body cellular processes and it forms high proportion of body fluid/ water. A significant difference was observed between fruit intake, consumption of glass of milk, sachet of water and supplement intake of the rural and urban adolescents ($p<0.05$).

5.1.6 Dietary Diversity of the Respondents

Dietary diversity is an indicator of the quality of nutrient intake. Jiang *et al.,* (2018) reported that residing in urban environment was a positive predictor of dietary

diversity. Ample fruits and vegetables intake are important index of diet quality and diversity which is believed to assure adequate intake of micronutrients and antioxidants(Bolajoko, Adesanwo and Akinhanmi, 2019). In this study, majority of the adolescents had medium dietary diversity score (4-5) while only a very low proportion (2.7%) had a high dietary diversity score of > 6.0. The adolescents and their parents need to be educated on taking variety of different foods for their optimal health. No significant relationship was observed between the dietary diversity score of adolescents residing in urban and rural areas ($p>0.05$). Using the minimum dietary diversity score classification, majority of the adolescents had low dietary diversity score. Although, Zhao *et al.,* (2017) reported that dietary diversity could vary with age and place of residence with those residing in rural areas tends to have poorer dietary diversity. No significant relationship was observed between the dietary diversity score of the urban and rural adolescents involved in this study ($p>0.05$) except in the inclusion of meat, fish and poultry which were consumed more in the urban area.

5.1.7 Nutrient intake and Adequacy

Many physiological and behavioural changes take place among adolescents because adolescence is a transition stage between childhood and adulthood (Omobuwa, *et al.,* 2014). Their dietary habits are also complex in nature. However, many factors influence their dietary pattern and food practices. Blood pressure has been predicted to be affected by high consumption of salty foods and higher intakes was evident in increased blood pressure in some studies (Sacks *et al.,* 2001; Laffer, 2004).

High consumption of fast foods, chips, and soft-drinks as snacks which are energy dense food (Carbohydrate-rich and fat-rich foods) observed in this study could contribute to elevated blood pressure among the adolescents. Soft drinks, fast food and convenient food consumed by these adolescents are often high in salts, sweeteners and often low in both minerals, vitamins and fibres (Myers and Champagne, 2007; Miller and Adeli, 2008; Dhingra *et al.,* 2007). Frequent consumption of salty food was observed among adolescents in this study. This result also supported earlier observation that adolescents had poor food habits characterized by snacking or junk foods (very salty, high sugar and fat) which may not include fruits and vegetables in their diets (Myers and Champagne, 2007). Similarly, disproportionately high ratio of

sodium potassium intake among children/ adolescents has been documented in some studies (Laffer, 2004). This imbalance is more pronounced in adolescent population where dietary sodium far exceeds nutritional requirements and the reduced intake of fruits and vegetables (Sacks *et al.,* 2001). The result of this study indicated a low consumption of fruits and vegetables. A substantial proportion of adolescents has not met their recommended dietary intake for micronutrients such as folate, iron, calcium and potassium.

5.1.8 Nutritional Status of the Respondents

Optimal nutritional status in puberty is important for healthy growth, development, maturation and prevention of chronic diseases in adulthood (Buhendwa *et al.,* 2017, Abdulkarim *et al.,* 2014). In this study, a high proportion of adolescents had normal height for age (and index for stunting). Only a few were either moderately stunted, severely stunted or above normal height for their age. This indicate that chronic malnutrition was not a major problem among the adolescents. There was no significant difference in the height for age of the urban and rural adolescents. Omobuwa *et al.,* 2014 report on in-school adolescents in Ibadan indicates that about a third of the adolescents were underweight while a few were obese using body mass index for age. In this study, a high proportion of adolescents had normal body weight using body mass index for age. However, about a fifth were either overweight or obese. A very low proportion were underweight. This observation indicates that overweight and obesity problem among the adolescents which can predispose them to non-communicable diseases in adulthood.

This present study found a lower prevalence of obesity (2.5%) which is in agreement with previous studies focused on different locations such as (1.9%) in South Eastern Nigeria (Ujunwa *et al.,* 2013), 5.3% in Portugal (Maldonado*et al.,* 2009), 7.0% in South Iran (Basiratnia *et al,* 2013), 4.8% in India (Nawab *et al.,* 2014), 4.1% and 8.7% in China (Yi *et al.,* 2012; Dong *et al.,* 2014). The low prevalence of obesity obtained in this study with body mass index for age was lower than those reported among healthy American and Chinese population. Difference in race and socio-economic development between African, American and Chinese population could account for the inconsistency in the prevalence of obesity among adolescents. The discrepancies in

years in which the study was conducted and age range of reference population could account for the differences observed. Some of those studies were conducted with a population within the ages of 6-18 years, 5-19 years as opposed to 10-19 years in this present study.

Differences in culture, ethnicity, diet, age, socioeconomic development, level and anthropometric indicator including gender could account for the variation in anthropometric measure (norms) among different regions and population (Moreno, 2010). However, a higher prevalence (9.4%) was observed in Nigeria (Oduwole *et al.,* 2012), 9.5% in Peru (Nam *et al.,* 2015) while a higher prevalence of 11.3% was observed in Nepal (Koirala *et al.,* 2015). In this study, 9.0% of respondents were underweight which is in contrast with a study conducted in South China which revealed that more than one-third of the students were underweight.

The observed prevalence of overweight in this study was 18.1% and was lower than the 27.0% of the global average for the prevalence of overweight among adolescents (WHO, 2000) and the 19.4% reported in a study in Anambra State; the prevalence of overweight/ obesity could be attributed to lifestyle. Similarly, prevalence of overweight in the Eastern Mediterranean region range from 15.0% -40.0% among adolescents aged 11-18 years (Moreno*,* 2013). In Canada, 25.0% was reported to be at risk of being overweight and 11.0% overweight. Prevalence of overweight (18.1%) observed in this study was lower than the 19.2% in Nnewi, Anambra State but higher than the 9.9% prevalence reported in Delta State. The participants in this study were within the ages of 10-19 years and had greater proportion (70.4%) of ideal body weight.

In most developing countries especially in Africa, overweight/obesity were closely linked with ignorance of healthy eating, affluence and high social status (Williams *et al.,* 2007). In addition, the fast-changing lifestyle is more apparent among adolescents. Limited exercise and sedentary lifestyle have been reported to be a factor for obesity in school children and adolescents (Bhuiyan *et al.,* 2013). Intensive nutrition education should be organised for the adolescents to enable them to know the implication of maintaining a normal body weight.

5.1.9 Blood Pressure of the Respondents

Hypertension is a public health problem especially in developing countries that require identification of risk factors such as obesity and others to reduce complications of hypertension and cardiovascular diseases (Din-Dziethame*t al.,* 2007). The prevalence of hypertension in this study was 11.9% and this falls within the documented prevalence of childhood/ adolescence hypertension of (1.0%-13.0%) in Nigeria (Ejike *et al.,* 2008; Mijiyawa *et al.,* 2008). The prevalence of adolescents' hypertension ranges from 5.2% to 17.2% and has been documented in other studies: 5.4% in South East Nigeria (Ujunwa *et al.,* 2013), 8.12% in Brazil (Magliano *et al.,* 2013), 9.8% in Portugal (Maldonado *et al.,* 2009), 11.8% in Southern Iran (Basiratnia *et al.,* 2013), 12.0% in Nepal (Stewart *et al.,* 2013) and 17.2% in Israel (Mazor-Aronovitch *et al.,* 2014).

Different studies have indicated different prevalence of blood pressure among adolescents (Adekanbi *et al.,* 2016) and Jansen *et al.,* 2012 in Netherlands among others. According to the study of Adekanbi *et al.,* 2016 in Ogun State, Nigeria, the nutritional status of the adolescents was related to their blood pressure. Pre-hypertension and hypertension were observed among adolescents with normal weight. In this study, pre-hypertension was observed among about a third while hypertension stage 1 was about 11.9% among the adolescents. This prevalence of 11.9% was higher than the 5.8% observed by Ujunwa *et al.,* 2013 but lower than the 17.5% recorded by Ejike *et al.,* 2010 in Kogi State, Nigeria. Varying methodology, different criteria for diagnosis of hypertension, regional variances and factors such as age, sex, family history of hypertension could be responsible for the variation observed in the prevalence of hypertension (Mistsnefes, 2006). Increase in body size, sexual maturation could be attributed to increase in blood pressure with age which agrees with the result of the study by Mistsnefes, 2006 in children and adolescents. The increase in the observed prevalence rate when compared to the 3.3% obtained in South West Nigeria in 1999, implies that hypertension can be detected among adolescents. Regular screening of these group of individuals who are generally assumed to be a healthy population thus remained underdiagnosed is required.

Pre-hypertension status indicates a need for preventing heart related lifestyle changes (Ejike, 2010). Prevalence of pre-hypertension in this study was found to be 34.1%. This was observed to be closely related to the Nigerian study on children and adolescents such as that of Ejike *et al.,* 2010 which reported a prevalence of 25.0% but

higher than that of Ujunwa *et al.,* 2013 and Ogboye, 2012 which reported 17.3% and 10.0% respectively. Individuals in the pre-hypertensive class are those who might become hypertensive in later life thereby increasing the prevalence of hypertension and its associated complications (Ujunwa *et al.,* 2013). Routine examination is therefore important for these group of individuals and intervention targeted at them to reduce the prevalence of hypertension when these individuals becomes adults.

The focus of this study and other studies on elevated blood pressure as a combination of pre-hypertension and hypertension (Yang *et al.,* 2012; Ujunwa *et al.,* 2013; Rosner *et al.,* 2013) is based on the submission which states that pre-hypertension is clinically relevant because children which blood pressure is repeatedly greater than 90% exhibits signs of very early target organ damage in young adulthood.

This also calls for nutrition education for the adolescents to be aware of the need to make selection of the right choice of food and engage in regular moderate physical exercise which will help them maintain ideal body weight to prevent development of chronic diseases such as hypertension and its complications now and in adulthood.

5.1.10 Body Image Dissatisfaction of the Adolescents

According to Smolak, (2012), teenagers especially girls with body image distortion often experience disappointment with their body size and shape. Body dissatisfaction has been related to has been related to several unhealthy eating disordered behaviours such as dieting, skipping of meals, fasting, use of dieting pills and laxative (Newmark-Szteaner *et al.,* 2006). Body dissatisfaction is also associated with low self-esteem, stigmatization and depression among adolescents (Santana *et al.,* 2013; Bhat-Poulose *et al.,* 2016). Bibloni, Pich, Pons and Tur, (2013) reported body dissatisfaction is associated with meal pattern and food consumption among overweight/obese adolescents who wished for a thinner body image. In this study, more than 50% of the adolescents were worried about their shape and had the feeling that they ought to diet. Many felt their shape was unfavourable because they appear to be overweight. Many realized that eating high calorie food could predispose them to body image disproportion. Female adolescents are more worried their body size and shape than adolescent boys and would desire to go through dieting to maintain normal/ideal body size and shape. However, a large proportion of the adolescents still like their shape and never brood their body size and shape. According to Bhat-Poulose *et al.,* (2016) report

among Jamaican adolescents and the risk of depression was higher among those who perceive themselves to be over or underweight and adolescent girls were at greater risk of having body dissatisfaction issue. In this study, body image dissatisfaction was observed to be significantly associated with the nutritional status of the adolescents.

5.1.11 Nutrition Knowledge of the adolescents

Adequate knowledge of nutrition was reported to be positively associated with the nutritional status of Individuals (Artanti and Febriana, 2019). The knowledge of the adolescents involved in this study was not poor. Majority of the respondents had fair or good nutrition knowledge. The knowledge of the respondents was significantly related to the nutritional status of the adolescents ($p<0.05$).

5.2 Conclusion

Unhealthy dietary habits and practices such as frequent intake of chips, fast foods and salty foods, low intake of fruits and vegetables; and regular addition of table salts could be implicated as risk factors foradolescent hypertension. Majority had medium dietary diversity while about a half had a low dietary diversity. The nutrient adequacy of the adolescents revealed that the calorie, carbohydrate and protein were adequately consumed. However, micronutrient such as potassium, calcium, vitamin C, dietary fibre, folate and iron were not adequately consumed. About a fifth (20.6%) of the adolescents were either overweight or obese while only a few (9.0%) were underweight. Prevalence of hypertension (11.9%) and pre-hypertension (34.1%) were detected among adolescents in Edo State.

5.3 Contribution to Knowledge

It has been established from this study that:

1. The consumption pattern of the respondents indicated more of African diet– staples, meat, fish and protein; and Western diet- mainly cereals and fruits/vegetables.
2. Total fat, energy (calorie), protein, sodium, vitamin A and carbohydrate were adequately consumed by the respondents. Potassium, Calcium, vitamin C, dietary fibre, folate and iron intakes were inadequate by the respondents.
3. Majority of the respondents had medium dietary diversity while about a half had a low dietary diversity.Regarding the minimum dietary diversity of the respondents, greater proportion had a low minimum dietary diversity of < 5.0 food groups while more than a quarter had minimum dietary diversity of ≥ 5.0 food groups.
4. Prevalence of underweight, overweight and obese was 9.0%, 18.1% and 2.5% respectively.
5. About 45.8% and 6.7% of male respondents had moderate and high risk of cardiovascular disease. Similarly, 32.4% and 4.6% of the female respondents had moderate and high risk of cardiovascular disease.
6. Prevalence of pre-hypertension and hypertension was 34.1% and 11.9%, respectively.
7. Female adolescents were more worried about their body size and shape than male adolescents and would desire to go through dieting to maintain ideal body size and shape.
8. Majority (66.4%) of the respondents had fair knowledge while 28.2% and 5.4% had good and poor knowledge of nutrition respectively.

5.4 Recommendation

Unhealthy dietary and lifestyle practices modification is essential in designing the nutrition education programmes to reduce malnutrition and blood pressure among the adolescents by:

1. Nutrition education programmes should be implemented for adolescents and their families by Nutritionist and allied health professionals to provide primary prevention steps for decreasing the risk of underweight, overweight, obesity and hypertension among adolescents.

2. Adoption of healthy lifestyle practices among the adolescents should be encouraged and supported.
3. Food and nutrition should be a compulsory subject for every student at secondary school level.
4. Parents should be given nutrition education for them to be aware of the right kind of food to give their children.
5. School authority should ensure that nutrient dense snacks including fruits are sold at school by the food vendors.
6. Routine blood pressure examination in secondary schools should be encouraged.
7. Influencing the adolescents' choice of diet to include adequate intake of fruits and vegetables to increase the intake of potassium for protection against elevated blood pressure.
8. Encouraging reduction of intake of salty foods, sugar sweetened drinks and fried chips by the adolescents.
9. Encouraging regular aerobic physical activities as one of the primary interventions for controlling overweight and obesity related hypertension.
10. Government should ensure that every secondary school have enough space for students to perform regular physical exercise.

REFERENCES

Abah, S.O., Aigbiremolen, A.O., Duru, C.B., Awunor, N.S., Asogun, A.D., Enahoro, F.O., Akpede, M.E. 2012. Prevalence of Overweight and Obesity among Students in Private and Public Secondary Schools in a Peri-Urban Nigerian Town.*Journal of Biology, Agriculture and Healthcare. Vol 2, No.11, 2012. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online).*

Abd El-Kader, R.G., Mekhamier, H.A. and Hegazy, A.E.S.A., 2019. Dietary Habits and Nutritional Knowledge among Primary School Children in Fayoum Governorate. *International Journal of Studies in Nursing, 4(2), p.95.*

Abdirahman, M. Chege, P and Joseph Kobia J. 2019. Nutrition Knowledge and Dietary Practices among Pregnant Adolescentsin Mandera County, Kenya. *Food Sci Nutr Res. 2019; 2(2): 1*-8.

Abdulkarim, A.A., Otuneye, A.T., Ahmed, P. and Shattima, D.R., 2014. Adolescent malnutrition: prevalence and pattern in Abuja municipal area council, Nigeria. *Nigerian Journal of Paediatrics*, *41*(2), pp.99-103.

Abedi, G.H., Mohamadpour, R.A., Rostami, F., Ahmadinia, F. and Rajabi, M., 2011. Study of consumption pattern of food and obesity of female students of Mazandaran University of Medical Sciences. *Journal of Mazandaran University of Medical Sciences, 20(80), pp.77-80*.

