Knowledge and Perception of In-School Adolescents on the Role of Adequate Diet in Non-Communicable Diseases Prevention and Management in Ogun State, Nigeria

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Certification

This is to certify that **Gbemisola Taiwo OLAPO** with matriculation number **LCU/PG/005079** carried out this research work titled **"Knowledge and Perception of In-School Adolescents on the Role of Adequate Diet in Non-Communicable Diseases Prevention and Management in Ogun State, Nigeria"** in the Department of Human Nutrition and Dietetics, Faculty of Basic Medical and Applied Sciences, Lead City University, Ibadan, Oyo State, for the award of Masters of Science (MSc) in Human Nutrition And Dietetics and that this has not been previously submitted.

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Dedication

This research work is dedicated to God Almighty, for seeing me through to the successful completion of this project.

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Abstract

Non-communicable diseases (NCDs) have become a significant public health challenge, particularly among adolescents in low- and middle-income countries like Nigeria. Consuming unhealthy food is a significant and modifiable behavioral risk factor for the development of NCDs later in life. To address the global NCD pandemic, which is responsible for 74% of deaths globally and 29% of deaths in Nigeria, nutrition literacy and healthy eating habits, particularly among adolescents and younger age groups must be encouraged. This cross sectional study assessed the knowledge and perception of in-school adolescents (N=480) aged 10-19 years in Ogun State, Nigeria regarding the role of adequate diet in NCDs prevention and management. Using a 23-item assessment scale, 302(63%) respondents demonstrated good knowledge of NCDs (scores ≥70%), 129(27.4%) showed fair knowledge (50-70%), and 46(9.6%) showed poor knowledge (50%). On a 7-item scale assessing knowledge of diet's role in NCD prevention, 273.6(57%) demonstrated good knowledge (scores ≥70%), 52.8(11%) showed fair knowledge (scores 50-70%), and 153.6(32%) showed poor knowledge (scores <50%). Regarding perceptions, 36% of respondents had a positive perception of the importance of diet in NCD prevention and management, while 64% had a negative perception. Correlation analyses revealed weak but significant positive associations between respondents' age (r=0.045, p=0.004), gender (r=0.016, p=0.029), and residential location (r=0.025, p=0.003) with more positive perceptions. Anthropometric measurements showed that 60.8% of respondents had normal weight, 23.3% were underweight, and 15.9% were overweight and obese. Despite generally demonstrating good knowledge of major NCDs and their dietary link, 43.1% believed NCDs were caused by supernatural powers, 72.1% perceived traditional cultural foods as generally healthy, and 65% viewed consuming a balanced diet as inconvenient and expensive. The findings highlight the need for culturally sensitive nutrition education programs to address knowledge gaps, dispel misconceptions, and promote healthier dietary habits among Nigerian adolescents.

Keywords: Knowledge, Perception, In-School Adolescents, Adequate Diet, Non-Communicable Diseases.

Word Count: 295

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List of Acronyms

Abbreviation	Meaning
NCDs	Non-Communicable Diseases
WHO	World Health Organization
CVDs	Cardiovascular Diseases
IHD	Ischemic Heart Disease
COVID-19	Coronavirus Disease 2019
BMI	Body Mass Index
CRDs	Chronic Respiratory Diseases
COPD	Chronic Obstructive Pulmonary Disease
DALYs	Disability-Adjusted Life Years
LMICs	Low- and Middle-Income Countries
HICs	High-Income Countries
SCT	Social Cognitive Theory
LDL	Low-Density Lipoprotein
DASH	Dietary Approaches to Stop Hypertension
UN	United Nations
HIV	Human Immunodeficiency Virus
EGCG	Epigallocatechin Gallate
CKD	Chronic Kidney Disease
RDA	Recommended Dietary Allowance
NHGSFP	National Home Grown School Feeding Program

Chapter One

Introduction

1.1 Background to the Study

Non-Communicable Diseases (NCDs), which includes diabetes, cancer, chronic respiratory disorders, and cardiovascular disease, accounted for the majority of deaths globally in 2019[1]. The prevalence of NCDs is rising significantly, particularly in low- and middle-income countries. In 2019, these illnesses were responsible for 74% of all deaths[1]. The four core NCDs indicated above account for over 80% of all early NCD fatalities[1]. The primary behavioral risk factors for these illnesses include excessive alcohol intake, poor diet, insufficient physical activity, and tobacco use[2].

Childhood and adolescence are the times when eating habits and food preferences develop, and these inclinations usually persist throughout adulthood[3]. In particular, obesity in childhood is associated with a higher chance of developing NCDs such as diabetes and cardiovascular diseases later in life, as well as a higher chance of early death and disability[4].

Limiting saturated and trans fats, free sugars, and processed meats can help lower the incidence of obesity, diabetes, and cardiovascular disease. Reducing salt and sodium intake can also help avoid hypertension[5,6].

NCDs account for approximately 20% of fatalities among adolescents aged 10 to 19, with a greater impact on females aged 10 to 14 (nearly 25% of deaths) than boys in the same age range[7]. In 2022, WHO estimated that 20% of children and adolescents aged 5 to 19 were overweight or obese worldwide, up from 8% in 1990[8]. This clearly illustrates that childhood and adolescent obesity has become a serious global public health concern, with poor dietary patterns

heavy in fats, carbohydrates, and salt becoming more widespread among young people worldwide.

Nigeria has a high incidence of communicable and NCDs, with the latter accounting for 29% of deaths in 2019[7]. Over the last few decades, the frequency of risk factors for NCDs has increased dramatically, making NCDs a major health concern in Nigeria. In Nigeria, the age-standardized death rate across four main NCDs (cardiovascular disease, chronic respiratory disease, cancer, and diabetes) was 565 per 100,000 in males and 546 in females in 2021[7].

Nigeria is currently undergoing a nutrition transition, characterized by an increased consumption of processed foods, fats, and sugars[8]. This shift in dietary patterns is associated with rising rates of overweight, obesity, and diet-related NCDs[9]. For instance, the prevalence of obesity among Nigerians increased from 8.8% in 2000 to 14.5% in 2020. Along with this increase in obesity, there has been a growing incidence of hypercholesterolemia, hypertension, and diabetes, particularly in more affluent areas and urban centers[10].

In 2021, Ogun State, located in southwest Nigeria, contained 756,428 secondary school students[11]. A recent school-based study conducted in Ikenne Local Government Area of Ogun State revealed a 12.7% prevalence of overweight and obesity among in-school adolescents, with factors such as younger age (10-14 years), attending private schools, and having parents with higher education levels all associated with an increased risk[12]. Processed meals high in fats, oils, and salt have also been reported to be widely available to children and adolescents in certain sections of Ogun state[11].

Considering the Ogun State Ministry of Health's emphasis on promoting "active living from childhood" and preventing NCDs in accordance with WHO guidelines, comprehensive state-wide data on adolescents' eating patterns and nutrition knowledge are desperately needed[13]. The

purpose of this study is to assess the perception and knowledge of in-school adolescents in Ogun State on the importance of adequate diet in managing and preventing NCDs. This research aims to fill knowledge gaps by examining adolescents' perceptions of important concepts like healthy diets, processed foods, NCDs, and the value of adequate diet. The findings will help develop age-appropriate health promotion initiatives and policies for Ogun State, addressing the current lack of nutrition education interventions. In the end, the results will offer insightful information for focused interventions and evidence-based policy creation, ultimately contributing to the state's efforts in combating NCDs among its younger populace.

1.2 Statement of the Problem

Adolescent obesity, overweight, and the consumption of unhealthy foods are all on the rise in Nigeria, mirroring global trends. According to recent research, one-fifth of Nigerian adolescents aged 16 to 19 are overweight or obese[14]. Furthermore, according to nationally representative surveys, the prevalence of overweight and obesity among Nigerian children under the age of five rose from 11% to 18% between 2003 and 2018[10]. Dietary habits, which form and persist from childhood to adulthood, have a significant impact on the trajectory of NCD risk[15]. This makes the figures alarming.

Obesity, poor nutrition, and other lifestyle variables have been related to the most common NCDs: cardiovascular disease, diabetes, chronic respiratory disease, and cancer[1]. Childhood overweight and obesity are linked to a much higher risk of developing these NCDs. For example, obese children are more likely to develop prediabetes, which can progress to type 2 diabetes in adolescence or early adulthood[15]. Obese children are more likely to have abnormal lipid profiles, high blood pressure, breathing problems such as asthma, and musculoskeletal problems that might persist into adulthood[16]. Obesity-related NCDs later in life include heart disease, kidney

disease, and stroke[17]. Obesity-related malignancies include endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon cancer. Obese adolescents may have a higher risk of developing certain cancers as adults[18]. Obesity and poor diets have an impact on Nigerian youth's mental health and quality of life, as well as their physical health[19].

Improving diets and tackling the rising rate of childhood obesity are critical investments for Nigeria's future productivity, well-being, and health. To promote healthier lifestyles, effective public health interventions focusing on physical activity, diet, and policy are required[20]. Evidence-based prevention measures can make a positive difference in NCD trajectories during infancy and adolescence.

Underweight in adolescents, though more prevalent than obesity in Nigeria, remains a concern in some regions and socioeconomic groups[21]. Chronic undernutrition during adolescence can lead to stunted growth, weakened immune systems, and increased susceptibility to infections[22]. Moreover, underweight adolescents may face an elevated risk of certain NCDs later in life, such as osteoporosis due to inadequate bone mineral density development[23]. The dual burden of malnutrition, where underweight and overweight coexist within the same population, complicates public health efforts to address NCDs[24]. This highlights the need for a comprehensive approach to adolescent nutrition that addresses both ends of the malnutrition spectrum, ensuring that interventions aimed at reducing obesity do not inadvertently exacerbate underweight issues among vulnerable groups.

Community-based studies of children and adolescents in Ogun state, southwest Nigeria, have likewise indicated alarming rises in adolescent undernutrition and obesity. According to a study, 17.4% of school children and adolescents aged 5-19years in Abeokuta were stunted, which indicates chronic malnutrition[25]. Furthermore, 23.8% of children in another study were classified

as obese, showing an increase in the incidence of overnutrition[26]. Adolescent undernutrition, paired with overnutrition, can render people more prone to NCDs later in life. As a result, in today's Nigeria, activities targeted at increasing nutrition knowledge among young adolescents are critical to the country's current nutrition transition.

There is a large research gap in analyzing adolescents enrolled in schools across Ogun State's numerous local government areas on nutrition knowledge gaps and food perceptions. Furthermore, there is limited data on how nutrition literacy differs by gender and among other adolescent age groups, which could help adapt interventions. Programs and policies about a certain area can also be modified by assessing differences between living in rural and urban areas. Furthermore, acquiring qualitative, contextual understanding is critical for devising culturally appropriate interventions. Dispelling common misconceptions or cultural barriers to behavior change can be accomplished by assessing adolescent perceptions on concepts such as processed foods and a balanced diet, as well as their significance in preventing NCDs.

Consequently, the purpose of this study is to address these gaps by conducting a statewide research project on nutrition knowledge and perceptions among adolescents enrolled in schools in both urban and rural areas in Ogun state. The findings can help to lower the state and region's increased risk of nutrition-related NCDs among adolescents by guiding policies and activities that promote nutrition knowledge and beneficial eating habits. Furthermore, given Nigeria's rapidly changing food situation, the study may serve as a reference for future studies analyzing nutrition education programs created for various adolescent subgroups based on gender, age, and place of residence, etc.

1.3 Justification

Consuming unhealthy food is a significant and modifiable behavioral risk factor for the development of NCDs later in life. To address the global NCD pandemic, public health officials must now encourage nutrition literacy and healthy eating habits, particularly among adolescents and younger age groups.

Nigeria currently has one of Africa's highest rates of NCDs, including diabetes, cancer, stroke, and hypertension[25]. Furthermore, given its strong association with the early development of nutrition-related NCDs, the implications of rising adolescent obesity exacerbate concerns. According to recent data, Nigeria has one of the worst rates of overweight and obesity among young people in Africa, with 11% of children under the age of five and 20% of adolescents aged 16 to 19. As a result, population-based policies and interventions are critical for raising knowledge and encouraging healthy eating habits among Nigerian adolescents.

Southwest Nigeria's Ogun State reflects national trends in NCDs and obesity. According to state-level data, 19% of Ogun's school-age adolescents (13-19 years old) were classified as overweight or obese in 2020[26]. Furthermore, local study among urban youths has found that a lack of variety in diet, a poor consumption of fruits and vegetables, and a high prevalence of processed and fried snacks all contribute to the persistence of obesity and malnutrition[11].

1.4 Aim and Objectives of the Study

The aim of this study is to assess the knowledge and perception of in-school adolescents on the role of adequate diet in NCDs prevention and management in some selected LGAs in Ogun State, South West, Nigeria.

The Objectives are to;

i. evaluate the level of knowledge of in-school adolescents on the role of adequate diet in the prevention and management of NCDs.
ii. describe in-school adolescents' perception of adequate nutrition in the prevention and management of NCDs.
iii. assess the anthropometric status of in-school adolescents based on their body mass index (BMI).
iv. identify knowledge gaps related to nutrition and NCD prevention among in-school adolescents.

1.5 Research Questions

i. What is the level of nutrition knowledge among adolescents in the study area regarding the prevention and management of NCDs?
ii. How do adolescents in the study area perceive the relationship between adequate nutrition and the prevention and management of NCDs?
iii. What is the anthropometric status of adolescents in the study area based on their BMI?
iv. What are the knowledge gaps related to nutrition and NCD prevention among adolescents in the study area?

1.6 Significance of the study

The increasing public health epidemic of nutrition-related NCDs among Nigerian adolescents requires prompt action, given that NCDs account for 29% of all deaths in Nigeria[27]. Obesity, poor diets, and other modifiable behavioral risk factors are also becoming more prevalent among adolescents[28]. This study focuses on adolescents in Ogun State, southwest Nigeria, who have recently demonstrated worrisome rates of undernutrition and overnutrition. Obesity, diabetes,

cancer, and cardiovascular disease are among NCDs that develop later in life due to the combined effects of under and overnutrition[29]. Thus, this study has significant public health significance since it addresses knowledge gaps and perception about nutrition and NCD prevention among adolescents. The collecting of representative data for the entire state will aid in the creation of tailored policies and interventions aimed at this vulnerable age group[30]. Currently, programs and policies such as Ogun's "Strategic Health Development Plan" emphasize nutrition and NCD prevention, but there is limited research on how well these messages are received by adolescents[31]. The purpose of this research is to identify specific knowledge gaps and cultural norms that must be considered when developing health promotion initiatives. Evaluating variances based on age, gender, and residence location can also help to design effective, evidence-based interventions.

Overall, enhancing adolescent nutrition knowledge and perception provides an invaluable opportunity to shape lifelong health trajectories, productivity, and well-being[32]. At the national level, this study serves as a preliminary resource for nutrition education initiatives directed at Nigerian adolescents. Given that 20% of Nigerian adolescents are overweight or obese, intervention is required[33]. This study can help predict programmatic potential and difficulties, as well as highlight key aspects for age-appropriate health messages.

Furthermore, this study addresses international calls to action on population nutrition education as a strategy of combating the global NCD problem[34].

1.7 Scope of the Study

This study included in-school adolescents (10-19 years old) from selected public and private secondary schools in Ogun State. The study covered all three senatorial districts in the state: Ogun Central, Ogun East, and Ogun West. Both the urban and rural student populations in each

senatorial district was surveyed. Two local government areas (LGAs) were randomly selected from each senatorial district, one representing an urban region and the other a rural area. The chosen LGAs for the study are:

Ogun Central:	Urban: Abeokuta South LGA	Rural: Odeda LGA
Ogun East:	Urban: Ijebu Ode LGA	Rural: Remo North LGA
Ogun West:	Urban: Ado-Odo/Ota LGA	Rural: Yewa North LGA

The study used multistage stratified cluster sampling. The data was designed to be generally applicable to the entire adolescent school-going population in Ogun state, with a target minimum sample size of 480 adolescents. To assess nutrition knowledge and perceptions, quantitative data were collected using questionnaires and grading systems.

1.8 Limitation of the Study

The study's cross-sectional design makes it more difficult to determine which variables cause which other. Although correlations between anthropometric status, knowledge, and perceptions can be seen, it is impossible to say with certainty how these connections will develop over time or in which direction they will run. Additionally, because its design just offers a moment in time, it could not reflect continuous shifts in behaviour or understanding. The study's emphasis on adolescents enrolled in school excludes out-of-school adolescents who may have varying degrees of knowledge, perception, and nutritional status, even if it offers an accessible and organised sample pool. This limits the findings' applicability to the larger adolescent population in Ogun State and Nigeria at large. Adolescents who are not in school may encounter distinct obstacles and have uneven access to nutrition information, which may have a substantial effect on their understanding of and actions about NCDs. Another thing to think about is geographical restrictions. The study was carried out in a few Ogun State local government areas, which might

not be indicative of the state as a whole or of other parts of Nigeria. Regional variations in cultural, economic, and environmental variables may have a substantial impact on dietary practices, availability of nutrition information, and the incidence of NCDs. Social desirability bias may be present when knowledge and views are evaluated using self-reported data. Rather of giving responses that accurately reflected their knowledge or perception, respondents could have given responses they thought were appropriate or socially acceptable. This may cause people to overestimate their understanding of nutrition or their commitment to healthy living. The study measured anthropometric traits, however it did not thoroughly evaluate nutritional consumption or levels of physical activity. Because of this restriction, it is difficult to establish a clear connection between knowledge and views and real food habits and lifestyle choices. A more thorough dietary evaluation may have revealed additional information about the connection between eating patterns and nutrition knowledge.

Although sufficient for a broad analysis, the study's sample size could make it more difficult to conduct more in-depth subgroup analyses. For in-depth comparisons, smaller subgroups based on certain anthropometric or demographic traits might not have enough statistical power. A preset set of questions was used to measure adolescents' knowledge and perception, which may not have fully captured their understanding of nutrition and NCDs. Richer, more detailed information on respondents' attitudes and views may have been obtained by open-ended questions or qualitative research techniques. The impact of family dynamics, socioeconomic position, and media exposure on adolescents' views and understanding of nutrition was not thoroughly investigated in this study. The exclusion of these factors may result in gaps in our understanding of the complete context of teenage nutrition in this group. These factors have the potential to greatly alter dietary habits and health behaviours. The lack of a control group and

comparison with other age groups in the study makes it more difficult to conclude whether the observed levels of knowledge and views are exclusive to adolescents or indicative of a wider knowledge in the community. Finally, the study design did not specifically explore how the COVID-19 pandemic would affect eating patterns, access to nutrition information, and general health knowledge. It's possible that the pandemic had an impact on respondents' responses and behaviours in ways that the study instruments missed.

1.9 Definition of Terms

In-School Adolescents: Adolescents attending secondary schools (public and private).

Adolescents: Individuals aged 10 to 19 years, as defined by the World Health Organization.

Knowledge: The facts, information, and skills acquired through experience or education. For NCDs, this includes understanding disease causes and risk factors, awareness of healthy lifestyle choices and their health impacts, comprehension of diet-disease relationships, recognition of warning signs and symptoms, and understanding of preventive and management strategies.

Perception: The process by which individuals interpret and organize health-related information to form meaningful understanding and beliefs. In the context of NCDs, this includes personal views, beliefs, and attitudes about disease causation, prevention practices, and the importance of dietary choices in disease management.

Non-Communicable Diseases (NCDs): Chronic conditions not transmissible from person to person, characterized by slow progression and long duration.

Body Mass Index (BMI): A measure used to determine weight status, calculated by dividing weight in kilograms by height in meters squared.

Obesity: Having a BMI greater than 30 kg/m^2.

Overweight: Having a BMI greater than or equal to 25 kg/m^2.

Underweight: Having a BMI lesser than 18.5 kg/m².

Normal weight: Having a BMI between 18-5 and 24.9kg/m².

Cardiovascular Diseases (CVDs): Disorders affecting the heart and blood vessels, including heart attacks, strokes, and hypertension.

Type 2 Diabetes: A metabolic disorder characterized by high blood sugar levels due to the body's inability to effectively use insulin.

Chronic Respiratory Diseases (CRDs): Diseases affecting the airways and lungs, including chronic obstructive pulmonary disease (COPD), asthma, and occupational lung diseases.

Risk Factors: Elements that increase the likelihood of developing NCDs, categorized into:

Modifiable Risk Factors: Factors that can be changed or controlled, such as diet, physical activity, and tobacco use.

Non-Modifiable Risk Factors: Factors that cannot be changed, such as age, gender, and genetic predisposition.

Mediterranean Diet: Characterized by high consumption of fruits, vegetables, whole grains, legumes, nuts, and olive oil, moderate amounts of fish and red wine, and low consumption of red and processed meats.

Dietary Approaches to Stop Hypertension (DASH) Diet: Diet emphasizing fruits, vegetables, whole grains, and low-fat dairy products.

Plant-Based Diet: Focuses on foods primarily from plants, including fruits, vegetables, nuts, seeds, oils, whole grains, legumes, and beans.

Adequate Diet: A balanced and nutritious eating plan providing necessary nutrients in proper proportions to maintain health and prevent nutrition-related NCDs.

Dietary Diversity: The variety of different food groups consumed in a diet.

Food Insecurity: Limited or uncertain access to adequate, safe, and nutritious food.

Food Neophobia: Reluctance to eat, or avoidance of, new foods.

Emotional Eating: Consuming large quantities of food in response to feelings instead of hunger.

Nutrient Deficiency: A condition where the body doesn't get enough of a nutrient essential for proper functioning.

Disability-Adjusted Life Years (DALYs): A measure of overall disease burden, expressed as years lost due to ill-health, disability, or early death.

Neurodegenerative Diseases: Conditions characterized by progressive nervous system dysfunction, such as Alzheimer's and Parkinson's diseases.

Parental Modelling: The process by which parents demonstrate and reinforce healthy eating behaviors for their children.

Urbanization: The population shift from rural to urban areas, often accompanied by lifestyle and dietary changes.

Globalization: The process of interaction and integration among people, companies, and governments worldwide, often leading to the spread of products, technology, information, and jobs across national borders.

School-Based Interventions: Programs implemented within the school environment to promote healthy eating among students.

Family-Based Interventions: Strategies involving family members, particularly parents, in promoting healthy eating habits among adolescents.

Community-Based Interventions: Programs and initiatives implemented at the community level to create an environment supportive of healthy eating.

Endnotes

1. World Health Organization, "*The Top 10 Causes of Death*." **World Health Organization,** 2020. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.

2. World Health Organization. "*Noncommunicable Diseases*." **World Health Organization,** 2020. https://www.who.int/health-topics/noncommunicable-diseases.

3. S. Anzman-Frasca, A. K. Ventura, S. Ehrenberg, & K. P. Myers, "*Promoting Healthy Food Preferences from the Start: A Narrative Review of Food Preference Learning from the Prenatal Period through Early Childhood*," **Obesity Reviews** 19, 2017: 576–604. https://doi.org/10.1111/obr.12658.

4. World Health Organization. "*Background World Health Organization Regional Office for Africa Country Disease Outlook*", **World Health Organization,** 2023. https://www.afro.who.int/sites/default/files/2023-08/Nigeria.pdf.

5. G. Alison, R. Threlkeld. "*Nutritional Recommendations for Individuals with Diabetes*." ed. K. Feingold, B. Anawalt, A. Boyce, G. Chrousos & Wouter de Herder. **PubMed. South Dartmouth (MA): MDText.com, Inc.,** (2000). [Updated 2024 Apr 28] https://www.ncbi.nlm.nih.gov/books/NBK279012.

6. B. Nick & P. Bovet. *Noncommunicable Diseases*. **Taylor & Francis**, 2023.

7. United Nations Children's Fund. "Noncommunicable Diseases." **UNICEF DATA**, 2021. https://data.unicef.org/topic/child-health/noncommunicable-diseases/.

8. E. Chukwu & W. Dogbe, "*The Cause and Effect of the Nutrition Transition in Nigeria: Analysis of the Value of Indigenous Knowledge and Traditional Foods in Enugu State, Igboland*," **Journal of Ethnic Foods** 10(1), 2023.

9. World Health Organization. "*Obesity and Overweight*." **World Health Organization**, 2024. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

10. I.I Chukwuonye, K.A Ohagwu, O.S Ogah, C. John, E. Oviasu, E.N Anyabolu, I.U Ezeani, "*Prevalence of Overweight and Obesity in Nigeria: Systematic Review and Meta-Analysis of Population-Based Studies*," **PLOS Global Public Health** 2(6), 2022.

11. O. Sholeye, A. Gbadebo, & F. Gbadebo, "*Sugar Sweetened Beverage Consumption and Its Associated Factors among Adolescents in Rural and Urban Areas of Ogun State, Nigeria*," **Research Square**, 2023.

12. O. Oduyoye, S. Bello, & A. Chinenye-Julius, "*Prevalence of Overweight and Obesity Among In-School Adolescents in a Selected District in Southwest Nigeria*," **ActaSATECH** 13(2), 2021: 126-139.

13. FMOH, "*Federal Ministry of Health*", www.health.gov.ng. Accessed August 2024. https://www.health.gov.ng/.

14. B, Mobolanle, B. Kola-Raji, & T. Odugbemi, "*A Comparative Study of Nutritional Status of Adolescents from Selected Private and Public Boarding Secondary Schools in Ibadan, South Western Nigeria*", **Journal of Medicine in the Tropics** 19(1), 2017.

15. W. Eleanor, E.V Sluijs, M. White, K.I Klepp, B. Wold, & N. Lien, "*Changes in Diet through Adolescence and Early Adulthood: Longitudinal Trajectories and Association with Key Life Transitions*", **International Journal of Behavioral Nutrition and Physical Activity** 15(1), 2018.

16. K. Kakleas, A. Soldatou & K. Karavanaki, "*Childhood Obesity and Its Associations with Morbidity and Mortality in Adult Life*", **Diabetes and Its Complications** 2(4), 2018: 1–12.

17. A. Ahmed, "*Obesity-Linked Diseases (Comorbidities)*", **Obesity and Its Impact on Health**, 2021, 97–116. https://doi.org/10.1007/978-981-33-6408-0_8.

18. S. Weihrauch-Blüher, P. Schwarz & J.H. Klusmann, "*Childhood Obesity: Increased Risk for Cardiometabolic Disease and Cancer in Adulthood*", **Metabolism** 92 2019: 147–52.

19. U. Davidson, E.C. Aniwada, C.V. Okeke, S.O. Nwaoha & C.N. Obionu, "*Pattern and Predictors of Psychosocial Disorders among Overweight and Obese Children in Enugu, Southeast Nigeria,*" **African Health Sciences** 12(1), 2018: 3–9. https://doi.org/10.4314/ahs.v18i1.2.

20. O.C. Oguejiofor, C.U. Odenigbo & U.M. Odenigbo, "*The Emerging Epidemic of Cardiovascular Risk Factors in the Nigerian Population: A Call for Intervention*", **Nigerian Journal of Cardiology** 9(1), 2012: 3-6.

21. A. Adeomi, A. Fatusi & K. Klipstein-Grobusch, "*Double Burden of Malnutrition among School-Aged Children and Adolescents: Evidence from a Community-Based Cross-Sectional Survey in Two Nigerian States*", **AAS Open Research** 4, 2021: 38.

22. J.R. Galler, J.R. Koethe & R.H. Yolken, "*Neurodevelopment: The Impact of Nutrition and Inflammation during Adolescence in Low-Resource Settings*," **Pediatrics** 139(1), 2017: 72-84.

23. C. Han, H. Kim & S. Kim, "*Effects of Adolescents' Lifestyle Habits and Body Composition on Bone Mineral Density,"* **International Journal of Environmental Research and Public Health** 18(11), 2021: 6170.

24. G. Guldan, "*Undernutrition and Overnutrition: The Challenging Double Burden of Malnutrition*", **Good Health and Well-Being**, 2019: 747–59.

25. I. Senbanjo, K. Oshikoya, O. Odusanya & O. Njokanma, "*Prevalence of and Risk Factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria*", **Journal of Health, Population and Nutrition** 29(4), 2011.

26. O. Solana, O. Ogunwale, G. Ogungbayi, Y. Uthman-Akinhanmi & I. Olaleru, "*Childhood obesity: Assessing the prevalence during child development periods (5-12 years) in Yewa community, Ogun state, Nigeria*", **Indian Journal of Health and Wellbeing** 11(4-6), 2020: 208-212.

27. World Health Organization Regional Office for Africa, "*Nigeria*", **World Health Organization**, 2019. https://www.afro.who.int/countries/nigeria

28. World Health Organization, "*Nigeria NCD Profile 2018*." **World Health Organization**, 2018.

29. P. Winichagoon & B. Margetts, "*The Double Burden of Malnutrition in Low- and Middle-Income Countries*", **International Agency for Research on Cancer**, 2017

30. World Health Organization, "*Global Action Plan for Prevention and Control of NCDs 2013-2020*". **World Health Organization: Geneva**, 2013: 30

31. Ogun State Ministry of Health. "*Ogun State Strategic Health Development Plan (2010-2015)*." 2015. http://ngfrepository.org.ng:8080/jspui/handle/123456789/3210.

32. D. Bundy, N. de Silva & S. Horton, "*Child and Adolescent Health and Development: Realizing Neglected Potential in Reproductive, Maternal, Newborn, and Child Health*", **The International Bank for Reconstruction and Development / The World Bank**, 2017.

33. O. Adegoke, E. Nyenwe & N. Onyemelukwe, "*Overweight and obesity among Nigerian adolescents and young adults: Prevalence and correlates*," **Front Endocrinol (Lausanne)** 11, 2020: 461.

34. World Health Organization, "**Global Action Plan for Prevention and Control of NCDs 2013-2020**", World Health Organization, 2020.

Chapter Two

Literature Review

2.1 Conceptual Review

2.1.1 Adolescent Nutrition Knowledge

Adolescent nutrition knowledge encompasses the understanding of food components, dietary requirements, and the relationship between diet and health outcomes among individuals aged 10-19 years[1]. This knowledge forms a crucial foundation for developing healthy eating habits and making informed dietary choices that can significantly impact both immediate and long-term health outcomes[2].

Nutrition knowledge in adolescents operates on multiple levels, ranging from basic awareness of food groups to more complex understanding of nutrient functions and their role in disease prevention[3]. According to the Health Belief Model, adolescents' dietary behaviors are influenced by their perceived susceptibility to health problems, perceived severity of these problems, and perceived benefits of taking preventive actions through proper nutrition[4]. This theoretical framework suggests that enhanced nutrition knowledge can lead to better health outcomes by modifying these perceptions and ultimately influencing behavior.