Abiola, O.J., 2017. Evaluating Patterns of Snacks Consumption, Energy Nutrient Intakes among In-School Adolescent Students in Ibadan, Nigeria. *Technology (IJOSEET)*, *2*(6), pp.38-44.

ACC/SCN, U.N., 1992. Second report on the world nutrition situation. *Global and regional results. 1*.ACC/SCN, WHO, Geneva, Switzerland.

ACC/SCN. 1997. Third Report on the World Nutrition Situation. Geneva: ACC/SCN.

ACC/SCN. 2000. Fourth Report on the world nutrition situation – Nutrition throughout the life cycle, Geneva: ACC/SCN in collaboration with IFPRI, 2000.

Adekanmbi, A.F., Obadina, O.O., Fetuga, M.B. and Adejumo, A.O., 2016. Prevalence of malnutrition and high blood pressure amongst adolescents in semi-urban area of Ogun State south-western Nigeria. *Nigerian Medical Practitioner*, *69*(6), pp.83-88.

Adesina, A.F., Peterside, O., Anochie, I. and Akani, N.A. 2012. Weight status of adolescents in secondary schools in Port Harcourt using Body Mass Index (BMI). *Italian Journal of Pediatrics, 38:31. Pg. 1-7.*

Adinma, J.I., Adinma, E.D. 2011. Impact of reproductive health on socio-economic development: a case study of Nigeria. *Afr J Reprod Health. 15:7-12*.

Ahmad, M.M., Ahmed, H. and Airede, K. 2013. Body mass index among school adolescents in Sokoto, North-Western Nigeria. *Sahel Medical Journal. Vol 16, Issue 1. Pg. 5-9.*

Ahmad, S., Shukla, N.K., Singh, J.V., Shukla, R. and Shukla, M., 2018. Double burden of malnutrition among school-going adolescent girls in North India: A cross-sectional study. *Journal of family medicine and primary care, 7(6), p.1417.*

Alam, P., 2012. Nutritional status and eating practices among university students in selected universities in Selangor, Malaysia. *Asian Journal of Clinical Nutrition, 4(3), pp.77-87.*

Also, U., Asani, M. and Ibrahim, M., 2016. Prevalence of elevated blood pressure among primary school children in Kano Metropolis, Nigeria. *Nigerian Journal of Cardiology*, *13*(1), p.57.

Ambrosini, G.L., Emmett, P.M., Northstone, K. and Jebb, S.A., 2014. Tracking a dietary pattern associated with increased adiposity in childhood and adolescence. *Obesity*, *22*(2), pp.458-465.

Ambrosini, G.L., Huang, R.C., Mori, T.A., Hands, B.P., O'Sullivan, T.A., de Klerk, N.H., Beilin, L.J. and Oddy, W.H., 2010. Dietary patterns and markers for the metabolic syndrome in Australian adolescents. *Nutrition, metabolism and cardiovascular diseases*, *20*(4), pp.274-283.

Amole, I.O., OlaOlorun, A.D., Odeigha, L.O. and Adesina, S.A. 2011. The prevalence of abdominal obesity and hypertension among adults in Ogbomosho Nigeria. *African Journal of Primary Health care and Family Medicine 3(1): 118-112.*

Anand, D. and Anuradha R.K. 2019. Impact of nutrition education programme onknowledge, attitude and practice (KAP) about nutritionamong adolescent girls. *International Journal of Home Science 2018; 4(3): 313-315*.

Anector, G.O., Ogundele, B.O., Oyewole, O.E. 2012. Effect of nutrition education on the eatinghabits of undergraduates in south-west Nigeria. *Asian Journal of Epidemiology.5(2):32-41.*

Ansa, V.O., Anah, M.U. and Ndifon, W.O., 2008. Soft drink consumption and overweight/obesity among Nigerian adolescents. *CVD Prevention and control*, *3*(4), pp.191-196

Ansa, V.O., Odigwe, C.O. and Anah, M.U., 2001. Profile of body mass index and obesity in Nigerian children and adolescents. *Nigerian journal of medicine: journal of the National Association of Resident Doctors of Nigeria*, *10*(2), pp.78-80.

Antony, M. and Bhatti, R.K. 2013. Junk Food Consumption and Knowledge about its Ill Effects among Teenagers: A Descriptive Study. *International Journal of Science and Research (IJSR). ISSN (Online): 2319-7064. Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438.*

Aounallah-Skhiri, H., Traissac, P., El Ati, J., Eymard-Duvernay, S., Landais, E., Achour, N., Delpeuch, F., Romdhane, H.B. and Maire, B. 2011. Nutrition transition among adolescents of a South-Mediterranean country: dietary patterns, association with socio-economic factors, overweight and blood pressure. A cross-sectional study in Tunisia. *Nutrition Journal, 10:38. Pg. 1-17.*

Appannah, G., Pot, G.K., Huang, R.C., Oddy, W.H., Beilin, L.J., Mori, T.A., Jebb, S.A. and Ambrosini, G.L., 2015. Identification of a dietary pattern associated with greater cardiometabolic risk in adolescence. *Nutrition, Metabolism and Cardiovascular Diseases*, *25*(7), pp.643-650.

Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M.C., Deitchler, M., Fanou-Fogny, N., Joseph, M.L., Kennedy, G., Martin-Prevel, Y. and Torheim, L.E., 2010. Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. *The Journal of nutrition*, *140*(11), pp.2059S-2069S.

Artanti, G.D. and Febriana, R., 2019. Identification of Young Women's Nutrition and Reproductive Knowledge in Making Video on Community-based Learning. *KnE Social Sciences*, *pp.445-452.*

Astbury, N.M., Taylor, M.A., Macdonald, I.A. 2011. Breakfast Consumption Affects Appetite, Energy Intake, and the Metabolic and Endocrine Responses to Foods Consumed Later in the Day in Male Habitual Breakfast Eaters. *The Journal of Nutrition. 141:1381–9*.

Atkinson, S.A. and Koletzko, B., 2007. Determining life-stage groups and extrapolating nutrient intake values (NIVs). *Food and nutrition bulletin, 28(1_suppl1), pp. S61-S76.*

Ayer J, Charakida M, Deanfield JE, Celermajer DS 2015.Lifetime risk: Childhood obesity and cardiovascular risk. *Eur Heart J,* 36(22): 371-1376.

Azadbakht, L., Akbari, F. and Esmaillzadeh, A. 2014. Diet quality among Iranian adolescents needs improvement. *Public Health Nutrition: 18(4), 615–621.*

Azeredo, C.M., Machado de Rezende, L.F., Canella, D.S., Claro, R.M., Ribeiro de Castro, I.R., Luiz, O. and Levy, R.B. 2014. Dietary intake of Brazilian adolescents. *Public Health Nutrition: 18(7), 1215–1224.*

Bailey, R.L., Fulgoni, V.L. 3rd, Keast, D.R., 2012. Do dietary supplements improve micronutrient sufficiency in children and adolescents? *J Pediatr. 161:837*.

Banfield, E.C., Liu, Y., Davis, J.S. 2016. Poor Adherence to US Dietary Guidelines for Children and Adolescents in the National Health and Nutrition Examination Survey Population. *J Acad Nutr Diet; 116:21*.

Barbara-Mullan, C.W., Emily Kothe, Kathleen O'Moore, Kristen Pickles and Kirby Sainsbury 2014. An examination of the demographic predictors of adolescent breakfast consumption, content, and context. *BMC Public Health. Pg. 1-9.*

Barbu, C.G., Teleman, M.D., Albu, A.I., Anca Elena Sirbu, A.E., Martin, S.C., Bancescu, A. and Fica, S.V. 2015. Obesity and eating behaviors in school children and adolescents –data from a cross sectional study from Bucharest, Romania. *BMC Public Health.15:206.*

Basiratnia, M., Derakhshan, D., Ajdari, S. and Saki, F., 2013. Prevalence of childhood obesity and hypertension in south of Iran. *Iranian journal of kidney diseases*, *7*(4), p.282.

Bastien, M., Poirier, P., Lemieux, I., Despres, J.P. 2014. Overview of epidemiology and contribution of obesity to cardiovascular disease. *Prog Cardiovasc Dis. 56:369–81*.

Bearman, S.K., Presnell, K., Martinez, E. and Stice, E., 2006. The skinny on body dissatisfaction: A longitudinal study of adolescent girls and boys. *Journal of youth and adolescence*, *35*(2), pp.217-229.

Bellisle, F., Hébel, P., Colin, J., Reyé, B. and Hopkins, S., 2014. Consumption of whole grains in French children, adolescents and adults. *British journal of nutrition*, *112*(10), pp.1674-1684.

Ben-Bassey, U.P., Oduwole, A.O. and Ogundipe, O.O., 2007. Prevalence of overweight and obesity in Eti-Osa LGA, Lagos, Nigeria. *Obesity Reviews, 8(6), pp.475-479.*

Bhattacharyya, H. and Barua, A., 2013. Nutritional status and factors affecting nutrition among adolescent girls in urban slums of Dibrugarh, Assam. *Natl J Community Med, 4(1), pp.35-9.*

Bhatt-Poulose, K., James, K., Reid, M., Harrison, A. and Asnani, M., 2016. Increased rates of body dissatisfaction, depressive symptoms, and suicide attempts in Jamaican teens with sickle cell disease. *Pediatric blood & cancer, 63(12), pp.2159-2166.*

Bhuiyan, M.U., Zaman, S. and Ahmed, T., 2013. Risk factors associated with overweight and obesity among urban school children and adolescents in Bangladesh: a case–control study. *BMC pediatrics*, *13*(1), p.72.

Bhutta, Z.A., Das, J.K., Rizvi, A., Gaffey, M.F., Walker, N., Horton, S., Webb, P., Lartey, A., Black, R.E. 2013. Lancet Nutrition Interventions Review Group, and Maternal and Child Nutrition Study Group. 'Evidence- based interventions for improvement of maternal and child nutrition: what can be done and at what cost?' *The Lancet 382, 9890, pp 452–77.*

Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., de Onis, M., Ezzati, M., Grantham- McGregor, S., Katz, J., Martorell, R., Uauy, R., and Maternal and Child Nutrition Study Group 2013. 'Maternal and child undernutrition and overweight in low-income and middle-income countries', T*he Lancet 382, 9890, pp 427–51.*

Bleyere, M.N., Kouadio, J.H., Koné, M., Sawadogo, D. and Yapo, P.A. 2014. Comparison during pregnancy of iron metabolism between adolescent and adult women in Côte d'Ivoire. *App. Sci. Report. 5 (1): 16-23.*

Blum, R.W., Bastos, F.I., Kabiru, C.W. and Le, L.C. 2012. 'Adolescent health in the 21st century.' *The Lancet 379, 9826, pp 1567–8.*

Bolajoko, O., Ogundahunsi, G.A., Folahan, O., Odugbemi, B.A. and Alakuro, O. 2014. Nutrient Adequacy of Foods Eaten by Students Attending Boarding and Day Secondary Schools in Owo. *Curr. Res. Nutr Food Sci Jour., Vol. 2(2), 84-87*.

Bolajoko, O.O., Adesanwo, A.S. and Akinhanmi, Y.O., 2019. Contribution of dietary pattern and family history to hypertension among adults in Abeokuta North Local Government Area, Ogun State, Nigeria. *Nigerian Journal of Nutritional Sciences*, *40*(2), pp.152-159.

Brannsether, B., Roelants, M., Bjerknes, R. and Júlíusson, P.B., 2011. Waist circumference and waist-to-height ratio in Norwegian children 4–18 years of age: Reference values and cut-off levels. *Acta Paediatrica*, *100*(12), pp.1576-1582.

Bray, G.A., 2010. Soft drink consumption and obesity: it is all about fructose. *Current opinion in lipidology*, *21*(1), pp.51-57.

Buhendwa, R.A., Roelants, M., Thomis, M. and Nkiama, C.E., 2017. Nutritional status and height, weight and bmi centiles of school-aged children and adolescents of 6–18-years from kinshasa (DRC). *Annals of human biology*, *44*(6), pp.554-561.

Burt, M.R. 1996. Why should we invest in adolescents? Paper prepared for the Conference on Comprehensive Health of Adolescents and Youth in Latin America and the Caribbean, July 9-12, Washington DC: PAHO, Kellogg Foundation.

Cappa, C, Wardlaw, T, Langevin-Falcon, C and Diers, J .2012. 'Progress for children: a report card on adolescents', *The Lancet 379, 9834, pp 2323–5.*

Carista, K., Govindarajan, P.K., John, W.F., Ethirajan, N. and Senthil-Muruga, T.K. 2014. A study on nutritional status of adolescent girls with reference to BMI among school going adolescent girls, Chidambaram. *Journal of Drug Discovery and Therapeutics 2 (22) 2014, 39-42.*

Caroline, P.K., Seenvasan, P., Praveen H., Amala, G.M., Annapoorani, V. and Shruthi D.R.S. 2014. A Study on Nutritional Status of School Children in Rural, Semi Urban and Urban Areas of Tamil Nadu. *Stanley Medical Journal, Vol.1, Issue 1, pg 1-9.*

Castro-Quezada, I., Román-Viñas, B. and Serra-Majem, L., 2014. The Mediterranean diet and nutritional adequacy: a review. *Nutrients*, *6*(1), pp.231-248.

Centres for Disease Control and Prevention (CDC) 2002. Iron Deficiency-United States, 1999-2000. MMWR Morb Mortal Wkly *Rep; 51:897*.

Chandrashekarappa, S.M., Ramakrishnaiah, N.M.M. and Manjunath, R., 2018. Nutritional status in adolescent girls: Attempt to determine its prevalence and its association with socio-demographic variables. *Family Medicine and Community Health*, *6*(4), pp.184-190.

Chang, Y.J., Lin, W. and Wong, Y., 2011. Survey on eating disorder–related thoughts, behaviours, and their relationship with food intake and nutritional status in female high school students in Taiwan. *Journal of the American College of Nutrition, 30(1), pp.39-48.*

Cheah, W.L., Helmy Hazmi, Hui Qi Chia, Empiang Tindin, Nur Adilah Ahmad Zafri and Syarul Haziq Mohd Shah, 2015. Hypertension and its association with

anthropometric indexes among pre-university students. *Int J Adolesc Med Health 2015; aop. Pg. 1-7.*

Chen, X., Wang, Y. 2008. Tracking of blood pressure from childhood toadulthood: a systematic review and meta-regression analysis. *Circulation, 117:3171–3180.*

Chirilă S., Hangan L. T, Broască V., Severin B. and Mocanu E. 2014. Difference of Height, Body Mass Index and Self-Assessment Among High-School Students in Constanta County– a comparison between rural and urban areas. *ARS Medica Tomitana - 2014; 3(78): 144 – 149. 10.2478/arsm-2014-0026.*

Cho, S., Dietrich, M., Brown, C.J., Clark, C.A., Block, G. 2003. The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and Nutrition Examination Survey (NHANES III). *J Am Coll Nutr. 22: 296-302.*

Chou, Y.C., Choy, C.S. and Liao, C.C., 2011. Hip Circumference and Risk of Elevated Blood Pressure in Children: A Cross-Sectional Study. *Journal of Arrhythmia*, *27(Supplement), pp.PE4_107*.

Choudhary, S., Saluja, N., Sharma, S., Dube, S., Pandey, S. M. and Kumar, A. 2015. Association of Energy Balance and Protein Intake with Nutritional Status of Adolescent Girls in A Rural Area of Haryana. *Journal of Evolution of Medical and Dental Sciences; Vol. 4, Issue 01, Page: 6-11.*

Choy, C.S., Chan, W.Y., Chen, T.L., Shih, C.C., Wu, L.C. and Liao, C.C., 2011. Waist circumference and risk of elevated blood pressure in children: a cross-sectional study. *BMC Public Health*, *11(1), p.613*.

Christa, K., Govindarajan, P.K, John, W. F., Ethirajan, N. Senthil, M. Christa, R. 2014. A study on nutritional status of adolescent girls with reference to BMI among school going adolescent girls, Chidambaram. *Journal of Drug Discovery and Therapeutics 2 (22), 39-42.*

Christofedes, N.J., Jewkes, R.K., Dunkle, K.L., McCarty, F., Jama Shai, N., Nduna, M and Sterk, C. 2014. 'Risk factors for unplanned and unwanted teenage pregnancies occurring over two years of follow-up among a cohort of young South African women', *Global Health Action 7, 23719.*

Claro, R.M., Santos, M.A.S. and Oliveira-Campos, M., 2014. Body image and extreme attitudes toward weight in Brazilian schoolchildren (PeNSE 2012). *Revista Brasileira de Epidemiologia*, *17*, pp.146-157.