The development of nutrition knowledge during adolescence is particularly critical as this period represents a decisive phase in establishing long-term dietary patterns[5]. Research indicates that adolescents with higher levels of nutrition knowledge demonstrate greater tendency to make healthier food choices and show increased awareness of the connection between diet and disease prevention[6]. However, the translation of this knowledge into actual behavioral change is complex and influenced by various factors including peer pressure, socioeconomic status, food availability, and cultural contexts[7].

Several studies have demonstrated that school-based nutrition education programs can significantly improve adolescents' understanding of healthy eating principles and their ability to make informed dietary choices[6]. The effectiveness of these programs is enhanced when they incorporate practical skills development alongside theoretical knowledge, such as reading food labels, understanding portion sizes, and identifying processed foods[8]. This practical application of nutrition knowledge helps bridge the gap between awareness and actual behavior change.

The relationship between nutrition knowledge and health behavior in adolescents is mediated by several psychological factors, including self-efficacy, outcome expectations, and behavioral capabilities[9]. Adolescents with higher levels of nutrition knowledge typically display greater self-efficacy in making healthy food choices and better understanding of the consequences of their dietary decisions[10]. This enhanced self-efficacy often translates into improved dietary practices and increased likelihood of maintaining healthy eating habits.

Social Cognitive Theory suggests that adolescents' nutrition knowledge and subsequent health behaviors are shaped through observational learning and social reinforcement[11]. This theoretical perspective emphasizes the importance of role models, including parents, teachers, and peers, in influencing adolescents' understanding and application of nutrition principles[11]. The theory also highlights the reciprocal relationship between environmental factors and individual behavior in determining dietary choices.

Furthermore, recent research has highlighted the role of digital literacy and social media in shaping adolescents' nutrition knowledge and health behaviors[12]. The increasing accessibility of nutrition information through digital platforms has created both opportunities and challenges in developing accurate nutrition knowledge among adolescents[13]. While these platforms can

provide valuable information, they may also contribute to misconceptions and potentially harmful dietary practices if not properly guided.

Understanding the complex interplay between nutrition knowledge and health behavior in adolescents is crucial for developing effective interventions that promote healthy eating habits and prevent diet-related NCDs[3]. This understanding should inform the design of age-appropriate, culturally sensitive education programs that not only enhance knowledge but also facilitate sustainable behavioral change.

2.1.2 Diet-Related NCDs

Diet-related Non-Communicable Diseases (NCDs) represent a significant global health challenge, particularly in relation to adolescent health outcomes[14]. These diseases, including type 2 diabetes, cardiovascular diseases, certain cancers, and obesity, are increasingly being recognized as having their roots in dietary patterns established during adolescence[15]. Understanding the relationship between dietary choices and NCDs is crucial for developing effective prevention strategies among adolescent populations.

The concept of diet-related NCDs encompasses the complex interplay between nutritional intake, metabolic processes, and disease development[16]. Research has demonstrated that excessive consumption of processed foods, saturated fats, added sugars, and sodium during adolescence significantly increases the risk of developing NCDs in later life[17]. This relationship is particularly concerning given the global trend toward unhealthy dietary patterns among adolescents, characterized by high intake of ultra-processed foods and sugar-sweetened beverages[5].

Prevention awareness among adolescents regarding diet-related NCDs involves understanding both the immediate and long-term consequences of dietary choices[18]. Studies have shown that adolescents often have limited awareness of the connection between current dietary behaviors

and future health outcomes[18]. This knowledge gap is particularly pronounced in understanding how dietary choices during adolescence can influence the development of NCDs decades later[19].

The World Health Organization emphasizes that early awareness and prevention of diet-related NCDs is crucial, as approximately 70% of premature deaths in adulthood are linked to behaviors initiated during adolescence[20]. This highlights the importance of developing comprehensive awareness programs that specifically target adolescent populations. Such programs should focus on building understanding of the biological mechanisms through which poor dietary choices contribute to NCD development, while also addressing the social and environmental factors that influence food choices[21].

Recent studies have highlighted the importance of cultural context in shaping both understanding and prevention of diet-related NCDs[22]. In many societies, traditional dietary patterns are being rapidly replaced by Western-style diets high in processed foods, leading to increased NCD risk[23]. This transition necessitates awareness programs that are culturally sensitive while promoting healthy dietary choices[24].

A comprehensive understanding of diet-related NCDs and prevention awareness must also consider the role of food environments in shaping adolescent dietary choices[25]. School environments, family eating patterns, and community food accessibility all contribute to the development of dietary habits that either promote or prevent NCDs[22]. Therefore, effective prevention awareness programs must address both individual knowledge and environmental factors that influence dietary decisions.

2.2 Empirical Review

2.2.1 Overview of Non-Communicable Diseases

NCDs are a wide range of chronic conditions that are not transmissible from person to person and are characterized by slow advancement and extended duration.[15] The most common types of NCDs include cardiovascular illnesses (such as heart attacks and strokes), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), and diabetes[15]. NCDs are currently the main cause of death globally, accounting for 41 million deaths per year, or 74% of all deaths worldwide[15].

2.2.2 Types and Characteristics of Major Non-Communicable Diseases

1. Cardiovascular Diseases (CVDs)

Cardiovascular diseases (CVDs) are a group of conditions characterized by the accumulation of plaque in the arteries, which can cause constriction or blockage, leading to heart attacks or strokes[26]. The cardiovascular systems consist of the heart and blood arteries[27]. CVDs are linked not only to heart conditions like ischemic heart disease (IHD), stroke, congenital heart disease, coronary heart disease, cerebrovascular disease, peripheral arterial disease, and rheumatic heart disease, but also to hypertension in blood vessels and conditions affecting cerebral, carotid, and peripheral circulation[28]. While CVD affects both sexes, men have a higher incidence than women. CVDs remain the primary cause of death among women in developed countries[29].

Every year, CVDs kill 17.9 million people in the world. Cardiovascular diseases (CVDs) account for 32% of global mortality, with heart attacks and strokes accounting for 85%.[26] Patients with CVD appear to be more vulnerable to acquiring COVID-19, with more severe illness and poor clinical outcomes[30,31]. The American Heart Association describes seven factors that increase the risk of heart disease and stroke[32].

I. Improper nutrition

II. Overweight /obesity

III. Sedentary lifestyle

IV. Smoking

V. Imbalance in blood pressure

VI. Elevated levels of cholesterol, and

VII. Uncontrolled blood sugar level.

Cardiovascular diseases (CVDs) are the largest contributors to the global burden of disease among NCDs, accounting for the majority of fatalities each year—more than cancer and chronic respiratory illnesses combined[26]. In modern society, the industrialization of the economy has moved from physically demanding to sedentary work, along with the current situation of consumerism and technology-driven culture, which is mostly related to overlong work hours, overlong commutes, and less leisure time for some recreational activities, these are associated with the significant and steady increase in the rates of CVD over the last few decades[33].

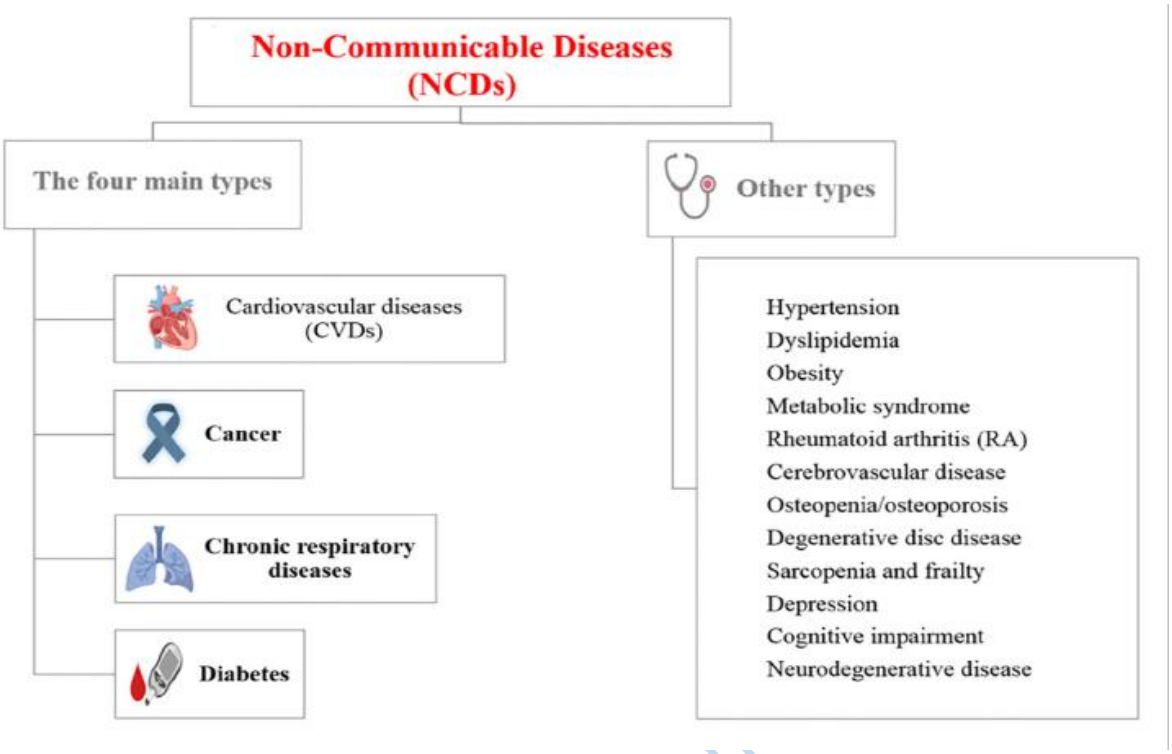

Figure 2.1: Types of Non communicable Diseases[21].

2. Cancer: Cancer is a broad range of diseases characterized by the uncontrolled growth and spread of abnormal cells in the body. Cancer is categorized into various categories based on the tissue or organ of origin, including lung cancer, breast cancer, colorectal cancer, and prostate cancer. Cancer can be caused by a number of reasons, including genetic predisposition, environmental exposures, and lifestyle factors such as tobacco use, poor diet, and physical inactivity[34].

Cancer is a major global health concern. It is one of the main causes of death worldwide, accounting for over 10 million deaths in 2020, or roughly one in every six[35]. It has common risk factors with other important NCDs, and various documented and undiagnosed variables can be linked to cancer. Cancer development can be classed into two types: external and internal variables. Internal factors include age and genetics, while external causes include smoking, nutrition, and lifestyle[36]. Cancer is also grouped into nine groups based on the frequency of

developing diseases; the major cancers are lungs cancer, breast cancer, cervix, ovary, esophagus, gall bladder, rectum, and stomach; while other types of cancers mainly are the cancer of the anus, appendix, lip, prostate and tongue etc[37]. The causes of cancer can be classified into three categories:

(i) Biological carcinogens (e.g., viral, bacterial, or parasite infections, hormonal and genetics factors);

(ii) Chemical carcinogens (such as food and water contamination, and tobacco; and

(iii) Physical carcinogens (such as ultraviolet and ionizing radiation).

Tobacco smoking is the leading cause of cancer, followed by poor diets, while obesity and a lack of physical exercise are linked to the most frequent cancer types, including breast (postmenopausal), colon, endometrial, kidney, and esophageal cancers[35,38].

Recent studies show that lung cancer is the most commonly occurring cancer worldwide, accounting for 12.4% of total new cases and 18.7% of total cancer deaths. This is followed by female breast cancer (11.6% of new cases), colorectal cancer (9.6% of new cases, 9.3% of deaths), prostate cancer (7.3% of new cases), and stomach cancer (4.9% of new cases, 6.8% of deaths). While not among the top five in terms of incidence, liver cancer is the third leading cause of mortality from cancer, accounting for 7.8%[39]. Some studies reveal that 50% of the cancer cases can be prevented with balanced nutrition, a healthy lifestyle, encouraging physical exercise, and maintaining a normal weight[40].

3. Diabetes mellitus: Diabetes Mellitus has received global attention due to its increasing prevalence and incidence. It is not only a chronic disease, but also an acutely life-threatening condition that causes other serious problems such as kidney failure, heart disease, eye damage that leads to blindness, and foot ulcers that may necessitate limb amputation, resulting in higher

medical care costs, a lower standard of living, and a higher mortality rate.[41] The major two kinds of diabetes both cause hyperglycemia. Type 1 diabetes involves insufficient insulin production by pancreatic β-cells, while type 2 diabetes involves impaired insulin response by body cells[42]. Other types of diabetes include gestational diabetes mellitus, which affects pregnant women with glucose intolerance, and type 3 diabetes, which is linked to Alzheimer's disease and occurs when neurons in the brain do not respond to insulin[43]. The World Health Organization estimates that 422 million persons globally had diabetes in 2014. The WHO South-East Asia and Western Pacific Regions had the highest prevalence of diabetes, accounting for over half of all diabetes cases worldwide. In 2012, diabetes caused 1.5 million deaths, while higher-than-optimal blood glucose was responsible for an additional 2.2 million deaths, totaling 3.7 million deaths related to blood glucose levels. Globally, high blood glucose causes around 7% of mortality among males aged 20-69 and 8% among women aged 20-69, with women bearing a slightly greater burden. Diabetes prevalence has increased significantly across all economic levels, with low- and middle-income nations having a higher growth in the last decade[44].

While diabetes can be partially inherited, various lifestyle factors, such as obesity, excessive sugar consumption, and a lack of physical activity, can all have a substantial impact on its progression. However, lifestyle adjustments can help avoid diabetes and its complications. Patients with type 2 diabetes can control or even reverse the condition by modifying their lifestyle and dietary habits[44].

4. Obesity/Overweight: The World Health Organization (WHO) defines overweight and obesity as "abnormal or excessive fat accumulation that poses a health risk." A BMI more than or equal to 25kg/m2 is considered overweight, whereas a BMI greater than 30kg/m2 is classified as obese[45]. In 2016, more over 1.9 billion adults were overweight, while 650 million were obese.

Every year, at least 2.8 million individuals die from being overweight or obese. Obesity rates nearly quadrupled between 1975 and 2016[45]. Being overweight or obese is an important risk factor for type 2 diabetes mellitus, systemic arterial hypertension, cardiovascular illnesses, many types of cancer, and premature death[46]. Obesity has long been assumed to be caused by poor food habits and a lack of physical activity; however, new research has shown that various other factors, such as circadian misalignment and sleep disorder, are also implicated in obesity[45]. Global obesity rates have risen dramatically since 1990, with 1 in 8 people worldwide living with obesity in 2022, including 890 million adults (16% of the adult population) and 160 million children and adolescents aged 5-19 years, while overweight affects an even larger portion of the population, including 2.5 billion adults (43% of adults), 37 million children under 5, and more than 390 million children and adolescents aged 5-19 years, highlighting a significant public health crisis that has seen adult obesity more than double and adolescent obesity quadruple over the past three decades[45]. To lower the risk of obesity/overweight, various preventative interventions should be considered, such as promoting prolonged breastfeeding, physical exercise, and plant-based diets rich in fruits and vegetables[47].

5. Chronic respiratory diseases: Chronic Respiratory Diseases (CRDs) encompass an array of diseases affecting the airways and other pulmonary tissues. The majority of CRD-related morbidity and mortality increases with age. CRDs include COPD, occupational lung illnesses, asthma and respiratory allergies, sleep apnea syndrome, and pulmonary hypertension. Asthma and COPD constitute for the majority of CRD-related mortality in low and medium income nations[46]. Chronic respiratory diseases (CRDs) affect roughly one billion people worldwide and are a leading cause of death. The most common forms of the disease are noncommunicable, such as chronic obstructive pulmonary disease (COPD), asthma, chronic bronchitis, occupational lung

disease, and pulmonary hypertension[48]. Chronic respiratory disorders were the third biggest cause of mortality in 2017, accounting for 544.9 million deaths worldwide, trailing only cardiovascular disease and neoplasm[49]. Asthma is a diverse disease that affects 339 million people globally, with a higher prevalence in developing nations[50]. Common asthma symptoms include chest tightness, wheezing, shortness of breath, and airway obstruction[50]. CRD risk factors include both genetic and environmental variables, with environmental factors outweighing genetic influences. These include exposure to air pollution, particularly tobacco smoke and secondhand smoke, as well as indoor and outdoor air pollution, occupational exposures, and socioeconomic status[46]. Air pollution is a leading environmental factor that is affecting respiratory health at the global level[46]. CRDs are not completely reversible but are partially preventable[46]. Maternal smoking during pregnancy contributes to respiratory problems in newborns. Furthermore, a child's health during their early years has an impact on their future respiratory health[51]. Thus, adopting a healthy lifestyle early in life, avoiding respiratory infections, and avoiding environmental and occupational agents can all help to prevent CRD. Filtration and ventilation, as well as the usage of natural gas, can help to reduce exposure to indoor and outdoor contaminants[21].

6. High blood pressure: High blood pressure (HBP) is one of the leading risk factors for disease and mortality worldwide, accounting for an estimated 10.4 million deaths in 2017[52]. High blood pressure is caused by stiffer blood vessels, worse renal function, lower cognitive function, an increased risk of depressive symptoms, autonomic nervous system imbalance, and diabetes[53]. Increased blood pressure is mostly caused by a rise in body mass index (BMI) and age, which can lead to hypertension and obesity[54]. Controlling blood pressure has been linked to a decrease in diabetes-related deaths, as well as a reduction in CVD, stroke, and microvascular

complications[54]. Various types of foods are useful in reducing hypertension, such as potassium, calcium, proteins, and magnesium[55].

2.3 Prevalence and Impact of NCDs among Adolescents

NCDs are an increasing public health concern globally, impacting people of all ages, including adolescents. The global burden of NCDs in adolescents is alarmingly high and rising, driven by a variety of factors including urbanization, changing food patterns, physical inactivity, and environmental exposures. This trend is particularly worrying because NCDs throughout adolescence can have long-term effects on health and well-being, potentially leading to difficulties and untimely death later in life[14].

Globally, the prevalence of overweight and obesity among children and adolescents aged 5 to 19 years has risen considerably in recent decades. According to WHO, the prevalence of overweight (including obesity) in this age group has risen from 8% in 1990 to 20% by 2022, affecting approximately 390 million children and adolescents worldwide. In 2022, 19% of girls and 21% of boys are overweight, reflecting a comparable trend in both genders[56].

The rising prevalence of overweight and obesity has contributed to an increase in type 2 diabetes cases among adolescents. Type 2 diabetes, which was formerly thought to be an adult-onset disorder, is now being diagnosed increasingly commonly in young people, particularly those from specific ethnic groups and those living in low- and middle-income nations[57]. A research in the US revealed that the incidence of type 2 diabetes among adolescents aged 10-19 years grew from 9 cases per 100,000 people in 2002-03 to 12.5 cases per 100,000 people in 2011-12, with a 7.1% yearly rise[58].

Cardiovascular risk factors are becoming more common among adolescents worldwide. A cross-sectional study conducted in Brazil with students aged 12 to 17 years discovered significant

prevalence rates of numerous cardiovascular risks. The study found that 11.5% of people had hypertension, 23.3% were overweight, and 3.4% had an increase in their waist circumference. The prevalence of hypertension was slightly higher than previously published data from Brazilian adolescents (8.1-9.6%), but consistent with statistics from the same region of Brazil (11.7%)[59]. Compared to worldwide data, the hypertension prevalence was consistent with the global average of 11.2% recorded for adolescents. Notably, the majority of the adolescents in the study (68.9%) had at least two cardiovascular risk factors, with over 10% having more than four. This high incidence of several risk factors in adolescents is significant because it is directly related to greater severity of atherosclerosis, even at young ages[59].

While cancer is less prevalent in adolescents than in adults, certain forms of cancer, such as leukemia, brain tumors, and lymphomas, can develop during this age range. According to the American Cancer Society, cancer is the second highest cause of death among children and adolescents aged 1-19 years in the United States, with leukemia being the most common type of cancer in this age group[60].

NCDs have a significant and growing burden in Sub-Saharan Africa, owing to an increase in the prevalence of cardiovascular risk factors such as poor diets, low physical activity, hypertension, obesity, diabetes, dyslipidemia, and air pollution. There is a large increase in disability-adjusted life-years (DALYs) owing to NCDs in the region, from 90.6 million in 1990 to 151.3 million in 2017, a 67.0% rise[61]. This increase brings the age-standardized DALY rate of NCDs closer to that of communicable, maternal, neonatal, and nutritional disorders. The study found significant differences among different NCDs, with cardiovascular diseases (22.9 million DALYs), neoplasms (16.9 million DALYs), mental disorders (13.6 million DALYs), and diabetes (10.4 million DALYs) emerging as the top sources of NCD burden in 2017. Notably, NCDs are

expected to overtake communicable illnesses as the primary cause of death in Sub-Saharan Africa by 2030, emphasizing the critical need for comprehensive prevention and control initiatives in the region. Furthermore, the study found considerable differences between countries, with the greatest prevalence rates seen in Mauritius (33.7%), South Africa (25.6%), and Namibia (20.5%)[61].

The prevalence of overweight and obesity among Nigerian adolescents is becoming increasingly concerning. A cross-sectional study of 2,282 secondary school students aged 10 to 19 years in Port Harcourt found that 13.2% were overweight and 4.6% were obese, for a total of 17.8%. Females had higher rates (14.6% overweight and 5.2% obese) than males (11.4% overweight and 3.8% obese), with a statistically significant difference ($P = 0.041$)[62].

The prevalence of prediabetes, a precursor to type 2 diabetes, among Nigerian adolescents is a growing public health problem. A study conducted in Osogbo Local Government Area, Osun State, Nigeria discovered a prediabetes prevalence rate of 9.4% among secondary school adolescents. The study revealed several risk factors for prediabetes, including age, religion, and family history, as well as interpersonal and communal factors. Notably, the study found that adolescents with normal BMI and high blood pressure were more likely to acquire prediabetes than those with underweight and normal blood pressure[63].

Cardiovascular risk factors, such as prehypertension and a high BMI, are becoming more common among adolescents in rural Nigeria. This cross-sectional study conducted in rural southwest Nigeria found that 33.2% of adolescents aged 15-18 years had systolic pre-hypertension, with a higher frequency among those who were overweight or obese. Similarly, the study discovered that almost 15% of adolescents were overweight or obese, indicating an elevated risk of cardiovascular illness[64].

A systematic review and meta-analysis of the prevalence of depression among Nigerian students seeking higher education revealed a pooled prevalence of 26% (95% confidence interval 0.18, 0.36). The study looked at data from 18 studies, with sample sizes ranging from 81 to 1482 individuals and mean student ages ranging from 19.09 to 26.3 years[65].

The analysis showed significant variability between trials (I^2 = 97%, τ^2 = 0.9512). Subgroup studies revealed regional disparities in depression prevalence, with the Northwestern region of Nigeria having the highest rates (45.9%), followed by the South-South region (33%), the Southeastern region (22.1%), and the Southwestern region (18.1%)[65].

The researchers stated that stigmatization, insufficient financial resources, poor healthcare infrastructure for correct diagnosis, and a lack of research attention all contribute to the incidence of depression among young people in West Africa, especially Nigeria. The study indicates that depression among higher education students in Nigeria is quite frequent, calling for additional exploration into the contributing variables, particularly in the Northwestern region where rates are highest[65].

2.3.1 Leading Causes of Morbidity and Mortality

NCDs are a major cause of morbidity and mortality among adolescents globally, constituting a huge public health issue. While infectious diseases and injuries continue to be major causes of illness and death in this age group, the burden of NCDs is increasing due to factors such as urbanization, changing eating patterns, physical inactivity, and environmental exposure[15].

The global burden of NCDs among adolescents is large and increasing. According to the Global Burden of Disease Study, NCDs accounted for approximately 18% of total disability-adjusted life years (DALYs) among adolescents aged 10 to 19 years worldwide, with females bearing a higher burden than males[66].

Overweight and obesity-related diseases are among the top causes of illness and mortality among adolescents worldwide. Overweight and obesity are significant risk factors for a variety of NCDs, including type 2 diabetes, cardiovascular disease, and certain forms of cancer. The Global Burden of Disease Study 2019 identified high body mass index (BMI) as the second largest risk factor for disability-adjusted life years (DALYs) among adolescent females in low- and middle-income countries (LMICs)[66].

2.3.2 Regional and Socioeconomic Disparities

Low- and Middle-Income Countries: Adolescents in low- and middle-income countries (LMICs) bear a disproportionate burden of NCDs compared to those in high-income countries. According to the World Health Organization (WHO), LMICs account for more than 80% of premature deaths from NCDs.[15] This disparity might be linked to reasons such as increased urbanization, changes in food habits, and inadequate access to preventive healthcare services[67].

High-Income Countries: NCDs are commonly associated with low- and middle-income countries (LMICs), however high-income nations (HICs) such as the United Kingdom are not immune to this public health burden. It was discovered that mental health disorders were especially common in the UK, with 37.7% of young adults reporting a diagnosis[68]. Similarly, in the United States, the prevalence of overweight and obesity among children and adolescents has reached epidemic proportions, with around 18.5% of children and adolescents aged 2 to 19 years suffering from obesity in 2015-2016. Obesity in childhood is related with several health consequences, including cardiovascular disease, type 2 diabetes, asthma, sleep apnea, and psychological disorders[69].

Socioeconomic Disparities:

Low Socioeconomic Status: Adolescents from low-income families are disproportionately affected by NCDs for a variety of reasons, including limited access to healthcare services, poor living circumstances, and insufficient financial resources to purchase nutritional diets[70]. For instance, a comprehensive study of the relationship between Socioeconomic Status and overweight/obesity among adolescents discovered a higher frequency of these diseases among individuals with lower Socioeconomic Status, particularly in high-income nations[71].

Furthermore, adolescents from low-income families may have greater exposure to environmental risk factors, such as air pollution, a lack of safe recreational spaces, and restricted access to preventative health services, worsening their risk of acquiring NCDs[72].

High Socioeconomic Status: While adolescents with low socioeconomic status are more likely to develop NCDs, those with greater socioeconomic status are not exempted. In some circumstances, higher SES has been related with an increased risk of certain NCDs, such as type 2 diabetes and cardiovascular illnesses, due to variables like sedentary lifestyles, unhealthy dietary patterns, and increased consumption of energy-dense foods[73].

Rural-Urban Disparities: The prevalence of NCDs in adolescents varies across rural and urban areas, indicating disparities in healthcare access, dietary habits, physical activity levels, and environmental exposures. In many LMICs, urbanization and the adoption of Westernized lifestyles have contributed to an increase in the prevalence of NCDs among urban adolescents. However, in some HICs, rural adolescents may suffer greater risks due to factors such as inadequate access to health care and limited availability of nutritious food options[74].

2.4 Risk Factors and Determinants of NCDs

Several factors can enhance the number of opportunities for developing NCDs and can be characterized in various ways. One approach classifies risk variables as modifiable or non-

modifiable, with changeable or non-changeable situations, respectively. Modifiable risk factors include high blood pressure, smoking, diabetes, physical inactivity, obesity, and high blood cholesterol, whereas non-modifiable risk factors include age, gender, genetics, race, and ethnicity[21,75]. Interestingly, whereas age and gender are not adjustable, the majority of their associated characteristics are.

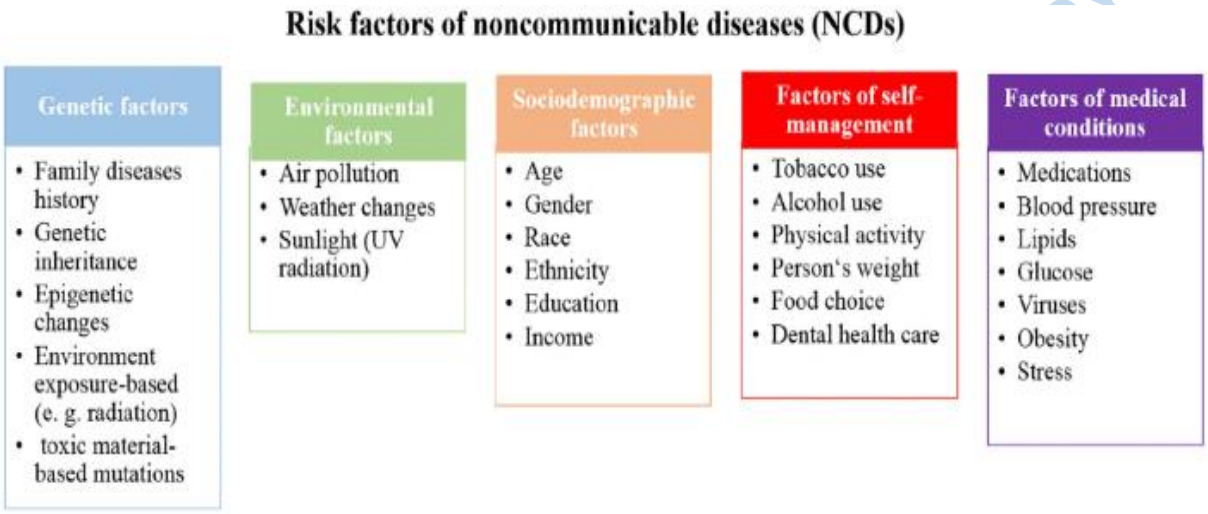

Figure 2.2: Classification of NCDs risk factors[45].

The following are some of the identified risk factors for NCDs;

Age: While NCDs are typically associated with the elderly, persons of all ages, including those before birth, are at risk. These disorders can begin in infancy and continue to progress throughout childhood, adolescence, and old age[21]. However, 15 million fatalities from NCDs were observed among adults aged 30 to 69 years old, with more than 82% of these "premature" deaths occurring in low and middle-income nations. The life course perspective provides evidence that adult NCDs originate in the uterus. Maternal nutrition plays an important effect in adult illnesses. For instance, exposing human fetuses to a limited amount of nourishment caused permanent alterations in shape and metabolism. As a result, these programmed modifications have been linked to a variety of conditions, including heart disease, diabetes, and hypertension in

later life. Furthermore, maternal habits such as nutrition, drug, stress, alcohol, and tobacco usage during pregnancy have a harmful impact on unborn offspring, as can environmental factors such as air pollution. These variables affect fetal and early brain development; for instance, low birth weight is linked to poor long-term health and cognition. New NCD hazards may emerge during childhood as a result of easy access to unhealthy food and beverages in kindergartens and schools. This results in a large number of overweight and obese children. Following that stage of life, young people in adolescence may develop new and harmful behaviors, such as smoking and consuming alcohol, which can greatly contribute to NCD risk. These unhealthy habits may persist throughout adulthood, with additional job challenges such as financial difficulties, unemployment, unhappy careers, and low social involvement all having an impact on NCD progression[21]. Retirement and leaving the employment might present new obstacles for the elderly, influencing the development of NCDs. Poor diet, a lack of physical activity, alcohol and tobacco use, social isolation, and financial stress all have a direct impact on older individuals and contribute significantly to NCDs. Prevention and control of NCDs can be achieved at any ages. Women's health state prior to and throughout pregnancy influences their children's vulnerability to NCDs later in life. This is the most effective technique for controlling NCDs since it addresses the source of the disease. High standards for food and drinks, increasing physical activity in schools and workplaces, monitoring air quality, and providing smoke-free zones can mainly prevent NCDs at all stages of life[21].