Cole, T.J., Flegal, K.M., Nicholls, D., Jackson, A.A. 2007. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ. 335:194–7*.

Cunha, D.B., Bezerra, I.N., Pereira, R.A. and Sichieri, R., 2018. At-home and away-from-home dietary patterns and BMI z-scores in Brazilian adolescents. *Appetite*, *120*, pp.374-380.

Cutler, G.J., Flood, A., Hannan, P., Neumark-Sztainer, D. 2011. Multiple sociodemographic and socioenvironmental characteristics are correlated with major patterns of dietary intake in adolescents. *J Am Diet Assoc. 111:230*.

Daboné, C., Delisle, H.F. and Receveur, O., 2011. Poor nutritional status of schoolchildren in urban and peri-urban areas of Ouagadougou (Burkina Faso). *Nutrition journal*, *10*(1), p.34.

D'Adamo, C., McArdle, P., Balick, L. 2015. Spice MyPlate: Nutrition Education Focusing Upon Spices and Herbs Improved Diet Quality and Attitudes Among Urban High School Students. *Am J Health Promot*.

De Cosmi, V., Scaglioni, S. and Agostoni, C., 2017. Early taste experiences and later food choices. *Nutrients, 9(2), p.107.*

De Moraes, A.C.F., Bel-Serrat, S., Manios, Y., Molnar, D., Kafatos, A., Cuenca-García, M., Huybrechts, I., Sette, S., Widhalm, K., Stehle, P. and Jiménez-Pavón, D., 2015. Dietary protein and amino acids intake and its relationship with blood pressure in adolescents: the HELENA STUDY. *The European Journal of Public Health*, *25*(3), pp.450-456.

de Onis, M., Blössner, M. 2000. Prevalence and trends of overweightamong preschool children in developing countries.*Am J Clin Nutr; 72:1032-9.*

de Onis, M., Blössner, M., Borghi, E. 2010. Global prevalenceand trends of overweight and obesity among preschoolchildren. *Am J Clin Nutr; 92:1257-64.*

de Onis, M., Onyango, A.W., Borghi, E., Siyam, A., Nishida, C., Siekmann. J. 2007. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ. 85:660–7.*

del Mar Bibiloni, M., Maffeis, C., Llompart, I., Pons, A. and Tur, J.A., 2013. Dietary factors associated with subclinical inflammation among girls. *European journal of clinical nutrition*, *67(12), p.1264*.

del Mar Bibiloni, M., Martínez, E., Llull, R., Pons, A. and Tur, J.A., 2012. Western and Mediterranean dietary patterns among Balearic Islands' adolescents: socio-economic and lifestyle determinants. Public health nutrition, 15(4), pp.683-692.

del Mar Bibiloni, M., Martínez, E., Llull, R., Pons, A. and Tur, J.A., 2012. Western and Mediterranean dietary patterns among Balearic Islands' adolescents: socio-economic and lifestyle determinants. *Public Health Nutrition, 15(4), pp.683-692.*

del Mar Bibiloni, M., Pich, J., Pons, A. and Tur, J.A., 2013. Body image and eating patterns among adolescents. *BMC public health, 13(1), p.1104*

Denloye, O., Popoola, B. and Ifesanya, J. 2015. Association between dental caries and body mass index in 12e15 year old private school children in Ibadan, Nigeria. *Pediatric Dental Journal. Vol. 30. Pg. 1-6.*

Dholpuria, R., Raja, S., Gupta, B.K., Chahar, C.K., Panwar, R.B., Gupta, R. and Purohit, V.P., 2007. Atherosclerotic risk factors in adolescents. *The Indian Journal of Pediatrics*, *74*(9), *pp.823-826.*

Dhringa, R., Sullivan, L. and Jacques, P.F., 2007. Soft drink consumption and risk factors of developing cardiometabolic risk factors and metabolic syndrome in middle-aged adults in the community. *Circulation*, *116*, pp.480-8.

Din-Dzietham, R., Liu, Y., Bielo, M.V. and Shamsa, F., 2007. High blood pressure trends in children and adolescents in national surveys, 1963 to 2002. *Circulation*, *116(13)*, *pp.1488-1496*.

Dishchekenian, V.R.M., Escrivão, M.A.M.S., Palma, D., Ancona-Lopez, F., Araújo, E.A.C.D. and Taddei, J.A.D.A.C., 2011. Dietary patterns of obese adolescents and different metabolic effects. *Revista de Nutrição*, *24(1), pp.17-29*.

Dong, J., Guo, X.L., Lu, Z.L., Cai, X.N., Wang, H.C., Zhang, J.Y., Yan, L.X. and Xu, A.Q., 2014. Prevalence of overweight and obesity and their associations with

blood pressure among children and adolescents in Shandong, China. *BMC public health*, *14(1), p.1080*.

Dong, Y., Pollock, N., Stallmann-Jorgensen, I.S. 2010. Low 25-hydroxyvitamin D levels in adolescents: race, season, adiposity, physical activity, and fitness. *Pediatrics; 125:1104*.

Dulskiene, V., Kuciene, R. Medzioniene, J. and Benetis, R. 2014. Association between obesity and high bloodpressure among Lithuanian adolescents: across-sectional study. *Italian Journal of Pediatrics 2014, 40:102. Pg. 1-10.*

Duru, C.B., Iwu, A.C., Uwakwe, K.A., Diwe, K.C., Nnebue, C.C., Merenu, I.A., Achigbu, K. and Chineke, H.N., 2016. Prevalence and determinants of adolescent malnutrition in Owerri, Imo State, Nigeria. *Int J Sci Health Res*, *1*, pp.2455-7587.

Ejike, C. 2011. Blood pressure to height ratios as simple, sensitive and specific diagnostic tools for adolescent (pre)hypertension in Nigeria. *Italian Journal of Pediatrics, 37:30. Pg. 1-6.*

Ejike, C.E. and Ugwu, C.2010. Hyperbolic Relationship between Blood Pressure and Body MassIndex in a Nigerian Adolescent Population. *WebmedCentral HYPERTENSION. 1(10): WMC00797*.

Ejike, C.E., 2014. Child and adolescent obesity in Nigeria: a narrative review of prevalence data from three decades (1983-2013). *Journal of Obesity and Metabolic Research*, *1(3), p.171*.

Ejike, C.E., Ugwu, C.E., Ezeanyika, L.U. and Olayemi, A.T., 2008. Blood pressure patterns in relation to geographic area of residence: a cross-sectional study of adolescents in Kogi state, Nigeria. *BMC Public Health*, *8(1), p.411*.

Ejike, C.E.C.C., Ugwu, C.E. and Ezeanyika, L.U.S., 2010. Physical growth and nutritional status of a cohort of semi-urban Nigerian adolescents. *Pak J Nutr*, *9(4), pp.392-397.*

Ejike, C.E.C.C., Ugwu, C.E., and Ezeanyika, L.U.S. 2010.Variations in the prevalence of point (pre) hypertension in a Nigerian school-going adolescent population living in a semi-urban and an urban area. *BMC Pediatrics 10:13.*

Eke, C.B., Chukwu, B.F., Ikefuna, A.N., Ezenwosu, O.U. and Emodi, I.J. 2015. Bioelectric Impedance Analysis of Body Composition of Children and

Adolescents with Sickle Cell Anemia in Enugu, Nigeria. *Pediatric Hematology and Oncology, Early Online:1–11.*

Elhassan, M.R., Gamal, H.E. and Mohammed, G.S., 2013. Nutrition knowledge attitude and practices among students of Ahfad University for women. *Indian Journal of Scientific Research, pp.25-35*.

El-Kader, R.G.A., Mekhamier, H.A.and Hegazy, A.E.S.A., 2019. Dietary Habits and Nutritional Knowledge among Primary SchoolChildren in Fayoum Governorate. *International Journal of Studies in Nursing; Vol. 4, No. 2; pg.95.*

Elnaeim, E.B., 2013. Dietary patterns of University students: A case study of the University of Sennar. *International Journal of Science and Research, 2(11), pp.396-400.*

Ene-Obong, H., Ibeanu, V., Onuoha, N. and Ejekwu, A., 2012. Prevalence of overweight, obesity, and thinness among urban school-aged children and adolescents in southern Nigeria. *Food and Nutrition Bulletin*, *33*(4), pp.242-250.

Esimai O.A., and Ojofeitimi, E.O. 2015. Nutrition and Health Status of Adolescents in a Private Secondary School in Port Harcourt. *Health Science Journal, Vol.9, No. 5:4. Pg. 1-5.*

Essien, E., Emebu, P.K., Iseh, K.R. and Haruna, M.J., 2014. Assessment of nutritional status and knowledge of students from selected secondary schools in Sokoto metropolis, Sokoto State, Nigeria. *African Journal for Food, Agriculture, Nutrition and Development, 14 (6), pp.2254-2268.*

Eun Woo Nam, Bimala Sharma, Ha Yun Kim, Doris Jackeline Vasquez Paja, Young Min Yoon, Sun Ha Lee, Eun Hwan Kim, Chung Hyeon Oh, Yun Seop Kim, Chang Hoon Song, Jong Koo Kim, 2015. Obesity and Hypertension among School-going Adolescents in Peru. *Journal of Lifestyle Medicine. Vol. 5, No. 2, 60-67.*

FANTA, F., 2006. Developing and validating simple indicators of dietary quality and energy intake of infants and young children in developing countries: summary of findings from analysis of 10 data sets. *Washington, DC: Academy for Educational Development*.

FAO, 2007. Nutritional Status Assessment and Analysis Lesson: Nutritional Status and Food Security. Food and Agriculture Organization, Pp. 1-12.

FAO, FHI 360, 2016. *Minimum dietary diversity for women: a guide for measurement. Rome: FAO*.

Fernandes, R.A., Zanesco, A. 2010. Early physical activity promotes lower prevalence of chronic diseases in adulthood. *Hypertens Res. 33:926-31.*

Fernandez, C., Kasper, N.M., Miller, A.L., Lumeng, J.C. and Peterson, K.E., 2016. Association of dietary variety and diversity with body mass index in US preschool children. *Pediatrics, 137(3), p.e20152307*.

Flores-Huerta, S., Klünder-Klünder, M., de la Cruz, L.R. and Santos, J.I., 2009. Increase in body mass index and waist circumference is associated with high blood pressure in children and adolescents in Mexico City. *Archives of medical research*, *40(3), pp.208-215*.

Fokeena, W.B. and Jeewon, R., 2012. Is there an association between socioeconomic status and body mass index among adolescents in mauritius?*The Scientific World Journal, 2012.*

Franks, P.W., Hanson, R.L., Knowler, W.C., Sievers, M.L.,Bennett, P.H., Looker, H.C. 2010. Childhood obesity, other cardiovascularrisk factors, and premature death. *N Engl J Med; 362:485-93.*

Friedemann, C., Heneghan, C., Mahtani, K., Thompson, M., Perera, R., Ward, A. M. 2012. Cardiovascular disease riskin healthy children and its association with body massindex: systematic review and meta-analysis. *BMJ; 345: e4759.*

Funtikova, A.N., Navarro, E., Bawaked, R.A., Fíto, M. and Schröder, H., 2015. Impact of diet on cardiometabolic health in children and adolescents. *Nutrition journal*, *14*(1), p.118.

Ghosh, A., 2014. Explaining overweight and obesity in children and adolescents of Asian Indian origin: The Calcutta childhood obesity study. *Indian journal of public health, 58(2), p.125.*

Gibbs, C.M., Wendt, A., Peters, S. and Hogue, C.J. 2012. 'The impact of early age at first childbirth on maternal and infant health', *Paediatric and Perinatal Epidemiology 26, Suppl 1, pp 259–84.*

Gibson, R. S., 2005. Principles of Nutritional Assessment (2nd ed.). New York: Oxford University Press.

Giovannelli, T.S., Cash, T.F., Henson, J.M., Engle, E.K., 2008. The measurement of body-image dissatisfaction-satisfaction: Is rating importance important? *Body Image; 5: 216–223*

Gomez-Marin, O., Prineas, R.J., Rastam, L., 1992. Cuffbladder width and blood pressure measurementin children and adolescents. *J Hypertens 1992;10:1235–41*.

Goon, D.T., Toriola, A.L., Shaw, B.S., Amusa, L.O., Monyeki, M.A., Akinyemi, O. and Alabi, O.A. 2011.Anthropometrically determined nutritional status of urban primary schoolchildren in Makurdi, Nigeria. *BMC Public Health 2011, 11:769.*

Gracey, D., Stanley, N., Burke, V., Cortis, B. and Beilin, L.J. 1996. Nutritional Knowledge, belief and behaviours in the teenage school students. *Health Educ. Res. 11, 187-204*.

Guedes, D.P., Neto, J.T.M. and Silva, M. 2014.Anthropometric nutritional of adolescents from a region of low economic development in Brazil: comparison with the WHO-2007 reference. *Rev Bras Cineantropom Desempenho Hum, 16(3):258-267*.

Gunther, A.LB., Liese, A.D., Bell, R. A., Dabelea, D., Lawrence, J.M., Rodriguez, B.L., Standiford, D.A. and Mayer-Davis, E.J. 2009. Association between the Dietary Approaches to Hypertension Diet and Hypertension in Youth with Diabetes Mellitus. *DOI: 10.1161/HYPERTENSIONAHA.108.116665. pg. 6-13.*

Guo, X., Zheng, L., Li, Y., Yu, S., Liu, S., Zhou, X., Zhang, X., Sun, Z., Wang, R. and Sun, Y. 2011. Association between Sleep Duration and Hypertension among Chinese Children and Adolescents. *Clin. Cardiol. 34, 12, 774–781.*

Guo, X., Zheng, L., Li, Y., Yu, S., Sun, G., Yang, H., Zhou, X., Zhang, X., Sun, Z. and Sun, Y., 2012. Differences in lifestyle behaviors, dietary habits, and familial factors among normal-weight, overweight, and obese Chinese children and adolescents. *International Journal of Behavioral Nutrition and Physical Activity, 9(1), p.120.*

Guo, X., Zheng, L., Li, Y., Yu, S., Zhou, X., Wang, R., Zhang, X., Sun, Z. and Sun, Y., 2013. Gender-specific prevalence and associated risk factors of

prehypertension among rural children and adolescents in Northeast China: a cross-sectional study. *European journal of pediatrics*, *172(2), pp.223-230*.

Haileselassie, B., Roba, K.T. and Weldegebreal, F., 2019. Undernutrition and its Associated Factors among Pediatric Age Children Attending Antiretroviral Therapy in Eastern Ethiopia. *East African Journal of Health and Biomedical Sciences*, *3*(1), pp.1-12.

Haines J, Neumark-Sztainer D., 2006. Prevention of obesity and eating disorders: a consideration of shared risk factors. *Health Educ Res 21: 770–782.*

Hallstrom, L., Labayen, I., Ruiz, J.R. 2012. Breakfast consumption and CVD risk factors in European adolescents: the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. *Public Health Nutrition. 16(7), 1296–1305.*

Harika, R., Faber, M., Samuel, F., Kimiywe, J., Mulugeta, A. and Eilander, A., 2017. Micronutrient status and dietary intake of iron, vitamin A, iodine, folate and zinc in women of reproductive age and pregnant women in Ethiopia, Kenya, Nigeria and South Africa: a systematic review of data from 2005 to 2015. *Nutrients*, *9*(10), p.1096.

Harnden, K.E., Frayn, K.N. and Hodson, L., 2010. Dietary Approaches to Stop Hypertension (DASH) diet: applicability and acceptability to a UK population. *Journal of human nutrition and dietetics*, *23(1), pp.3-10*.

Heather, J. and Leidy, P. 2013. The Benefits of Breakfast Consumption to Combat Obesity and Diabetes in Young People. *American J Lifestyle Med. 2013;7.*

Heinberg, L., Thompson, J., Matzon, J., 2001. Body image dissatisfaction as a motivator for healthy lifestyle change: Is some distress beneficial? In: Striegel-Moore R, Smolak L (eds). Eating Disorders. Innovative Directions in Research and Practice. American Psychological Association: Washington, DC, pp 215–232

Henry-Unaeze, H.N. and Okomkwo, C.N. 2011. Food Consumption Pattern and Calcium Status of Adolescents in Nnewi, Nigeria. *Pakistan Journal of Nutrition. 10 (4)317-321.*

Heshmat, R., Kelishadi, R., Motamed-Gorji, N., Motlagh, M., Ardalan, G., Arifirad, T., Rastad. H., Asayesh, H., Djalalinia, S., Larijani, B. and Qorbani, M. 2014. Association between body mass index and perceived weight status with self-

rated health and life satisfaction in Iranian children and adolescents: the CASPIAN-III study. *Qual Life Res (2015) 24:263–272.*

Himes,J., Dietz, W. 1994. Guidelines for overweight in adolescent preventive services: Recommendations from an expert committee. *Am J Clin Nutr 59(2):307-316.*

Hu, Y., Chen, J., Wang, R., Li, M., Yun, C., Li, W., Yang, Y., Piao, J., Yang, X. and Hu, Y., Chen, J., Wang, R., Li, M., Yun, C., Li, W., Yang, Y., Piao, J., Yang, X. and Yang, L., 2017. Vitamin D nutritional status and its related factors for Chinese children and adolescents in 2010–2012. *Nutrients, 9(9), p.1024.*

Hubbard, V.A., Hubbard, L.R.,1997. Clinical assessment of nutritional status. In: Walker WA, Watkins JB, editors. Nutrition in Paediatrics: Basic Science and Clinical Applications, 2nd edition. Hamilton, ON: BC Decker; p. 7–28.

Idowu O. Senbanjo, I.O. Oshikoya, K.A., Odusanya, O.O. and Njokanma, O.F. 2011. Prevalence of and Risk factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria. *J Health Popul Nutr. Aug 29 (4)364-370.*

Ilesanmi, O.S., Ilesanmi, F.F. and Ijarotimi, I.T. 2014. Determinants of Fruit Consumption among In-school Adolescents in Ibadan, South West Nigeria. *European Journal of Nutrition & Food Safety 4(2): 100-109.*

Iyalomhe, S.I., Iyalomhe, S.E., Nwadike, I.G., Osunde, R.N. and Iyalomhe, G.B.S., 2018. Assessment of Dietary Habits and Nutritional Status of Adolescents in a Resource–Poor Environment in Nigeria. *International Journal of Nutrition and Food Sciences*, *7*(4), p.121.

Izuora1, A. N., Animasahun, B. A., Nwodo, U., Ibeabuchi, N. M., Njokanma, O. F. and Renner, J. K., 2013. Assessment of overweight and obesity among Nigerian children and adolescents using triceps skin-fold thickness and body mass index. *Clinical Obesity. International Association for the Study of Obesity. clinical obesity 3, 103–111.*

Jalal, D.I., Smits, G., Johnson, R.J. and Chonchol, M., 2010. Increased fructose associates with elevated blood pressure. *Journal of the American Society of Nephrology*, *21*(9), pp.1543-1549.

Jansen, P.W., Roza, S.J., Jaddoe, V.W., Mackenbach, J.D., Raat, H., Hofman, A., Verhulst, F.C. and Tiemeier, H., 2012. Children's eating behavior, feeding

practices of parents and weight problems in early childhood: results from the population-based Generation R Study. *International Journal of Behavioral Nutrition and Physical Activity, 9(1), p.130.*

Jaswant, S. and Nitish, M. 2014. Use of Upper-Arm Anthropometry as Measure of Body-Composition and Nutritional Assessment in Children and Adolescents (6-20 Years) Of Assam, Northeast India. *Ethiop J Health Sci. Vol. 24, No. 3. Pg. 243-253.*

Jiang, H., Zhao, A., Zhao, W., Tan, S., Zhang, J., Zhang, Y. and Wang, P., 2018. Do Chinese Preschool Children Eat a Sufficiently Diverse Diet? A Cross-Sectional Study in China. *Nutrients*, *10*(6), p.794.

Jildeh, C., Papandreou, C., Mourad, T.A., Hatzis, C., Anthony Kafatos, A., Qasrawi, R., Philalithis, A and Abdeen, Z. 2011. Assessing the Nutritional Status of Palestinian Adolescents from East Jerusalem: A School-based Study 2002-03. *Journal of Tropical Pediatrics, Vol. 57, No. 1, pg 51-58.*

Johnson, O.E., Mbada C.E., Alao, D.Y. Okonji, A.M., Nweke, C.O. 2016. Obesity in Nigeria children and adolescents-waist circumference a more sensitive indicator. *International Journal of Community Medicine and Public Health. Mar;3(3):721-729.*

Jollie-Trottier, T., Jeffrey E. Holm, J.E. and McDonald, J.D. 2009. Correlates of Overweight and Obesity in American Indian Children. *Journal of Paediatric Psychology vol. 34 no. 3. Pg. 245-253.*

Kakkar, R., Kakkar, M., Kandpal, S.D., Jethani, S. 2011. Study of anaemia in adolescent school girls of Bhopal. *Indian Journal of Community Health Vol. 22 No. 2, Vol. 23 No. 1 July 2010-June.*

Kalkan, İ., Türkmen, A., S., and Filiz, E. 2015. Dietary habits of Turkish adolescents in Konya. *Turkey, Global Journal on Advances in Pure & Applied Sciences. [Online]. 07, pp 190-196.*

Kann, L., Kinchen, S., Shanklin, S.L. 2014. Youth risk behaviour Surveillance-United States, 2013. *MMWR Suppl; 63:1*.

Karatzi, K., Moschonis, G., Barouti, A.A., Lionis, C., Chrousos, G.P. and Manios, Y., 2014. Dietary patterns and breakfast consumption in relation to insulin

resistance in children. The Healthy Growth Study. *Public health nutrition*, *17(12), pp.2790-2797*.

Kennedy, G., Ballard, T. and Dop, M.C., 2011. *Guidelines for measuring household and individual dietary diversity*. Food and Agriculture Organization of the United Nations.

Khoshoo, V. 1997. Nutritional assessment in children and adolescents. *Curr. Opin. Pediat. 9, 502–507.*

Kiboi, W., Kimiywe, J. and Chege, P., 2016. Dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County, Kenya. *International Journal of Health Sciences & Research*, pp.378-379.

Klimek-Piotrowska, W., Mateusz Koziej, M., Hołda, M.K., Piątek, K., Wszołek, K., Tyszka, M., Kmiotek, E., Pliczko, M. Śliwińska, A., Krauss, K. Miszczyk, M. and Walocha, J. 2015. Anthropometry and Body Composition ofAdolescents in Cracow, Poland. *PLOS ONE | DOI: 10.1371/journal.pone.0122274. pg 1-12.*

Koirala, M., Khatri, R.B., Khanal, V. and Amatya, A., 2015. Prevalence and factors associated with childhood overweight/obesity of private school children in Nepal. *Obesity research & clinical practice*, *9*(3), pp.220-227.

Kovacs, V.A., Gabor, A., Fajcsak, Z., Martos, E. 2010. Role of waist circumference inpredicting the risk of high blood pressure in children. *Int J Pediatr Obes, 5:143–150.*

Kozuki, N., Lee, A.C., Silveira, M.F., Sania, A., Vogel, J.P., Adair, L., Barros, F., Caulfield, L.E., Christian, P., Fawzi, W., Humphrey, J., Huybregts, L., Mongkolchati, A., Ntozini, R., Osrin, D., Roberfroid, D., Tielsch, J., Vaidya, A., Black, R.E., Katz, J., and Child Health Epidemiology Reference Group Small-for- Gestational-Age-Preterm Birth Working Group 2013. 'The associations of parity and maternal age with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-analysis', *BMC Public Health 13, Suppl 3, p S2.*

Kuciene, R. and Dulskiene, V. 2014. Associations of short sleep duration with prehypertension and hypertension among Lithuanian children and adolescents: a cross-sectional study. *BMC Public Health, 14:255*.

Kumar, A., Srivastava, K. 2011. Cultural and social practices regarding menstruation among adolescent girls. *Soc Work Public Health. 26:594-604.*

Laffer, C.L., 2004. Is sodium restriction important to hypertension? The argument for. *Journal of clinical hypertension (Greenwich, Conn.)*, *6(6), pp.335-337*.

Lateef, O.J., Njogu, E., Kiplamai, F., Haruna, U.S. and Lawal, R.A. 2016. Breakfast, Food Consumption Pattern and Nutritional Status of Students in Public Secondary Schools in Kwara State, Nigeria. *Pakistan Journal of Nutrition 15 (2): 140-147.*

Lavie, C.J., Milani, R.V., Ventura, H.O. 2009. Obesity and cardiovascular disease: risk factor, paradox, and impact of weight loss. *J Am Coll Cardiol. 53:1925.*

Lawler, M. and Nixon, E., 2011. Body dissatisfaction among adolescent boys and girls: the effects of body mass, peer appearance culture and internalization of appearance ideals. *Journal of youth and adolescence, 40(1), pp.59-71.*

Lippevelde, W.V., Velde, S.J.T., Verloigne, M.T. 2013. Associations between Family-Related Factors, Breakfast Consumption and BMI among 10- to 12-Year-Old European Children: The Cross-Sectional ENERGY-Study. *PLoS ONE. 11: e79550*.

Lloyd, L.J., Langley-Evans, S.C. and McMullen, S., 2012. Childhood obesity and risk of the adult metabolic syndrome: a systematic review. *International journal of obesity*, *36*(1), p.1.

Loth, K.A., MacLehose, R.F., Larson, N. 2016. Food availability, modelling and restriction: How are these different aspects of the family eating environment related to adolescent dietary intake? *Appetite 2016; 96:80.*

Lu, X., Shi, P., Luo, C.Y., Zhou, Y.F., Yu, H.T., Guo, C.Y., Wu, F.2013. Prevalence ofhypertension in overweight and obese children from a large school-based population in Shanghai, China. *BMC Public Health, 11:13–24.*

Magliano, E.S., Guedes, L.G., Coutinho, E.S.F., Bloch, K.V. 2013. Prevalence of arterial hypertension among Brazilianadolescents: systematic review and meta-analysis.*BMC Public Health. 13:833.*

Mahajan, A. and Negi1, P. C. 2015. Hypertension and pre-hypertension among adolescents in Shimla, Northern India-Time to awaken.*Nigerian Journal of Cardiology | July - December 2015 | Vol 12 | Issue 2. Pg. 71-76.*

Maiti, S., Ali, K.M., De, D., Bera, T.K. and Paul, S. 2011. A Comparative Study on Nutritional Status of Urban and Rural Early Adolescent School Girls of West Bengal, India. *J. Nepal Paediatr. Soc. Vol (31):3; Pg 169-174.*

Maiti, S., Chattterjee, K., Ali, K.M., Ghosh, D. and Paul, S. 2011. Assessment of Nutritional Status of Rural Early Adolescent School Girls in Dantan-Ii Block, Paschim Medinipur District, West Bengal. *National Journal of Community Medicine. Volume 2 Issue 1. Pg. 14-18.*

Makkes, S., Renders, C.M., Bosmans, J.E., van der Baan-Slootweg, O.H., Seidell, J.C. 2013. Cardiometabolic risk factorsand quality of life in severely obese children and adolescents in The Netherlands. *BMC Pediatr. 13:62.*

Malak, E., Hiba, A. and Mustafa, K., 2015. Eating habits among medical students in a Sudanese medical faculty. *International Research Journal of Medicine and Medical Sciences, 3(3), pp.64-9.*

Maldonado, J., Pereira, T., Fernandes, R. and Carvalho, M., 2009. Blood pressure distribution of a sample of healthy Portuguese children and adolescents: the AVELEIRA registry. *Revista portuguesa de cardiologia: orgao oficial da Sociedade Portuguesa de Cardiologia= Portuguese journal of cardiology: an official journal of the Portuguese Society of Cardiology*, *28(11), pp.1233-1244*.

Malik M. and Bakir, A. 2007. Prevalence of overweight and obesity among children in the United Arab Emirates. *Obesity Reviews 8(1) 15-50*

Malik, V.S., Popkin, B.M., Bray, G.A., Després, J.P. and Hu, F.B., 2010. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation*, *121(11), pp.1356-1364.*

Malik, V.S., Willett, W.C. and Hu, F.B., 2013. Global obesity: trends, risk factors and policy implications. *Nature Reviews Endocrinology, 9(1), p.13.*

Mansur, D.L., Haque, M.K., Sharma, K., Mehta, D.K. and Shakya, R. 2015. A Study on Nutritional Status of Rural School going Children in Kavre District. *Kathmandu University Medical Journal Vol. 13, No. 2, Issue 50, pg 146-151.*

Mariza, Y.Y. and Kusumastuti, A.C. 2013. Hubungan antara kebiasaan sarapan dan kebiasaan jajan dengan status gizi anak sekolah dasar di kecamatan pedurungan kota semarang. *Journal of Nutrition College. 2(1):207-213.*

Marrodán Serrano, M.D., Cabañas Armesilla, M.D., Carmenate Moreno, M.M.,González-Montero de Espinosa, M., López-Ejeda, N, JR MÁ, Prado Martínez, C.,Romero-Collazos, J.F. 2012. Association between adiposity and blood pressurelevels between the ages of 6 and 16 years: analysis in a studentpopulation from Madrid, Spain. *Rev Esp Cardiol 2013, 66:110–115.*

Martı´nez, E., Rosa, L., Maria del Mar Bibiloni, Antoni, P and Joseph A. T. 2010. Adherence to the Mediterranean dietary pattern among Balearic Islands adolescents. *British Journal of Nutrition, 103, 1657–1664.*

Maruf, F.A., Aronu, U., Chukwuegbu, K. and Aronu, A.E. 2013. Influence of gender on prevalence of overweight and obesity in Nigerian schoolchildren and adolescents. *Tanzania Journal of Health Research. Volume 15, Number (4)1-6, October 2013*

Matthys, C., van't Veer, P., de Groot, L., Hooper, L., Cavelaars, A.E.J.M., Collings, R., Donutske-Rutten, R., Harvey, L.J., Casgrain, A., Rollin, F. and Contor, L., 2011. EURRECA's approach for estimating micronutrient requirements. *International Journal for Vitamin and Nutrition Research*, *81*(4), p.256.

Maureen T. Timlin, P., Mark, A., Pereira, P., Mary, S.P. and Neumark-Sztainer, P. D. 2008. Breakfast Eating and Weight Change in a 5-Year Prospective Analysis of Adolescents: Project EAT (Eating Among Teens). *Journal of the American Academy of Pediatrics. 121(2); e638-e645*

Mazor-Aronovitch, K., Lotan, D., Modan-Moses, D., Fradkin, A. and Pinhas-Ham, O., 2014. Blood pressure in obese and overweight children and adolescents. *Sat, 26, p.19.*

Mbagwu, S.I., Ibeabuchi, N.M. Aniah, J.A. and Adelakun, S.A. 2015. Anthropometric evaluation of growth variation in urban dwelling female adolescent school children. *Annals of Bioanthropology. Vol 3, Issue 1, pg. 6-9.*

McLaren, D. and Burman, D. (1982) Textbook of Paediatric Nutrition. 2nd ed., Churchill Livingstone, New York.

McNaughton, S.A. 2011. Understanding the eating behaviours of adolescents: application of dietary patterns methodology to behavioural nutrition research. *J Am Diet Assoc. 111:226.*

McNaughton, S.A., Ball, K., Mishra, G.D. and Crawford, D.A. 2008. Dietary Patterns of Adolescents and Risk of Obesity and Hypertension. *The Journal of Nutrition Nutritional Epidemiology. 138: 364–370.*

McNiece, K.L., Poffenbarger, T.S., Turner, J.L., Franco, K.D., Sorof, J.M., Portman, R.J. 2007. Prevalence of hypertension and pre-hypertension among adolescents.*J Pediatr 2007, 150:640–644. e1.*

Mehdad, S., Hamrani, A., El Kari, K., El Hamdouchi, A., El Mzibri, M., Barkat, A., Aguenaou, H. and Mokhtar, N., 2013. Prevalence of elevated blood pressure and its relationship with fat mass, body mass index and waist circumference among a group of Moroccan overweight adolescents. *Obesity research & clinical practice*, *7*(4), *pp. e284-e289*.

Meng, L., Wang, Y., Li, T., Loo-Bouwman, C.A.V., Zhang, Y. and Man-Yau Szeto, I., 2018. Dietary Diversity and Food Variety in Chinese Children Aged 3–17 Years: Are They Negatively Associated with Dietary Micronutrient Inadequacy? *Nutrients*, *10*(11), p.1674.