Diet: Infectious and parasitic diseases were once the leading causes of death, but in recent decades, NCDs have taken their place as the leading cause. This could be linked to changes in nutrition and lifestyle throughout time, resulting in a shift in illness patterns in humans. Several dietary components, such as meat, whole grain products, good eating patterns, sugar-sweetened

beverage consumption, and iron-rich diets, have a clear link to NCDs. Furthermore, the excessive consumption of processed meat and sugar-sweetened beverages, combined with other unhealthy lifestyle variables, such as a high body mass index (BMI), physical inactivity, and smoking, have a substantial relationship with NCDs[76]. Wholegrain products provide protective effects regardless of BMI due to their high fiber content and capacity to slowly release glucose into circulation; as a result, the postprandial insulin response is reduced and insulin sensitivity may increase[77-79]. Dietary transitions refer to changes in production, processing, availability, dietary consumption, and energy expenditure. The notion expands to include body composition, anthropometric measurements, and physical activity[80]. Dietary transition phrases are used to describe the change to Western diets, particularly in developing nations. Most countries' traditional diet is healthier, natural, and fiber-rich, and cereal has been replaced by unhealthy processed food that is rich in sugars and fats, animal-source foods, and refined carbohydrates. As a result, low- and middle-income countries have experienced significant changes in the nutrition transition, as well as rises in NCDs[81]. High food consumption and decreased physical activity rates coexist, leading in NCDs. The key element contributing to physical inactivity is the rapid and continual development of technology. The ease of access to contemporary technology and manufacturing in homes and workplaces, including machines, automobiles, and labor-saving technologies, makes life easier but unhealthier in terms of reducing the risk of NCDs[81].

Physical Inactivity: Regular physical activity provides several health benefits, including improved cardiovascular health, better weight management, and a lower risk of acquiring chronic diseases[82]. Despite these well-established benefits, a large minority of adolescents worldwide are physically inactive. It was found that around 81% of adolescents aged 11 to 17 did not reach the

WHO's recommended levels of physical exercise[83]. This alarming trend was noted in all locations, with adolescent girls experiencing higher rates of inactivity than boys.

Physical inactivity among adolescents has increased as a result of a variety of socioeconomic and environmental factors. Sedentary habits, such as excessive screen usage and restricted possibilities for active play and recreation, have become more common in modern life. Furthermore, factors such as lack of access to safe and accessible recreational facilities, inadequate physical education programs in schools, and sociocultural norms and attitudes towards physical activity all add to the problem[84]. Physical inactivity during adolescence not only increases the risk of developing NCDs but also contributes to the establishment of sedentary habits that can persist into adulthood[85]. Addressing this risk factor early in life is crucial for promoting lifelong physical activity and reducing the burden of NCDs across the lifespan.

Tobacco Use: Tobacco smoking is a well-known risk factor for a variety of NCDs, such as cardiovascular disease, cancer, and chronic respiratory disease. Despite continued attempts to limit tobacco smoking, it remains a major public health issue, especially among adolescents. Over one-fifth of adolescents aged 13 to 15 use tobacco products[86]. Tobacco use during adolescence is linked to an increased risk of nicotine addiction, lung difficulties, and other long-term health issues. Furthermore, early initiation of tobacco use is a powerful predictor of sustained use throughout adulthood, increasing the chance of developing NCDs[87].

Harmful Use of Alcohol: Alcohol drinking throughout adolescence is especially troubling since it has the potential to harm brain development and raise the likelihood of developing alcohol-related issues later in life. High episodic drinking is common among young individuals aged 15 to 19, accounting for 26.5%[87]. A study conducted in Ethiopia, discovered that 27.84% of

secondary school students had consumed alcohol in the previous 12 months, with differences identified across characteristics such as age, gender, and urban/rural residency[88].

The alcohol industry has been chastised for targeting adolescents with sophisticated marketing strategies that frequently portray alcohol drinking as a desirable and socially acceptable habit[89]. This normalization of alcohol use, together with peer pressure and societal standards, has contributed to the increasing risk of harmful alcohol intake among adolescents, potentially laying the stage for long-term health implications[90].

Overweight and Obesity

Overweight and obesity, defined as abnormal or excessive fat buildup that can harm health, have become major public health concerns among adolescents globally[91]. Overweight and obesity rates in this age group have risen dramatically in recent decades, owing to a variety of reasons such as bad eating habits, sedentary lifestyles, and environmental influences[56].

Adolescent overweight and obesity increase the risk of acquiring a variety of NCDs, including type 2 diabetes, cardiovascular disease, some types of cancer, and musculoskeletal issues[92]. These disorders can have serious long-term effects for bodily and mental health, as well as significant economic and societal implications[93].

According to research, higher adherence to "snacks" and "fast food" dietary patterns was associated with increased odds of being overweight, with odds ratios of 1.50 and 1.55 respectively for the highest quintile of adherence compared to the lowest quintile[94].

Raised Blood Pressure: High blood pressure is a major risk factor for cardiovascular disorders such as stroke, coronary heart disease, and heart failure. While increased blood pressure is commonly thought of as an adult disorder, it can appear in childhood and adolescents, increasing the chance of developing hypertension and associated consequences later in life[95,96]. In Sub-

Saharan Africa, the prevalence of high blood pressure in adolescents ranges from 0.2% to 24.8%, with Nigeria having a frequency of 0.1% to 17.5%. Using the 2017 American Academy of Pediatrics standards, it was discovered that a significant prevalence rate of high blood pressure among adolescents in Lagos was at 26.7%[97]. This increase is closely related to unhealthy lifestyle factors such as poor dietary habits, physical inactivity, and obesity[95].

Adolescents that consumes diets high in salt, saturated fats, and processed foods and deficient in fruits, vegetables, and whole grains are more likely to have high blood pressure[95]. However, the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes the consumption of fruits, vegetables, whole grains, and low-fat dairy products while restricting sodium, saturated fats, and added sweets, has been proven to effectively lower blood pressure in adolescents[55].

Raised Blood Glucose: Diabetes mellitus, a chronic metabolic ailment that can cause major complications such as cardiovascular disease, renal failure, blindness, and lower limb amputation, is characterized by elevated blood glucose levels, often known as hyperglycemia[41]. While type 2 diabetes is more common in adults, it is becoming increasingly prevalent in adolescents as a result of unhealthy lifestyle factors such as poor eating habits and physical inactivity[58]. Diets high in sugar-sweetened beverages, processed meat, and red meat contributed to an increasing proportion of DALYs attributable to early-onset type 2 diabetes in adolescents and young adults between 1990 and 2019, particularly in countries with middle and low-middle socio-demographic index levels. In contrast, low-fruit diets were related with a higher proportion of DALYs in countries with a low socio-demographic index[58].

In addition to dietary factors, there are other major contributors to the burden of early-onset type 2 diabetes in adolescents and young adults. High body mass index was consistently the most significant risk factor across all locations. Low physical activity also had a substantial impact,

particularly in nations with high socio-demographic indexes. Environmental factors such as ambient particulate matter pollution and residential air pollution from solid fuels played significant roles in nations with high and low socio-demographic indices, respectively[58].

Raised Blood Lipids: Raised blood lipid levels, particularly high levels of low-density lipoprotein (LDL) cholesterol and triglycerides, are strong risk factors for cardiovascular disease, such as coronary heart disease and stroke. While dyslipidemia is commonly thought of as an adult ailment, it can show in children and adolescence, increasing the risk of developing cardiovascular disease later in life[98].

Raised blood pressure, often known as hypertension, is a key risk factor for several NCDs, significantly contributing to the worldwide burden of disease and mortality. NCDs, which include cardiovascular disease, chronic renal disease, and cognitive impairment, are responsible for more than 70% of all fatalities globally[15]. The negative effects of high blood pressure on human health have been well documented, and eliminating this risk factor remains an important public health goal. Dyslipidemia is becoming more common among adolescents worldwide, owing to harmful lifestyle factors such as poor food habits, physical inactivity, and obesity. Diets heavy in saturated and trans fats, as well as poor in fiber and plant-based meals, have been related with an increased risk of elevated blood lipid levels in adolescents[98,99]. In contrast, diets high in fruits, vegetables, greens, beans, and whole grains were connected to more favorable cardiovascular risk profiles in this age range, including lower BMI, blood pressure, total cholesterol, and LDL cholesterol[100].

Urbanization and Globalization: Rapid urbanization in Sub-Saharan Africa, has had a significant impact on eating habits and the risk of developing NCDs. This rural-to-urban transition, which includes socioeconomic shifts and a shift from subsistence farming to more

specialized professions, has resulted in major changes in food surroundings and dietary choices[101]. As families relocate from rural areas to cities, their traditional plant-based diets are replaced by more Western-oriented diets that provide easier access to a wider range of foods, including highly caloric and processed options. This dietary transformation, together with improved socioeconomic status in newly growing metropolitan regions, is having a significant impact on illness epidemiology, reflecting previous trends found in Western countries[101]. The wide availability and accessibility of energy-dense, nutrient-poor items, such as fast food, processed snacks, and sugar-sweetened beverages, in urban environments has contributed to an increase in bad eating habits among adolescents. The growth of food outlets, combined with strong marketing methods aimed at young people, has worsened this trend [101].

Globalization has had a substantial impact on developing countries' food systems, impacting dietary patterns and availability. The introduction of big multinational fast food chains and supermarkets has increased competition, frequently displacing tiny local agents and traditional food markets. While this has brought greater food diversity and improved food safety standards, it has also caused a gradual move towards a more universal eating culture. This shift is disproportionately harming lower socioeconomic groups, who are gravitating towards low-cost, energy-dense, but often low-quality foods, potentially jeopardizing their nutritional condition and health[102]. Furthermore, the globalization of food systems and the power of transnational food businesses have been connected to the spread of unhealthy food environments, particularly in cities[102]. These surroundings can alter adolescents' conceptions of healthy eating, normalizing the intake of highly processed and energy-dense meals and limiting access to nutritious, locally sourced alternatives[103].

Poverty and Social Inequalities: Adolescent health behaviors and outcomes are heavily influenced by socioeconomic status, with those from lower-income homes being more likely to engage in poor food patterns, physical inactivity, and obesity. Youth from lower-income households are more likely to consume sugary drinks (18% vs 15%), eat fewer fruits (32% vs 46%) and vegetables (32% vs 54%) daily, and are more likely to be overweight or obese (27% vs 18%) than their richer classmates. These differences contribute to a cycle of poverty, potentially impeding impacted adolescents' school progress, job prospects, and overall quality of life[104].

Numerous factors contribute to the association between poverty and bad food habits among adolescents. Low-income families sometimes encounter financial constraints that limit their capacity to purchase nutrient-dense foods like fresh fruits, vegetables, and lean proteins. Instead, they may rely on energy-dense, nutrient-poor foods, which are typically less expensive and more frequently available, especially in cities and food deserts[104].

Furthermore, poverty-stricken households may face food insecurity, which is described as a lack of continuous access to enough food for an active, healthy lifestyle. Food insecurity has been linked to poor nutritional quality, increased consumption of calorie-dense foods, and a higher risk of overweight and obesity in adolescents[105]. Social inequalities, such as inadequate access to school, healthcare, and safe physical activity conditions, aggravate the obstacles that low-income adolescents experience. These characteristics can influence adolescents' perceptions of healthy eating, as well as their capacity to adopt and sustain healthy habits[104].

2.5 Management of Risk Factors and NCDs

Management of Risk Factors

The most common causes of NCDs are metabolic and behavioral risk factors, which may be mainly avoided through a variety of current strategies. The majority of global conversations

focus on risk factors for self-management (tobacco and alcohol usage, physical activity, weight, food, and dental health care) and the role of human responsibility in controlling NCD risk factors[21]. Healthcare professionals should educate patients on their nutritional worth and highlight the importance of didactics, practicums, and seminars in daily practice[106]. Furthermore, in most countries, the public health sector prioritizes NCD management because it is the primary goal of NCD preventive initiatives. Interventions are employed in public health management to promote healthy behavior. For example, India, with its wide sociocultural, economic, and geographical diversity, is implementing multi-sectorial actions to prevent NCDs, including school health programs, initiatives of the National Cancer Control Program, National Trauma Control Program, National Program for Control of Blindness, National Mental Health Program, the National Tobacco Control Program, and the National Program for Control of Diabetes, Stroke[21]. Another technique involves researchers highlighting environmental elements (air pollution, climate change, sunlight) and their impact on NCD development. Air pollution will be a key concern in the future, with new technology, such as microchips, having a greater impact on air monitoring[107]. Because diet is a common risk factor for the majority of NCDs, there is a greater emphasis on developing effective programs to supply healthy food to the community at all ages. Evidence-based nutrition interventions should be a worldwide health priority, and the dietary fat investigated should be considered a modifiable variable in the prevention of chronic diseases[21]. Recent research reveals that a diet high in healthy fat and unsaturated fatty acids reduces the risk of metabolic disorders and cardiovascular events[80]. Many initiatives aimed at poverty and development have an impact on NCD prevalence and risk[21]. The current evidence focuses on diets, and it has been proposed that agricultural-based food security programs have a positive impact on diet indicators[108]. A poor diet is the major risk factor for NCDs, and eating

certain foods, rather than macronutrients or micronutrients, may be the most significant risk factor[21]. Strategic health communication in population-wide interventions involves working with the food industry to reduce salt content in foods[109]. The notion of a sustainable diet incorporates health and environmental concerns, as well as the aforementioned risk factors, into recommendations to limit processed meat intake and increase whole grain consumption[110]. While our bodies can produce many of the chemicals needed to function effectively, important nutrients are obtained through diet. Food is primarily composed of carbohydrates, proteins, and lipids. Minerals are inorganic necessary nutrients that must come from food. Omega-3 alpha-linolenic and omega-6 linoleic acids are important fatty acids required for the production of certain membrane phospholipids. Vitamins (B, C, A, D, E, and K) are groups of important chemical compounds (such as cofactors) that most enzymes require in small amounts to function properly. Vitamin deficiency or insufficiency can have serious consequences for health. An emphasis on the requirement to meet adequate dietary intakes of vital nutrients through a healthy diet is thought to be extremely important for an ageing society[111]. Food supplements are concentrated forms of nutrients (minerals and vitamins) or other compounds having nutritional or physiological effects that are sold as pills, capsules, and/or liquids. These nutritional supplements offer many benefits, including maintaining an adequate intake of certain nutrients, correcting nutritional deficiencies, or supporting specific physiological functions. Recently, researchers have been looking for new solutions to implement an efficient food production process and to discover the benefits of starch waste on human health[112].

Management of NCDs

NCDs are silent killers that endanger health without causing any symptoms until the disease has progressed to an advanced degree. Patients who have NCDs or are at risk of developing one

require long-term treatment that is personalized, proactive, and sustainable[21]. Primary healthcare may plan and implement healthcare policies to manage NCDs in each community and detect diseases at an early stage. As a result, they can significantly address the difficulties associated with high healthcare costs. For example, multiple studies have shown that lifestyle factors are directly related to cancer risk, and that modifying lifestyles in a favorable direction can significantly reduce the cancer burden[21]. Changes in behavior, such as dietary modifications, physical exercise, weight control, obesity management, tobacco prevention, safe sex and oncogenic virus control, sun protection, pharmaceuticals, and reduced alcohol use, can all help to prevent cancer[113]. Cardiovascular disease (CVD) deaths have increased significantly in SSA, while CVD mortality rates have decreased in high-income nations. While CVD treatments offered in HIC may be available to certain people in SSA, the vast majority of the population may not have access to the best care. Obstacles to CVD prevention and management in SSA include inadequate healthcare systems and infrastructure, lack of cardiac experts, biased budget allocation away from NCDs, and expensive costs of cardiac treatments, and rarity of health insurance systems.

The epidemiological change is occurring later in SSA than in HIC, and SSA currently bears a double burden of communicable and NCDs. CVDs in SSA tend to afflict younger people, occurring about two decades earlier than in HIC. Furthermore, the underlying causes of heart failure vary, with hypertensive heart disease, cardiomyopathy, and rheumatic heart disease being more prevalent in SSA and ischemic heart disease predominating in HIC. In SSA, key CVD risk factors such as hypertension and diabetes continue to be poorly diagnosed, treated, and controlled. For example, less than 40% of persons with hypertension are aware of their diagnosis, less than 35% receive therapy, and barely 10-20% have their blood pressure under control. These

results are far lower than those observed in HIC[114]. The main reason for an increase in the number of NCD patients in poor and middle-income communities is the lack of a well-designed plan to prevent disease development and dissemination. Each country must develop its own management plan, rather than relying solely on high-income countries' coping techniques[21]. Several successful models have been validated, taking into account low-cost ways for preventing, diagnosing, and treating NCD. Kenya, for example, has established a low-cost technique for early detection of diabetes and hypertension. While visiting homes to assess human immunodeficiency virus (HIV) infection, health workers often measure blood glucose and blood pressure. Furthermore, type 2 diabetes is a global pandemic that has a significant impact on human health and global economic development[21]. The International Diabetes Federation projected that 415 million individuals had type 2 diabetes in 2015, with the number expected to rise to 642 million by 2040 due to hereditary and environmental causes. The genetic-environmental interaction causes insulin resistance and impaired insulin secretion, which are the primary defects that lead to type 2 diabetes[43].

The prevention strategy for NCDs is focused on risk factor management at the individual, societal, national, and global levels, with measures such as resource allocation, multi-sectorial collaboration, knowledge and information management, and innovation. The most important aspect of the prevention strategy is lifestyle management at the individual level, with a focus on actions such as innovations that can assist society in increasing risk factor management awareness, making health policy decisions at the national level, and developing a global health strategy[21]. Leadership is highlighted as critical to the change management process, necessitating the development of innovative ways to NCD prevention[21]. At the global level, WHO and UN agencies can collaborate to design policies and strategies to reduce the risk of NCDs[21]. It is

critical to monitor and assess NCD progress at the national, regional, and global levels. These organizations can fund research and promote collaboration between national and international health agencies and academic institutions[115]. Furthermore, tobacco smoke, a common component in the four major types of NCDs, must be controlled. The WHO assists smokers who want to stop using tobacco products and adopt rules to promote a smoke-free environment. Furthermore, WHO can legally defend tobacco control programs from the tobacco industry's financial interests. At the national level, each government must develop a plan based on its economy[116]. There are several low-cost and very successful techniques for preventing and managing NCDs[117]. For example, encouraging people to participate in sports for physical activity is the most effective component that can easily influence NCD prevention while also saving time and money[21]. Furthermore, improved budgetary allocations for primary healthcare systems should be implemented to ensure that all community members have access to health services[118]. To make significant progress, governments and non-governmental organizations, schools, and universities must work together to provide guidance on lifestyle changes and warn people about the hazards of NCDs. At the societal level, research centers and institutes can make major contributions to NCD prevention through research initiatives and activities[21]. Focusing research on food biotechnology and agriculture has a direct impact on NCD risk. The development of diagnostic technologies allows for the rapid identification of NCD biomarkers with great sensitivity to help detect diseases at their early stages, hence contributing to easier treatment and speedier cures[21].

2.6 Role of Dietary Habits in the Prevention of NCDs

2.6.1 Dietary Habits and Cardiovascular Disease Prevention

The Mediterranean diet, which includes plenty of fruits and vegetables, whole grains, legumes, nuts, and olive oil, as well as moderate amounts of seafood and red wine, has been thoroughly

researched for its possible cardiovascular advantages. Several comprehensive meta-analyses, consistently found that higher adherence to the Mediterranean diet was associated with a lower risk of cardiovascular disease incidence and mortality, coronary heart disease, myocardial infarction, and ischemic stroke[119]. The relationship between a traditional Nigerian dietary pattern (characterized by a high intake of whole grains, legumes, and vegetables) and cardiovascular risk factors was evaluated. The authors discovered that better adherence to the Nigerian dietary pattern was related with lower blood pressure, total cholesterol levels, and a lower incidence of metabolic syndrome, indicating a potential preventive benefit against CVDs[120].

In addition to dietary patterns, specific dietary components have been linked to cardiovascular health. According to research, it was discovered that eating more whole grains, fruits, and vegetables was associated with a decreased risk of CVDs[121]. Conversely, large consumption of red and processed meats, as well as sugar-sweetened beverages, was linked to an increased risk of CVDs[122]. Furthermore, evidence from randomized controlled trials suggests that replacing saturated fats with unsaturated fats, such as those found in nuts, olive oil, and fatty fish, can improve lipid profiles and reduce the risk of CVDs[123].

2.6.2 Dietary Habits and Cancer Prevention

Several eating habits have been linked to a lower risk of certain cancers. It was discovered that following a Mediterranean diet was associated with a lower incidence of both overall cancer and specific cancers such as colorectal, breast, and prostate cancer[124]. Furthermore, adhering to the DASH diet, which includes fruits, vegetables, whole grains, and low-fat dairy products, was linked to a lower incidence of breast cancer[125]. Plant-based diets, particularly those high in fruits, vegetables, whole grains, and legumes, have been demonstrated to help prevent some types of cancer. Higher intake of plant-based foods was associated with a lower risk of overall cancer, as

well as specific cancers, including colorectal, breast, and prostate cancers[126]. This protective effect is due to the high concentration of antioxidants, fiber, and other bioactive components found in plant-based meals[127]. Antioxidants, such as curcumin, resveratrol, and epigallocatechin gallate (EGCG), has been found to help alleviate the oxidative stress and inflammation associated with cancer formation[128].

2.6.3. Dietary Patterns and Type 2 Diabetes

Dietary choices play a significant role in the development and progression of type 2 diabetes. Following a Mediterranean diet has been found to be associated with a lower risk of developing type 2 diabetes. Furthermore, a plant-based diet high in whole grains, fruits, vegetables, nuts, and legumes has been linked to a lower incidence of type 2 diabetes and better glycemic management in people with the illness. Scientists hypothesize that plant-based diets' high in fiber and antioxidant content may contribute to their positive effects on glucose metabolism and insulin sensitivity[129].

2.6.4 Dietary Habits and Chronic Kidney Disease

Dietary adjustments are critical in the treatment of chronic kidney disease (CKD). A comprehensive evaluation of plant-based diets, such as the Mediterranean and DASH diets, found that they reduce the risk of CKD development while also improving renal function[130]. Furthermore, increased consumption of fruits, vegetables, and whole grains has been associated with a decreased risk of CKD and a slower deterioration in kidney function. Researchers have proposed that the high amount of antioxidants, fiber, and other bioactive components in these plant-based diets could contribute to their beneficial effects[131].

2.7 Adolescents Nutritional Needs

Adolescence is a phase of rapid growth and development, with increasing nutritional requirements for physical maturity, cognitive development, and overall well-being[132]. Adequate nutrition during this time is critical for reaching peak growth, avoiding nutrient deficits, and lowering the chance of acquiring NCDs in adulthood[133].

Macronutrient Requirements

Carbohydrates: Adolescents require a well-balanced intake of complex carbohydrates, primarily from whole grains, fruits, and vegetables, to meet their energy requirements and promote healthy growth. Adolescents get 45-65% of their total energy from carbs, with an emphasis on nutrient-dense foods[134].

Proteins: Adolescents have higher protein requirements due to increased muscular growth and development. The RDA for protein ranges from 0.85 g/kg of body weight for adolescent girls to 0.99 g/kg for adolescent males, with an emphasis on lean protein sources such as lean meats, poultry, fish, legumes, and nuts[135].

Fats: Adolescent growth and development require enough fat consumption, as does the absorption of fat-soluble vitamins (A, D, E, and K). Adolescents get 25-35% of their total energy intake from healthy fats, with a concentration on unsaturated fats and a restriction on saturated and trans fats[134].

Micronutrient Requirements

Vitamins: Adolescents require proper intake of different vitamins, including vitamins A, C, D, and E, B-complex vitamins (B1, B2, B3, B6, B12, folate), and choline. These vitamins have important functions in immunological function, bone health, growth, and cognitive development[136].

Minerals: Adolescents require calcium, iron, zinc, and iodine. Calcium is required for bone growth and development, but iron is required to avoid anemia, especially in adolescent girls due to menstrual blood loss. Zinc promotes immunological function and growth, while iodine is required for appropriate thyroid function and cognitive development[137].

Other Nutrients: Adolescents also require enough amounts of fiber, omega-3 fatty acids, and antioxidants. Fiber improves digestion and may lower the incidence of chronic diseases, whilst omega-3 fatty acids promote brain and cardiovascular health. Antioxidants help to neutralize free radicals and protect against oxidative stress[138,139].

2.8 Consequences of Nutrient Imbalances

Failure to meet nutritional needs during adolescence can have significant short-term and long-term consequences for physical and mental health, as well as the risk of developing NCDs later in life.

1. **Nutrient deficiencies**: Inadequate intake of vital nutrients can cause a variety of deficiencies, including iron deficiency anemia, vitamin D insufficiency, and calcium shortage. These deficiencies can impede growth, cognitive development, immunological function, and bone health, potentially leading to long-term health implications[140].

2. **Overweight and obesity:** Excessive consumption of high-energy, low-nutrient meals, combined with physical inactivity, can lead to the development of overweight and obesity during adolescence. Obesity during adolescence increases the chance of acquiring NCDs such as type 2 diabetes, cardiovascular disease, and some types of cancer later in life[55].

3. **Eating disorders**: Adolescents are also at risk of developing eating disorders such anorexia nervosa, bulimia nervosa, and binge eating disorder, which can have serious medical and psychological implications. These disorders may be caused by a variety of circumstances,

including body image problems, peer influence, and cultural demands on appearance and weight[141].

4. Metabolic and physiological imbalances: Imbalanced macronutrient and micronutrient consumption during adolescence might lead to the development of metabolic and physiological risk factors such as dyslipidemia, hypertension, and poor glucose metabolism. These risk factors increase the likelihood of getting NCDs, such as cardiovascular disease and type 2 diabetes, later in life[142].

2.9 Factors Influencing Adolescents' Food Choices and Eating Behaviors

2.9.1 Social and cultural factors

Social and cultural factors play a significant role in shaping adolescents' perceptions, attitudes, and behaviors related to food and nutrition. These factors operate at various levels, including the family, peer group, and broader societal norms and traditions.

Family environment and parental influences: The home environment and parental modelling have a significant impact on adolescents' eating habits and behaviors. Parents' food preferences, cooking skills, and mealtime rituals can have an impact on their children's nutritional habits from a young age.[143] Furthermore, parental support, encouragement, and participation in meal planning and preparation can help adolescents develop good eating habits[144].

Peer influence and social norms: During adolescence, peer interactions and social norms have a greater influence on food choices and eating habits. Adolescents may adopt dietary patterns and preferences that are consistent with their peer group norms in order to achieve acceptance or meet perceived social expectations[145]. Peer influence can also contribute to the development of unhealthy eating habits, such as regular consumption of fast food, snacks, and sugar-sweetened beverages[146].

Cultural and traditional beliefs: Cultural and traditional ideas significantly influence adolescents' food preferences, dietary patterns, and views of healthy eating. Food is profoundly ingrained in many cultures' customs, rituals, and social gatherings, affecting adolescents' attitudes and behaviors towards specific meals and eating habits[147]. Cultural norms and beliefs can also influence perceptions of body image, portion sizes, and the perceived healthiness of various meals[148].

Socioeconomic status and food insecurity: Socioeconomic position and food insecurity can have a substantial impact on adolescents' food choices and eating habits. Adolescents from low-income families or those suffering food insecurity may have restricted access to nutritional foods, opting instead for energy-dense, nutrient-poor alternatives that are more economical and readily available. These situations can contribute to the development of bad eating habits and raise the risk of obesity and other NCDs[149].

2.9.2 Environmental factors

Food environments: Adolescent eating patterns are heavily influenced by the availability, accessibility, and price of numerous foods in their surroundings. Neighborhoods with a high concentration of fast-food restaurants, convenience stores, and limited access to supermarkets or grocery stores that sell fresh and healthful foods are commonly referred to as "food deserts" or "food swamps"[150]. These circumstances can normalize the intake of unhealthy foods, making it difficult for adolescents to acquire and maintain good eating habits.

School and institutional environments: The school environment has a significant impact on adolescents' food choices and eating behaviors. The availability and promotion of healthy or harmful food selections at school cafeterias, vending machines, and other food outlets can influence adolescents' eating habits[151]. Furthermore, nutrition education programs, school

wellness policies, and the inclusion of healthy eating principles into the curriculum might significantly influence adolescents' beliefs and behavior linked to healthy eating[152].

Physical activity environments: The availability and accessibility of safe physical activity environments, such as parks, playgrounds, and recreational facilities, might have an impact on adolescents' general lifestyle and eating habits. Physical activity-promoting surroundings may contribute to a healthier lifestyle and better food choices, whereas sedentary environments can raise the risk of bad eating habits and obesity[153].

Food marketing and media influences: Adolescents are routinely exposed to intensive marketing and advertising for unhealthy foods and beverages via a variety of media outlets, including television, social media, and digital platforms[154]. These marketing efforts frequently use tactics that appeal to adolescents' desire for autonomy, social approval, and aspirational lives[155]. Adolescents' perceptions of healthy and unhealthy foods can be shaped by exposure to such marketing, which can normalize the intake of energy-dense and nutrient-poor options while also influencing their food preferences and purchasing decisions[156].

2.9.3 Personal factors

Body image and weight concerns: Adolescents frequently experience body image problems and weight-related challenges, which can have a substantial impact on their dietary habits and overall eating behaviors. Adolescents who are unhappy with their body shape or weight may engage in harmful eating habits such as restricting diets, binge eating, or using weight-loss supplements or drugs. These habits can cause dietary shortages, disordered eating patterns, and an increased risk of developing eating disorders or obesity[157].

Taste preferences and food neophobia: Personal taste preferences and food neophobia (the unwillingness to try new foods) can influence adolescents' food choices and willingness to

embrace healthy eating practices. Adolescents frequently prioritise flavour and sensory appeal over nutritional value, which can lead to excessive consumption of high-energy, low-nutrient foods and beverages[158]. In contrast, food neophobia may hinder adolescents' exposure to and acceptance of new, potentially healthier food options[159].

Self-efficacy and motivation: Adolescents' self-efficacy, or belief in their abilities to adopt and sustain good eating habits, has a substantial impact on their nutritional choices. High self-efficacy and drive to adopt healthier food choices are linked to improved dietary quality and greater consumption of fruits and vegetables[160]. In contrast, low self-efficacy and lack of drive might function as impediments to adopting and maintaining healthy eating patterns[161].