Menzel, J. E., & Levine, M. P., 2011. Embodying experiences and the promotion ofpositive body image: The example of competitive athletics. In R. M. Calogero,S. Tantleff-Dunn & J. K. Thompson (Eds.), Self-objectification in women: Causes,consequences, and counteractions (pp. 163–186). Washington, DC: American Psychological Association

Meyers, L.D., Hellwig, J.P. and Otten, J.J. eds., 2006. *Dietary reference intakes: the essential guide to nutrient requirements*. National Academies Press.

Michels, K.B. and Schulze, M.B., 2005. Can dietary patterns help us detect diet–disease associations? *Nutrition research reviews*, *18*(2), pp.241-248.

Mijinyawa, M.S., Iliyasu, Z. and Borodo, M.M., 2008. Prevalence of hypertension among teenage students in Kano, Nigeria. *Nigerian Journal of Medicine*, *17(2), pp.173-178*.

Mijinyawa, M.S., Yusuf, S.M., Gezawa, I.D., Musa, B.M., Uloko, A.E. 2014. Prevalence of thinness among adolescents in Kano, Northwestern Nigeria.*Nigerian Journal of Basic and Clinical Sciences / Jan-Jun 2014 / Vol 11 | Number (1)24-29*.

Miller, A. and Adeli, K., 2008. Dietary fructose and the metabolic syndrome. *Current opinion in gastroenterology*, *24(2), pp.204-209*.

Milosavljević, D., Mandić, M.L., Banjari, I. 2015. Nutritional knowledge and dietary habits survey in high school population. *Coll Antropol. 39:101.*

Minaker, L.M., Storey, K.E., Raine, K.D., Spence, J.C., Forbes, L.E., Plotnikoff, R.C. and McCargar, L.J. 2011. Associations between the perceived presence of

vending machines and food and beverage logos in schools and adolescents' diet and weight status. *Public Health Nutrition: 14(8), 1350–1356.*

Mirmiran, P., Azadbakht, L., Esmaillzadeh, A. and Azizi, F., 2004. Dietary diversity score in adolescents-a good indicator of the nutritional adequacy of diets: Tehran lipid and glucose study. *Asia Pacific journal of clinical nutrition*, *13*(1), pp.56-60.

Mistsnefes, M.M. 2006. Hypertension in children and adolescents. *Pediatr Clin North Am 2006; 53:493–498.*

Mladenova1, S. and Andreenko, E. 2015. The Prevalence of High-Normal Blood Pressure and Hypertension among 8 to 15-Year-Old Bulgarian Childrenand Adolescents with Various Nutritional Status(Smolyan Region, 2012-2014). *Anthropologist, 21(1,2): 51-60.*

Mohammadifard, N., Sarrafzadegan, N., Nouri, F., Sajjadi, F., Alikhasi, H., Maghroun, M., Kelishadi, R., Iraji, F. and Rahmati, M., 2012. Using factor analysis to identify dietary patterns in Iranian adults: Isfahan Healthy Heart Program. *International journal of public health*, *57*(1), pp.235-241.

Molak, L. 2012. Appearance in childhood and adolescence. In N. Rumsey & D.Harcourt (Eds.), Oxford Handbook of the Psychology of Appearance (pp. 123–141).London: Oxford University Press.

Monika-Arora, G.P.N., Gupta, V.K., Perry, C.L., Reddy, K.S., Stigler, M.H. 2012. Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: results of a cross-sectional study. *BMC Public Health, 12:881*

Morales, I.F., Vilas, M.V.A., Vega, C.J.M. and Para, M.C.M. 2011. Breakfast quality and its relationship to the prevalence of overweight and obesity in adolescents in Guadalajara (Spain). *Nutricion Hospitalaria. 26:952-8.*

Moreno, L.A., 2013. Obesity in children and adolescents. A critical review. *Endocrinología y Nutrición*, *60(Suppl 1), pp.7-9*.

Moreno, L.A., Pigeot, I. and Ahrens, W., 2011. Epidemiology of obesity in children and adolescents. *Prevalence and etiology, Nueva York: Springer*.

Moschonis, G., Papandreou, D., Mavrogianni, C., Giannopoulou, A., Damianidi, L., Malindretos, P., Lionis, C., Chrousos, G.P. and Manios, Y. 2013. Association of Iron Depletion with Menstruation and Dietary Intake Indices in Pubertal Girls: The Healthy Growth Study.*BioMed Research International Volume 2013, Article ID 423263, Pages 1-9.*

Moselakgomo, V.K., Toriola, A.L., Shaw, B.S., Goon, D.T. and Akinyemi, O. 2012. Body mass index, overweight, and blood pressure among adolescent schoolchildren in Limpopo province, South Africa. *Rev Paul Pediatr; 30(4):562-9.*

Musaiger, A.O., Al-Mannai, M. and Zagzoog, N., 2014. Association between food intake frequency and obesity among adolescent girls in Saudi Arabia. *International journal of adolescent medicine and health*, *26*(1), pp.145-147.

Mushengezi, B. and Chillo, P. 2014. Association between body fat composition and blood pressure level among secondaryschool adolescents in Dar es Salaam, *Tanzania. Pan African Medical Journal. 2014; 19:327 doi:10.11604/pamj.2014.19.327.5222.*

Mustapha, R.A. and Sanusi, R.A., 2013. Overweight and obesity among in-school adolescents in Ondo State, Southwest Nigeria. *African Journal of Biomedical Research*, *16*(3), pp.205-210.

Myers, V.H. and Champagne, C.M., 2007. Nutritional effects on blood pressure. *Current opinion in lipidology*, *18(1), pp.20-24*.

Nabag, O.F. 2011. Comparative Study of Nutritional Status of Urban and Rural School Girl's Children Khartoum State, Sudan. *Journal of Science and Technology 12 (02). Pg. 60-68.*

Nago, E.S., Lachat, C.K., Huybregts, L., Roberfroid, D., Dossa, R.A. and Kolsteren, P.W. 2010. Food, energy and macronutrient contribution of out-of-home foods in school-going adolescents in Cotonou, Benin. *British Journal of Nutrition (2010), 103, 281–288*.

Nam, E.W., Sharma, B., Kim, H.Y., Paja, D.J.V., Yoon, Y.M., Lee, S.H., Kim, E.H., Oh, C.H., Kim, Y.S., Song, C.H. and Kim, J.K., 2015. Obesity and

hypertension among school-going adolescents in Peru. *Journal of lifestyle medicine*, *5*(2), p.60.

Napier, C. and Oldewage-Theron, W. 2015. Dietary Intake and Nutritional Status of Adolescent Girls and Young Women in Durban, South Africa. *Journal of Family Ecology and Consumer Sciences, Vol 43, pg. 1-15.*

Napier, C.E. and Hlambelo, N. 2014. Contribution of school lunchboxes to the daily food intake of adolescent girls in Durban. *S. Afr J CH. 8(2):59-63. DOI:10.7196/SAJCH.658 pg. 59-63*.

Nasreddine, L., Mehio-Sibai, A., Mrayati, M., Adra, N. and Hwalla, N. 2009. Adolescent obesity in Syria: prevalence and associated factors. *Journal Compilation;Child: care, health and development. 36:3, 404-413*.

National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. May 2005. NIH Publication No. 05-5267.

National High Blood Pressure EducationProgram Working Group on HypertensionControl in Children and Adolescents. Updateon the 1987 Task Force Report on HighBlood Pressure in Children and Adolescents:A working group report from the NationalHigh Blood Pressure Education Program.*Pediatrics 1996;98:649–58.*

National High Blood Pressure Education Program, 2005. *The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents* (No. 5). US Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, National Hight Blood Pressure Education Program.

National Population Commission (NPC) [Nigeria] and ICF International. 2014. ***Nigeria Demographic and Health Survey 2013.*** Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF International.

National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. ***Nigeria Demographic and Health Survey 2008***. Abuja, Nigeria: National Population Commission and ICF Macro.

National Population Commission (NPC) [Nigeria] and ORC Macro. 2004. ***Nigeria Demographic and Health Survey 2003.*** Calverton, Maryland: National Population Commission and ORC Macro.

Nawab, T., Khan, Z., Khan, I.M. and Ansari, M.A., 2014. Influence of behavioral determinants on the prevalence of overweight and obesity among school going adolescents of Aligarh. *Indian journal of public health, 58(2), p.121*.

Neumark-Sztainer, D., Levine, M., Paxton, S., Smolak, L., Piran, N.,Wertheim, E., 2006. Prevention of body dissatisfaction and disordered eating: what next? *Eating Disorders. 14: 265–285*

Neumark-Sztainer, D., Paxton, S.J., Hannan, P.J., Haines, J., Story, M., 2006. Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *J Adolesc Health; 39: 244–251*

Neumark-Sztainer, D., Story, M., Hannan, P.J., Perry, C.L., Irving, L.M., 2002. Weight-related concerns and behaviors among overweight and non-overweight adolescents: implications for preventing weight-related disorders. *Arch Pediatr Adolesc Med. 156: 171–178*

Neumark-Sztainer, D.R., Wall, M.M., Haines, J.I., Story, M.T., Sherwood, N.E., van den Berg, P.A., 2007. Shared risk and protective factors for overweight and disordered eating in adolescents. *Am J Prev Med 33: 359–369.*

Nithya, D.J. and Bhavani, R.V., 2018. Dietary diversity and its relationship with nutritional status among adolescents and adults in rural India. Journal of biosocial science, 50(3), pp.397-413.

Noronha, J.A.F., Ramos, A.L.C., Ramos, A.T., Cardoso, M.A.A., de Carvalho, D.F., Medeiros, C.C.M. 2012. High Blood Pressure in Overweight Children and Adolescents.*Journal of Human Growth and Development. 2012; 22(2): 196-201.*

Nto, N.J., Anibeze, C.I, Egwu, E.O., Eteudo, A.N., Egwu, A.O., Esom, E.A., Njoku, C.O. 2015. Prevalence of nutrition associated ponderal outcomes among school children and adolescents in Ebonyi State, South-East Nigeria. *J Exp Clin Anat. 14:105-10.*

Nto, N.J., Anibeze, C.P.I., Egwu, O.A., Obikili, E.N., Agu, A.U., Anyanwu, G.E., Ozoemena, F.N. 2014. Growth status of school children and adolescents in Ebonyi State, Southeast Nigeria. *Annals of Bioanthropology | Jul-Dec 2014 | Vol 2 | Issue 2. Pg. 59-64.*

Ocké, M.C., 2013. Evaluation of methodologies for assessing the overall diet: dietary quality scores and dietary pattern analysis. *Proceedings of the Nutrition Society*, *72(2), pp.191-199.*

Odaman, K.I. and Odaman, O.M. 2013. Mothers' Socio-economic Background and Feeding Practices of Secondary Schools Students in Edo Central, Nigeria. *Stud Home Com Sci, 7(2): 71-81.*

Oduwole, A.A., Ladapo, T.A., Fajolu, I.B., Ekure, E.N. and Adeniyi, O.F., 2012. Obesity and elevated blood pressure among adolescents in Lagos, Nigeria: a cross-sectional study. *BMC Public Health*, *12(1), p.616.*

Ogboye, O., 2012. *Blood pressure and its correlates in children and adolescents in urban Nigeria* (Doctoral dissertation, University of Warwick).

Ogden, C.L., Carroll, M.D., Kit, B.K. and Flegal, K.M., 2012. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *Jama*, *307(5), pp.483-490.*

Ogunkunle, M.O. and Oludele, A.S. 2013. Food intake and meal pattern of adolescents in school in Ila Orangun, south-west Nigeria. *S Afr J Clin Nutr. 2013;26(4):188-193.*

Ogunsile S.E. and Ogundele, B. O. 2016. Effectof game-enhanced nutrition education on knowledge, attitude and practice of healthyeating among adolescents in Ibadan, Nigeria.*International Journal of Health Promotion and Education.*

Ojofietimi, E.O., Olugbenga-Bello, E.A. and Adekanle, D.A. 2011. Pattern and determinants of obesity among adolescent females in private and public schools in the Olorunda Local Government Area of Osun State, Nigeria: a comparative study. *Journal of Public Health in Nigeria Vol. 2: 45-49*

Olumakaiye, M.F., Atinmo, T., Olubayo-Fatiregun, M.A. 2010. Food Consumption Patterns of Nigerian Adolescents and Effect on Body Weight. *BMI Journal of Nutrition Education and Behavior Volume 42, Number 3, 2010*

Omisore, B., Omisore, A.G. and Abioye-Kuteyi, E.A. 2015. Gender comparisons of adolescents' anthropometry and blood pressure in Osun State, South-Western Nigeria. *Int J Adolesc Med Health 2015; 27(3): 247–251.*

Omobuwa, O., Alebiosu, C.O., Olajide, F.O. and Adebimpe, W.O., 2014. Assessment of nutritional status of in-school adolescents in Ibadan, Nigeria. *South African Family Practice*, *56*(4), pp.246-250.

Omuemu, V.O. Omuemu, C.E. 2010. The Prevalence of Overweight and its Risk Factors Among Adolescents in an Urban City in Edo State. *Nigerian Journal of Clinical Practice. June 2010 Vol. 13(2):128-133.*

Onabanjo, O.O. and Balogun, O.L. 2014. Anthropometric and Iron Status of Adolescents from Selected Secondary Schools in Ogun State, Nigeria. *ICAN: Infant, Child, & Adolescent Nutrition. Vol. 20, No. 10, pg 1-10.*

Onyiriuka, A.N., Ikuren, J.I. and Onyiriuka, R.C. 2015. Body Mass Index of Nigerian Adolescent Urban Secondary School Girls. *Rom J Diabetes Nutr Metab Dis. 22(2):151-157*.

Onyiriuka, A.N., Umoru, D.D. and Ibeawuchi, A. N. 2013. Weight status and eating habits of adolescent Nigerian urban secondary school girls. *S Afr J CH 7(3):108-112*.

Ostchega Y, Prineas RJ, Paulose-Ram R,Grim CM, Willard G, Collins D. 2003. NationalHealth and Nutrition Examination Survey1999–2000: Effect of observer training andprotocol standardization on reducing bloodpressure measurement error. *J Clin Epidemiol.56:768–74*.

Otuneye, A.T., Ahmed, P.A., Abdulkarim, A.A., Aluko, O.O. and Shatima, D.R. 2017. Relationship between dietaryhabits and nutritional statusamong adolescents in Abujamunicipal area council ofNigeria. *Niger J Paediatr 2017; 44 (3): 128 – 135.*

Park, S.J., Lee, S. M., Kim, S. M. and Lee, M., 2013. Gender specific effect of major dietary patterns on the metabolic syndrome risk in Korean pre-pubertal children. *Nutrition research and practice*, *7(2), pp.139-145.*

Pell, C., Allotey, P., Evans, N., Hardon, A., Imelda, J.D., Soyiri, I. and Reidpath, D.D., 2016. Coming of age, becoming obese: a cross-sectional analysis of obesity among adolescents and young adults in Malaysia. *BMC public health, 16(1), p.1082.*

Peltzer, K., and Pengpid, S. 2011. Overweight and Obesity and Associated Factors among School-Aged Adolescents in Ghana and Uganda. *Int. J. Environ. Res. Public Health, 8, 3859-3870.*

Pereira, M.A., Erickson, E., McKee, P. 2011. Breakfast Frequency and Quality May Affect Glycemia and Appetite in Adults and Children. *The Journal of Nutrition. 141:163S–8S.*

Petkeviciene, J., Klumbiene, J., Kriaucioniene, V., Raskiliene, A., Sakyte, E., Ceponiene, I. 2015. Anthropometric measurementsin childhood and prediction of cardiovascularrisk factors in adulthood: Kaunas cardiovascular riskcohort study. *BMC Public Health. 15:1528.*

Povey, R., Conner, M., Sparks, P., James, R. and Shapherd, R. 1998. Interpretation of healthy and unhealthy eating and implications for dietary change. *Health Educ. Res. 13, 171- 183*.

Prineas, R.J., 1991. Measurement of blood pressurein the obese. *Ann Epidemiol.1:321–36*.