Stress and emotional eating: Adolescence is characterized by a variety of stressors, including academic pressures, social interactions, and hormonal changes. Stress and emotional distress can trigger maladaptive coping mechanisms, such as emotional eating or disordered eating patterns[162]. Adolescents may gravitate to energy-dense, nutrient-poor meals as a form of comfort or stress reduction. This can contribute to unhealthy eating patterns and weight gain[163].

Nutrition knowledge and health literacy: Adolescents' knowledge and awareness of nutrition principles and healthy eating behaviors can influence their food preferences and dietary habits. Limited nutrition knowledge and health literacy can result in misconceptions about the healthfulness of certain foods, an inability to correctly interpret nutrition labels, and trouble making educated dietary decisions[152]. Adolescents who have superior nutrition knowledge and health literacy are more likely to make healthier food choices and acquire long-term healthy eating habits[164].

2.10 Adolescents' Knowledge and Perceptions of Healthy Eating Habits

Knowledge of Nutritional Guidelines and Recommendations

Numerous studies have evaluated adolescents' knowledge of nutritional rules and recommendations, demonstrating various degrees of comprehension and gaps in their knowledge. A systematic review discovered that, while adolescents usually grasp the significance of a balanced diet, their knowledge of precise dietary recommendations and portion sizes is frequently lacking[165]. A cross-sectional survey done in Western Australia discovered that only 50% of secondary school adolescents aged 12-17 years properly categorized their vegetable and fruit diet as insufficient[166]. Similarly, a survey found that 53.5% of males and 30.8% of females had poor understanding about diet and nutrition. This conclusion is consistent with previous studies suggesting that young people have just adequate dietary knowledge[167]. A survey conducted in Lagos discovered that only 12.0% of adolescents had a good level of nutritional knowledge while another study carried out in Ibadan Nigeria discovered that 58.7% of adolescents had poor nutrition knowledge, with the majority coming from the out-of-school group, while 41.3% had strong nutrition knowledge, with a bigger proportion coming from the in-school group. This suggests that a large proportion of the adolescents investigated, particularly those who did not attend school, lacked sufficient understanding about healthy eating[168,169].

Understanding of the link between diet and NCDs

Globally, research have revealed that adolescents have varying levels of understanding about the relationship between nutrition and the risk of acquiring NCDs. While some adolescents recognize the need of a balanced diet, their understanding of diet-related chronic diseases such as diabetes, hypertension, and obesity is often limited. A survey found that 89.2% of adolescent respondents had fair to poor understanding of these diseases. However, there was a substantial

link between knowledge of diet-related chronic illnesses and dietary behaviors; as knowledge of the disorders grew, so did dietary diversity among adolescents[170].

In West Africa, there is little study on adolescents understanding of the diet-disease link, with only a few studies investigating this topic. A survey of undergraduate students at the University of Ibadan found that fewer than half (49%) had adequate nutrition-related knowledge of cancer prevention. This shows a disconnect between broad knowledge of cancer and a detailed grasp of how diet affects cancer risk. Furthermore, despite some information, many students continued to have poor nutritional habits, with just 30-40% usually ingesting legumes/nuts, vegetables, and fruits and 75% frequently consuming processed cereals and grains. This suggests that even among people who are aware of nutrition's involvement in cancer prevention, converting that information into good eating habits remains difficult. The findings underscore the need for more comprehensive nutrition education and interventions to close the knowledge-practice gap in NCD adolescents[171].

Perceptions of adolescent on the importance of adequate diet

Studies reveal that adolescents' perceptions on the significance of eating a healthy diet varies depending on their context and the social circle they belong to. A lot of adolescents show that they understand the importance of eating a balanced diet and having regular meal times. But their actions frequently defy this understanding, especially in social situations where making poor dietary choices is more common[172].

Mothers and teachers have a significant role as socializing agents since they frequently impact adolescents' healthy eating habits[172]. Adolescents also see healthy eating as reasonable and balanced, and some even acknowledge the significance of it for growth and well-being. But obstacles such food accessibility, taste preferences, and ignorance frequently made it difficult to

adopt healthy practices[173]. Adolescents generally consume unhealthy foods, with a penchant for fast food, especially on weekends and when hanging out with friends, even though they are generally aware of dietary guidelines[173].

In general, addressing the many viewpoints, underlying causes, and gender disparities is essential to creating beneficial attitudes and behaviors towards healthy eating among adolescents.

2.11 Barriers and Facilitators to Healthy Eating Among Adolescents

Adolescents in Africa and Nigeria frequently confront specific obstacles and barriers that limit their capacity to eat a balanced and nutritious diet. The next sections address the many barriers and facilitators that shape adolescents' attitudes and behaviors towards healthy eating.

2.11.1 Barriers

Availability and Accessibility of Healthy Food Options

One of the most significant impediments to good eating among adolescents is a lack of nutrient-dense meals. Many communities, particularly in rural and low-income metropolitan regions, face barriers to acquiring fresh fruits, vegetables, nutritious grains, and lean proteins for a variety of reasons. In a study conducted in Ghana, adolescents identified the high cost and restricted availability of healthy foods in local markets and school canteens as important hurdles to maintaining a balanced diet[174]. Similarly, study from Nigeria found that adolescents frequently experienced barriers to getting and consuming nutrient-dense meals, due to factors such as food insecurity, poverty, and limited access to health care all contributing to these problems. As a result, many adolescents have turned to less expensive, more energy-dense, and nutritionally inferior alternatives[175].

Furthermore, the rise of fast-food restaurants and street sellers selling unhealthy snacks and beverages in cities has worsened accessibility issues[176]. The prevalence of these vendors near

schools and residential areas contributes to adolescents' increased consumption of processed and fried meals[177]. Inadequate food storage facilities, conflicting household needs, and limited access to healthy foods can all affect food availability and accessibility for Nigeria's low-income households. This can lead to a reliance on locally available basic foods, which may not contain all of the critical elements required for good nutrition and health, particularly in growing children and adolescents[178].

Peer Influence and Social Norms

Peer influence and social norms have a considerable impact on adolescents' food choices because the desire for social approval and compliance to group standards can lead to adolescents adopting unhealthy eating habits, even if they are aware of the benefits of healthy eating. Adolescents frequently felt compelled to consume certain meals or engage in specific eating behaviors in order to fit in with their classmates and avoid being viewed as different or "uncool." Peer pressure was especially high when it came to consuming energy-dense snacks, sugary beverages, and fast foods, which were widely acceptable and even praised within adolescent social circles[179]. Furthermore, societal norms and traditions can influence adolescent eating habits. For example, a study in Nigeria discovered that some traditional beliefs and practices, such as the assumption that larger body size is a sign of wealth and good health, contributed to the normalization of unhealthy eating habits among adolescents[180].

Taste Preferences and Food Habits

Adolescent taste preferences and established dietary habits can also be obstacles to establishing healthy eating patterns. When it comes to food choices, many adolescents choose flavor and familiarity over nutritional content, frequently opting for energy-dense, processed, and sugary meals due to their enticing flavors and comfort[181]. According to research, adolescents'

consumption of vegetables was significantly influenced by their taste. Vegetable dislike was a major barrier to eating, as many adolescents stated. The innate tendency of humans to dislike meals that are sour or bitter may help to explain this aversion. Studies have shown that early and consistent vegetable exposure seems to be essential for overcoming this aversion since early experiences influence how tasty vegetables are perceived in relation to other foods. Furthermore, a major obstacle to this population's consumption of vegetables has been found to be the desire of adolescents for unhealthy options like fast food, which is higher in fat, sugar, and salt. Social norms and cultural influences within families and communities also appeared to support these taste preferences and eating habits[182].

2.11.2 Facilitators

Family Support and Parental Modelling

Families and parents have critical roles in developing adolescents' eating habits and attitudes towards healthy eating. Numerous studies have shown that family support and parental modelling improve adolescents' eating choices and overall health outcomes. Adolescents whose parents actively supported and modelled healthy eating habits were more likely to consume fruits, vegetables, and other nutrient-rich foods[183].

Similarly, adolescents who had good family support systems and saw their parents make conscious attempts to maintain a balanced diet were more likely to adopt comparable eating habits. Hence, there’s need for culturally relevant methods that involve families and harness traditional beliefs and practices to promote healthy eating habits[184].

Furthermore, a systematic analysis of the effectiveness of family-based interventions in improving children and adolescents' eating behaviors showed that these interventions frequently

focused on improving parental knowledge, skills, and self-efficacy in supporting healthy eating behaviors in the home, resulting in a supportive environment for adolescents[185].

Community and Environmental Support

Fostering supportive community contexts and increasing access to healthy food options can help adolescents develop healthy eating habits. Several projects and techniques have been proposed to solve this issue. A study conducted to assess the impact of a community-based intervention that included the formation of local food cooperatives and the promotion of urban gardening revealed an increase in the availability and consumption of fresh fruits and vegetables among in participating communities[186].

Furthermore, government rules and laws can help create an environment conducive to healthy eating. The assessment of the impact of the National Home Grown School Feeding Program (NHGSFP) in Nigeria, which mandates the supply of nutritious lunches in public schools in resulted in positive changes in children's food intake and a reduction in the consumption unhealthy foods during school hours[187].

Positive Peer Influence and Social Media: While peer influence can often be a barrier to healthy eating, it can also be used to promote beneficial peer norms and behaviors. Several studies have investigated the feasibility of utilizing peer-led treatments and social media to promote healthy eating among adolescents.

Social media platforms have been investigated as potential strategies for promoting healthy eating habits among adolescents. A systematic study discovered that social media campaigns and influencer-led efforts can effectively reach and engage adolescents, providing them with correct nutrition information and encouraging healthy eating choices[188].

2.12 Interventions and Strategies for Promoting Healthy Eating Habits

To combat the rising prevalence of NCDs among adolescents, a variety of interventions and techniques have been introduced to encourage healthy eating habits. These interventions are intended to overcome the barriers and exploit the facilitators outlined in the previous section.

2.12.1 School-based interventions

Schools offer a unique and significant setting for molding adolescents' food habits and attitudes towards healthy eating. School-based interventions have the ability to reach a large number of adolescents and establish a supportive environment that encourages healthy eating habits[189]. This section looks at three important aspects of school-based interventions: nutrition education programs, healthy food options in school cafeterias, and school gardens and culinary workshops.

Nutrition Education Programs

Nutrition education programs in schools attempt to raise adolescents' knowledge and awareness of good eating habits while also providing them with the skills and motivation to make educated dietary choices. These programs can take many different forms, including classroom instruction, interactive workshops, and multimedia tools[190]. According to research, school-age adolescents' understanding of nutrition was enhanced by nutrition education programs; knowledge scores in intervention groups rose from 45.4% to 58.8% when compared to control groups[191].

Cooking demonstration, taste testing, and hands-on activities are examples of interactive components used in effective nutrition education programs, which can help adolescents learn more engagingly and practically[192]. Involving parents and carers in these programs can further reinforce the lessons and encourage the adoption of good eating habits at home.

Healthy Food Options in School Cafeterias

Ensuring the availability and promotion of healthy food alternatives in school cafeterias and canteens is an essential component of school-based programs aimed at encouraging adolescents to eat healthily. Schools can establish an environment that fosters and supports positive dietary behaviors by providing nutrient-dense options while limiting the availability of harmful options[193]. However, merely having healthy food alternatives may not be enough; active promotion and marketing efforts are frequently required to persuade adolescents to make healthier decisions[194].

Furthermore, integrating adolescents in the decision-making process for the types of healthy foods available in school cafeterias helps increase their engagement and ownership of the effort. Incorporating their preferences and input can assist ensure that the healthy options available are appealing and culturally appropriate[195].

School Gardens and Cooking Classes

Hands-on experiences, such as school gardens and cooking lessons, have been identified as helpful ways for instilling good eating habits in adolescents. These projects not only teach practical skills, but also promote a better understanding and appreciation for nutritious foods and their origins[196].

School gardens can also be used as learning laboratories, giving adolescents hands-on experience with producing, harvesting, and cooking fresh produce. This experiential learning approach can create a stronger connection to food and a greater appreciation for the value of sustainable and healthy food systems[196]. Cooking programs provide adolescents with practical culinary skills to prepare balanced meals and snacks independently. These classes can also provide opportunities

for experimentation and creativity, encouraging adolescents to explore new flavors and ingredients while adhering to healthy eating principles[197].

2.12.2 Family-Based Interventions

While school-based interventions are helpful in fostering healthy eating habits among adolescents, the family environment also influences dietary behaviors and attitudes. Family-based interventions recognize the important role that parents, carers, and home dynamics have in adolescents' food choices and eating habits. This section delves into two important aspects of family-based interventions: parental involvement and education, and fostering healthy family meals.

Parental Involvement and Education

Engaging and educating parents is a vital component of effective family-based programs to promote healthy eating habits among adolescents. Parents and guardians are role models and main influencers on their children's food habits, and their participation can significantly improve the success of treatments[198]. Effective parental education components includes interactive and practical elements, such as hands-on cooking demos, grocery shopping trips, and goal-setting activities[193].

A systematic assessment of the impact of parental involvement in nutrition interventions for adolescents discovered that interventions that actively included parents through educational sessions, seminars, and counselling were more effective in improving adolescents' food intake and promoting long-term behavior change[186].

Promoting Healthy Family Meals

Family dinners are an essential component of family-based practices because they allow for positive role modelling, social support, and the reinforcing of healthy eating habits. Regular

family meals have been linked to better food quality and a lower incidence of obesity and other health problems among adolescents[199].

Effective solutions for encouraging healthy family meals frequently include meal planning and preparation advice, recipe resources, and techniques for fostering good mealtime circumstances. Addressing practical hurdles like time limits and busy schedules can also improve the feasibility and sustainability of regular family meals[200].

Furthermore, involving adolescents in meal planning and preparation can promote a sense of ownership and responsibility for good eating habits. According to research, adolescents who actively participated in grocery shopping, meal preparation, and family meal planning were more likely to consume a range of nutrient-rich foods and acquire good attitudes towards healthy eating[201].

Overall, family-based practices that emphasize parental involvement, education, and the promotion of healthy family meals can help adolescents develop better eating habits. Creating a supportive and loving environment within the household, these interventions can reinforce the messages and practices promoted in school-based efforts, resulting to a more comprehensive and sustainable approach to promoting healthy eating habits[202].

2.12.3 Community-Based Interventions

While school and family-based interventions are critical in encouraging healthy eating habits among adolescents, community-based interventions are just as important in building an enabling environment that supports and reinforces appropriate dietary behaviors. These interventions acknowledge the importance of the larger social, cultural, and environmental factors in shaping adolescents' food choices and eating patterns. This section investigates two important aspects of

community-based interventions: Increasing the availability and affordability of healthy food options, as well as launching public awareness campaigns and social marketing tactics.

Accessibility and Affordability of Healthy Food Options

One of the most significant hurdles to healthy eating among adolescents, particularly in low-income and marginalized neighborhoods, is the scarcity and cost of nutrient-dense foods. Community-based treatments seek to address this issue by implementing methods to increase the availability and affordability of healthy food options in the surrounding community[203].

In addition to improving physical access, community-based interventions can address affordability issues by introducing measures such as food subsidy programs, voucher systems, or community-supported agriculture projects. These strategies help make nutritious food selections more affordable for low-income families and adolescents[204].

Furthermore, engagement with local food shops, farmers' markets, and community organizations can help to distribute and promote inexpensive, culturally relevant, and nutrient-dense foods in the community. These alliances can also provide opportunities for nutrition education and skill-building workshops, further enhancing the impact of the intervention[205].

Public Awareness Campaigns and Social Marketing

Community-based initiatives can also use public awareness campaigns and social marketing methods to encourage healthy eating habits among adolescents. These programs try to raise awareness, change attitudes, and affect social norms regarding healthy eating habits in the community. Well-designed programs, especially those that use multimedia platforms and engaging message, can effectively reach and affect adolescents' eating behaviors[206]. Furthermore, community-based interventions can use existing social networks and important community members to spread healthy eating messages and encourage favorable social norms[207].

Effective public awareness campaigns and social marketing strategies frequently include culturally relevant message, include local groups and stakeholders, and use a variety of communication platforms to reach a wide range of audiences[205]. These efforts can be combined with other community-based activities, such as increasing access to healthy food options, to form a more holistic and synergistic strategy to encouraging healthy eating habits among adolescents[202].

2.12.4 Policy Interventions

In addition to school, family, and community-based interventions, national and local policy interventions plays an important role in creating an environment that encourages adolescents to eat healthily. These interventions include the application of laws, rules, and policies that target various areas of the food system, such as production and distribution, marketing, and consumption[207]. This section investigates two important policy interventions: regulating food advertising and marketing, and using taxation and subsidies to impact the pricing and accessibility of good versus unhealthy foods.

Regulation of Food Advertising and Marketing

The widespread marketing and advertising of unhealthy foods, particularly those aimed at children and adolescents, has been identified as a major contributor to poor eating habits and the rising prevalence of obesity and NCDs[208]. Policy actions aimed at regulating food advertising and marketing can contribute to a more favorable environment for promoting healthy eating habits among adolescents[209]. A systematic study of the impact of regulations that prohibit the marketing of unhealthy foods to children and adolescents discovered that complete laws, including bans on television advertising, product placement, and digital marketing, were

associated with reductions in the intake of unhealthy foods and improved dietary behavior among adolescents[210].

However, the breadth and enforcement mechanisms in place can have an impact on the success of these policies. For instance, adopting and enforcing food advertising restrictions, particularly in the digital and social media domains is challenging. Hence, there is need for strong monitoring methods and coordination with stakeholders, including the food sector and media platforms, to ensure compliance and maximize the impact of these policies[211].

Taxation and Subsidies for Healthy and Unhealthy Foods

Fiscal policies, such as taxation on unhealthy foods and subsidies for healthy alternatives, have been proposed as a strategy for influencing the affordability and accessibility of various food products, thereby shaping consumer behavior and encouraging healthier dietary choices[212]. However, the effectiveness of taxation and subsidy programs can be modified by a variety of factors, including taxation or subsidy levels, substitute availability, and the target population's socioeconomic status[213]. To maximize their impact on eating habits, these regulations may also require supplementary measures, such as public awareness campaigns and nutrition education[214]. Furthermore, the implementation of such policies necessitates careful consideration of potential unintended consequences, such as disproportionate effects on low-income households or a shift in consumption towards less healthy alternatives[215]. Designing and executing efficient taxes and subsidy policies requires engaging stakeholders, conducting comprehensive impact assessments, and resolving significant hurdles[216].

Overall, government policies, such as regulating food promotion and marketing, as well as implementing taxation and subsidies for healthy and unhealthy foods, can play an important role in creating an enabling environment for adolescents to adopt good eating habits[217].

Endnotes

1. A Iyassu, K Tilahun, F Workneh, S Mogues, S Chitekwe, & K Baye, "*The Influence of Adolescents' Nutrition Knowledge and School Food Environment on Adolescents' Dietary Behaviors in Urban Ethiopia: A Qualitative Study"*, **Maternal and Child Nutrition,** 2023. https://doi.org/10.1111/mcn.13527.

2. R Guiné, S G Florença, G Aparício, A P Cardoso, & M Ferreira, "Food Knowledge for Better Nutrition and Health: A Study among University Students in Portugal", **Healthcare** 11(11), 2023: 1597-97. https://doi.org/10.3390/healthcare11111597.

3. Z Lassi, A Moin, & Z Bhutta, "Nutrition in Middle Childhood and Adolescence", *PubMed. Washington (DC): The International Bank for Reconstruction and Development / The World Bank*, 2017. https://www.ncbi.nlm.nih.gov/books/NBK525242/.

4. A Alyafei & R Easton-Carr, "The Health Belief Model of Behavior Change", **Nih.gov. StatPearls Publishing,** 2024. https://www.ncbi.nlm.nih.gov/books/NBK606120/.

5. T Sinai, R Axelrod, T Shimony, M Boaz, & V Kaufman-Shriqui,"Dietary Patterns among Adolescents Are Associated with Growth, Socioeconomic Features, and Health-Related Behaviors", **Foods**, 10(12), 2021: 3054. https://doi.org/10.3390/foods10123054.

6. S Raut, K.C Dirghayu, D.R Singh, R.R Dhungana, M Singh, & D R Sunuwar, "*Effect of Nutrition Education Intervention on Nutrition Knowledge, Attitude, and Diet Quality among School-Going Adolescents: A Quasi-Experimental Study*", **BMC Nutrition,** 10(1), 2024. https://doi.org/10.1186/s40795-024-00850-0.

7. F Fernqvist, S Spendrup, & R Tellström, "*Understanding Food Choice: A Systematic Review of Reviews*", **Heliyon** 10(12), 2024: e32492-92.

8. P. Silva, "*Food and Nutrition Literacy: Exploring the Divide between Research and Practice*", **Foods** 12(14): 2023: 2751. https://doi.org/10.3390/foods12142751.

9. M. Ezzat, M.E Hashad, & M. Abou Taleb, "*Student Nutritional Knowledge and Dietary Behavior: The Mediating Role of Students' Self-Efficacy and The...",* **ResearchGate** 6(2), 2022: 109-33.

10. V Efthymiou, E Charmandari, D Vlachakis, A Tsitsika, A Pałasz, G Chrousos & F Bacopoulou, "*Adolescent Self-Efficacy for Diet and Exercise Following a School-Based Multicomponent Lifestyle Intervention*", **Nutrients** 14(1), 2021: 97. https://doi.org/10.3390/nu14010097.

11. S Sutton, "*Social Cognitive Theory - an Overview | Sciencedirect Topics*", **Sciencedirect.com**, 2019. https://www.sciencedirect.com/topics/medicine-and-dentistry/social-cognitive-theory.

12. Y Qutteina, L Hallez, M Raedschelders, C De Backer & T Smits, "*Food for Teens: How Social Media Is Associated with Adolescent Eating Outcomes*", **Public Health Nutrition** 25(2), 2021: 1–31. https://doi.org/10.1017/s1368980021003116.

13. M A Ruani, M J Reiss & A Z Kalea, "*Diet-Nutrition Information Seeking, Source Trustworthiness, and Eating Behavior Changes: An International Web-Based Survey,*" **Nutrients** 15(21), 2023: 4515. https://doi.org/10.3390/nu15214515.

14. N Akseer, S Mehta, J Wigle, R Chera, Z J Brickman, S Al-Gashm, B Sorichetti, "*Non-Communicable Diseases among Adolescents: Current Status, Determinants, Interventions and Policies",* **BMC Public Health** 20(1), 2020. https://doi.org/10.1186/s12889-020-09988-5.

15. World Health Organization, "*Noncommunicable Diseases*," **World Health Organization**, 2023. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

16. T T Alamnia, G M Sargent & M Kelly, "*Dietary Patterns and Associations with Metabolic Risk Factors for Non-Communicable Disease*", **Scientific Reports** 13(1), 2023: 21028. https://doi.org/10.1038/s41598-023-47548-0.

17. S Thapsuwan, S Phulkerd, A Chamratrithirong, R S Gray, N Jindarattanaporn, N Loyfah, N Thongcharoenchupong & U Pattaravanich, "*Relationship between Consumption of High Fat, Sugar or Sodium (HFSS) Food and Obesity and Non-Communicable Diseases*", **BMJ Nutrition, Prevention & Health**, 2024: e000794. https://doi.org/10.1136/bmjnph-2023-000794.

18. K S N Liu, J Y Chen, K S Sun, J P Y Tsang, & C L K Lam, "*Adolescent Knowledge, Attitudes and Practices of Healthy Eating: Findings of Qualitative Interviews among Hong Kong Families*", **Nutrients** 14(14), 2022: 2857. https://doi.org/10.3390/nu14142857.

19. A Iyassu, A Laillou, K Tilahun, F Workneh, S Mogues, S Chitekwe & K Baye, "*The Influence of Adolescents' Nutrition Knowledge and School Food Environment on Adolescents' Dietary Behaviors in Urban Ethiopia: A Qualitative Study,*" **Maternal and Child Nutrition**, 2023. https://doi.org/10.1111/mcn.13527.

20. World Health Organization. "*Adolescent Health: The Missing Population in Universal Health Coverage",* **Geneva: WHO,** 2021.

21. A Budreviciute, S Damiati, D K Sabir, K Onder, P Schuller-Goetzburg, G Plakys, A Katileviciute, S Khoja & R Kodzius, *"Management and Prevention Strategies for Non-Communicable Diseases (NCDs) and Their Risk Factors",* **Frontiers in Public Health** 8(574111), 2020: 1–11. https://doi.org/10.3389/fpubh.2020.574111.

22. M R Islam, J Trenholm, A Rahman, J Pervin, E C Ekström & S M Rahman, *"Sociocultural Influences on Dietary Practices and Physical Activity Behaviors of Rural Adolescents—a Qualitative Exploration*", **Nutrients** 11(12), 2020: 2916. https://doi.org/10.3390/nu11122916.

23. S Godbharle, H Kesa & A Jeyakumar. "*Processed Food Consumption and Risk of Non-Communicable Diseases (NCDs) in South Africa: Evidence from Demographic and Health Survey (DHS) VII*", **Journal of Nutritional Science** 13, 2024: e19.

24. K Nemec, "*Cultural Awareness of Eating Patterns in the Health Care Setting*", **Clinical Liver Disease** 16(5), 2020: 204–7. https://doi.org/10.1002/cld.1019.

25. B A Swinburn, V I Kraak, S Allender. "*The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission Report*." **The Lancet**. 2019, 393(10173):791-846.

26. World Health Organisation, "*Cardiovascular Diseases*," **World Health Organization**, 2021. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases.

27. C. Storad, "*Your Circulatory System*", **Minneapolis: Lerner Publishing Group,** 2017.

28. S. Mendis, P. Puska & B. Norrving, "*Global Atlas on Cardiovascular Disease Prevention and Control*", **Geneva: World Health Organization**. 2011.

29. Z. Gao, Z. Chen, A. Sun & X. Deng, "*Gender Differences in Cardiovascular Disease", Medicine in Novel Technology and Devices* 4, 2019: 100025.

30. I. Basu-Ray, N. Almaddah, A. Adeboye, S. Vaqar & M. Soos, "*Cardiac Manifestations of Coronavirus (COVID-19)*", **PubMed,** 2024.

31. Z. Wu & J. McGoogan, "*Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases from the Chinese Center for Disease Control and Prevention*", **JAMA** 323(13), 2020: 1239-1242.

32. American Heart Association, "*Understand Your Risks to Prevent a Heart Attack*," 2018. https://www.heart.org/en/health-topics/heart-attack/understand-your-risks-to-prevent-a-heart-attack.

33. E. Rasure, "*Industrialization*," **Investopedia**, 2023.

34. National Cancer Institute, "*What Is Cancer*?," **National Cancer Institute**, 2021. https://www.cancer.gov/about-cancer/understanding/what-is-cancer.

35. World Health Organization, "*Cancer*," **World Health Organization**, 2022. https://www.who.int/news-room/fact-sheets/detail/cancer.

36. American Cancer Society, "*The Global Cancer Burden*," **American Cancer Society**, https://www.cancer.org/about-us/our-global-health-work/global-cancer-burden.html

37. F. Bray, J. Ferlay, I. Soerjomataram, R. Siegel, L. Torre & A. Jemal, "*Global Cancer Statistics 2018: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries*", **CA: A Cancer Journal for Clinicians** 68, 2018: 394-424

38. S. Clinton, E. Giovannucci & S. Hursting, "*The World Cancer Research Fund/American Institute for Cancer Research Third Expert Report on Diet, Nutrition, Physical Activity, and Cancer: Impact and Future Directions*", **The Journal of Nutrition** 150(4), 2019: 663-671

39. World Health Organization, "*Global Cancer Burden Growing, amidst Mounting Need for Services*," **World Health Organization**, 2024. https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing--amidst-mounting-need-for-services.

40. E. Riggi, M. Baccini, E. Camussi, F. Gallo, C. Anatrone, A. Pezzana, C. Senore, L. Giordano & N. Segnan, "*Promoting Healthy Lifestyle Habits among Participants in Cancer Screening Programs: Results of the Randomized Controlled Sti.Vi Study*", **Journal of Public Health Research** 11(3), 2022: 2499-8176.

41. World Health Organization, "*Diabetes*," **World Health Organization**, 2023. https://www.who.int/news-room/fact-sheets/detail/diabetes.

42. M. Nakrani, R. Wineland & F. Anjum, "*Physiology, Glucose Metabolism*", **StatPearls**, 2023:

43. International Diabetes Federation, "*IDF Diabetes Atlas 10th Edition*," **International Diabetes Federation**, 2021: 1-180.

44. World Health Organization, "*Global Report on Diabetes*", **Geneva: World Health Organization,** 2016.

45. World Health Organization, "*Obesity*", **World Health Organization**, 2024. https://www.who.int/health-topics/obesity.

46. World Health Organization Regional Office for Africa, "*Chronic Respiratory Diseases*", **WHO Regional Office for Africa**, 2017. https://www.afro.who.int/health-topics/chronic-respiratory-diseases.

47. World Health Organization, "*Healthy Diet*," **World Health Organization,** 2020, https://www.who.int/news-room/fact-sheets/detail/healthy-diet.

48. S. Shukla, K. Vanka, A. Chavelier, M. Shastri, M. Tambuwala, H. Bakshi, K. Pabreja, M. Mahmood & R. O'Toole, "*Chronic Respiratory Diseases: An Introduction and Need for Novel Drug Delivery Approaches*", **Targeting Chronic Inflammatory Lung Diseases Using Advanced Drug Delivery Systems**, 2020: 1-31.

49. J. Soriano, P. Kendrick, K. Paulson, V. Gupta, E. Abrams, R. Adedoyin & T. Adhikari, "*Prevalence and Attributable Health Burden of Chronic Respiratory Diseases, 1990–2017: A Systematic Analysis for the Global Burden of Disease Study 2017*", **The Lancet Respiratory Medicine** 8(6), 2020: 585-596.

50. Global Asthma Network, "*The Global Asthma Report 2018*", **Global Asthma Network**, 2018. https://globalasthmareport.org/2018/resources/Global_Asthma_Report_2018.pdf.

51. T. Grant, E. Brigham & M. McCormack, "*Childhood Origins of Adult Lung Disease as Opportunities for Prevention*", **The Journal of Allergy and Clinical Immunology: In Practice** 8(3), 2020: 849-858.

52. D. Aune, W. Huang, J. Nie & Y. Wang, "*Hypertension and the Risk of All-Cause and Cause-Specific Mortality: Outcome-Wide Association Study of 67 Causes of Death in the National Health Interview Survey*", **BioMed Research International,** 2021: 1-10.

53. Z.T Lai, "*Blood Pressure Variability*." **PhD diss., Maastricht University**, 2021. https://doi.org/10.26481/dis.20200115tz.