Prochnik Estima, C.C., Costa, R.S., Sichieri, R.2009. Meal consumption patterns andanthropometric measurements in adolescents from a low socioeconomic neighbourhoodin the metropolitan area of Rio de Janeiro, Brazil. *Appetite. 3:735-739.*

Puder, J.J., Munsch, S. 2010. Psychological correlates of childhood obesity. I*nt J Obes (Lond). 34: S37–43.*

Puhl, R.M., Moss-Racusin, C.A., Schwartz, M.B., 2007. Internalization of weight bias: implications for binge eating and emotional well-being. *Obesity. 15: 19–23*

Pulgaron, E.R., 2013. Childhood obesity: a review of increased risk for physical and psychological comorbidities. *Clinical therapeutics*, *35*(1), *pp. A18-A32.*

Rademacher, E.R., Jacobs, D.R. Jr, Moran, A., Steinberger, J., Prineas, R.J., Sinaiko, A. 2009. Relation of blood pressureand body mass index during childhood to cardiovascular risk factor levels in young adults. *J Hypertens 2009; 27:1766-74.*

Rah, J.H., Christian, P, Shamim, A.A., Arju, U.T., Labrique, A.B. and Rashid, M. 2008. 'Pregnancy and lactation hinder growth and nutritional status of adolescent girls in rural Bangladesh', *Journal of Nutrition 138, 8, pp 1505–11*

Rahmani, E., Faghih, S., Teimury, M., Kojouri, Z., Jalilpiran, Y. and Akhlaghi, M. 2015. Body Mass Index Is Important Determinant of Blood Pressure in Adolescents. *Nutrition and Food Sciences Research Vol 2, No 4, pages: 21-28.*

Rebelo, D., Teixeira, J., Marques-Vidal, P., Oliveira, J.M. 2008. Obesity markers andblood pressure in a sample of Portuguese children and adolescents.*Eur J Cardiovasc Prev. Rehabil. 15:73–77.*

*Ribe*iro-Silva, R.D.C., Fiaccone, R.L., Conceição-Machado, M.E.P.D., Ruiz, A.S., Barreto, M.L. and Santana, M.L.P., 2018. Body image dissatisfaction and dietary patterns according to nutritional status in adolescents. *Jornal de pediatria*, *94*(2), pp.155-161.

Riley, M., Bluhm, B. 2012. High blood pressure in children and adolescents. *Am Fam Physician 85(7):693–700*

Rocha, N.P., Milagres, L.C., Longo, G.Z., Ribeiro, A.Q. and de Novaes, J.F., 2017. Association between dietary pattern and cardiometabolic risk in children and adolescents: a systematic review. *Jornal de Pediatria (Versão em Português)*, *93*(3), *pp.214-222*.

Rode, S., 2015. Prevalence of Malnutrition among Adolescent the Socio-Economic Issues and Challenges in Mumbai Metropolitan Region. *Global Journal of Human Social Science Economic*, *15*(8), pp.1-12.

Rodgers, R.F., McLean, S.A., Marques, M., Dunstan, C.J. and Paxton, S.J., 2016. Trajectories of body dissatisfaction and dietary restriction in early adolescent

girls: A latent class growth analysis. *Journal of Youth and Adolescence, 45(8), pp.1664-1677.*

Rodrigues, P.R.M., Pereira, R.A., Cunha, D.B., Sichieri, R., Ferreira, M.G., Vilela, A.A.F. and Gonçalves-Silva, R.M.V., 2012. Factors associated with dietary patterns in adolescents: a school-based study in Cuiabá, Mato Grosso. *Revista Brasileira de Epidemiologia, 15(3), pp.662-674.*

Román-Vinas, B., Serra-Majem, L., Ribas-Barba, L., Ngo, J., García-Álvarez, A., Wijnhoven, T.M., Tabacchi, G., Branca, F., De Vries, J. and De Groot, L.C., 2009. Overview of methods used to evaluate the adequacy of nutrient intakes for individuals and populations. *British Journal of Nutrition*, *101*(S2), pp. S6-S11.

Romero-Polvo, A., Denova-Gutiérrez, E., Rivera-Paredez, B., Castañón, S., Gallegos-Carrillo, K., Halley-Castillo, E., Borges, G., Flores, M. and Salmerón, J., 2012. Association between dietary patterns and insulin resistance in Mexican children and adolescents. *Annals of Nutrition and Metabolism*, *61*(2), *pp.142-150.*

Romero-Sandoval, N. Guanopatin, A., Gallegos, G. 2013. Breakfast Habits and Family Structure Associated with Overweight and Obesity in General Basic Students, Ecuador. *British Journal of Medicine & Medical Research 3(1): 128-139.*

Rosner, B., Cook, N.R., Daniels, S. and Falkner, B., 2013. Childhood blood pressure trends and risk factors for high blood pressure: the NHANES experience 1988–2008. *Hypertension*, *62(2), pp.247-254*.

Ruopeng A. 2015. Diet quality and physical activity in relation to childhood obesity. *Int J Adolesc Med Health; aop. Pg. 1-9.*

Sacks, F.M., Svetkey, L.P., Vollmer, W.M., Appel, L.J., Bray, G.A., Harsha, D., Obarzanek, E., Conlin, P.R., Miller, E.R., Simons-Morton, D.G. and Karanja, N., 2001. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. *New England journal of medicine*, *344(1), pp.3-10*.

Sajwani, R.A., Shoukat, S., Raza, R., Shiekh, M.M., Rashid, Q., Siddique, M.S., Panju, S., Raza, H., Chaudhry, S. and Kadir, M.M., 2009. Knowledge and practice of healthy lifestyle and dietary habits in medical and non-medical students of Karachi, Pakistan. *Journal of the Pakistan Medical Association, 59(9), p.650.*

Salvadori, M., Sontrop, J.M., Garg, A.X., Truong, J., Suri, R.S., Mahmud, F.H., Macnab, J.J., Clark, W.F. 2008. Elevated blood pressure in relation to overweight andobesity among children in a rural Canadian community. *Pediatrics. 122: e821–e827.*

Saneei, P., Salehi-Abargouei, A., Esmaillzadeh, A. and Azadbakht, L., 2014. Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: a systematic review and meta-analysis on randomized controlled trials. *Nutrition, Metabolism and Cardiovascular Diseases*, *24(12), pp.1253-1261*.

Santaliestra-Pasías, A.M., Rey-López, J.P. and Aznar, L.A.M., 2013. Obesity and sedentarism in children and adolescents: what should be bone? *Nutricion hospitalaria*.

Santana, M.L., Rita de Cássia, R.S., Assis, A.M., Raich, R.M., Machado, M.E.P., Pinto, E.D.J., de Moraes, L.T. and Júnior, H.D.C.R., 2013. Factors associated with body image dissatisfaction among adolescents in public schools' students in Salvador, Brazil. *Nutrición hospitalaria, 28(3), pp.747-755.*

Sanusi, R.A., Yusuf, F.K. and Ejoh, S.I. 2014. Assessment of Dietary Diversity of In-School Adolescents in Ibadan, Oyo State, Nigeria. *West African Journal of Food and Nutrition. ISSN 1595 2290 | Dec., 2014| Vol. 12 | No. 2. Pg. 69-88.*

Sawyer, S.M., Afifi, R.A., Bearinger, L.H., Blakemore, S.J., Dick, B., Ezeh, A.C. and Patton, G.C. 2012. 'Adolescence: a foundation for future health', *The Lancet 379, 9826, pp 1630–40.*

SCN (United Nation Standing Committee on Nutrition), Fifth Report on the World Nutrition.

Sen, J., Mondal, N. and Ghosh, P. 2015. Upper Arm Composition as an Indicator of Body Composition and Nutritional Status of Adolescent Boys Aged 10-18 Years. *J Nepal Paediatr Soc 2015;35(2):152-161*

Senbanjo, I. O. 2011. Overweight and Obesity in Nigerian Preschool Children. *Journal of Tropical Pediatrics Vol.53 (2): 143-144.*

Senbanjo, I.O., Njokanma, O.F. and Oshikoya, K.A., 2009. Waist circumference values of Nigerian children and adolescents. *Annals of Nutrition and Metabolism*, *54*(2), *pp.145-150.*

Senbanjo, I.O., Oshikoya, K.A. and Njokanma, O.F., 2011. Changes in the nutritional status of school children and adolescents in Abeokuta, Nigeria between 1983 and 2006. *West African journal of medicine*, *30*(6).

Senbanjo, I.O., Oshikoya, K.A., Njokanma, O.F. 2015.Upper arm composition and nutritional status of school children and adolescents in Abeokuta, Southwest Nigeria. *World J Pediatr, Online First, March 2014.*

Serrano, M.D.M., Armesilla, M.D.C., Moreno, M.M.C., de Espinosa, M.G.M., López-Ejeda, N., Álvarez, J.R.M., Martínez, C.P. and Romero-Collazos, J.F., 2013. Association between adiposity and blood pressure levels between the ages of 6 and 16 years. Analysis in a student population from Madrid, Spain. *Revista Española de Cardiología (English Edition)*, *66*(2), *pp.110-115*.

Shafieea, G., Kelishadi, R., Qorbanid, M. 2013. Association of breakfast intake with cardio-metabolic risk factors. *Journal Pediatric;89(6):575-582*

Shah, A.M., Memon, A.N., Laghari, A.H., Kazi, M.A., Abdull Hakim, N.H., Muniandy, N.D., Danish, A., Akinyemi, O., Ibraheem, A.G., Anderson, J. and Deskins, B., 2012. Knowledge and practices on food safety among secondary school students in Johor Bahru, Johor, Malaysia. *Pakistan Journal of Nutrition*, *12*(4), pp.77-87.

Shang, X., Li, Y., Liu, A., Zhang, Q., Hu, X., Du, S., Ma, J., Xu, G., Li, Y., Guo, H., Lin Du, L. and Ma, G. 2012. Dietary Pattern and Its Association with the Prevalence of Obesity and Related Cardiometabolic Risk Factors among Chinese Children. *PLOS ONE | www.plosone.org. Volume 7, Issue 8, e43183. Pg. 1-9.*

Sharma, S., Akhtar, F., Singh, R.K., Mehra, S., 2019. Relationships between nutrition-related knowledge,attitude, and self-efficacy among adolescents:A community-based survey. *Journal of Family Medicine and Primary Care, 8 (6), p.2012.*

Shrestha, B. 2015. Anthropometrically Determined Undernutrition among the Adolescent Girls in Kathmandu Valley. *Kathmandu University Medical Journal. Vol.51, Issue 3, pg 224-229.*

Singh, A.S., Mulder. C., Twisk, J.W., van Mechelen, W., Chinapaw, M.J. 2008. Tracking ofchildhood overweight into adulthood: a systematic review of the literature. *Obes Rev, 9:474–488.*

Sjöberg, A. and Hulthén, L. 2015. Comparison of food habits, iron intake and iron status in adolescents before and after the withdrawal of the general iron fortification in Sweden.*European Journal of Clinical Nutrition, pg. 1–7*.

Slining, M.M., Mathias, K.C., Popkin, B.M. 2013. Trends in food and beverage sources among US children and adolescents: 1989-2010. *J Acad Nutr Diet. 113:1683.*

Smolak, L. 2012. Appearance in childhood and adolescence. In N. Rumsey & D.Harcourt (Eds.), Oxford Handbook of the Psychology of Appearance (pp. 123–141). London: Oxford University Press.

Spano, S., 2004. Stages of adolescent development: Research FACTS and findings. ACT for Youth: Upstate Center of Excellence, Cornell University. Retrieved April, 24, p.2012.

Stewart, C.P., Christian, P., Wu, L.S., LeClerq, S.C., Khatry, S.K. and West Jr, K.P., 2013. Prevalence and risk factors of elevated blood pressure, overweight, and dyslipidemia in adolescent and young adults in rural Nepal. *Metabolic syndrome and related disorders*, *11*(5), *pp.319-328*.

Story, M. and Stang, J., 2005. Nutrition needs of adolescents. *Guidelines for adolescent nutrition services. Minneapolis, MN: Centre for Leadership, Education and Training in Maternal and Child Nutrition Division of Epidemiology and Community Health, School of Public Health, University of Minnesota*, pp.21-34.

Tayel, D.I., El-Sayed N.A and El-Sayed, N.A. 2013. Dietary pattern and blood pressure levels of adolescents in Sohag. *Egypt Journal of the Egyptian Public Health Association*, *88:97–103*.

Thompson F.E., Subar, A.F., 2001. Dietary assessment methodology, in: Coulston A.M., Rock C.L., MonsenE.R. (Eds), Nutrition in the Prevention and Treatment of Disease, Academic Press, San Diego, 2001.

Thompson, D.R., Obarzanek, E., Franko, D.L. 2007. Childhood overweight and cardiovascular disease risk factors: The National Heart, Lung, and Blood Institute Growth and Health Study. *J Pediatr. 150:18.*

Thompson, FE and Byers, T., 1994. Dietary assessment resource manual. *J Nutr.;124 (11 Suppl): 2245S-2317S*

Thompson, J. K., & Gray, J. 1995. Development and validation of new body imageassessment tool. *Journal of Personality Assessment, 64, 258–269.*

Thompson, J. K., Cattarin, J. A., & Fowler, B., 1995. The Perception of Teasing Scale[POTS]: A revision and extension of the Physical Appearance Related TeasingScale [PARTS]. *Journal of Personality Assessment, 65, 146–157.*

Thompson, J. K., Heinberg, L., & Tantleff, S. 1991. The Physical Appearance Comparison Scale [PACS]. *Behaviour Assessment Review, 14, 174.*

Thompson-McCormick, J.J.,Thomas, J.J.,Bainivualiku, a., Khan, A.N., Becker, A.E. 2010. Breakfast skipping as a risk correlate of overweight and obesity in school-going ethnic Fijian adolescent girls. *Asia Pac J Clin Nutr. 19 (3):372-382*.

Thurnham, D.I. 2013. 'Nutrition of Adolescent Girls in Low- and Middle-Income Countries' in Sight and Life.

Timlin, M.T., Pereira, M.A., Story, M., Neumark-Sztainer, D. 2008. Breakfast eating and weight change in a 5-year prospective analysis of adolescents: Project EAT (Eating Among Teens). *Pediatrics. 121: e638-45*.

Tsai, M.R., Chang, Y.J., Lien, P.J. and Wong, Y., 2011. Survey on eating disorders related thoughts, behaviors and dietary intake in female junior high school students in Taiwan. *Asia Pacific journal of clinical nutrition*, *20*(2), p.196.

Tucker, K.L., 2010. Dietary patterns, approaches, and multicultural perspective. *Applied physiology, nutrition, and metabolism*, *35*(2), pp.211-218.

Turconi, G., Celsa, M., Rezzani, C., Biino, G., Sartirana, M.A. and Roggi, C. 2003. Reliability of dietary questionnaire on food habits, eating behaviour and nutritional knowledge of adolescents. *European Journal of Clinical Nutrition. 57: 753-763.*

Tzioumis, E. and Adair, L.S., 2014. Childhood dual burden of under-and overnutrition in low-and middle-income countries: a critical review. *Food and nutrition bulletin*, *35*(2), pp.230-243.

Uddin, M.D.J. Nag, S.K. and Sil, S.K. 2015. Anthropometric Assessment of Nutritional Status of Adolescents in Rural School of Unokoti District of Tripura, North-East India. *Anthropologist, 19(1): 277-284.*

Ujunwa, F.A., Ikefuna, A.N., Nwokocha, A.R. and Chinawa, J.M., 2013. Hypertension and prehypertension among adolescents in secondary schools in Enugu, South East Nigeria. *Italian journal of pediatrics*, *39(1), p.70.*

Ukegbu, P. O. and Ukegbu A. U. 2014. Assessment of nutritional and health status of institutionalized blind adolescent students in Umuahia, Abia State. *Sky Journal of Medicine and Medical Sciences Vol. 2(9), pp. 079 – 084. ISSN 2315-8808.*

UNFPA. 2013a. Adolescent Pregnancy: A review of the evidence, United Nations Population *Fund,www.unfpa.org/sites/default/files/pub-pdf/*

UNICEF 2012. Progress for Children: A report card on adolescents, UNICEF, *www.unicef.org/publications/ index_62280.html*

UNICEF 2018. Nutrition Situation in Nigeria: What is the role of nutrition? UNICEF, *www.unicef.org/nigeria/nutrition*

United States- Dietary Guidelines Advisory Committee, 2010. *Dietary guidelines for Americans, 2010* (No. 232). US Department of Health and Human Services, US Department of Agriculture.

US DHHS, Public Health Service: Healthy People 2010: Objectives for improving health. Government Printing Office, Washington, DC 2000.