54. J. Edwards, "*Obesity-Induced Hypertension: Causes, Risks, and Treatment*", **Healthline**, 2022.

55. H. Challa & K. Uppaluri, "*DASH Diet (Dietary Approaches to Stop Hypertension)*", **StatPearls**, 2023.

56. World Health Organization. "*Obesity and Overweight*." **World Health Organization**, 2024. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

57. S. Hotu, B. Carter, P. Watson, W. Cutfield & T. Cundy, "*Increasing prevalence of type 2 diabetes in adolescents*", **Journal of Paediatrics and Child Health**, 40, 2004: 201-204.

58. J. Xie, M. Wang, Z. Long, H. Ning, J. Li, Y. Cao, Y. Liao, G. Liu, F. Wang & A. Pan, "*Global Burden of Type 2 Diabetes in Adolescents and Young Adults, 1990-2019: Systematic Analysis of the Global Burden of Disease Study 2019*", **BMJ**, 379, 2022: e072385.

59. T. Jardim, T. Gaziano, F. Nascente, C. Carneiro, P. Morais, V. Roriz & K. Mendonça, "*Multiple Cardiovascular Risk Factors in Adolescents from a Middle-Income Country: Prevalence and Associated Factors*", **PLOS ONE** 13(7) 2018: e0200075.

60. National Cancer Institute, "*Cancer in Children and Adolescents*", **National Cancer Institute**, 2017. https://www.cancer.gov/types/childhood-cancers/child-adolescent-cancers-fact-sheet.

61. J. Bigna & J. Noubiap, "*The Rising Burden of Non-Communicable Diseases in Sub-Saharan Africa*", **The Lancet Global Health** 7(10), 2019: e1295-e1296.

62. J. Okagua, B. Alex-Hart & T. Jaja, "*Overweight and obesity status of school adolescents in Portharcourt, southern Nigeria*", **Nigerian Journal of Medicine** 25(1), 2016: 53-59.

63. N. Akintayo-Usman, F. Okanlawon & S. Usman, "*Prevalence of Pre-Diabetes and Risk Factors among Secondary School Adolescents in Osogbo Local Government Area, Osun State, Nigeria*", **African Health Sciences** 21(3), 2021: 1301-1309.

64. N. Odunaiya, Q. Louw & K. Grimmer, "*Are lifestyle cardiovascular disease risk factors associated with pre-hypertension in 15–18 years rural Nigerian youth? A cross sectional study*", **BMC Cardiovascular Disorders**, 15, 2015.

65. S. Cui, B. Ajayi, E. Kim & R. Egonu, "*A Systematic Review and Meta-Analysis of Depression Prevalence amongst Nigerian Students Pursuing Higher Education"*, **Journal of Behavioral and Brain Science**, 12, 2022: 589-598.

66. GBD 2019 Diseases and Injuries Collaborators. "*Global Burden of 369 Diseases and Injuries, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019.*" **The Lancet**, 396(10258), 2020: 1204-1222.

67. National Academies of Sciences, Engineering, and Medicine, "*Health-Care Utilization as a Proxy in Disability Determination*", **National Academies Press**, 2018.

68. A. Mtintsilana, A. Craig, W. Mapanga, S. Dlamini & S. Norris, "*Association between Socio-Economic Status and Non-Communicable Disease Risk in Young Adults from Kenya, South Africa, and the United Kingdom*", **Scientific Reports** 13(1), 2023: 728.

69. A. Sanyaolu, C. Okorie, X. Qi, J. Locke & S. Rehman, "*Childhood and Adolescent Obesity in the United States: A Public Health Concern*", **Global Pediatric Health,** 6, 2019: 1-11.

70. L. Allen, J. Williams, N. Townsend, B. Mikkelsen, N. Roberts, C. Foster & K. Wickramasinghe, "*Socioeconomic Status and Non-Communicable Disease Behavioral Risk Factors in Low-Income and Lower-Middle-Income Countries: A Systematic Review*", **The Lancet Global Health** 5(3), 2017: e277-e289.

71. M. Luiggi, O. Rey, M. Travert & J. Griffet, "*Overweight and Obesity by School Socioeconomic Composition and Adolescent Socioeconomic Status: A School-Based Study*", **BMC Public Health** 21(1), 2021:1837.

72. S. Mathiarasan & A. Hüls, "*Impact of Environmental Injustice on Children's Health—Interaction between Air Pollution and Socioeconomic Status*", **International Journal of Environmental Research and Public Health** 18(2), 2021.

73. I. Sommer, U. Griebler, P. Mahlknecht, K. Thaler, K. Bouskill, G. Gartlehner & S. Mendis, "*Socioeconomic Inequalities in Non-Communicable Diseases and Their Risk Factors: An Overview of Systematic Reviews*", **BMC Public Health** 15(1), 2015.

74. K. Juma, P. Juma, C. Shumba, P. Otieno & G. Asiki, "*Non-Communicable Diseases and Urbanization in African Cities: A Narrative Review*", **IntechOpen**, 2019.

75. Pan American Health Organization, "*Noncommunicable Diseases*," **Pan American Health Organization**, 2022. https://www.paho.org/en/topics/noncommunicable-diseases.

76. F. Schultze, X. Gao, D. Virzonis, S. Damiati, M. Schneider & R. Kodzius, "*Air quality effects on human health and approaches for its assessment through microfluidic chips*", **Genes** 8, 2017: 244.

77. A. Kumar, "*The impact of obesity on cardiovascular disease risk factor*", **Asian Journal of Medical Sciences** 10, 2019: 21294.

78. H. Billingsley, S. Carbone & C. Lavie, "*Dietary fats and chronic noncommunicable diseases*", **Nutrients,** 10, 2018: 1385.

79. A. Katileviciute, G. Plakys, A. Budreviciute, K. Onder, S. Damiati & R. Kodzius, "*Sight to wheat bran: high value-added products*", **Biomolecules** 9, 2019: 887.

80. World Health Organization, "*The World Health Report 2002: Reducing Risks, Promoting Healthy Life*", **Geneva: World Health Organization**, 2002.

81. B. Popkin, "*Nutrition transition and the global diabetes epidemic*", **Current Diabetes Reports**, 15, 2015: 64.

82. R. Guthold, G. Stevens, L. Riley & F. Bull, "*Worldwide Trends in Insufficient Physical Activity from 2001 to 2016: A Pooled Analysis of 358 Population-Based Surveys with 1.9 Million Participants*", **The Lancet Global Health** 6(10), 2018: e1077-e1086.

83. R. Guthold, G. Stevens, L. Riley & F. Bull, "*Global Trends in Insufficient Physical Activity Among Adolescents: A Pooled Analysis of 298 Population-Based Surveys with 1.6 Million Participants*", **The Lancet Child & Adolescent Health** 4(1), 2020: 23-35.

84. E. van Sluijs, U. Ekelund, I. Crochemore-Silva, R. Guthold, A. Ha, D. Lubans, A. Oyeyemi, D. Ding & P. Katzmarzyk, "*Physical Activity Behaviors in Adolescence: Current Evidence and Opportunities for Intervention*", **The Lancet** 398(10298), 2021.

85. R. Telama, X. Yang, E. Leskinen, A. Kankaanpää, M. Hirvensalo, T. Tammelin, J. Viikari & O. Raitakari, "*Tracking of Physical Activity from Early Childhood through Youth into Adulthood*", **Medicine & Science in Sports & Exercise** 46(5), 2014: 955-962.

86. World Health Organization, "*Adolescents: Health Risks and Solutions*," **WHO**, 2023, https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions.

87. A. Park & M. Smyth, "*Tobacco: A Challenge for Pediatric and Adult Health*", **The Lancet Public Health** 6(7), 2021: e441-e442.

88. T. Shibiru, A. Arulandhu, A. Belete, J. Etana & W. Amanu, "*Prevalence and Factors Associated with Alcohol Consumption Among Secondary School Students in Nekemte, Ethiopia: A Cross-Sectional Study*", **Substance Abuse and Rehabilitation** 14, 2023: 35-47.

89. L. Smith & D. Foxcroft, "*The effect of alcohol advertising, marketing and portrayal on drinking behavior in young people: Systematic review of prospective cohort studies*", **BMC Public Health** 9, 2009: 51.

90. M. Sudhinaraset, C. Wigglesworth & D. Takeuchi, "*Social and Cultural Contexts of Alcohol Use: Influences in a Social-Ecological Framework*", **Alcohol Research: Current Reviews** 38(1), 2016: 35-45.

91. World Health Organization, "*Adolescent Health*," **World Health Organization**, 2023. https://www.who.int/health-topics/adolescent-health.

92. World Health Organisation, "*Noncommunicable Diseases*: *Childhood Overweight and Obesity*", **World Health Organisation**, 2020. https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity.

93. World Health Organization, "*Mental Health*," **World Health Organization**, 2024, https://www.who.int/health-topics/mental-health.

94. C. Borges, D. Marchioni, R. Levy & B. Slater, "*Dietary patterns associated with overweight among Brazilian adolescents*", **Appetite,** 123, 2018.

95. World Health Organisation, "*Hypertension*." ***World Health Organization***, 2023. https://www.who.int/news-room/fact-sheets/detail/hypertension.

96. M. Meher, S. Pradhan & S. Pradhan, "*Risk Factors Associated with Hypertension in Young Adults: A Systematic Review*", **Cureus** 15(4), 2023.

97. I. Atoh, J. Ezeogu, C. Okeke, S. Umeh, E. Ekure, S. Omokhodion & O. Njokanma, "*High blood pressure pattern amongst adolescents in Lagos, South West Nigeria*", **Pan African Medical Journal** 44, 2023: 206.

98. N. Pappan & A. Rehman, "*Dyslipidemia*", **StatPearls**, 2023.

99. L. Morenga & J. Montez, "*Health effects of saturated and trans-fatty acid intake in children and adolescents: Systematic review and meta-analysis*", **PLOS ONE**, 12, 2017: e0186672.

100. K. Mellendick, L. Shanahan, L. Wideman, S. Calkins, S. Keane & C. Lovelady, "*Diets Rich in Fruits and Vegetables Are Associated with Lower Cardiovascular Disease Risk in Adolescents*", **Nutrients** 10(2), 2018: 136.

101. S. Casari, M. Di Paola, E. Banci, S. Diallo, L. Scarallo, S. Renzo, A. Gori, S. Renzi, M. Paci, Q. de Mast, T. Pecht, K. Derra, B. Kaboré, H. Tinto, D. Cavalieri & P. Lionetti, "*Changing Dietary Habits: The Impact of Urbanization and Rising Socio-Economic Status in Families from Burkina Faso in Sub-Saharan Africa*", **Nutrients** 14(9), 2022: 1782.

102. M. Mendez & B. Popkin, "*Globalization, Urbanization and Nutritional Change in the Developing World*", **The Electronic Journal of Agricultural and Development Economics,** 1, 2004: 220-241.

103. R. De Amicis, S. Bertoli Mambrini, M. Pellizzari, A. Foppiani, S. Bertoli, A. Battezzati & A. Leone, "*Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review*", **European Journal of Nutrition,** 61(5), 2022: 2297-2311.

104. World Health Organization, "*The Inequality Epidemic: Low-Income Teens Face Higher Risks of Obesity, Inactivity and Poor Diet*", **World Health Organization,** 2024.

105. H. Seligman, B. Laraia & M. Kushel, "*Food insecurity is associated with chronic disease among low-income NHANES participants*", **Journal of Nutrition,** 140(2), 2010: 304-310.

106. V. Baute, R. Sampath-Kumar, S. Nelson & B. Basil, "*Nutrition Education for the Health-care Provider Improves Patient Outcomes*", **Global Advances in Health and Medicine** 7, 2018.

107. W. Suk, H. Ahanchian, K. A. Asante, D. Carpenter, F. Diaz-Barriga, E. H. Ha & X. Huo, "*Environmental Pollution: An Under-Recognized Threat to Children's Health, Especially in Low- and Middle-Income Countries*", **Environmental Health Perspectives** 124(3), 2016.

108. A. Garbero & L. Jäckering, "*The Potential of Agricultural Programs for Improving Food Security: A Multi-Country Perspective*", **Global Food Security** 29, 2021.

109. J. Webster, A. Pillay, A. Suku, P. Gohil, J. Santos, J. Schultz, J. Wate, K. Trieu, S. Hope, W. Snowdon, M. Moodie, S. Jan & C. Bell, "*Process Evaluation and Costing of a Multifaceted Population-Wide Intervention to Reduce Salt Consumption in Fiji*", **Nutrients** 10(2), 2018: 155.

110. S. Steenson & J. Buttriss, "*The challenges of defining a healthy and 'sustainable' diet*", **Nutrition Bulletin** 45, 2020: 206-222.

111. S. Malmquist & K. Prescott, "*Nutrition and Diet: In Human Biology*", **Minneapolis: OpenStax**, 2022.

112. S. Hassan, C. Egbuna, H. Tijjani, J. Ifemeje, O. C. Michael, K. Patrick-Iwuanyanwu, P. Onyeike & B. Ephraim-Emmanuel, "*Dietary Supplements: Types, Health Benefits, Industry and Regulation*", **Dietary Supplements**, 2020.

113. World Cancer Research Fund International and American Institute for Cancer Research. "*Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective*." **Choice Reviews Online** 45(9) 2008: 45-5024.

114. M. F. Yuyun, K. Sliwa, A. P. Kengne, A. O. Mocumbi, G. Bukhman, "*Cardiovascular Diseases in Sub-Saharan Africa Compared to High-Income Countries: An Epidemiological Perspective*", **Global Heart** 15(1), 2020: 15.

115. Virani & S. Reddy, "*Strengthening evidence to inform health systems: opportunities for the WHO and partners to accelerate progress on non-communicable diseases*", **BMJ Global Health** 8(11), 2023: e013994.

116. "*Tobacco Control & NCD Prevention*." **HealthBridge**, 2024. https://healthbridge.ca/tobacco-control-ncd-prevention.

117. J. Zarocostas, "*Need to increase focus on non-communicable diseases in global health, says WHO*", **BMJ** 341, 2010: c7065.

118. E. Langlois, A. McKenzie, H. Schneider & J. Mecaskey, "*Measures to Strengthen Primary Health-Care Systems in Low- and Middle-Income Countries*", **Bulletin of the World Health Organization** 98(11), 2020: 781-791.

119. M. Martínez-González, A. Gea, M. Ruiz-Canela, "*The Mediterranean Diet and Cardiovascular Health*", **Circulation Research** 124(5), 2019: 779-798.

120. I. Petrikova, R. Bhattacharjee & P. Fraser, "*The 'Nigerian Diet' and Its Evolution: Review of the Existing Literature and Household Survey Data*", **Foods** 12(3), 2023: 443.

121. K. Mellendick, L. Shanahan, L. Wideman, S. Calkins, S. Keane & C. Lovelady, "*Diets Rich in Fruits and Vegetables Are Associated with Lower Cardiovascular Disease Risk in Adolescents*", **Nutrients** 10(2), 2018: 136.

122. F. Juul, G. Vaidean & N. Parekh, "*Ultra-Processed Foods and Cardiovascular Diseases: Potential Mechanisms of Action*", **Advances in Nutrition** 12(5), 2021.

123. A. Tindall, K. Petersen, A. Skulas-Ray, C. Richter, D. Proctor & P. Kris-Etherton, "*Replacing Saturated Fat with Walnuts or Vegetable Oils Improves Central Blood Pressure and Serum Lipids in Adults at Risk for Cardiovascular Disease: A Randomized Controlled-Feeding Trial*", **Journal of the American Heart Association** 8(9), 2019.

124. M. C. Mentella, F. Scaldaferri, C. Ricci, A. Gasbarrini & G. A. D. Miggiano, "*Cancer and Mediterranean Diet: A Review*", **Nutrients** 11(9), 2019: 2059.

125. F. Toorang, B. Sasanfar, A. Esmaillzadeh & K. Zendehdel, "*Adherence to the DASH Diet and Risk of Breast Cancer*", **Clinical Breast Cancer**, 2021.

126. V. DeClercq, J. Nearing & E. Sweeney, "*Plant-Based Diets and Cancer Risk: What Is the Evidence?*", **Current Nutrition Reports**, 2022.

127. M. Samtiya, R. Aluko, T. Dhewa & J. M. Moreno-Rojas, "*Potential Health Benefits of Plant Food-Derived Bioactive Components: An Overview*", **Foods** 10(4), 2021: 839.

128. A. Muscolo, O. Mariateresa, T. Giulio & R. Mariateresa, "*Oxidative Stress: The Role of Antioxidant Phytochemicals in the Prevention and Treatment of Diseases*", **International Journal of Molecular Sciences** 25(6), 2024: 3264-3264.

129. C. O. Johannesen, H. F. Dale, C. Jensen & G. A. Lied, "*Effects of Plant-Based Diets on Outcomes Related to Glucose Metabolism: A Systematic Review*", **Diabetes, Metabolic Syndrome and Obesity** 13, 2020: 2811-2822.

130. M. Charkviani, C. Thongprayoon, S. Tangpanithandee, P. Krisanapan, J. Miao, Michael A. Mao, & W. Cheungpasitporn, "*Effects of Mediterranean Diet, DASH Diet, and Plant-Based Diet on Outcomes among End Stage Kidney Disease Patients: A Systematic Review and Meta-Analysis*", **Clinics and Practice** 13(1), 2022: 41–51. https://doi.org/10.3390/clinpract13010004.

131. M. Charkviani, C. Thongprayoon, S. Tangpanithandee, P. Krisanapan, J. Miao, M. Mao, W. Cheungpasitporn, "*Effects of Mediterranean Diet, DASH Diet, and Plant-Based Diet on Outcomes among End Stage Kidney Disease Patients: A Systematic Review and Meta-Analysis*", **Clinics and Practice** 13(1), 2022: 41-51.

132. L. Dorn, C. Hostinar, E. Susman & P. Pervanidou, "*Conceptualizing Puberty as a Window of Opportunity for Impacting Health and Well-Being across the Life Span*", **Journal of Research on Adolescence** 29(1), 2019: 155-176.

133. S. Norris, E. Frongillo, M. Black, Y. Dong, C. Fall, M. Lampl & A. Liese, "*Nutrition in Adolescent Growth and Development*", **The Lancet** 399 (10320), 2021.

134. K. Thompson, M. Barth & M. Gutschall, "*Life Cycle Nutrition for Public Health Professionals*", **Springer Publishing Company**, 2024.

135. T. Xiong, Y. Wu, J. Hu, S. Xu, Y. Li, B. Kong & Z. Zhang, "*Associations between High Protein Intake, Linear Growth, and Stunting in Children and Adolescents: A Cross-Sectional Study*", **Nutrients** 15(22), 2023: 4821-4821.

136. Z. Lassi, A. Moin & Z. Bhutta, "*Nutrition in Middle Childhood and Adolescence," In Disease Control Priorities, Third Edition (Volume 8): Child and Adolescent Health and Development, edited by D. Bundy, N. de Silva, S. Horton, D. Jamison & G. Patton*, **Washington, DC: World Bank**, 2017: 133-146.

137. A. Singh & A. Nandy, Lifestyle Diseases in Adolescents: "*Addressing Physical, Emotional, and Behavioral Issues*", **Bentham Science Publishers**, 2024.

138. X. Zhang, "*Effects of Omega-3 Intake on Adolescent Health*", **Highlights in Science Engineering and Technology**, 19, 2022: 89-98.

139. J. More, "*Infant, Child and Adolescent Nutrition*", **CRC Press**, 2021. https://doi.org/10.1201/9781003093657

140. E. Combet & C. Buckton, "*Micronutrient Deficiencies, Vitamin Pills and Nutritional Supplements*", **Medicine** 47(3), 2019: 145-151.

141. E. Marzilli, L. Cerniglia & S. Cimino, "*A Narrative Review of Binge Eating Disorder in Adolescence: Prevalence, Impact, and Psychological Treatment Strategies*", **Adolescent Health, Medicine and Therapeutics**, 9, 2018: 17-30.

142. J. Carrasco-Luna, M. Gombert, Á. Carrasco-García & P. Codoñer-Franch, "*Adolescent Feeding: Nutritional Risk Factors*", **Journal of Child Science** 8(1), 2018: e99-e105.

143. K. Loth, M. J. Uy, M. Winkler, D. Neumark-Sztainer, J. O. Fisher & J. Berge, "*The Intergenerational Transmission of Family Meal Practices: A Mixed-Methods Study of Parents of Young Children*", **Public Health Nutrition** 22(7), 2019: 1269-1280.

144. S. Quelly, "*Helping with Meal Preparation and Children's Dietary Intake: A Literature Review*", **The Journal of School Nursing** 35(1), 2018: 51-60.

145. A. Chung, D. Vieira, T. Donley, N. Tan, G. Jean-Louis, K. Gouley & A. Seixas, "*Adolescent Peer Influence via Social Media on Eating Behaviors: A Scoping Review*," **Journal of Medical Internet Research** 23(6), 2021: e19697.

146. T. Ragelienė & A. Grønhøj, "*The Influence of Peers' and Siblings' on Children's and Adolescents' Healthy Eating Behavior. A Systematic Literature Review*", **Appetite** 148, 2020: 104592.

147. M. R. Islam, J. Trenholm, A. Rahman, J. Pervin, E. C. Ekström & S. M. Rahman, "*Sociocultural Influences on Dietary Practices and Physical Activity Behaviors of Rural Adolescents—a Qualitative Exploration*", **Nutrients** 11(12), 2019: 2916.

148. C. Zorbas, C. Palermo, A. Chung, I. Iguacel, A. Peeters, R. Bennett & K. Backholer, "*Factors Perceived to Influence Healthy Eating: A Systematic Review and Meta-Ethnographic Synthesis of the Literature*", **Nutrition Reviews** 76(12), 2018.

149. O. Placzek, "*Socio-economic and demographic aspects of food security and nutrition*", **OECD Food, Agriculture and Fisheries Papers**, 150, 2021.

150. M. Yang, H. Wang & F. Qiu, "*Neighbourhood Food Environments Revisited: When Food Deserts Meet Food Swamps*", **The Canadian Geographer / Le Géographe Canadien** 64(1), 2019.

151. S. A. Ghaffar, R. A. Talib & N. Karim, "*Food choices and diet quality in the school food environment: a qualitative insight from the perspective of adolescents*", **Malaysian Journal of Medicine and Health Sciences** 45, 2019: 15.

152. O. Amahmid, Y. El Guamri, Y. Rakibi, M. Yazidi, B. Razoki, K. K. Rassou, S. El Boukaoui, O. Izerg & D. Belghyti, "*Nutrition Education in School Curriculum: Impact on Adolescents' Attitudes and Dietary Behaviors*", **International Journal of Health Promotion and Education** 58(5), 2019: 242-258.

153. O. Sarmiento, M. A. Rubio, A. King, N. Serrano, A. A. Hino, R. Hunter & N. Aguilar-Farias, "*Built Environment in Programs to Promote Physical Activity among Latino Children and Youth Living in the United States and in Latin America*", **Obesity Reviews** 22, 2021.

154. É. Demers-Potvin, M. White, M. P. Kent, C. Nieto, C. White, X. Zheng, D. Hammond & L. Vanderlee, "*Adolescents' Media Usage and Self-Reported Exposure to Advertising across Six Countries: Implications for Less Healthy Food and Beverage Marketing*", **BMJ Open** 12(5), 2022: e058913.

155. S. Butler, "*The Development of Market-Driven Identities in Young People: A Socio-Ecological Evolutionary Approach*", **Frontiers in Psychology** 12, 2021: 1-19.

156. K. K. Rampalli, "*Food Choice Decision-Making Among School-Going Adolescents Amidst the Nutrition Transition in Urban Accra, Ghana*", **PhD diss., University of South Carolina**, 2021.

157. A. Kansra, S. Lakkunarajah & S. Jay, "*Childhood and Adolescent Obesity: A Review*", **Frontiers in Pediatrics** 8, 2021: 581461.

158. A. Drewnowski & P. Monsivais, "*Taste, cost, convenience, and food choices: Present Knowledge in Nutrition*", **Academic Press**, 2020: 185-200.

159. S. A. Siddiqui, O. Zannou, I. Karim, Kasmiati, N. Awad, J. Gołaszewski, V. Heinz & S. Smetana, "*Avoiding Food Neophobia and Increasing Consumer Acceptance of New Food Trends—a Decade of Research*", **Sustainability** 14(16), 2022: 10391.

160. I. Raaijmakers, H. Snoek, B. Maziya-Dixon & T. Achterbosch, "*Drivers of vegetable consumption in urban Nigeria: Food choice motives, knowledge, and self-efficacy*", **Towards Sustainable Global Food System**, 124, 2018: 258-273.

161. K. Hamilton & M. Hagger, "*Effects of Self-Efficacy on Healthy Eating Depends on Normative Support: A Prospective Study of Long-Haul Truck Drivers*", **International Journal of Behavioral Medicine** 25(2), 2017: 265-270.

162. A. Brytek-Matera, "*Negative Affect and Maladaptive Eating Behavior as a Regulation Strategy in Normal-Weight Individuals: A Narrative Review*", **Sustainability** 13(24), 2021: 13704.

163. K. T. Kombanda, C. Margerison, A. Booth & A. Worsley, "*Socio-Psychological Factors Associated with Young Australian Adults' Consumption of Energy Dense and Nutrient Poor (EDNP) Foods*", **Nutrients** 14(4), 2022: 812.

164. S. Ayaz-Alkaya & H. Kulakçı-Altıntaş, "*Nutrition-Exercise Behaviors, Health Literacy Level, and Related Factors in Adolescents in Turkey*", **Journal of School Health** 91(8), 2021: 625-631.

165. B. Koca & G. Arkan, "*The Relationship between Adolescents' Nutrition Literacy and Food Habits, and Affecting Factors*", **Public Health Nutrition** 24(4), 2021: 717-728.

166. M. Jongenelis, M. Scully, B. Morley & I. Pratt, "*Vegetable and Fruit Intake in Australian Adolescents: Trends over Time and Perceptions of Consumption*", **Appetite** 129, 2018: 49-54.

167. S. Mizia, A. Felińczak, D. Włodarek & M. Syrkiewicz-Świtała, "*Evaluation of Eating Habits and Their Impact on Health among Adolescents and Young Adults: A Cross-Sectional Study*", **International Journal of Environmental Research and Public Health** 18(8) 2021: 3996.

168. O. T. Adepoju & B. O. Abike, "*Nutrition Knowledge, Dietary Diversity and Nutritional Status of Adolescents in Three Selected Local Government Areas of Ibadan Municipality, Nigeria*", **Biomedical Journal of Scientific & Technical Research** 37(3), 2021: 29417-29426.

169. F.A. Olatona, P.I. Ogide, E.T. Abikoye, O.T. Ilesanmi & K.E. Nnoaham, "*Dietary Patterns, Nutritional Knowledge and Status of Adolescents in Lagos, Nigeria*", **Research Square**, 2020.

170. C. Nti, A. Brown & A. Danquah, "*Adolescents' Knowledge of Diet-Related Chronic Diseases and Dietary Practices in Ghana*", **Food and Nutrition Sciences** 3(11) 2012: 1527-1532.

171. O.F. Folasire, A.M. Folasire & S. Chikezie, "*Nutrition-Related Cancer Prevention Knowledge of Undergraduate Students at the University of Ibadan, Nigeria*", **South African Journal of Clinical Nutrition** 29(4), 2016: 165-171.

172. K. Chan, G. Prendergast, A. Grønhøj & T. Bech-Larsen, "*Adolescents' Perceptions of Healthy Eating and Communication about Healthy Eating*", **Health Education** 109(6) 2009: 474-490.

173. S. Ishak, S.I.Z. Sharif, Y.S. Chin, M.N.M. Taib & Z.M. Shariff, "*Malaysian Adoescents' Perceptions of Healthy Eating: A Qualitative Study*", **Public Health Nutrition** 23(8), 2020: 1440-1449.

174. R.A. Annan, N.A.F. Agyapong, C. Apprey & R. Aryeetey, "*Review of Ghana's Food Environment: Drivers of Availability, Barriers to Healthy Food Access, and Impact of Interventions and Policies*", **African Journal of Food, Agriculture, Nutrition and Development** 22(2), 2022: 19658-19701.

175. H.A. Abubakar, M.R. Shahril & S. Mat, "*Nutritional Status and Dietary Intake among Nigerian Adolescent: A Systematic Review*", **BMC Public Health** 24(1), 2024.

176. N. Vaida, "*Prevalence of Fast Food Intake among Urban Adolescent Students*", **The International Journal of Engineering and Science** 2(1), 2013: 353-359.

177. U. Trübswasser, E. Talsma, S. Ekubay, M. Poelman, M. Holdsworth, E. Feskens & K. Baye, "*Factors Influencing Adolescents' Dietary Behaviors in the School and Home Environment in Addis Ababa, Ethiopia*", **Frontiers in Public Health** 10, 2022.

178. I. Odunze, E. Ike, E. Adamu & A. Mohammed, "*Food Availability, Accessibilty and Nutritional Status of Low Income Households of Selected Federal Tertiary Institutions in Kaduna State, Nigeria*", **African Journal of Food Science and Technology** 7(1), 2016.

179. N.H. Yılmaztürk, "*A Phenomenological Study on Emotional Eating Experiences of Adolescents*", **PhD diss., Middle East Technical University**, 2024.

180. T. Osayomi, "*Being Fat Is Not a Disease but a Sign of Good Living': The Political Economy of Overweight and Obesity in Nigeria*", **Ghana Journal of Geography** 12(1), 2020: 99-114.

181. A. Daly, "*Exploring Factors Associated with the Eating Behaviors and Influences on Food Choice in Irish Teens*", **PhD diss., Technological University Dublin**, 2022.

182. S. Bel-Serrat, A. von der Schulenburg, M. Marques-Previ, A. Mullee & C. Murrin, "*What Are the Determinants of Vegetable Intake among Adolescents from Socioeconomically Disadvantaged Urban Areas? A Systematic Review of Qualitative Studies"*, **International Journal of Behavioral Nutrition and Physical Activity** 19(1), 2022.

183. R. Wirthlin, J. Linde, A. Trofholz, A. Tate, K. Loth & J. Berge, "*Associations between Parent and Child Physical Activity and Eating Behaviors in a Diverse Sample: An Ecological Momentary Assessment Study*", **Public Health Nutrition** 23(15), 2020: 2728-2736.

184. E. Orehek & R. Ferrer, "*Parent Instrumentality for Adolescent Eating and Activity*", **Annals of Behavioral Medicine** 53(7), 2018: 652-664.

185. A. Black, K. D'Onise, R. McDermott, H. Vally & K. O'Dea, "*How Effective Are Family-Based and Institutional Nutrition Interventions in Improving Children's Diet and Health? A Systematic Review*", **BMC Public Health** 17(1), 2017.

186. K. Alaimo, A. Beavers, E. Coringrato, K. Lacy, W. Ma, T. Hurley & J. Hébert, "*Community Gardening Increases Vegetable Intake and Seasonal Eating from Baseline to Harvest: Results from a Mixed Methods Randomized Controlled Trial*", **Current Developments in Nutrition** 7(5), 2023: 100077.

187. N.E. Okolo-Obasi & J.I. Uduji, "*The Impact of National Home Grown School Feeding Programme (NHGSFP) on Rural Communities in Nigeria*", **Journal of Economic and Administrative Sciences ahead-of-print,** 2022.

188. Y. Kulandaivelu, J. Hamilton, A. Banerjee, A. Gruzd, B. Patel & J. Stinson, "*Social Media Interventions for Nutrition Education among Adolescents: Scoping Review*", **JMIR Pediatrics and Parenting** 6(1), 2023: e36132.

189. A. Verdonschot, B. Follong, C. Collins, E. Vet, A. Haveman-Nies & T. Bucher, "*Effectiveness of School-Based Nutrition Intervention Components on Fruit and Vegetable Intake and Nutrition Knowledge in Children Aged 4–12 Years Old: An Umbrella Review*", **Nutrition Reviews** 81(3), 2022: 304-321.

190. A. Adeoya, A. Akinwusi & R. Nagatomi, "*Effectiveness of Nutrition Education in Enhancing Knowledge and Attitude of Pupils on Choice of School Mid-Day Meal in Ibadan, Nigeria*", **Food Science & Nutrition,** 2023.

191. S. Raut, D. KC, D. Singh, R. Dhungana, M. Singh & D. Sunuwar, "*Effect of Nutrition Education Intervention on Nutrition Knowledge, Attitude, and Diet Quality among School-Going Adolescents: A Quasi-Experimental Study*", **BMC Nutrition** 10(1), 2024.

192. S. Varman, D. Cliff, R. Jones, M. Hammersley, Z. Zhang, K. Charlton & B. Kelly, "*Experiential Learning Interventions and Healthy Eating Outcomes in Children: A Systematic Literature Review*", **International Journal of Environmental Research and Public Health** 18(20), 2021: 10824.

193. C. Barnes, S. McCrabb, F. Stacey, N. Nathan, S. Yoong, A. Grady & R. Sutherland, "*Improving Implementation of School-Based Healthy Eating and Physical Activity Policies, Practices, and Programs: A Systematic Review*", Translational Behavioral Medicine 11, 7 2021.

194. A. Tsochantaridou, T. Sergentanis, M. Grammatikopoulou, K. Merakou, T. Vassilakou & E. Kornarou, "*Food Advertisement and Dietary Choices in Adolescents: An Overview of Recent Studies*", **Children** 10(3), 2023: 442.

195. L. Devine, A. Gallagher, S. Briggs & A. Hill, "*Factors That Influence Food Choices in Secondary School Canteens: A Qualitative Study of Pupil and Staff Perspectives*", **Frontiers in Public Health** 11, 2023.

196. J. Morris, M. Briggs & S. Zidenberg-Cherr, "*School-Based Gardens Can Teach Kids Healthier Eating Habits*", **California Agriculture** 54(5), 2000: 40-46.

197. A. Cox, "*Nurturing Independence: Building Kitchen Skills and Support for Teens. By Andrea Cox, RND, LD*", **NWPF Nutrition | Katharine Jeffcoat, RDN, LD,** 2024.

198. Z. Ma & D. Hample, "*Modeling Parental Influence on Teenagers' Food Consumption: An Analysis Using the Family Life, Activity, Sun, Health, and Eating (FLASHE) Survey*", **Journal of Nutrition Education and Behavior** 50(10), 2018: 1005-1014.

199. G.A. Melo, P. Silva, J. Nakabayashi, M. Bandeira, N. Toral & R. Monteiro, "*Family Meal Frequency and Its Association with Food Consumption and Nutritional Status in Adolescents: A Systematic Review*", **PLOS ONE** 15(9), 2020: e0239274.

200. S. Woodruff & A. Kirby, "*The Associations among Family Meal Frequency, Food Preparation Frequency, Self-Efficacy for Cooking, and Food Preparation Techniques in Children and Adolescents*", **Journal of Nutrition Education and Behavior** 45(4), 2013: 296-303.

201. J. Berge, R. MacLehose, N. Larson, M. Laska & D. Neumark-Sztainer, "*Family Food Preparation and Its Effects on Adolescent Dietary Quality and Eating Patterns*", **Journal of Adolescent Health** 59(5), 2016: 530-536.

202. D. Ziso, O. Chun & M. Puglisi, "*Increasing Access to Healthy Foods through Improving Food Environment: A Review of Mixed Methods Intervention Studies with Residents of Low-Income Communities*", **Nutrients** 14(11), 2022: 2278.

203. S. Durao, M. Visser, V. Ramokolo, J. Oliveira, B.M. Schmidt, Y. Balakrishna, A. Brand, E. Kristjansson & A. Schoonees, "*Community-Level Interventions for Improving Access to Food in Low- and Middle-Income Countries*", **Cochrane Database of Systematic Reviews** 8, 2020.

204. S. Lucan, "*Local Food Sources to Promote Community Nutrition and Health: Storefront Businesses, Farmers' Markets, and a Case for Mobile Food Vending*", **Journal of the Academy of Nutrition and Dietetics**, 119(1), 2019: 39-44.

205. L. Haynes-Maslow, G. Hofing & A. Marks, "*Use of a Social Marketing Campaign to Promote Healthy Eating Behaviors among Low-Income Caregivers*", **Journal of Human Sciences and Extension,** 2020.

206. M. Chau, M. Burgermaster & L. Mamykina, "*The Use of Social Media in Nutrition Interventions for Adolescents and Young Adults-A Systematic Review*", **International Journal of Medical Informatics** 120, 2018: 77-91.

207. D. Mozaffarian, S. Angell, T. Lang & J. Rivera, "*Role of Government Policy in Nutrition—Barriers to and Opportunities for Healthier Eating*", **BMJ** 361(1), 2018: k2426.

208. R. Smith, B. Kelly, H. Yeatman & E. Boyland, "*Food Marketing Influences Children's Attitudes, Prefrences and Consumption: A Systematic Critical Review*", **Nutrients** 11(4), 2019: 875.

209. L. Taillie, E. Busey, F. Stoltze & F. Carpentier, "*Governmental Policies to Reduce Unhealthy Food Marketing to Children*", **Nutrition Reviews** 77(11), 2019: 787-816.

210. A. Alfraidi, N. Alafif & R. Alsukait, "*The Impact of Mandatory Food-Marketing Regulations on Purchase and Exposure: A Narrative Review*", **Children (Basel)** 10(8), 2023: 1277-1277.

211. UNICEF, "*KEY BARRIERS to FOOD MARKETING REGULATION Global Survey Results of 24 Countries Acknowledgement*s", **UNICEF**, 2023.

212. J. Caro, P. Valizadeh, A. Correa, A. Silva & S. Ng, "*Combined Fiscal Policies to Promote Healthier Diets: Effects on Purchases and Consumer Welfare*", **PLOS ONE** 15(1), 2020: e0226731.

213. R. An, "*Effectiveness of Subsidies in Promoting Healthy Food Purchases and Consumption: A Review of Field Experiments*", **Public Health Nutrition** 16(7), 2012: 1215-1228.

214. Y. Wu, S. Wang, M. Shi, X. Wang, H. Liu, S. Guo, L. Tan, X. Yang, X. Wu & L. Hao, "*Awareness of Nutrition and Health Knowledge and Its Influencing Factors among Wuhan Residents*", **Frontiers in Public Health** 10, 2022.

215. E. Pineda, M. Gressier, D. Li, T. Brown, S. Mounsey, J. Olney & F. Sassi, "*Review: Effectiveness and Policy Implications of Health Taxes on Foods High in Fat, Salt, and Sugar*", **Food Policy** 123, 2024: 102599-102599.

216. S. Ogungbesan, "*Stakeholders' Engagement as a Strategy toward Optimizing Voluntary Tax Compliance: A Case Study of the Nigerian Tax Administration*", **International Journal of Research and Innovation in Applied Science IX** 2024: 294-302.

217. K. Dickin, K. Litvin, J. McCann & F. Coleman, "*Exploring the Influence of Social Norms on Complementary Feeding: A Scoping Review of Observational, Intervention, and Effectiveness Studies*", **Current Developments in Nutrition** 5(2), 2021.

Chapter Three

Methodology

3.1 Research Design

The study employed cross-sectional design.

3.2 Research Population and Study Area

Research Population

The study sample consisted of adolescents aged 10 to 19 from Ogun State, southwest Nigeria, who attended public and private secondary schools in randomly selected LGAs in the state. In 2021, Ogun State, contained 756,428 secondary school students[1].

Understanding the knowledge and perception of this diverse adolescent population is critical for creating effective interventions against NCDs. Given that Ogun State Costed Nutrition Strategic Plan of Action (SPAN) prioritizes NCD prevention through improved nutrition, state-level evaluation is also important[2].

Study Area

Ogun State, the study region, is one of 36 states in Nigeria's south-western region and one of the country's fastest growing states. It comprises a total land area of 16,980.55 square kilometers. It is bounded in the north by Oyo and Osun State, east by Ondo State, south by Lagos, and west by the Republic of Benin and the Atlantic Ocean. Abeokuta, the state capital, is located around 100 kilometers north of Lagos, Nigeria's business hub. Its geographical location makes it conveniently accessible to other economically developed regions in Nigeria[3]. According to the 2006 national census, the state's population is 3,751,140, divided into 1,864,907 males and 1,886,233 females. The predicted population for 2022 is 6,267,473 at a growth rate of 3.3%[4].

The people of the state are from the Yoruba ethnic group of South-west Nigeria. The State's primary ethnic groups include Egbas, Yewas, Ijebus, and Remos. Ogun State contains twenty Local Government Areas (LGAs). It is separated into three geopolitical zones: Ogun Central, Ogun West, and Ogun East Senatorial District[3].

Ogun Central Senatorial District governs the Egbas and includes six LGAs: Abeokuta North, Abeokuta South, Odeda, Ewekoro, Ifo, and Obafemi Owode. The Ogun West Senatorial District governs the Yewas/Egbados and includes five LGAs: Imeko Afon, Ipokia, Yewa North, Yewa South, and Ado Odo/Ota. Ogun East district controls Ijebus and Remos and includes nine LGAs, including Remo North. Sagamu, Odogbolu, Ikenne, Ijebu-Ode, Ijebu East, Ijebu North, Ijebu North-east, and Ogun Waterside[3].

Ogun State was established in 1976 with 77 secondary schools, and the number of schools and educational institutions has steadily increased since then. The state placed a high value on education for its population, producing several educational icons such as Chief Obafemi Awolowo, Prof. Wole Soyinka, and Dr. Tai Solarin, to name a few[3]. Ogun state was chosen as an ideal study location since it is the heart of Nigeria's unique educational inventions.

3.3 Sample and Sampling Techniques

Sample Size

The goal is to interview 157 adolescents from each senatorial district, for a total sample size of 470 adolescents. The multi-stage stratified cluster sampling approach improved the data's representativeness and generalizability to the state's adolescent student population of interest.

Using Cochran's formula for sample size calculation[5]: $n = \frac{Z^2pq}{e^2}$

Confidence level = 95% (Z = 1.96)

Maximum variability (p = 0.575, q = 1- 0.575)

Margin of error (e) = 0.05 (±5%)

Prevalence of good knowledge on adequate nutrition[6] = 57.5%

Therefore; n= $\frac{1.96^2 \times 0.575 \times (1-0.575)}{0.05^2}$ n= 376

To account for potential non-response and incomplete data, the sample size was increased by 20%. Assuming an 80% response rate, the adjusted sample size would be:

n = 376 / 0.8 n = 470 adolescents.

Therefore minimum Target sample size is 470 adolescents enrolled in schools across Ogun State. However, the study recruited 480 participants (n=480), slightly exceeding the calculated minimum sample size of 470, to enhance statistical robustness and account for possible data attrition.

Sampling Techniques

In Ogun State's 20 local government areas (LGAs) spread over the 3 senatorial districts (Ogun Central, Ogun East, and Ogun West) this study gathered cross-sectional data using multi-stage stratified cluster sampling. The research population consisted of adolescents from the ages of 10 and 19 years who are currently enrolled in school (private and public school).

The steps and procedure for the multi-stage stratified cluster sampling are as follows,

Step 1 (Stratification):

- Assign each of the three senatorial districts (Ogun Central, Ogun East, and Ogun West) as separate strata
- From each senatorial district, choose at random two LGAs one in the urban and the other in the rural area.
- Randomly select two secondary schools one private and one public in each LGA.

Step 2 (Clustering):

- Randomly select two classes from each grade level (JSS 1-2 and SSS 1-2) in the selected secondary schools.

Step 3 (Proportionate Stratified Random Sampling):

- Administer copies of questionnaire to each selected school proportionate to the school's size relative to the total population of schools in the senatorial district.
- The total number of questionnaire for each senatorial district remains 160, but they were distributed across the selected schools based on their respective student populations.
- Larger schools received more copies of questionnaire, while smaller schools received fewer copies of questionnaire, ensuring that the sample is representative of the different school sizes within the senatorial district.

3.4 Description of Research Instruments

A structured questionnaire was designed to collect information from the study participants consisting of five (5) sections. The first two sections are related to demographic characteristics and anthropometry measurements. The information includes age, class, parents' educational qualification, parents' occupation, weight, and height of the respondents.

The third to fifth sections contains closed ended questions with questions assessing knowledge and statements assessing perceptions of respondents on the role of adequate diet in the prevention and management of NCDs.

3.5 Validity of the Research Instrument

The validity of the research data is determined by the correctness and logic of the information collected from the source. In this study, the survey questionnaire was developed based on recommendations from the Food and Agriculture Organisation (FAO) of the United Nations. The purpose of the questionnaire was to assess the knowledge and perceptions of in-school

adolescents regarding the importance of a healthy diet for the prevention and management of non-communicable diseases (NCDs) in Ogun State. The questionnaire consisted of closed-ended questions that evaluated various facets of the participants' perceptions and knowledge about healthy diets and NCDs. To ensure the validity of the instrument, a draft of the questionnaire was submitted to the research supervisor for approval. The supervisor provided insightful feedback, recommendations, and adjustments to improve the language appropriateness, clarity, and phrasing accuracy, thereby enhancing the face, content, and construct validity of the instrument. Furthermore, the themes and domains covered in the questionnaire were closely aligned with the study objectives. This ensured that the instrument adequately captured the key variables of interest, including the participants' knowledge and perceptions of the role of diet in the prevention and management of NCDs. The supervisor's review and the alignment with the study objectives collectively strengthened the overall validity of the research instrument.

3.6 Reliability of the Research Instrument

Reliability is the ability of a measure to produce consistent results across time. A male and a female research assistant were hired and trained to guarantee data consistency and quality throughout the investigation. The study's objectives, sampling techniques, informed consent guidelines, and management of refusals, confidentiality preservation, and guaranteeing questionnaire completeness were all covered in the training session. To establish the reliability of the research instrument, a pilot test was conducted with 10 respondents who were not part of the main study. The questionnaire was tested using Cronbach's alpha coefficient, which yielded a reliability value of 0.82, indicating good internal consistency of the instrument. Every day during the time of data collection, completed questionnaires were examined for accuracy and consistency. To preserve the accuracy of the information gathered, any inconsistencies or

problems were quickly fixed. This meticulous method of gathering data and ensuring quality control contributed to guaranteeing the general dependability of the research tool and the data produced**.**

3.7 Data Collection

Data was collected from respondents through the administration of structured questionnaire. The questionnaire serves as the primary data collection instrument, capturing the following information from respondents:

- Socio-demographic characteristics (age, gender, income, educational level)
- Anthropometry measurements (weight, and height)
- Nutrition knowledge and perception assessment across three key domains:
    - Knowledge of NCDs (What are NCDs?, Types of NCDs, risk factors and prevention of NCDs)
    - Knowledge of components of a healthy, balanced diet and knowledge of nutrition-related strategies for NCD prevention.
    - Perception of respondents on the role of adequate diet in the prevention and management of NCDs.

3.8 Data Analysis

The data collected through the structured questionnaire was sorted, cleaned, coded, and analyzed using the Statistical Package for Social Sciences (SPSS version 25.0). The findings were presented using appropriate tables, charts, and graphs.

The following data analysis techniques was employed to address each of the specific objectives:

i. To assess the level of knowledge of in-school adolescents on the role of adequate diet in the prevention and management of NCDs:

- Nutrition knowledge scores on NCDs were analyzed using descriptive statistics, including frequencies, percentages based on a 23-item knowledge assessment scale where scores ≥70% indicated adequate knowledge.
- Nutrition knowledge scores on the role of adequate diet in NCDs prevention and management were analyzed using descriptive statistics, including frequencies, percentages based on a 7-item knowledge assessment scale where scores ≥70% indicated adequate knowledge.

ii. To assess in-school adolescents' perception of adequate nutrition in the prevention and management of NCDs:

- Responses to the Likert-scale statements on diet-related perceptions was analyzed using descriptive statistics (frequencies and percentages) to gauge overall perceptions.
- Perception scores were measured based on a 10-item scale where scores ≥70% indicated adequate knowledge.
- Correlation analysis was used to assess relationship between the perceptions and demographic variables such as age, gender, and residential area (rural vs urban).

iii. To assess the anthropometric status of in-school adolescents based on their BMI

- BMI values was calculated from the collected height and weight measurements.
- Descriptive statistics (frequencies, percentages) was used to categorize respondents as underweight, normal weight, overweight, or obese based on standard BMI-for-age cutoffs.

iv. To identify knowledge gaps related to nutrition and NCD prevention among in-school adolescents:

- Item-level analysis of the nutrition knowledge assessment questions was conducted to identify specific areas where knowledge gaps exist.

3.9 Ethical Approval

This study meets the definition of the human research subject. Studies involving human subjects are associated with ethical challenges due to the sensitive nature of the data that are collected from respondents. It is a priority for researchers to protect study respondents from harm and exploitation. Before the start of data collection, approval was obtained from the Lead City University Institutional Review Board and the State Ministry of Education, Science and Technology with permissions also obtained from appropriate schools' authorities.

Endnotes

1. A. Gbadebo, O. Sholeye & F. Gbadebo, "*Sugar Sweetened Beverage Consumption and Its Associated Factors among Adolescents in Rural and Urban Areas of Ogun State, Nigeria*", **Research Square**, 2023.

2. Ogun state, "*Strategic Plan of Action for Nutrition 2021 – 2025*", **Ogun State Ministry of Health, Nigeria**, 2021.

3. Ogun State Government, "*About Ogun State*", **Ogunstate.gov.ng**, 2024.

4. Nigeria Population Commission, ICF International, "*Nigeria Demographic and Health Survey 2018*", **Ngfrepository.org.*ng***, 2018.

5. J. Charan & T. Biswas, "*How to Calculate Sample Size for Different Study Designs in Medical Research?*", **Indian Journal of Psychological *Medicine*** 35(2), 2013: 121.

6. G. Oladosu, O. Onabanjo, S. Amoda, B. Olajide & E. John, "*Nutritional status and Micronutrients Adequacy of food consumed by Adolescents in School in Abeokuta, Ogun state*", **Nigerian Journal of Nutritional Sciences** 43, 2022: 227-238.

Chapter Four

Results and Discussion of Findings

4.1 Results

4.1.1 Socio-Demographic Characteristics of Respondents

The four hundred and eighty (480) respondents' vital demographic data are included in Table 4.1. Most (63.1%, n=303) respondents were in mid-adolescence, which falls within the 14–16 year age group. The next biggest group, which represented early adolescence, was 10–13 years old (24.6%, n=118). The group of late adolescents, aged 17–19 (12.3%, n=59), constituted the smallest share. The gender distribution was almost equal, with a slight predominance of females shown by 50.6% (n=243) and males made up 49.4% (n=237).

The respondents in SSS1 constituted 26.5% (n=127), JSS1 students constituted 25.4% (n=122), JSS2 students constituted 22.1% (n=106), and SSS2 students constituted 26.0% (n=125). Insights from early to mid-adolescence are provided by this balanced representation across class levels, which captures possible variations in knowledge and views as students go through secondary education. It makes it possible to examine the potential long-term effects of nutrition education in the educational system on students' comprehension of food and NCDs.

The distribution of public and private secondary schools is reflected in the percentage 62.3% and 37.7% respectively. This distribution is useful for the study because it makes it possible to compare adolescents from private and public schools, which might highlight variations in students' understanding of nutrition or in the kind of foods they eat depending on their school. These kinds of comparisons might shed light on any discrepancies in availability to healthy food alternatives or nutrition information, as well as the efficacy of nutrition education programs in various school contexts. In terms of religion, the majority (59.6%, n = 286) of respondents were

Christians, Islam, 32.7% n = 157, and traditional religion, 7.7%; n = 37 which is in line with the religious demography of southwest Nigeria.

Majority of respondents are from urban region with 54.0% (n = 259), while those from rural region made up 46.0% (n = 221). This distribution enables comparisons across adolescents in rural and urban areas, which may highlight disparities in dietary customs, food surroundings, or access to nutrition information, and may help design tailored interventions for various contexts. 82.1% (n=394) of the respondents lived with their parents and 17.9%, n=86 lived with guardians. The educational background of respondents' fathers and mothers is also shown in Tables 4.1. Mothers' educational attainment was 16.0% (n =77) for elementary school, 38.5% (n =185) for secondary school, and 45.4% (n =218) for tertiary education. Fathers had slightly higher educational levels: 63.1% (n=303) had a tertiary education, 25.2% (n=121) had a secondary school education, and 11.7% (n=56) had a primary school education. These numbers show that parental education levels are often high, especially for men. Due to their greater access to health services and information, the adolescent respondents' understanding of nutrition and eating habits may be impacted.

The professions of the fathers or male guardians of the respondents shows that the majority (41.0%, n=197) were employed, self-employed people (39.0%, n = 187) coming in second. 12.3% (n=59) artisans, while 7.1% (n=34) were unemployed and 0.6% (n=3) were retired.

Table 4.1: Socio-Demographic Characteristics of Respondents

N= 480

SN	Demographics		Frequency (%)	Mean(±SE)	SD
1	Age	10-13years	118(24.6)	1.88±0.027	0.595
		14-16years	303(63.1)		
		17-19years	59(12.3)		
2	Gender	Female	243(50.6)	1.49±0.023	0.500
		Male	237(49.4)		
3	Class	JSS1	122(25.4)	2.53±.052	1.132
		JSS2	106(22.1)		
		SSS1	127(26.5)		
		SSS2	125(26.0)		
4	School	Private	181(37.7)	1.49±0.023	0.500
		Public	299(62.3)		
5	Religion	Christianity	286(59.6)	1.48±0.029	0.636
		Islam	157(32.7)		
		Traditional	37(7.7)		
6	Residence	Urban	259(54)	1.46±0.023	0.499
		Rural	221(46)		
7	Who are you currently living with	Parents	394(82.1)	2.63±0.035	0.770
		Guardian	86(17.9)		
8	Mother's education status	primary	77(16)	2.29±0.033	0.728
		Secondary	185(38.5)		
		Tertiary	218(45.4)		
9	Father's education status	primary	56(11.7)	2.51±0.032	0.696
		Secondary	121(25.2)		
		Tertiary	303(63.1)		
10	Occupationof Father/Guardian	Artisans	59(12.3)	3.13±0.072	1.567
		Employed	197(41)		
		Unemployed	34(7.1)		
		Retired	3(0.6)		
		Self Employed	187(39)		

4.1.2 Anthropometric Status of Respondents

Based on their BMI, respondents' anthropometric status is shown in Table 4.2. The majority of respondents (60.8%, n=292) fit into the normal weight group. Nonetheless, a noteworthy percentage (23.3%, n=112) were categorised as underweight. Conversely, 2.1% (n=10) and 13.8% (n=66) of the population were obese and overweight respectively. These numbers demonstrate the dual burden of malnutrition that adolescents faces. The sample's mix of underweight and overweight/obese people illustrates the nutrition shift that is taking place in many emerging nations, including Nigeria. Notable is the very high frequency of underweight adolescents (23.3%), which may be a sign of persistent issues with food security or adequate nutrition. The combined prevalence of obesity and overweight (15.9%) is noteworthy and consistent with global patterns of rising adolescent obesity rates. The significance of tackling both extremes of the malnutrition continuum in public health programs aimed at this age group is highlighted by this study.

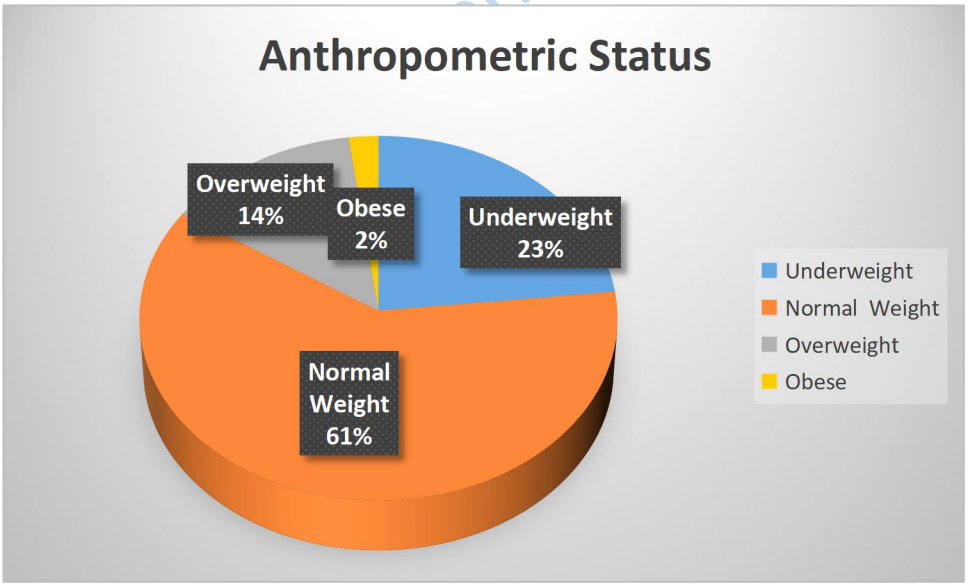

Figure 4.1 Anthropometric Status of Respondents

Table 4.2: Anthropometric Status of Respondents

Weight Status	Frequency	Percent (%)
Underweight	112	23.3
Normal Weight	292	60.8
Overweight	66	13.8
Obese	10	2.1
Total	480	100

4.1.3 Respondents Knowledge of NCDs

A thorough evaluation of respondents' knowledge of NCDs is shown in Table 4.3. Knowledge scores were categorized based on a 23-item assessment scale where scores ≥70% indicated good knowledge, scores 50%-70% indicated fair knowledge, and scores <50% indicated poor knowledge. As shown in Figure 4.2, 302(63%) respondents demonstrated good knowledge of NCDs while 129(27.4%) respondents showed fair knowledge, and 46(9.6%) showed poor knowledge. The findings show that the adolescent respondents had a combination of true information and false beliefs. Regarding the statement, "NCDs are caused by supernatural power," 43.1% of respondents (n = 207) agreed, 48.3% of respondents (n = 232) disagreed, and 8.5% of respondents (n = 41) had no idea. However, respondents' comprehension of other broad NCD ideas was superior. The majority (89.4%, n=429) expressed a valid disagreement with the statement "NCDs only occur at old age," This suggests a solid general grasp of the idea that NCDs may impact individuals of different ages, which is crucial for encouraging adolescents to engage in preventive behaviours. Additionally, respondents showed a strong understanding of the importance of NCDs to public health. Regarding the statement "NCDs are a public health problem," the majority (79.4%, n=381) properly agreed. Similarly, majority of respondents (82.1%, n=394) correctly agreed that "NCDs cause premature death." These findings demonstrate that most respondents are aware of the seriousness of NCDs, which is essential for motivating preventive actions. Knowledge of particular NCD types was strong with high rates of accurate identification for the main NCDs—hypertension (76.9%, n=369), diabetes (82.9%, n=398), cancer (81.9%, n=393), and stroke (76.3%, n=366). On the other hand, there was some misunderstanding about other disorders; 21% (n=101) wrongly classified accidents as NCDs, and 29% (n=139) wrongly classified blindness as one. These findings imply that although

respondents understand the main NCDs well, further education is necessary to fully understand the meaning and range of non-communicable illnesses.

In terms of NCD risk factors, 82.3% and 75.8% (n=364) of respondents correctly recognised smoking and alcohol intake as risk factors respectively. The recognition of dietary components was equally high; 69.8% (n=335) properly identified the consumption of junk food, and 72.7% (n=349) correctly identified the use of excess salt as risk factors. 68.3% (n=328) of them correctly identified stress as a risk factor and 70% (n=336) of them identified a lack of physical activity as a risk factor. These findings show that most people are generally aware of the primary risk factors for NCDs. Still, there is much to learn about the functions of stress, exercise, and nutrition.