Van Abeelen, A.F., Elias, S.G., Bossuyt, P.M., Grobbee, D.E., van der Schouw, Y.T., Roseboom, T.J. and Uiterwaal, C.S. 2012. 'Cardiovascular consequences of famine in the young', *European Heart Journal 33, 4, pp 538–45.*

Van Horn, L., McCoin, M., Kris-Etherton, P.M. 2008. The evidence for dietary prevention and treatment of cardiovascular disease. *J Am Diet Assoc. 108:287.*

Velásquez-Rodríguez, C.M., Velásquez-Villa, M., Gómez-Ocampo, L., Bermúdez-Cardona, J. 2014. Abdominal obesityand low physical activity are associated with insulinresistance in overweight adolescents: A cross-sectionalstudy. *BMC Pediatr. 14:258.*

Victora, C.G., Adair, L., Fall, C., Hallal, P.C., Martorell, R., Richter, L., Sachdev, H.S. and Maternal and Child Undernutrition Study Group 2008. 'Maternal and child undernutrition: consequences for adult health and human capital', *The Lancet 371, 9609, pp 340–57.*

Wang, H., Wang, D., Ouyang, Y., Huang, F., Ding, G. and Zhang, B., 2017. Do Chinese children get enough micronutrients? *Nutrients, 9(4), p.397.*

Wang, Y. and Beydoun, M.A., 2007. The obesity epidemic in the United States—gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. *Epidemiologic reviews*, *29(1), pp.6-28*.

Wang, Y., 2001. Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. *International journal of epidemiology*, *30*(5), *pp.1129-1136*.

Wang, Y., Lim, H. 2012. The global childhood obesity epidemic and the association between socio-economic status and childhood obesity. *Int Rev Psychiatry. 24:176–88*.

Watson, R.R. ed., 2010. *Handbook of disease burdens and quality of life measures* (pp. 4271-4272). New York: Springer.

WHO 2014a. 'Adolescent pregnancy', WHO factsheet no 364, www.who.int/mediacentre/ factsheets/fs364/en/

WHO and UNU. 2001. Human Energy Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation, Rome, 17–24 October, FAO/WHO/ UNU.

WHO. 1995. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organ Tech Rep Ser. Geneva; 1995

Williams, C.L., Strobino, B.A. and Brotanek, J., 2007. Weight control among obese adolescents: a pilot study. *International journal of food sciences and nutrition*, *58*(3), pp.217-230.

Wittenberg, D.F. and Hansen, J.D.L., 1998. Nutritional disorders in Paediatrics and Child Health: A Manual for Health Professionals in the Third World, 4th ed. (Coovadia, H.M. and Wittenberg, D.F, eds.), Oxford University Press, Cape Town, South Africa.

Wolde, M., Berhan, Y. and Chala, A. 2015. Determinants of underweight, stunting and wasting among schoolchildren. *BMC Public Health. 15:8. Pg. 1-9.*

World Health Organisation, 2018. The state of food security and nutrition in the world 2018: building climate resilience for security and nutrition. Food and Agriculture Organisation.

World Health Organization / Food and Agriculture Organization. Preparation use of food based dietary guidelines. WHO technical report series; 880. Geneva: WHO 1998.

World Health Organization, 1995. The use and interpretation of anthropometry; report of the WHO expert committee on physical status. Geneva, Switzerland, WHO, 1995. (WHO Tech. Rep. Series, 854).

World Health Organization, 2005. Nutrition in adolescence. Issues for the health sector: issuesin adolescent health and development. Geneva: WHO; 2005.

World Health Organization. WHO, 2003. Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (2002: Geneva, Switzerland) Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation, Geneva, 28 January - 1 February 2002.

World Health Organization: Global status report onnon-communicable diseases 2010 [Internet]. WHO;Available from: http://www.who.int/nmh/publications/ncd_report_full_en.pdf.

World Health Organization: Non-communicable DiseasesCountry Profile 2014. [Internet]. WHO; Available from: http://www.who.int/nmh/publications/ncd-profiles-2014/en/

World Health Organization: Obesity and overweight.Fact sheet No 311.2015. [Internet]. WHO; Available from: http://www.who.int/mediacentre/factsheets/fs311/en/.

Wrieden, W., Peace, H., Armstrong, J. and Barton, K., 2015. A short review of dietary assessment methods used in National and Scottish Research Studies. 2003. URL: http://multimedia.food.gov.uk/multimedia/pdfs/scotdietassessmethods.

Xu, T., Zhu, G., Liu, J. and Han, S. 2015. Gender-specific prevalence and associated risk factors of high normal blood pressure and hypertension among multi-ethnic Chinese adolescents aged 8 – 18 years old.*Blood pressure, 24(3), pp.189-195.*

Yajun, C., Lu, M., Yinghua, M., Haijun, W., Jiayou, L., Xin, Z., Chunyan, L., Hong, W., Haiping, Z., Dehong, P., Yanna, Z., Li, C., Zhiyong, Z., Wenhan, Y., Jun, M. and Jin, J. Chen *et al.* 2015. A national school-based health lifestyles intervention among Chinese children and adolescents against obesity: rationale, design and methodology of a randomized controlled trial in China. *BMC Public Health 15:1-10.*

Yan, W., Bingxian, H., Hua, Y., Jianghong, D., Jun, C., Dongliang, G., Yujian, Z., Ling, L., Yanying, G., Kaiti, X. and Xiaohai, F., 2007. Waist-to-height ratio is an accurate and easier index for evaluating obesity in children and adolescents. *Obesity*, *15*(3), *pp.748-752.*

Yang, C.Y., Peng, C.Y., Liu, Y.C., Chen, W.Z. and Chiou, W.K., 2011. Surface anthropometric indices in obesity-related metabolic diseases and cancers. *Chang Gung Med J*, *34(1), pp.1-22.*

Yang, L., 2017. Vitamin D nutritional status and its related factors for Chinese children and adolescents in 2010–2012. *Nutrients, 9(9), p.1024.*

Yang, Q., Zhang, Z., Kuklina, E.V., Fang, J., Ayala, C., Hong, Y., Loustalot, F., Dai, S., Gunn, J.P., Tian, N. and Cogswell, M.E., 2012. Sodium intake and blood pressure among US children and adolescents. *Pediatrics*, *130(4), pp.611-619*.

Yi, X., Yin, C., Chang, M. and Xiao, Y., 2012. Prevalence and risk factors of obesity among school-aged children in Xi'an, China. *European journal of pediatrics*, *171(2), pp.389-394.*

Yusuf, S.M., Mijinyawa, M.S., Musa, B.M., Gezawa, I.D. and Uloko, A.E., 2013. Overweight and obesity among adolescents in Kano, Nigeria. *J Metab Syndr*, *2*, *p.126.*

Zhang, C.X., Shi, J.D., Huang, H.Y., Feng, L.M. and Ma, J., 2012. Nutritional status and its relationship with blood pressure among children and adolescents in South China. *European journal of pediatrics*, *171*(7), *pp.1073-1079.DOI 10.1007/s00431-012-1684-x.*

Zhao, W., Yu, K., Tan, S., Zheng, Y., Zhao, A., Wang, P. and Zhang, Y., 2017. Dietary diversity scores: an indicator of micronutrient inadequacy instead of obesity for Chinese children. *BMC Public Health, 17(1), p.440.*

Appendix 1

INFORMED CONSENT FORM
IRB Research Approval Number:

This approval will elapse on: dd/mm/yyyy

Title of the Research:

DIETARY PATTERN, NUTRITIONAL STATUS AND BLOOD PRESSURE LEVEL OF IN-SCHOOL ADOLESCENTS IN EDO STATE, NIGERIA

Name and Affiliation of Researcher:
Dear Respondent,

This study is being conducted by **Okolosi,** Joel Eviano, a PhD student of the Department of Human Nutrition, University of Ibadan. I am carrying out a research titled **"Dietary Pattern, Nutritional Status and Blood Pressure level of In-School Adolescents in Edo State, Nigeria"**.

Sponsor: The research is self-sponsored.

Purpose of the Research:
This questionnaire is designed to collect information from in-school adolescents (students). The goal of this research is to provide information on the Dietary Pattern, Nutritional Status, and Blood Pressure Level of In-School Adolescents in Edo State, Nigeria that will help in future policy development for adolescents' health in Edo State, Nigeria.

Procedure of the Research:
A total of 1440 participants will be recruited for the study. A pre-tested, semi-structured, interviewer-administered questionnaire will be used to collect information on socio-demographic characteristics (sex, age, parents' educational level, fathers' occupation, working status of mothers, and place of residence); medical history including family history of hypertension, cardiovascular diseases, and obesity; lifestyle practices including smoking, alcohol intake and physical activity (physically active adolescents will be those who reported practicing regular exercise or any type of sport >1 hour 3 times/week) of the respondents. Nutrition knowledge and food safety of the respondents will be assessed using 26 item questions which will be awarded one mark each for correct answers which will be classified as poor (Score ≤ 6.0), fair (Score >6.0-12.0) and good (Score > 12.0). Food behaviour and hygiene practices of the respondents will be assessed. Food frequency questionnaire will be used to collect information on the dietary pattern of the respondents.

- Twenty-four-hour dietary recall will be used to collect information for determining the nutrient intake and dietary diversity of the respondents
- Individual dietary diversity questionnaire will be used to determine the dietary diversity score of the respondents.
- Body dissatisfaction of the respondents will be assessed.

Expected Duration of and Participants involvement: We expected you to be involved in this research for 3 months. You will spend less than an hour for answering the questionnaire.

Risks: There is no risk involved in this study as biological samples such as blood, urine and saliva will not be collected.

Cost to the participants, if any of joining the research: Your participation in this research will not cost you nothing.

Benefits: This study seeks to provide relevant and up to date information on the dietary pattern, nutritional status and blood pressure level of the respondents to policy makers, public health consultants to design and implement specific policies and programme that will prevent the future development of non-communicable disease such as overweight/obesity and hypertension among adolescents in Edo State and Nigeria.

Confidentiality:
All information collected in this study will be coded. Name will not be collected or recorded. The data collected will be kept confidential. This cannot be linked to you in anyway.

Voluntariness: Your participation in this research is entirely voluntary.
Alternative to participation: If you choose not to participate, it will not affect you in anyway.

Due inducement: You will be compensated for your time, but you will not be paid any fees for participating in this research.

Consequences of participants' decision to withdraw from research and procedure for orderly termination of participation: You can choose to withdraw from the research at any time. Please note that some of the information that has been obtained about you before you choose to withdraw may have been modified or used in reports and publications. These cannot be removed anymore. However, I promise to make effort in good faith to comply with your wishes as much as practicable.

Modality of providing treatments and action(s) to be taken in case of injury or adverse event(s): You will not suffer injury because of your participation in this research because biological samples such as blood sample will not be collected.

What happens to the research participants and communities when the research is over: The researcher will inform you of the outcome of the research through journal publication. During the research, you will be informed about any information that may affect your health.

Statement about sharing benefits among researchers and whether this includes or exclude research participants: If this research leads to commercial product, the researcher will own it. There is no plan to contact any participants or in the future about such commercial benefits.

Any apparent or potential conflict of interest: I am not aware of any information that may cause the researcher to do their work in fear or favour.

Statement of persons obtaining informed consent:

I have fully explained the research to _____and have given enough information including about the risks and benefits, to make an informed decision.

DATE: _____ SIGNATURE: _____

NAME: _____

Statement of person giving the consent:

I have read the description of the research. I understand that my participation is voluntary. I know enough about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form and additional information sheet to keep for myself.

DATE: _____ SIGNATURE: _____

NAME: _____

WITNESS' SIGNATURE (if applicable): _____

WITNESS' NAME (if applicable): _____

Detailed Contact information including contact address, telephone, fax, email and any other contact information of researcher, institutional HREC and head of institution:

This research has been approved by the Ethics Committee of the University of Ibadan and the Chairman of this committee can be contacted at Biode Building, Room 210, 2nd Floor, Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, E-mail: uichirc@yahoo.com and uichec@gmail.com.

In addition, if you have any question about your participation in this research, you can contact the principal investigator

Name: Okolosi Joel Eviano

Department: Human Nutrition

Phone: +23480 338 96513

Email: okolosijoel@yahoo.com

PLEASE KEEP A COPY OF THE SIGNED INFORMED CONSENT FORM

DIETARY PATTERN, NUTRITIONAL STATUS AND BLOOD PRESSURE LEVEL OF IN-SCHOOL ADOLESCENTS IN EDO STATE, NIGERIA

DATE……QUESTIONNAIRE SERIAL NUMBER……

Circle the correct answer to each question or fill in the answer as appropriate

Section A: Demographic characteristics of the respondents

1. Senatorial District (1) Edo North (2) Edo Central (3) Edo South
2. Local Government Area …….
3. School …….
4. Class ……
5. Sex (1) Male (2) Female
6. Age of last birthday (years) …….
7. Ethnicity (1) Hausa (2) Yoruba (3) Ibo (4) Others (specify) …….
8. State of origin…….
9. Religion (1) Christianity (2) Islam (3) Traditional (4) Others (specify)

Section B: Family Structure, Composition and Socio-Economic Characteristics of the Respondents

1. Family type (1) Monogamous (2) Polygamous
2. Family size (1) ≤ (2) 4-6 (3)>6 (4) Others (specify)…….
3. What is your father's highest level of Education? (1) No formal education (2) Primary (3) Secondary (4) Tertiary
4. What is your mother's highest level of education? (1) No formal education (2) Primary (3) Secondary (4) Tertiary
5. What is your father's occupation? (1) Farmer (2) Petty trader (3) Artisan (4) Retired civil servant (5) Business man (6) others specify) ……
6. What is your mother's occupation? ((1) Farmer (2) Petty trader (3) Artisan (4) Retired civil servant (5) Business woman (6) others specify) ……
7. What is your father's estimated monthly income (₦)? (1) ≤ 30,000 (2) 31,000-60,000 (3) 61,000-90,000 (4) 91,000- 120,000 (5) >120,000
8. What is your mother's estimated monthly income (₦)? (1) ≤ 30,000 (2) 31,000-60,000 (3) 61,000-90,000 (4) 91,000- 120,000 (5) >120,000
9. Who is the bread winner of your household? (1) Father (2) Mother (3) Others specify…
10. Who do you live with? (1) Both parents (2) Mother alone (3) Father alone (4) Relatives (5) Others (specify)……
11. Primary source of energy for lightning in your house (1) Electricity (2) Generator (3) Solar (4) Lantern/Candle/wick (5) Others (specify)……
12. Housing type (1) Mud (2) Brick (3) Concrete (4) others (specify)…….
13. Do you live in a house built by your parents? (1) Yes (2) No
14. Type of toilet at home (1) Latrine {pit toilet} (2) Water closet {WC} (3) Bush (4) Others (specify)……
15. Source of drinking water at home (1) Well (2) Stream (3) Tap (4) Borehole (5) Others (specify)…….
16. Source of drinking water at school (1) Well (2) Stream (3) Tap (4) Borehole (5) Others (specify)…….
17. Source of cooking fuel (1) Electricity (2) Gas (3) Kerosene (4) Fire wood (5) Others (specify)……..