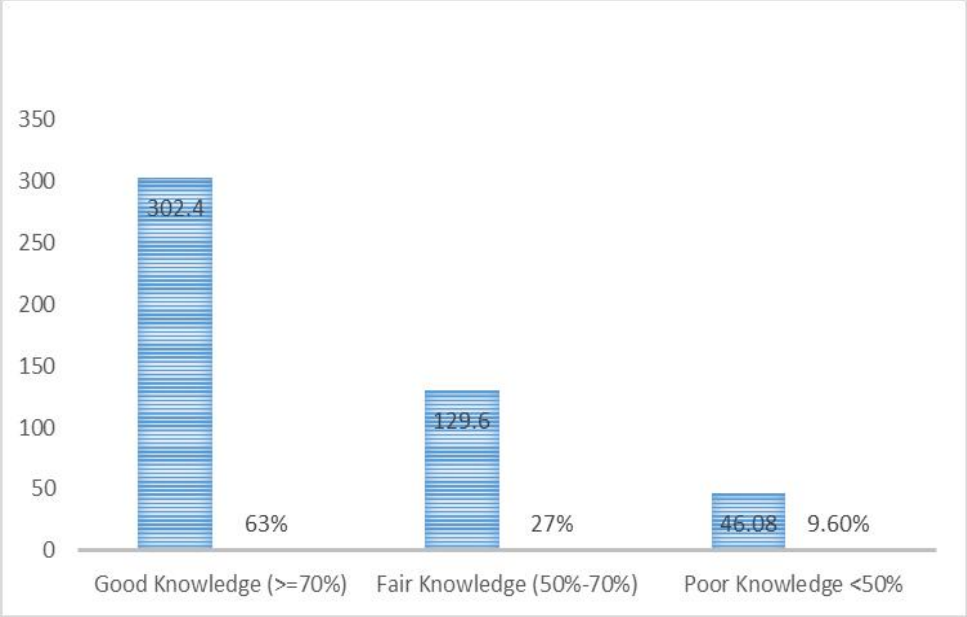

Figure 4.2: Respondents Knowledge of NCDs

Table 4.3: Respondents Knowledge of Non-Communicable Diseases

S/N	QUESTIONS	YES	NO	I DON'T KNOW
	What are NCDs?			
1.	NCDs are caused by supernatural power	207(43.1)	232(48.3)	41(8.5)
2.	NCDs occur only at old age	49(10.2)	429(89.4)	2(0.4)
3.	NCDs are a public health problem	381(79.4)	85(17.7)	14(2.9)
4.	NCDs cause premature death	394(82.1)	85(17.7)	1(0.2)
	Types of NCDs			
5.	Is hypertension a type of non-communicable disease	369(76.9)	107(22.3)	4(0.8)
6.	Is diabetes a type of non-communicable disease	398(82.9)	73(15.2)	9(1.9)
7.	Is cancer a type of non-communicable disease	393(81.9)	84(17.5)	3(0.6)
8.	Is accident a type of non-communicable disease	101(21)	376(78.3)	3(0.6)
9.	Is blindness a type of non-communicable disease	139(29)	336(70)	5(1)
10.	Is stroke a type of non-communicable disease	366(76.3)	114(23.8)	0
	Risk factors of NCDs			
11.	Smoking can cause non-communicable diseases	395(82.3)	80(16.7)	5(1)
12.	Drinking alcohol can cause non-communicable diseases	364(75.8)	115(24)	1(0.2)
13.	Consuming junk food can cause NCDs	335(69.8)	136(28.3)	9(1.9)
14.	Consuming excess salt can cause NCDs	349(72.7)	120(25)	11(2.3)
15.	Lack of physical exercise can cause NCDs	328(68.3)	134(27.9)	18(3.8)
16.	Stress can cause non-communicable diseases	336(70)	127(26.5)	17(3.5)
17.	Being anxious can cause non-communicable diseases	136(28.3)	318(66.3)	26(5.4)
18.	Do you think smoking around others could harm their health?	457(95.2)	22(4.6)	1(0.2)
	Prevention method of NCDs			
19.	Avoiding alcohol can prevent someone from developing non-communicable diseases	380(79.2)	91(19)	9(1.9)
20.	Doing physical exercise prevent someone from developing non-communicable diseases	379(79)	96(20)	5(1)
21.	Avoiding excess salt can prevent someone from developing non-communicable diseases	354(73.8)	111(23.1)	15(3.1)
22.	Losing weight can prevent someone from developing non-communicable diseases	323(67.3)	140(29.2)	17(3.5)
23.	Eating healthy diet can prevent someone from developing non-communicable diseases	412(85.8)	54(11.3)	14(2.9)

4.1.4 Knowledge of Respondents on the Role of Adequate Diet in NCDs Prevention and Management

Table 4.4 explores respondents' knowledge of the connection between nutrition and NCDs. Knowledge scores were categorized based on a 7-item assessment scale where scores ≥70% indicated good knowledge, scores 50%-70% indicated fair knowledge, and scores <50% indicated poor knowledge. As shown in Figure 4.3, 273.6(57%) respondents demonstrated good knowledge of the role of diet in NCD prevention and management while 52.8(11%) respondents showed fair knowledge, and 153.6(32%) showed poor knowledge. Regarding the statement, "It is true that what I eat increases my risk of getting sick when I get older," 64.6% of respondents (n = 310) said they agreed, 29.8% said they disagreed, and 5.6% said they weren't sure. Moreover, with 83.5% (n=401) of respondents agreeing that "Eating lots of fruits and vegetables can lower the risk of developing certain NCDs," respondents demonstrated a solid grasp of the preventive benefits of fruits and vegetables. Moreover, there was broad recognition of the role that processed and sugary foods play in the risk of NCDs; 75.2% of respondents (n=361) agreed that "Reducing the intake of processed foods and sugary beverages can contribute to the prevention of NCDs.".

Good knowledge of the relationship between salt and the risk of NCDs was shown by the respondents, as seen by the 73.5% (n=353) who correctly disagreed with the statement "Eating too much salt has no effect on the risk of developing NCDs." With 76.7% (n=368) accurately disagreeing with the statement "Being fat will not make me develop non communicable disease," it was evident that there was a clear correlation between obesity and NCDs. There was only a limited understanding of the relationship between alcohol and the risk of NCDs, as evidenced by the 61.3% (n=294) respondents who correctly disagreed with the statement "Alcohol

consumption doesn't matter in preventing NCDs." There is a moderate grasp of alcohol's role in NCD risk. However, given that almost a third of respondents (31.7%, n=152) agreed with this erroneous statement, there is a need for greater education on this issue.

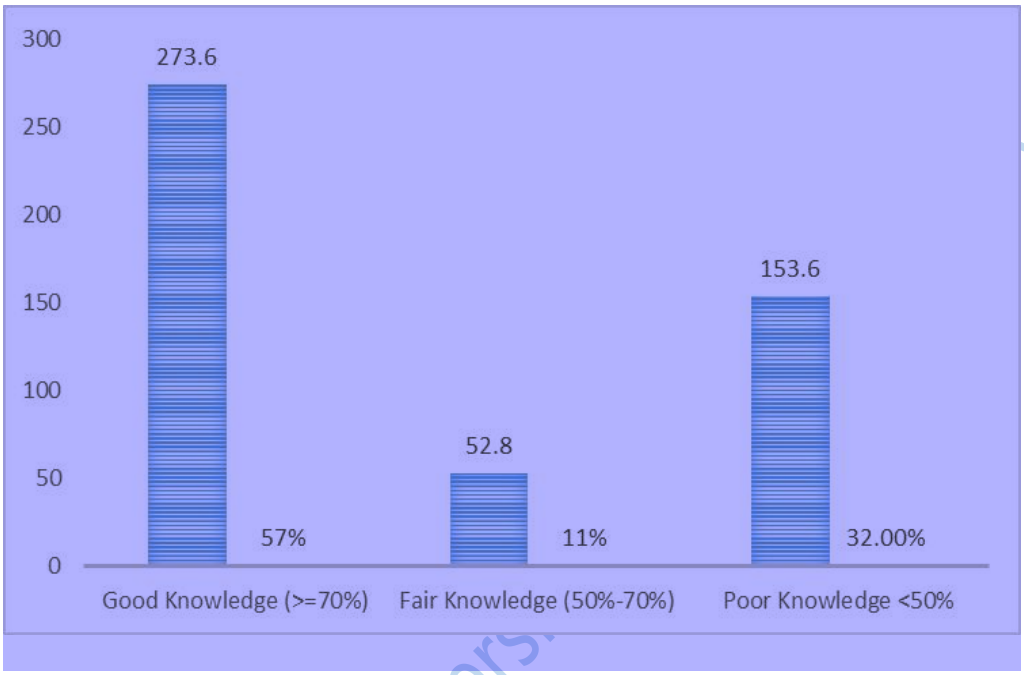

Figure 4.3: Knowledge of the role of adequate diet in NCDs prevention and management

Table 4.4: Respondents Knowledge on the Role of Diet in Non-Communicable Diseases Prevention and Management

S/N	QUESTIONS	YES	NO	I DON'T KNOW
1	It is true that what I eat increase my risk of getting sick when I gets older	310(64.6)	143(29.8)	27(5.6)
2	Eating lots of fruits and vegetables can lower the risk of developing certain non-communicable diseases	401(83.5)	79(16.5)	0
3	Reducing the intake of processed foods and sugary beverages can contribute to the prevention of NCDs	361(75.2)	119(24.8)	0
4	Maintaining a balanced diet can help prevent non-communicable diseases	398(82.9)	66(13.8)	16(3.3)
5	Eating too much salt have no effect on the risk of developing non communicable diseases	112(23.3)	(353(73.5)	15(3.1)
6	Being fat will not make me develop non communicable disease	80(16.7)	368(76.7)	32(6.7)
7	Alcohol consumption doesn't matter in preventing non-communicable diseases	294(61.3)	152(31.7)	34(7.1)

4.1.5 Perception of Respondents on the Role of Diet in NCDs Prevention and Management

The results provide insights into how respondents' knowledge translates into personal attitudes and perceived self-efficacy regarding the role of diet in non-communicable disease (NCD) prevention and management. Table 4.5 examines respondents' perceptions on various aspects related to diet and NCDs. Additionally, correlation analyses presented in Tables 4.6, 4.7, and 4.8 assess the relationships between these perceptions and demographic variables. The correlation analysis revealed weak but significant associations between demographic characteristics and perceptions. Age showed a minimal positive correlation ($r = 0.045$, $p = 0.004$), suggesting slightly more positive perceptions among older respondents. Similar weak positive correlations were found for gender ($r = 0.016$, $p = 0.029$) and residential location ($r = 0.025$, $p = 0.003$). Overall, 173 (36%) respondents had a positive perception of the role of adequate diet in the prevention and management of NCDs, while 307 (64%) respondents had a negative perception (Figure 4.4). This indicates that a substantial proportion of the sample did not fully appreciate the importance of diet in addressing the burden of NCDs. A closer examination of the individual statements reveals several important insights. The majority of respondents (73.5%, n=353) accurately disagreed that "Eating processed foods and snacks frequently is harmless for my health," suggesting good awareness of the potential hazards associated with these dietary choices. However, a significant proportion (24.2%, n=116) still agreed with this statement. Respondents widely acknowledged the significance of exercise and weight control in preventing chronic diseases, with 75.8% (n=364) agreeing that "Maintaining a healthy weight through diet and exercise prevents chronic diseases." This knowledge could serve as a foundation for promoting healthy lifestyles among adolescents. In the context of the relationship between lifestyle choices

and NCDs, 64.4% (n=309) of respondents correctly disagreed that "NCDs are not caused by lifestyle choices." This suggests a good understanding of the role of modifiable risk factors in the development of NCDs. Regarding self-efficacy in making healthy dietary choices, 33.1% (n=158.8) of respondents agreed that "I have the knowledge and resources to make dietary choices for preventing NCDs." However, a high proportion (63.1%, n=302.88) disagreed, indicating a need for practical nutrition education and skill-building interventions. Regarding perceived barriers to maintaining a balanced diet, 65% (n=312) agreed that "Consuming a balanced diet is inconvenient and expensive," while 31% (n=147) disagreed. Respondents demonstrated fair knowledge about the importance of reducing salt intake for NCD prevention, with 51% (n=245) correctly disagreeing that "Reducing salt intake is not necessary for prevention of NCDs." When asked about the relative importance of diet and physical activity in NCD prevention, 80.2% (n=385) wrongly agreed that "physical activity is more important than diet in preventing NCDs,". Furthermore, a large majority (72.1%, n=346) agreed that "Traditional cultural foods in my region are generally healthy and protective against chronic diseases.". Lastly, 63.8% of respondents (n=306) agreed with the statement "I am motivated to improve my dietary habits to reduce my risk of developing NCDs in the future." This suggests a high level of readiness and willingness among the respondents to adopt healthier dietary behaviours.

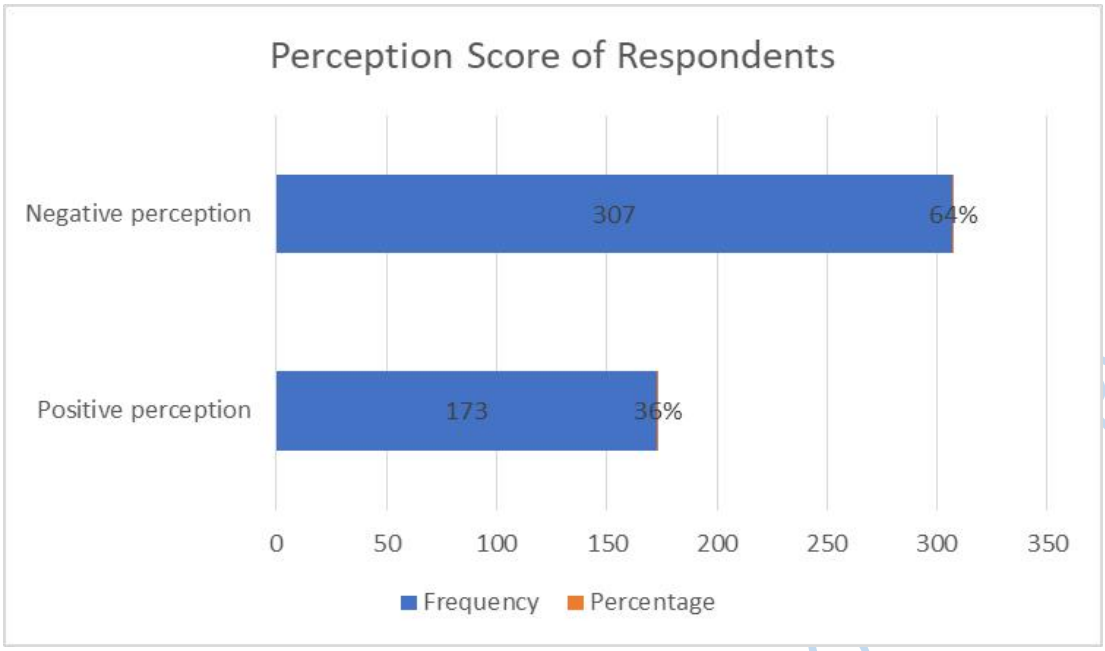

Figure 4.4: Perception of Respondents on the Role of Diet in the Prevention and Management of NCDs.

Table 4.5: Respondents perception on the role of diet in NCDs prevention and management

S/N	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	I believe that my current dietary habits can impact my risk of developing NCDs later in life.	85(17.7)	219(45.6)	38(7.9)	23(4.8)	115(24)
2	Eating processed foods and snacks frequently is harmless for my health.	93(19.4)	23(4.8)	11(2.3)	222(46.3)	131(27.3)
3	Maintaining a healthy weight through diet and exercise prevents chronic diseases.	158(32.9)	206(42.9)	19(4)	39(8.1)	58(12.1)
4	Non-communicable diseases are not caused by lifestyle choices.	130(27.1)	23(4.8)	18(3.8)	219(45.6)	90(18.8)
5	I have the knowledge and resources to make dietary choices for preventing non-communicable diseases	27(5.6)	132(27.5)	18(3.8)	114(23.8)	189(39.3)
6	Consuming a balanced diet is inconvenient and expensive.	123(25.6)	189(39.4)	21(4.4)	53(11)	94(19.6)
7	Reducing salt intake is not necessary for prevention of NCDS	86(17.9)	125(26)	24(5)	231(48.1)	14(2.9)
8	Physical activity is more important than diet in preventing NCDs.	152(31.7)	233(48.5)	12(2.5)	16(3.3)	61(12.7)
9	Traditional cultural foods in my region are generally healthy and protective against chronic diseases.	94(19.6)	252(52.5)	18(3.8)	16(3.3)	100(20.8)
10	I am motivated to improve my dietary habits to reduce my risk of developing non-communicable diseases in the future.	132(27.5)	174(36.3)	7(1.5)	75(15.6)	92(19.2)

Table 4.6: Relationship Between Age Of Correspondent And The Perception Of Respondents On The Role Of Diet In The Prevention And Management Of NCD

Correlations

		age	Perception of Respondents on the Role Of Diet In The Prevention And Management Of NCD
age	Pearson Correlation	1	.045
	Sig. (2-tailed)		.004
	N	480	480
Perception of Respondents on the Role Of Diet In The Prevention And Management Of NCD	Pearson Correlation	.045	1
	Sig. (2-tailed)	.004	
	N	480	480

Table 4.7: Relationship between Gender of Correspondent and the Perception of Respondents on the Role of Diet in the Prevention and Management of NCDs

		Perception of Respondents on the Role Of Diet In The Prevention And Management Of NCD	Gender
Perception of Respondents on the Role Of Diet In The Prevention And Management Of NCD	Pearson Correlation	1	.016
	Sig. (2-tailed)		.029
	N	480	480
Gender	Pearson Correlation	.016	1
	Sig. (2-tailed)	.029	
	N	480	480

Table 4.8: Relationship between Residence and the Perception of Respondents on the Role of Diet in the Prevention and Management of NCDs

		Perception of Respondents on the Role Of Diet In The Prevention And Management Of NCD	Residence
Perception of Respondents on the Role of Diet In The Prevention And Management Of NCD	Pearson Correlation	1	.025
	Sig. (2-tailed)		.003
	N	480	480
residence	Pearson Correlation	.025	1
	Sig. (2-tailed)	.003	
	N	480	480

4.2 Discussion of Findings

This study revealed a notable understanding of non-communicable diseases (NCDs) and their dietary relationships among respondents. The findings align with previous research among undergraduates where 73.1% of respondents demonstrated good knowledge of NCDs[1]. The recognition of major NCDs corresponds with research conducted in Kenya where recognition among adolescents ranged from 74.2% to 81.8%[2].

Notable knowledge gaps emerged in specific areas. Mental health literacy was particularly low, with just over a quarter of respondents identifying anxiety as an NCD risk factor. This finding is consistent with global trends of poor mental health literacy among adolescents and highlights a critical area for educational intervention[3]. A significant finding was the persistence of traditional beliefs, with nearly half of respondents attributing NCDs to supernatural causes. This belief system, documented in various African contexts, presents a potential barrier to evidence-based prevention strategies and highlights the need for culturally competent health education approaches that bridge traditional and biomedical understanding[4,5]. Regarding dietary knowledge, the majority of respondents acknowledged the protective role of fruit and vegetable consumption against NCDs. This level of knowledge is slightly lower than a study on the nutritional and health values of fruits and vegetables among adolescents in Lagos State where 84.99% of respondents displayed good knowledge, potentially indicating successful local health promotion efforts[6]. The strong recognition of balanced diet's role in NCD prevention exceeded rates reported in other low- and middle-income countries, such as India's 61.2%[7]. Moreover, the study found that 75.2% of respondents recognized the importance of reducing processed food and sugary beverage consumption for NCD prevention. This knowledge is particularly relevant given

Nigeria's ongoing nutrition transition, characterized by increasing consumption of energy-dense, nutrient-poor foods[8].

The study revealed weak but significant correlations between demographic characteristics and perceptions of diet's role in NCD prevention. Age, gender, and residential location showed minimal positive correlations, suggesting that demographic factors had negligible practical influence on perceptions. A notable finding was the high level of motivation among respondents, with nearly two-thirds expressing willingness to improve their dietary habits to reduce future NCD risks. However, this motivation is partially offset by perceived barriers, as most respondents considered consuming a balanced diet to be inconvenient and expensive. This perception aligns with findings from similar studies in developing countries where cost and accessibility often emerge as significant barriers to healthy eating[9]. The study revealed an interesting cultural dimension, with nearly three-quarters of respondents believing that traditional cultural foods are generally healthy and protective against chronic diseases. While this perception could encourage consumption of nutritious traditional foods, it may also lead to overreliance on traditional dietary practices without critical evaluation of their nutritional value in relation to NCD prevention.

The anthropometric findings reveal a complex nutritional landscape among in-school adolescents in Ogun State, Nigeria. The concerning dual burden of malnutrition observed aligns with findings from similar studies in other parts of Nigeria. For instance, a study in Osun State reported 20.1% underweight prevalence among secondary school adolescents, and 21.3% in a similar study in Ogun State[10],[11]. The combined overweight and obesity prevalence findings are comparable to results from more urbanized Nigerian settings[12],[13]. Furthermore, a recent school-based study in Ikenne Local Government Area of Ogun State corroborates these findings,

reporting a 12.7% prevalence of overweight and obesity among in-school adolescents[14]. An important public health concern is the coexistence of both underweight and overweight/obesity in the same population, which exemplifies the "double burden of malnutrition" that characterizes many LMICs undergoing nutrition transition. This pattern may be attributed to various factors including urbanization, changing dietary patterns, and socioeconomic disparities within the population[15]. The simultaneous presence of under- and over-nutrition emphasizes the complexity of managing NCDs and their risk factors, highlighting the necessity for nuanced, context-specific interventions that can address both overnutrition and food insecurity concurrently. These interventions must focus on improving overall diet quality rather than merely modifying caloric intake.

Endnotes

1. L. Akinyemi, R. Odebode & K. Okafor, "*Knowledge and Exposure to Non-Communicable Disease Risk Factors amongst Undergraduates in the University of Lagos*." **Nigerian Journal of Health Sciences** 22 (1), 2022. https://doi.org/10.4103/njhs.njhs_3_22.

2. S.J Kiplagat, T. Steyl, L.J Wachira, & Joliana Phillips. "*Knowledge of Non-Communicable Diseases among Adolescents in Uasin Gishu County, Kenya*." **African Health Sciences** 23(2), 2023: 589–96. https://doi.org/10.4314/ahs.v23i2.68.

3. K. Stan, Y. Wei, & C. Coniglio. "*Mental Health Literacy: Past, Present, and Future*." **The Canadian Journal of Psychiatry** 61(3), 2016: 154–58.

4. L. Elsabeth, T. Nigussie, D. Girma, L.A Geleta, H. Dejene, B.S Deriba, & T.A Geleta. "*Level of Adequate Knowledge of Non-Communicable Diseases and Associated Factors among Adult Residents of North Shewa Zone, Oromia Region, Ethiopia: A Mixed-Method Approach*." **Frontiers in Public Health** 10, 2022. https://doi.org/10.3389/fpubh.2022.892108.

5. Y. Alfred, E. Aaron, A. Abuosi, D. M Badasu, D. Atobra, F.A Adzei, & J.K Anarfi. "*Non-Communicable Diseases among Children in Ghana: Health and Social Concerns of Parent/Caregivers*." **African Health Sciences** 16 (2), 2016: 378.

6. O.O Silva, O. Ayankogbe, & T. Odugbemi, "*Knowledge and Consumption of Fruits and Vegetables among Secondary School Students of Obele Community Junior High School, Surulere, Lagos State, Nigeria*." **Journal of Clinical Sciences** 14(2), 2017: 68.

7. B. Divakaran, J. Muttapillymyalil, J. Sreedharan, & K. Shalini. "*Lifestyle Risk factors of Noncommunicable Diseases: Awareness among School Children.*" **Indian Journal of Cancer** 47(5), 2010: 9. https://doi.org/10.4103/0019-509x.63864.

8. C. U. Okoye, C. O. Enechi, I. A. Olanipekun, U. N. Obiefule, G. K. Asumadu-Boateng, S. C. Emejuru, R. K. Onwe, J. A. Ezehmalu, & B. T. Ayanwunmi. "*Impact of Food Systems Transformation on Dietary Patterns and Public Health in Africa: A Mini Review - Open Archive Press*." **2pressrelease.co.in**, 2024.

9. C. Russell, J. Whelan, & P. Love. "*Assessing the Cost of Healthy and Unhealthy Diets: A Systematic Review of Methods.*" **Current Nutrition Reports** 11(4), 2022. https://doi.org/10.1007/s13668-022-00428-x.

10. M. F. Olumakaiye, T. Atinmo, & M. A. Olubayo-Fatiregun. "*Food Consumption Patterns of Nigerian Adolescents and Effect on Body Weight.*" **Journal of Nutrition Education and Behavior** 42(3), 2010: 144–51. https://doi.org/10.1016/j.jneb.2008.12.004.

11. O. O. Onabanjo & O. L. Balogun. "*Anthropometric and Iron Status of Adolescents from Selected Secondary Schools in Ogun State, Nigeria*." **ICAN: Infant, Child, & Adolescent Nutrition** 6(2), 2014: 109–18. https://doi.org/10.1177/1941406414520703.

12. H. Ene-Obong, V. Ibeanu, N. Onuoha, & A. Ejekwu. "*Prevalence of Overweight, Obesity, and Thinness among Urban School-Aged Children and Adolescents in Southern Nigeria*." **Food and Nutrition Bulletin** 33(4), 2012: 242–50. https://doi.org/10.1177/156482651203300404.

13. N.V. Agu, T.O. Ulasi, K.N. Okeke, J.C. Ebenebe, S.T. Echendu, C.A. Nriezedi & E.I. Nwaneli, "*Prevalence of Overweight and Obesity among Secondary Schools Adolescents in Onitsha, Anambra State Nigeria*", **International Journal of Medical Science and Clinical Invention,** 9(1), 2022: 5891-5899.

14. O. Oduyoye, S. Bello & A. Chinenye-Julius, "*Prevalence of Overweight and Obesity Among In-School Adolescents in a Selected District in Southwest Nigeria*," **ActaSATECH** 13(2), 2021: 126-139.

15. M. Batal, A. Deaconu & L. Steinhouse, "*The Nutrition Transition and the Double Burden of Malnutrition*". 2023: 33-44. https://doi.org/10.1007/978-3-031-24663-0_3.

Chapter Five

Conclusion

5.1 Summary of Findings

The study showed a complicated picture of knowledge, perceptions, and health status regarding NCDs. According to the socio demographic characteristics of the respondents, mid-adolescents (63.1%) aged 14-16 years are predominant, with a nearly equal gender distribution. This representation in different classes in both public and private schools provided a comprehensive view of adolescent perspectives. Majority of respondents (88%) lived with their parents, and parental education levels were high, most especially for fathers, due to 63.1% attending tertiary institution. This factor tends to influence adolescents access to adequate information on health and nutrition. Analysis of knowledge scores revealed that 63% of respondents demonstrated adequate knowledge (scoring ≥70%), while 37% showed inadequate knowledge regarding diet and NCDs. Demographic factors showed minimal influence on perceptions, with weak but significant correlations found for age ($r = 0.045$, $p = 0.004$), gender ($r = 0.016$, $p = 0.029$), and residential location ($r = 0.025$, $p = 0.003$). Anthropometric measurements revealed double burden of malnutrition among the respondents. 60.8% of respondents had normal weight, while 23.3% were underweight exceeding the national average reported in the 2021 Nigerian Demographic and Health Survey, and 15.9% of overweight and obese. The study found that only 36% of respondents had positive perceptions of diet's role in NCD prevention and management, while 64% showed negative perceptions. Respondents showed good understanding NCDs such as hypertension, diabetes, cancer, and stroke. However, some vital misconceptions persisted, most importantly the belief held by 43.1% of respondents that NCDs are caused by supernatural powers. This belief has could undermine efforts to promote behavioral changes for NCD

prevention. The majority (89.4%) correctly understood that NCDs can affect people of all ages, and there was high knowledge (95.2%) of the dangers of second-hand smoking.

The level of knowledge regarding NCD risk factors varied. Behavioral risk factors such as smoking (82.3%) and alcohol consumption (75.8%) were widely recognized. Dietary risk factors, including processed food consumption (69.8%) and excess salt intake (72.7%), were also well understood by the majority. However, the knowledge of the role of mental health in NCDs was low, with only 28.3% identifying anxiety as a potential risk factor.

Respondents showed a strong grasp of the significance of nutrition in NCD prevention. A vast majority (83.5%) recognized the value of fruits and vegetables in decreasing NCD risk, whereas 75.2% understood the need to limit processed meals and sugary beverages. The importance of a balanced diet in NCD prevention was well appreciated by 82.9% of respondents. However, there were significant disparities in understanding, especially when it came to salt consumption, where 73.5% comprehended the relation to NCD risk yet 20.8% stated that limiting salt intake was unnecessary for prevention.

The study also provided insight into respondents' perception regarding healthy eating and NCD prevention. While 33.1% said they had the knowledge and means to make appropriate food choices, a sizable number (65%) considered eating a balanced diet stressful and costly. This impression might be a barrier to developing good eating habits. Interestingly, 72% stated that traditional cultural foods in their region were typically healthful and protective against chronic illnesses, which might be used to promote healthy eating but also requires a thorough analysis of these traditional diets. Encouragingly, 63.8% stated a desire to change their eating habits in order to lower future NCD risk, demonstrating a favorable attitude towards health promotion activities.

5.2 Conclusion

The thorough evaluation of in-school adolescents in Ogun State, Nigeria, regarding their knowledge and perception on the role that adequate diet plays in managing and preventing NCDs has produced insightful results. In a community undergoing a fast dietary change, this study offers a comprehensive understanding of the complex interactions between anthropometric status, perceptions, and nutrition knowledge. The results provide vital direction for upcoming public health actions and policy by highlighting both the strengths and weaknesses in adolescents' knowledge of NCDs and associated risk factors. According to the study, adolescents in Ogun State have a generally good understanding of the main NCDs, including diabetes, cancer, stroke, and hypertension. This core knowledge is promising since it offers a framework for the development of more specific and useful health information. But the existence of false beliefs especially with regard to the cause of non-communicable diseases, highlights the necessity of focused educational initiatives. The opinion that a sizable percentage of respondents had that supernatural forces are to blame for NCDs highlights the significance of culturally responsive health education that takes into account both accepted cultural beliefs and scientific realities.

Respondents showed high knowledge of behavioural risk factors related to NCD risk factors, including alcohol drinking, smoking, and inactivity. This knowledge shows that certain public health programs have been successful in reaching this group and is consistent with the rhetoric around global health. The diminished acknowledgement of mental health variables as plausible risk factors for NCDs suggests a crucial domain for enhancing health education. Adolescents must comprehend the connection between mental and physical health as the world's health community becomes more aware of it to promote a more holistic approach to health and well-being. The study's findings about attitudes and understanding of nutrition are very insightful. A

good indicator that messages about the value of plant-based diets are reaching this demographic is the high degree of knowledge of the preventive benefits of fruits and vegetables against NCDs. Similarly, the realisation that cutting back on processed foods and sugary drinks might help avoid NCDs suggests that adolescents are becoming more aware of their health. These revelations offer a solid platform for encouraging better food choices.

However, nutritious eating practices are significantly hampered by the belief held by a sizable majority that eating a nutritious diet is costly and inconvenient. This result emphasizes how important it is to provide practical instruction on simple, reasonably priced healthy eating practices. Subsequent interventions must to centre not just on defining a balanced diet, but also on incorporating good eating habits within the limitations of everyday living and scarce resources. The respondents' strong appreciation for traditional meals offers both a chance and a difficulty. This perspective may be used to encourage healthy eating habits that are accepted in the culture, but it also calls for cautious education about the nutritional value of traditional foods and the possible risks associated with certain cooking techniques. In order to provide successful dietary recommendations, it will be imperative to strike a balance between cultural preferences and nutritional research. The study's anthropometric results show a complicated dietary environment that is similar to the larger nutrition shift taking place in many low- and middle-income nations. The fact that underweight and overweight/obesity coexist in the same adolescent population emphasizes Ogun State's dual burden of malnutrition. This circumstance necessitates sophisticated, multidimensional solutions that can handle overnutrition and food insufficiency at the same time. It also emphasizes the need to provide individualised nutrition guidance that considers a person's risk factors and existing nutritional status. The high rate of underweight adolescents which is higher than the national average needs immediate action. This study implies

that although tackling the increasing prevalence of obesity and associated NCDs is essential, efforts should not overlook the ongoing problem of undernutrition. One encouraging finding of the study was that adolescents were very motivated to change their eating habits in order to prevent NCDs. Initiatives aimed at promoting health have a great chance because of this readiness to adapt. It may be possible to significantly enhance eating habits and long-term health results by using this incentive through focused, age-appropriate treatments.