Section C: Personal and Family Medical History of the Respondents

1. Do you have any recurrent or prolong illness? (1) Yes (2) No
2. Have you ever been admitted in a hospital or health facility? (1) Yes (2) No
3. Have you ever had your blood pressure measured before? (1) Yes (2) No
4. Has a doctor ever said that your blood pressure was high? (1) Yes (2) No
5. Does any of your parents have high blood pressure? (1) Yes (2) No
6. If yes, who? (1) Mother (2) Father (3) Both parents (4) Grandparent (5) None
7. Are you on any special medication in the last one year? (1) Yes (2) No
8. What is your common ailment? (1) Malaria (2) Typhoid (3) Diarrhoea (4) sickle cell anaemia (5) Others (specify)……
9. Where are you treated when ill? (1) Hospital (2) Clinic (3) At home (5) Others (specify)……
10. Tick if there is an history of any of this illness in your family {You can circle multiple options} (1) Heart trouble (2) Diabetes (3) Obesity (4) High blood pressure (5) sickle cell (6) Others (specify)……

Section D: Lifestyle of the Respondents

1. Do you engage in regular physical activity at school? (1) Yes (2) No
2. What do you prefer to do during physical activity? (1) Walking (2) Running (3) playing football (4) Volley ball (5) Others specify……
3. How many hours do you practice it per week? (1) < 1 hour (2) 1-2 hours/week (3) 3-4 hours/week (4) More than 4 hours/week
4. What do you prefer to do during leisure time? (1) Watching TV/listening/music/ (2) Using computer to play game (3) Reading story book (4) others specify……..
5. How many hours do you spend on the computer or watching TV? (1) 1-2 hours/day (2)3-4 hours/day (3) 5-6 hours/day (4) More than 6 hours/day
6. Have you ever smoked a cigarrete or any tobacco product? (1) Yes (2) No
7. If "YES", how often do you smoke? (1) Daily (2) Occasionally (3) Rarely (4) Never
8. Have you ever taken alcohol? (1) Yes (2) No
9. If yes, which of these do you take? (1) Beer (2) Wine (3) Hard liquor {pelebe/ogogoro}

Section E: Knowledge on Nutrition and Food Safety of the Respondents

1. Have you ever had any nutrition education? (1) Yes (2) No
2. Which food contain carbohydrate? (1) meat (2) palm oil (3) yam (4) milk
3. Function of carbohydrate is to: (1) Ensure adequate growth (2) Provide energy (3) Prevent diseases (4) 1 &3
4. Do soft drinks contain a lot of sugar? (1) Yes (2) No
5. Which of these foods do not contain fibre? (1) Whole-wheat bread (2) Beans (3) Vegetables (4) Meat
6. Which of these foods is low in fat (1) Milk (2) Butter (3) Meat (4) Fruits
7. Which of these foods is rich in protein? (1) Beans (2) Vegetables (3) Indomie

(4) apple
8. Function of protein is to: (1) Ensure adequate growth (2) Provide energy (3) Prevent diseases (4) 2 &3
9. Which of these food substances contain more energy? (1) protein (2) carbohydrate (3) fat (4) alcohol
10. Which of these foods is rich in vitamins? (1) Bread (2) Margarine (3) Sausage (4) Fruits
11. Is it necessary to eat fruits and vegetables every day? (1) Yes (2) No
12. Which of the following is not a mineral element? (1) Iron (2) Calcium (3) Sodium (4) Water
13. Is it important to take water for good health? (1) Yes (2) No
14. Does eating an adequate diet contribute to good health? (1) Yes (2) No
15. Which is an adequate/ healthy diet? (1) a diet rich in different foods (2) foods rich in protein {meat, fish, eggs, cheese, dried legume} (3) a diet without any fat (4) eating fish very often
16. What is the consequence for children of not having breakfast and being hungry at school? (1) Children have short attention, low concentration and cannot study well at school as they should (2) It does not affect the child in any way (3) Others
17. How can you recognize that someone that is not having enough food? (1) Lack of energy/weakness (2) cannot work, study or play as normal (3) Becomes ill easily (4) Loss of weight/thinness (4) Children do not grow as they should (5) Other
18. Is it good to be overweight or obese (1) Yes (2) No

Section F: Food habit/pattern of the respondents

1. Do you eat breakfast? (1) always (2) Often (3) Sometimes (4) Never
2. Where does your food mostly come from? (1) Food cooked at home (2) Food bought from outside
3. Do you take three meals per day? {Breakfast, lunch and dinner} (1) Yes (2) No
4. If "NO", which one do you skip? (1) Breakfast (2) Lunch (3) Dinner
5. Why do you skip meals? (1) My parents could not afford it (2) That is my lifestyle (3) Others (specify)……
6. Which meal do you eat most? (1) Breakfast (2) Lunch (3) Dinner

7. Do you eat snacks between meals? (1) always (2) often (3) sometimes (4) never
8. Do you consume fast foods? (1) always (2) often (3) sometimes (4) never
9. Do you consume salty foods? (1) always (2) often (3) sometimes (4) never
10. Do you consume chips? (1) always (2) often (3) sometimes (4) never
11. Do you consume coffee? (1) always (2) often (3) sometimes (4) never
12. Do you consume tea? (1) always (2) often (3) sometimes (4) never
13. Do you usually take soft drinks up to three times per day? (1) Yes (2) No
14. Do you usually add extra sugar to your food? (1) Yes (2) No
15. Do you usually add salt to your food at eating table? (1) Yes (2) No
16. Do you eat at least 2 portions of fruits every day? (1) always (2) often (3) sometimes (4) never
17. Do you have vegetables in your meals every day? (1) always (2) often (3) sometimes (4) never
18. How is your diet: (1) different every day (2) different sometimes during a week (3) different only the weekend days (4) Almost the same every day
19. What is your snack mostly based on (1) fruit/fruit juice/fruit and milk shake/yoghurt (2) biscuit/cracker/bread (3) plantain chips/popcorn/peanut (4) soft drinks (5) chocolate drink/ice cream/cakes
20. Which fluid do you usually drink between meals? (1) water (2) soft drinks {cola, orange, soda, ice tea, tonic, water etc.} (3) fruit/fruit juice/fruit and milk shakes
21. Do you drink at least one glass of milk or do you eat a cup of yoghurt every day? (1) always (2) Sometimes (3) Never
22. How many sachets of water do you take per day? (1) <2 (2) 3-4 (3) >4
23. Do you take any nutrient supplementation? (1) Yes (2) No
24. If "YES", how often? (1) Once daily (2) Twice daily (3) Twice weekly (4) More than twice a week

Food Frequency Questionnaire of the Respondents

Food Description	**Never 0x/wk (1)**	**Rarely 1x/wk (2)**	**Occasionally 2x/wk (3)**	**Regularly 3-6x/wk (4)**	**Daily 7x /wk**
A. Cereals & Grains					
Ogi/Pap/Koko					
Eko/Agidi					
Tunwo masara					
Maize grain (Cooked/roasted/pop)					

Sorghum					
Millet					
Oat meal					
Rice (cooked/fried/jollof)					
Tunwo shinkafa					
Whole wheat bread					
White bread					
Biscuits					
B. Roots & Tubers					
Garri					
Lafun					
Fufu					
Yam (Roasted/Boiled/fried)					
Water yam					
Yam flour (Amala)					
Pounded Yam					
Yam pottage					
Cocoyam (Cooked/fried)					
Sweet potatoes (cooked/fried)					
C. Legume					
Beans (Cooked/Boiled)					
Bean pudding (Moinmoin)					
Bean cake (Akara)					
Soya					
D. Nuts & Seeds					
Peanut/groundnut (Boiled/Roasted)					
Cashew seeds and nuts					
Oil palm seeds and nuts					
Coconuts/ walnut					

Food Frequency Questionnaire of the Respondents Continue

Food Description	**Never 0x/wk (1)**	**Rarely 1x/wk (2)**	**Occasionally 2x/wk (3)**	**Regularly 3-6x/wk (4)**	**Daily 7x /wk**
E. Meat, fish and poultry					
Beef					
Goat meat					
Sheep meat					
Pork					

Chicken					
Turkey					
Duck					
Fish					
Cray fish					
Shrimps					
Crabs					
Sardine					
Egg					
F. Milk and milk products					
Fresh Milk (Powered)					
Tinned milk (Liquid)					
Local Cheese					
Yoghurt /Ice cream					
G. Tea and Beverages/ Alcohol					
Tea (lipton, top, etc)					
Beverages (Milo, bournvita, richoco etc)					
Beer /wine					
Juice					
Soft drinks					
H. Fruits & Vegetables					
Orange/tangerine/lemon					
Mangoes					
Pawpaw					
Guava					
Pineapple/apple					
Water melon					
Cashew					
Pear					
Carrot					
Banana					
Plantain					
Leafy green (Ugwu, water)					
Non-leafy green (Okro)					
Tomatoes/pepper					
Miscellaneous					
Curry/tyme/maggi/ginger					

ASSESSMENT OF NUTRITIONAL STATUS OF THE RESPONDENTS.

Now I would like you to tell me everything you ate and drank since you woke up yesterday morning until you went to bed. Including everything you ate and drank at home and away from home, even snacks, tea or coffee

TWENTY-FOUR HOUR DIETARY RECALL

Item Number (a)	Food/Drink (b)	Description of Food or Drink (c)	Place taken (d)	Time (e)	How much did you ate/drank (f)	Weight equivalent (g)
\						

(1). Was food intake usual? (Y/N) If no, how was it unusual?	(4). Which supplements do you usually take? (iron, antimalaria, vitamins, other supplements) (Y/N) If yes, specify
(2). Was it a feast day? (Y/N)	
(3). Were you sick yesterday (Y/N): If yes, did the sickness affect appetite (Y/N) If yes, how? Increase or decrease	(5). What type of beverage do you usually take? _____ _____

DIETARYDIVERSITYQUESTIONNAIRE

Question number	Foodgroup	Examples	YES=1 NO=0
1	CEREALS	bread,noodles,biscuits,cookiesoranyotherfoodsmade frommillet,sorghum,maize,rice,wheat+*insertlocalfoods e.g.ugali,nshima,porridgeorpastesorotherlocally availablegrains*	
2	VITAMINARICH VEGETABLESAND TUBERS	pumpkin,carrots,squash,orsweetpotatoesthatareorange inside+*otherlocallyavailablevitamin-Arichvegetables (eg. sweetpepper)*	

3	WHITETUBERSAND ROOTS	Whitepotatoes,whiteyams,cassava,orfoodsmadefrom roots.	
4	DARKGREENLEAFY VEGETABLES	darkgreen/leafyvegetables,includingwildones+*locally availablevitamin-Arichleavessuchascassavaleavesetc.*	
5	OTHERVEGETABLES	othervegetables,includingwildvegetables	
6	VITAMINARICHFRUITS	ripemangoes,papayas+*otherlocallyavailablevitaminA-richfruits*	
7	OTHERFRUITS	otherfruits,includingwildfruits	
8	ORGANMEAT(IRON- RICH)	liver,kidney,heartorotherorganmeatsorblood-based foods	
9	FLESHMEATS	beef,pork,lamb,goat,rabbit,wildgame,chicken,duck,or otherbirds	
10	EGGS		
11	FISH	freshordriedfishorshellfish	
12	LEGUMES,NUTSAND SEEDS	beans,peas,lentils,nuts,seedsorfoodsmadefromthese	
13	MILKANDMILK PRODUCTS	milk,cheese,yogurtorothermilkproducts	
14	OILSANDFATS	oil,fatsorbutteraddedtofoodorusedforcooking	
15	SWEETS	sugar,honey,sweetenedsodaorsugaryfoodssuchas chocolates,sweetsorcandies	
16	SPICES,CONDIMENTS, BEVERAGES	Spices (blackpepper,salt),condiments(soysauce,hot sauce),coffee,tea,alcoholicbeveragesOR*localexamples*	
			YES=1 NO=0
Individual levelonly	Didyoueatanything(mealorsnack)OUTSIDEofthehomeyesterday?		
Household levelonly	Didyouoranyoneinyourhouseholdeatanything(mealorsnack)OUTSIDEofthehome yesterday?		

[1]FAO/NutritionandConsumerProtectionDivision,versionofMay2007.
PleaseacknowledgeFAOinanydocuments pertainingtouseofthisquestionnaire.

Body Dissatisfaction of the respondents

Body Shape Questionnaire-Revised-10. Please circle the option that best indicate how often you felt the following ways in the past month.

1. Have you been worried about your shape that you have been feeling that you ought to diet? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
2. Have you noticed that shape of other adolescents and felt that your own shape compared unfavourably? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
3. Has being naked, such as when taking a bath make you feel fat? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
4. Has eating sweets, cakes, or another high calorie food made you feel fat? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never

5. Have you felt excessively fat and rounded? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
6. Have you felt ashamed of your body? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
7. Has seeing your reflection (e.g. in mirror or a shop window) made you feel bad about your shape? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
8. Have you been particularly self-conscious about your shape when in the company of other people? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
9. Have you found yourself brooding about your shape? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never
10. Have seeing thin adolescents (male/female) made you feel bad about your own shape? (1) Always (2) Very often (3) Often (4) Sometimes (5) Rarely (6) Never

Anthropometric Measurements and Body Composition of the Respondents

VARIABLES	**VALUES**	**VARIABLES**	**VALUES**
Age (years)		Body Mass Index	
Sex		Body Fat (%)	
Height (cm)		Visceral fat (%)	
Weight (kg)		Skeletal Muscle Mass	
Waist Circumference (cm)		Resting Metabolism	
Hip Circumference (cm)			
Waist/Hip ratio			
Waist/Stature (height) ratio			

BLOOD PRESSURE OF THE RESPONDENTS

BLOOD PRESSURE	1^{ST} Reading	2^{nd} Reading	3^{rd} Reading
Systolic			
Diastolic			

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IAMRAT)
College of Medicine, University of Ibadan, Ibadan, Nigeria.

Director: **Prof. Catherine O. Falade,** *MBBS (Ib), M.Sc., FMCP, FWACP*
Tel: 0803 326 4593, 0802 360 9151
e-mail: cfalade@comui.edu.ng lillyfunke@yahoo.com

UI/UCH EC Registration Number: **NHREC/05/01/2008a**

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Dietary Pattern, Nutritional Status and Blood Pressure level of In-School Adolescents in Edo State

UI/UCH Ethics Committee assigned number: UI/EC/17/0460

Name of Principal Investigator: **Joel E. Okolosi**
Address of Principal Investigator: Department of Human Nutrition,
College of Medicine,
University of Ibadan, Ibadan, Nigeria

Date of receipt of valid application: 16/10/2017

Date of meeting when final determination on ethical approval was made: **N/A**

This is to inform you that the research described in the submitted protocol, the consent forms, and other participant information materials have been reviewed and *given full approval by the UI/UCH Ethics Committee.*

This approval dates from **28/12/2017 to 27/12/2018.** If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the* UI/UCH EC *assigned number and duration of* UI/UCH EC *approval of the study.* It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC at least four weeks before the expiration of this approval in order to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. *No changes are permitted in the research without prior approval by the* UI/UCH EC *except in circumstances outlined in the Code. The* UI/UCH EC *reserves the right to conduct compliance visit to your research site without previous notification.*

UI/UCH EC
28 DEC 2017
APPROVED
COLLEGE OF MEDICINE, U.I.

Professor Catherine O. Falade
Director, IAMRAT
Chairperson, UI/UCH Ethics Committee
E-mail: uiuchec@gmail.com

EDO STATE
MINISTRY OF EDUCATION
P.M.B. 1058
BENIN CITY, NIGERIA.

Our Ref: STT13612T[4]/133 31st **October, 2017.**

Okolosi Joel Eviano
Public Health/Community Nutrition,
Department of Human Nutrition,
Faculty of Public Health,
University of Ibadan.

APPROVAL

I am directed to refer to your letter dated 23rd October, 2017 and to inform you that the Honourable Commissioner has graciously approved your request to carry out your Research Work in Schools in Edo State.

2. You are to ensure that your research does not exceed administration of Questionnaires and taking of Blood Pressure of students as requested, please.

3. You are to liaise with the Principals of the Schools you intend to use in the three Senatorial Districts and ensure that your research does not affect the academic activities in the Schools.

3. While wishing you a successful Research Work in advance, accept the assurances of the Honourable Commissioner.

Ehimika, E.I.
For: Hon. Commissioner.

ATTENTION: All Principals

OKOLOSI Joel Eviano is a PhD student of the University of Ibadan.

2. Kindly accord him all necessary support to carry out his Research Work for his PhD programme in your School.

Ehimika, E.I.
For: Hon. Commissioner.

DEPARTMENT OF HUMAN NUTRITION
FACULTY OF PUBLIC HEALTH
COLLEGE OF MEDICINE
UNIVERSITY OF IBADAN
IBADAN, NIGERIA

+234-8022995251
+234-8133067711
nutrition-dept@mail.ui.edu.ng

O. T. Adepoju *Ph.D*
Ag. Head of Department

04 October, 2017

TO WHOM IT MAY CONCERN

LETTER OF INTRODUCTION: Joel Eviano **OKOLOSI: Matric No: 152706**

This is to certify that Joel Eviano OKOLOSI (Matric No. 152706), is a PhD student in the Department of Human Nutrition, Faculty of Public Health, College of Medicine, University of Ibadan and is currently undertaking a research titled, **"Dietary Pattern, Nutritional Status and Blood Pressure Level of In-School Adolescents in Edo State".**

I will appreciate your support for him to be able to collect the data for this research.

Thank you.

Dr O. T. Adepoju
Ag. Head of Department

DEPARTMENT OF HUMAN NUTRITION
UNIVERSITY OF IBADAN