5.3 Recommendations

Based on the study findings, the following recommendations are made to improve adolescent nutrition and NCD prevention efforts:

1. Schools urgently need to create culturally sensitive nutrition education programs. These programs should address prevalent misconceptions, particularly those about the causes of NCDs, and go beyond basic nutritional recommendations. While delivering scientifically accurate facts, they should consider the local cultural norms and beliefs. These programs should address the known knowledge gap in this subject by emphasising the link between physical and mental health.
2. Health education programs should include exercises to improve practical skills. These might include budgeting classes for healthy eating, time-saving meal preparation skills, and culinary lessons that focus on nutritional, fairly priced meals produced using ingredients that are readily accessible. Such activities may help to bridge the perceived expense and discomfort gap associated with healthy diets.
3. School-based activities can help reduce the double burden of malnutrition. This might mean giving personalised dietary counselling based on individual anthropometric status, ensuring that both underweight and overweight students receive the assistance they

require. Furthermore, where appropriate, school feeding programs should be assessed and enhanced to provide a balanced meal that satisfies calorie and micronutrient requirements.

4. Adolescent nutrition interventions require community engagement. Parent education efforts, community cooking demonstrations, and collaborations with local food vendors might all help to increase the availability of healthy choices. Involving religious and community leaders in health promotion activities may help overcome cultural restrictions that impede individuals from adopting healthy lifestyles.

5. Promoting healthy eating requires policy actions at the local and state levels. This might include improved food labelling rules, a ban on marketing food to minors, and incentives for vendors to give healthier choices near schools. Furthermore, efforts that increase access to nutrient-dense foods and improve food security must be prioritised, particularly in places with high prevalence of undernutrition. It is critical to study how technology might be integrated into programs for behaviour change and nutrition education. Mobile applications and social media platforms might be valuable tools for sharing nutrition information, providing personalised diet tracking and assistance, and developing supportive online communities for healthy living, especially as more adolescents now have access to the internet.

5.4 Contribution to Knowledge

This study made a substantial contribution to our current understanding of how adolescents, particularly in Ogun State, Nigeria, perceive NCDs and the risk factors that are linked to them. These contributions have an impact on public health initiatives and policies that target this significant population.

The study provides a comprehensive and in-depth analysis of the dual impact of malnutrition on adolescents in Ogun State. The population in question suffers complex dietary issues, as evidenced by the fact that 23.3% of respondents were underweight, which is higher than the national average, and 15.9% were overweight or obese. This research highlights the need of targeted interventions to address the double burden of malnutrition and advances our understanding of the nutrition transition in emerging nations.

The study offers a unique viewpoint on how traditional beliefs and scientific knowledge combine to shape adolescents knowledge of NCDs. Despite generally having a good knowledge of the major NCDs and their risk factors, 43.1% of respondents believed that supernatural powers were the cause of these conditions. This finding provides insight into the cultural context that influences health attitudes in this area. This study contributes to the ongoing discussion on how public health campaigns may integrate traditional beliefs with modern medical knowledge by highlighting the need of culturally sensitive health education strategies.

The study indicates a notable deficiency in teenagers' understanding of the connection between NCDs and mental health as only 28.3% of participants identified anxiety as a risk factor for NCDs, this study highlights a crucial subject for upcoming health education campaigns. With the growing emphasis on the mind-body connection in health and illness throughout the world, this contribution is especially relevant. The study also provides insightful information on the attitudes and viewpoints of adolescents on NCD prevention and a healthy diet. The finding that 65% of respondents claimed that eating a balanced diet was costly and difficult, even if they wanted to improve their eating habits, broadens our understanding of the real-world obstacles that prevent youth from adopting healthy lifestyles. This knowledge is essential for creating educational programs that also effectively address perceived obstacles to eating a healthy diet.

Furthermore, the study clarifies the significance of customary cultural foods in shaping teenagers' perspectives on eating healthily. Findings showed 72% of respondents said their traditional cultural meals were generally healthy and prevented chronic diseases present a fresh perspective on the potential role that cultural dietary practices may play in preventing NCDs. This conclusion highlights the significance of critically evaluating traditional diets and contributes to the larger problem of integrating cultural practices into public health programs.

5.5 Suggested Areas for Further Research

The study's results have outlined a number of directions for further investigation that might greatly advance our knowledge of NCDs among adolescents in Nigeria and other comparable settings. These recommended research topics seek to fill up the identified knowledge gaps and examine the intricate interactions among variables affecting NCD risk in this important population.

The relationship between cultural beliefs and NCD prevention is an important topic that needs more research. The significant percentage of teenagers who believe that supernatural factors cause NCDs emphasises the necessity for comprehensive qualitative research to explore the roots and consequences of these beliefs. Research of this kind may yield important insights into the ways in which scientific information and cultural perspectives interact, therefore guiding the development of culturally responsive health education programs that successfully reconcile traditional medical knowledge with contemporary cultural viewpoints.

The study's finding that little is known about the contribution of mental health to the development of NCDs suggests another crucial topic for further research. More comprehensive NCD prevention efforts may benefit greatly from research on adolescents understanding of the mind-body link and practical ways to convey the significance of mental health in physical health.

Studies that follow the relationship between adolescent mental health knowledge and adult risk of NCDs may provide very insightful data.

In order to fully explore the perceived obstacles to healthy eating that this study revealed, more investigation is also necessary. Research using a combination of methodologies might offer a more comprehensive understanding of the personal, environmental, and economical elements that contribute to the belief that eating a healthy diet is costly and difficult. Such studies might help design focused interventions to get through these obstacles and encourage adolescents to adopt healthy eating habits.

The study's findings about the high degree of belief in the healthfulness of traditional meals present an exciting opportunity for more research. Studies examining how local traditional diets have changed over time may provide insights into how to best optimise traditional eating habits for NCD prevention while maintaining cultural importance. Nutritional evaluations of local traditional diets could assess their true health benefits and possible hazards.

Another important topic for research is examining the efficacy of school-based NCD prevention programs, given the school-based aspect of this study. Research comparing various educational techniques in intervention studies may provide important information on the best ways to improve adolescents' knowledge, attitudes, and behaviours for the prevention of NCDs.

A more thorough understanding of the long-term effects of early health education might be obtained by longitudinal research that tracks how adolescents' knowledge and perceptions of NCDs transition into health behaviours and outcomes in adulthood. Research of this kind may help create age- and situation-appropriate therapies that are more successful.

Further investigation is required on possible gender disparities in NCD knowledge and risk factors, the impact of parental education on adolescent health literacy, and the function of digital

media in NCD education. Comparative research conducted in Nigeria's many areas may also reveal regional differences in adolescent NCD knowledge, guiding more focused and situation-specific treatments.

We could broaden the results of the current study by investigating these recommended research topics, filling in knowledge gaps and perhaps creating more potent methods for NCD prevention among adolescents in Nigeria and comparable settings. In order to reduce the burden of NCDs in this susceptible group, evidence-based policies and treatments must be informed by the results of this ongoing inquiry.

Bibliography

Journals

Abubakar, H.A., Shahril, M.R. & Mat, S., *"Nutritional Status and Dietary Intake among Nigerian Adolescent: A Systematic Review"*, **BMC Public Health** 24(1), 2024.

Adeoya, A., Akinwusi, A. & Nagatomi, R., *"Effectiveness of Nutrition Education in Enhancing Knowledge and Attitude of Pupils on Choice of School Mid-Day Meal in Ibadan, Nigeria"*, **Food Science & Nutrition**, 2023.

Adepoju, O. T. & Abike, B. O., *"Nutrition Knowledge, Dietary Diversity and Nutritional Status of Adolescents in Three Selected Local Government Areas of Ibadan Municipality, Nigeria"*, **Biomedical Journal of Scientific & Technical Research** 37(3), 2021: 29417-29426.

Akintayo-Usman N., Okanlawon F., & Usman S., "*Prevalence of Pre-Diabetes and Risk Factors among Secondary School Adolescents in Osogbo Local Government Area, Osun State, Nigeria*", **African Health Sciences** 21(3), 2021: 1301-1309.

Akseer N., Mehta S., Wigle J., Chera R., Brickman Z.J., Al-Gashm S., & Sorichetti B., "*Non-Communicable Diseases among Adolescents: Current Status, Determinants, Interventions and Policies*", **BMC Public Health** 20(1), 2020.

Alaimo, K., Beavers, A., Coringrato, E., Lacy, K., Ma, W., Hurley, T. & Hébert, J., *"Community Gardening Increases Vegetable Intake and Seasonal Eating from Baseline to Harvest: Results from a Mixed Methods Randomized Controlled Trial"*, **Current Developments in Nutrition** 7(5), 2023: 100077.

Alamnia T.T., Sargent G.M., & Kelly M., "*Dietary Patterns and Associations with Metabolic Risk Factors for Non-Communicable Disease*", **Scientific Reports** 13(1), 2023: 21028.

Alfraidi A., Alafif N. & Alsukait R., "*The Impact of Mandatory Food-Marketing Regulations on Purchase and Exposure: A Narrative Review*", **Children (Basel)** 10(8), 2023: 1277-1277.

Allen L., Williams J., Townsend N., Mikkelsen B., Roberts N., Foster C., & Wickramasinghe K., "*Socioeconomic Status and Non-Communicable Disease Behavioral Risk Factors in Low-Income and Lower-Middle-Income Countries: A Systematic Review*", **The Lancet Global Health** 5(3), 2017: e277-e289.

Amahmid, O., El Guamri, Y., Rakibi, Y., Yazidi, M., Razoki, B., Rassou, K. K., El Boukaoui, S., Izerg, O. & Belghyti, D., *"Nutrition Education in School Curriculum: Impact on Adolescents' Attitudes and Dietary Behaviors"*, **International Journal of Health Promotion and Education** 58(5), 2019: 242-258.

Annan, R.A., Agyapong, N.A.F., Apprey, C. & Aryeetey, R., *"Review of Ghana's Food Environment: Drivers of Availability, Barriers to Healthy Food Access, and Impact of Interventions and Policies"*, **African Journal of Food, Agriculture, Nutrition and Development** 22(2), 2022: 19658-19701.

Anzman-Frasca S., Ventura A.K., Ehrenberg S., & Myers K.P., "*Promoting Healthy Food Preferences from the Start: A Narrative Review of Food Preference Learning from the Prenatal Period through Early Childhood*," **Obesity Reviews** 19, 2017: 576--604.

Atoh I., Ezeogu J., Okeke C., Umeh S., Ekure E., Omokhodion S., & Njokanma O., "*High blood pressure pattern amongst adolescents in Lagos, South West Nigeria*", **Pan African Medical Journal** 44, 2023: 206.

Aune D., Huang W., Nie J., & Wang Y., "*Hypertension and the Risk of All-Cause and Cause-Specific Mortality: Outcome-Wide Association Study of 67 Causes of Death in the National Health Interview Survey*", **BioMed Research International,** 2021: 1-10.

Ayaz-Alkaya, S. & Kulakçı-Altıntaş, H., *"Nutrition-Exercise Behaviors, Health Literacy Level, and Related Factors in Adolescents in Turkey"*, **Journal of School Health** 91(8), 2021: 625-631.

Baute V., Sampath-Kumar R., Nelson S., & Basil B., "*Nutrition Education for the Health-care Provider Improves Patient Outcomes*", **Global Advances in Health and Medicine** 7, 2018.

Bel-Serrat, S., von der Schulenburg, A., Marques-Previ, M., Mullee, A. & Murrin, C., *"What Are the Determinants of Vegetable Intake among Adolescents from Socioeconomically Disadvantaged Urban Areas? A Systematic Review of Qualitative Studies"*, **International Journal of Behavioral Nutrition and Physical Activity** 19(1), 2022.

Berge, J., MacLehose, R., Larson, N., Laska, M. & Neumark-Sztainer, D., *"Family Food Preparation and Its Effects on Adolescent Dietary Quality and Eating Patterns"*, **Journal of Adolescent Health** 59(5), 2016: 530-536.

Bigna J., & Noubiap J., "*The Rising Burden of Non-Communicable Diseases in Sub-Saharan Africa*", **The Lancet Global Health** 7(10), 2019: e1295-e1296.

Billingsley H.E., Carbone S. & Lavie C.J., "*Dietary fats and chronic noncommunicable diseases*", **Nutrients,** 10, 2018: 1385.

Black, A., D'Onise, K., McDermott, R., Vally, H. & O'Dea, K., *"How Effective Are Family-Based and Institutional Nutrition Interventions in Improving Children's Diet and Health? A Systematic Review"*, **BMC Public Health** 17(1), 2017.

Borges C., Marchioni D., Levy R., & Slater B., "*Dietary patterns associated with overweight among Brazilian adolescents*", **Appetite,** 123, 2018.

Bray F., Ferlay J., Soerjomataram I., Siegel R., Torre L., & Jemal A., "*Global Cancer Statistics 2018: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries*", **CA: A Cancer Journal for Clinicians** 68, 2018: 394-424

Brytek-Matera, A., *"Negative Affect and Maladaptive Eating Behavior as a Regulation Strategy in Normal-Weight Individuals: A Narrative Review"*, **Sustainability** 13(24), 2021: 13704.

Budreviciute A., Damiati S., Sabir D.K., Onder K., Schuller-Goetzburg P., Plakys G., Katileviciute A., Khoja S. & Kodzius R., "*Management and Prevention Strategies for Non-*

Communicable Diseases (NCDs) and Their Risk Factors", **Frontiers in Public Health** 8(574111), 2020: 1--11.

Butler, S., *"The Development of Market-Driven Identities in Young People: A Socio-Ecological Evolutionary Approach"*, **Frontiers in Psychology** 12, 2021: 1-19.

Caro j., Valizadeh P., Correa A., Silva A., & Ng S., "*Combined Fiscal Policies to Promote Healthier Diets: Effects on Purchases and Consumer Welfare*", **PLOS ONE** 15(1), 2020: e0226731.

Carrasco-Luna, J., Gombert, M., Carrasco-García, Á. & Codoñer-Franch, P., *"Adolescent Feeding: Nutritional Risk Factors"*, **Journal of Child Science,** 8(1), 2018: e99-e105.

Casari S., Di Paola M., Banci E., Diallo S., Scarallo L., Renzo S., Gori A., Renzi S., Paci M., De Mast Q., Pecht T., Derra K., Kaboré B., Tinto H., Cavalieri D., & Lionetti P., "*Changing Dietary Habits: The Impact of Urbanization and Rising Socio-Economic Status in Families from Burkina Faso in Sub-Saharan Africa*", **Nutrients** 14(9), 2022: 1782.

Chan, K., Prendergast, G., Grønhøj, A. & Bech-Larsen, T., *"Adolescents' Perceptions of Healthy Eating and Communication about Healthy Eating"*, **Health Education** 109(6) 2009: 474-490.

Charan J. & Biswas T., "*How to Calculate Sample Size for Different Study Designs in Medical Research?*", **Indian Journal of Psychological *Medicine*** 35(2), 2013: 121.

Charkviani M., Thongprayoon C., Tangpanithandee S., Krisanapan P., Miao J., Michael A.M., & Cheungpasitporn W., "*Effects of Mediterranean Diet, DASH Diet, and Plant-Based Diet on Outcomes among End Stage Kidney Disease Patients: A Systematic Review and Meta-Analysis*", **Clinics and Practice** 13(1), 2022: 41–51. https://doi.org/10.3390/clinpract13010004.

Charkviani M., Thongprayoon C., Tangpanithandee S., Krisanapan P., Miao J., Mao M., Cheungpasitporn W., "*Effects of Mediterranean Diet, DASH Diet, and Plant-Based Diet on Outcomes among End Stage Kidney Disease Patients: A Systematic Review and Meta-Analysis*", **Clinics and Practice** 13(1), 2022: 41-51.

Chau M., Burgermaster M., & Mamykina L., "*The Use of Social Media in Nutrition Interventions for Adolescents and Young Adults-A Systematic Review*", **International Journal of Medical Informatics** 120, 2018: 77-91.

Chukwu E., & Dogbe W., "*The Cause and Effect of the Nutrition Transition in Nigeria: Analysis of the Value of Indigenous Knowledge and Traditional Foods in Enugu State, Igboland*," **Journal of Ethnic Foods** 10(1), 2023.

Chukwuonye I.I., Ohagwu K.A., Ogah O.S., John C., Oviasu E., Anyabolu E.N., Ezeani I.U., "*Prevalence of Overweight and Obesity in Nigeria: Systematic Review and Meta-Analysis of Population-Based Studies*," **PLOS Global Public Health** 2(6), 2022.

Chung, A., Vieira, D., Donley, T., Tan, N., Jean-Louis, G., Gouley, K. & Seixas, A., *"Adolescent Peer Influence via Social Media on Eating Behaviors: A Scoping Review"*, **Journal of Medical Internet Research** 23(6), 2021: e19697.

Clinton S., Giovannucci E., & Hursting S., "*The World Cancer Research Fund/American Institute for Cancer Research Third Expert Report on Diet, Nutrition, Physical Activity, and Cancer: Impact and Future Directions*", **The Journal of Nutrition** 150(4), 2019: 663-671

Combet, E. & Buckton, C., "*Micronutrient Deficiencies, Vitamin Pills and Nutritional Supplements*", **Medicine** 47(3), 2019: 145-151.

Cui S., Ajayi B., Kim E., & Egonu R., "*A Systematic Review and Meta-Analysis of Depression Prevalence amongst Nigerian Students Pursuing Higher Education"*, **Journal of Behavioral and Brain Science**, 12, 2022: 589-598.

Davidson U., Aniwada E.C., Okeke C.V., Nwaoha S.O & Obionu C.N., "*Pattern and Predictors of Psychosocial Disorders among Overweight and Obese Children in Enugu, Southeast Nigeria,*" **African Health Sciences** 12(1), 2018: 3--9.

De Amicis R., Bertoli Mambrini S., Pellizzari M., Foppiani A., Bertoli S., Battezzati A., & Leone A., "*Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review*", **European Journal of Nutrition,** 61(5), 2022: 2297-2311.

DeClercq V., Nearing J., & Sweeney E., "*Plant-Based Diets and Cancer Risk: What Is the Evidence?*", **Current Nutrition Reports**, 2022.

Demers-Potvin, É., White, M., Kent, M. P., Nieto, C., White, C., Zheng, X., Hammond, D. & Vanderlee, L., *"Adolescents' Media Usage and Self-Reported Exposure to Advertising across Six Countries: Implications for Less Healthy Food and Beverage Marketing"*, **BMJ Open** 12(5), 2022: e058913.

Devine, L., Gallagher, A., Briggs, S. & Hill, A., *"Factors That Influence Food Choices in Secondary School Canteens: A Qualitative Study of Pupil and Staff Perspectives"*, **Frontiers in Public Health** 11, 2023.

Dickin K., Litvin K., McCann J., & Coleman F., "*Exploring the Influence of Social Norms on Complementary Feeding: A Scoping Review of Observational, Intervention, and Effectiveness Studies*", **Current Developments in Nutrition** 5(2), 2021.

Dorn L., Hostinar C., Susman E., & Pervanidou P., "*Conceptualizing Puberty as a Window of Opportunity for Impacting Health and Well-Being across the Life Span*", **Journal of Research on Adolescence** 29(1), 2019: 155-176.

Efthymiou V., Charmandari E., Vlachakis D., Tsitsika A., Pałasz A., Chrousos G., & Bacopoulou F., "*Adolescent Self-Efficacy for Diet and Exercise Following a School-Based Multicomponent Lifestyle Intervention*", **Nutrients** 14(1), 2021: 97.

Eleanor W., Sluijs E.V., White M., Klepp K.I., Wold B., & Lien N., "*Changes in Diet through Adolescence and Early Adulthood: Longitudinal Trajectories and Association with Key Life Transitions*", **International Journal of Behavioral Nutrition and Physical Activity** 15(1), 2018.

Fernqvist F., Spendrup S., & Tellström R., "*Understanding Food Choice: A Systematic Review of Reviews*", **Heliyon** 10(12), 2024: e32492-92.

Folasire, O.F., Folasire, A.M. & Chikezie, S., *"Nutrition-Related Cancer Prevention Knowledge of Undergraduate Students at the University of Ibadan, Nigeria"*, **South African Journal of Clinical Nutrition** 29(4), 2016: 165-171.

Galler J.R., Koethe J.R., & R.H. Yolken, "*Neurodevelopment: The Impact of Nutrition and Inflammation during Adolescence in Low-Resource Settings*," **Pediatrics** 139(1), 2017: 72-84.

Gao Z., Chen Z., Sun A., & Deng X., "*Gender Differences in Cardiovascular Disease*", **Medicine in Novel Technology and Devices** 4, 2019: 100025.

Garbero A., & Jäckering L., "*The Potential of Agricultural Programs for Improving Food Security: A Multi-Country Perspective*", **Global Food Security** 29, 2021.

Gbadebo A., O. Sholeye & Gbadebo F., "*Sugar Sweetened Beverage Consumption and Its Associated Factors among Adolescents in Rural and Urban Areas of Ogun State, Nigeria*", **Research Square**, 2023.

GBD 2019 Diseases and Injuries Collaborators. "*Global Burden of 369 Diseases and Injuries, 1990--2019: A Systematic Analysis for the Global Burden of Disease Study 2019.*" **The Lancet**, 396(10258), 2020: 1204-1222.

Ghaffar, S. A., Talib, R. A. & Karim, N., *"Food choices and diet quality in the school food environment: a qualitative insight from the perspective of adolescents"*, **Malaysian Journal of Medicine and Health Sciences** 45, 2019: 15.

Godbharle S., Kesa H., & Jeyakumar A., "*Processed Food Consumption and Risk of Non-Communicable Diseases (NCDs) in South Africa: Evidence from Demographic and Health Survey (DHS) VII*", **Journal of Nutritional Science** 13, 2024: e19.

Grant T., Brigham E. & McCormack M., "*Childhood Origins of Adult Lung Disease as Opportunities for Prevention*", **The Journal of Allergy and Clinical Immunology: In Practice** 8(3), 2020: 849-858.

Guiné R., Florença S.G., Aparício G., Cardoso A.P., & Ferreira M., "Food Knowledge for Better Nutrition and Health: A Study among University Students in Portugal", **Healthcare** 11(11), 2023: 1597-97.

Guthold R., Stevens G., Riley L., & Bull F., "*Global Trends in Insufficient Physical Activity Among Adolescents: A Pooled Analysis of 298 Population-Based Surveys with 1.6 Million Participants*", **The Lancet Child & Adolescent Health** 4(1), 2020: 23-35.

Guthold R., Stevens G., Riley L., & Bull F., "*Worldwide Trends in Insufficient Physical Activity from 2001 to 2016: A Pooled Analysis of 358 Population-Based Surveys with 1.9 Million Participants*", **The Lancet Global Health** 6(10), 2018: e1077-e1086.

Hamilton, K. & Hagger, M., *"Effects of Self-Efficacy on Healthy Eating Depends on Normative Support: A Prospective Study of Long-Haul Truck Drivers"*, **International Journal of Behavioral Medicine** 25(2), 2017: 265-270.

Han C., Kim H., & Kim S., "*Effects of Adolescents' Lifestyle Habits and Body Composition on Bone Mineral Density,*" **International Journal of Environmental Research and Public Health** 18(11), 2021: 6170.

Haynes-Maslow L., Hofing G., & Marks A., "*Use of a Social Marketing Campaign to Promote Healthy Eating Behaviors among Low-Income Caregivers*", **Journal of Human Sciences and Extension,** 2020.

Hotu S., Carter B., Watson P., Cutfield W., & Cundy T., "*Increasing prevalence of type 2 diabetes in adolescents*", **Journal of Paediatrics and Child Health**, 40, 2004: 201-204.

Hyder A.A, Sarah R., Abeer A.S, Valery L.F, Ishu K., Tiina L., Liming Li., *"Strengthening Evidence to Inform Health Systems: Opportunities for the WHO and Partners to Accelerate Progress on Non-Communicable Diseases."* **BMJ Global Health** 8(11), 2023: e013994–94. https://doi.org/10.1136/bmjgh-2023-013994.

Ishak, S., Sharif, S.I.Z., Chin, Y.S., Taib, M.N.M. & Shariff, Z.M., *"Malaysian Adoescents' Perceptions of Healthy Eating: A Qualitative Study"*, **Public Health Nutrition** 23(8), 2020: 1440-1449.

Islam M.R., Trenholm J., Rahman A., Pervin J., Ekström E.C., & Rahman S.M., "*Sociocultural Influences on Dietary Practices and Physical Activity Behaviors of Rural Adolescents---a Qualitative Exploration*", **Nutrients** 11(12), 2020: 2916.

Islam, M. R., Trenholm, J., Rahman, A., Pervin, J., Ekström, E. C. & Rahman, S. M., *"Sociocultural Influences on Dietary Practices and Physical Activity Behaviors of Rural Adolescents—a Qualitative Exploration"*, **Nutrients** 11(12), 2019: 2916.

Jardim T., Gaziano T., Nascente F., Carneiro C., Morais P., Roriz V., & Mendonça K., "*Multiple Cardiovascular Risk Factors in Adolescents from a Middle-Income Country: Prevalence and Associated Factors*", **PLOS ONE** 13(7) 2018: e0200075.

Johannesen C.O, Dale H.F., Jensen C. & Lied G.A., "*Effects of Plant-Based Diets on Outcomes Related to Glucose Metabolism: A Systematic Review*", **Diabetes, Metabolic Syndrome and Obesity** 13, 2020: 2811-2822.

Jongenelis, M., Scully, M., Morley, B. & Pratt, I., *"Vegetable and Fruit Intake in Australian Adolescents: Trends over Time and Perceptions of Consumption"*, **Appetite** 129, 2018: 49-54.

Juul F., Vaidean G., & Parekh N., "*Ultra-Processed Foods and Cardiovascular Diseases: Potential Mechanisms of Action*", **Advances in Nutrition** 12(5), 2021.

Kakleas K., Soldatou A., & Karavanaki K., "*Childhood Obesity and Its Associations with Morbidity and Mortality in Adult Life*", **Diabetes and Its Complications** 2(4), 2018: 1--12.

Kansra, A., Lakkunarajah, S. & Jay, S., *"Childhood and Adolescent Obesity: A Review"*, **Frontiers in Pediatrics** 8, 2021: 581461.

Katileviciute A., Plakys G., Budreviciute A., Onder K., Damiati S., & Kodzius R., "*Sight to wheat bran: high value-added products*", **Biomolecules** 9, 2019: 887.

Koca, B. & Arkan, G., *"The Relationship between Adolescents' Nutrition Literacy and Food Habits, and Affecting Factors"*, **Public Health Nutrition** 24(4), 2021: 717-728.

Kombanda, K. T., Margerison, C., Booth, A. & Worsley, A., *"Socio-Psychological Factors Associated with Young Australian Adults' Consumption of Energy Dense and Nutrient Poor (EDNP) Foods"*, **Nutrients** 14(4), 2022: 812.

Kulandaivelu, Y., Hamilton, J., Banerjee, A., Gruzd, A., Patel, B. & Stinson, J., *"Social Media Interventions for Nutrition Education among Adolescents: Scoping Review"*, **JMIR Pediatrics and Parenting** 6(1), 2023: e36132.

Kumar A., "*The impact of obesity on cardiovascular disease risk factor*", **Asian Journal of Medical Sciences** 10, 2019: 21294.

Langlois E., McKenzie A., Schneider H., & Mecaskey J., "*Measures to Strengthen Primary Health-Care Systems in Low- and Middle-Income Countries*", **Bulletin of the World Health Organization** 98(11), 2020: 781-791.

Liu K.S., Chen J.Y., Sun K.S., Tsang J.P., & Lam C.L., "*Adolescent Knowledge, Attitudes and Practices of Healthy Eating: Findings of Qualitative Interviews among Hong Kong Families*", **Nutrients** 14(14), 2022: 2857.

Loth, K., Uy, M. J., Winkler, M., Neumark-Sztainer, D., Fisher, J. O. & Berge, J., *"The Intergenerational Transmission of Family Meal Practices: A Mixed-Methods Study of Parents of Young Children"*, **Public Health Nutrition** 22(7), 2019: 1269-1280.

Lucan, S., "Local Food Sources to Promote Community Nutrition and Health: Storefront Businesses, Farmers' Markets, and a Case for Mobile Food Vending", **Journal of the Academy of Nutrition and Dietetics**, 119(1), 2019

Luiggi M., Rey O., Travert M., & Griffet J., "*Overweight and Obesity by School Socioeconomic Composition and Adolescent Socioeconomic Status: A School-Based Study*", **BMC Public Health** 21(1), 2021:1837.

Ma, Z. & Hample, D., *"Modeling Parental Influence on Teenagers' Food Consumption: An Analysis Using the Family Life, Activity, Sun, Health, and Eating (FLASHE) Survey*", **Journal of Nutrition Education and Behavior** 50(10), 2018: 1005-1014.

Martínez-González M., Gea A., Ruiz-Canela M., "*The Mediterranean Diet and Cardiovascular Health*", **Circulation Research** 124(5), 2019: 779-798.

Marzilli, E., Cerniglia, L. & Cimino, S., "*A Narrative Review of Binge Eating Disorder in Adolescence: Prevalence, Impact, and Psychological Treatment Strategies*", **Adolescent Health, Medicine and Therapeutics**, 9, 2018: 17-30.

Mathiarasan S., & Hüls A., "*Impact of Environmental Injustice on Children's Health—Interaction between Air Pollution and Socioeconomic Status*", **International Journal of Environmental Research and Public Health** 18(2), 2021.

Meher M., Pradhan S., & Pradhan S.R., "*Risk Factors Associated with Hypertension in Young Adults: A Systematic Review*", **Cureus** 15(4), 2023.

Mellendick K., Shanahan L., Wideman L., Calkins S., Keane S., & Lovelady C., "*Diets Rich in Fruits and Vegetables Are Associated with Lower Cardiovascular Disease Risk in Adolescents*", **Nutrients** 10(2), 2018: 136.

Mellendick K., Shanahan L., Wideman L., Calkins S., Keane S., & Lovelady C., "*Diets Rich in Fruits and Vegetables Are Associated with Lower Cardiovascular Disease Risk in Adolescents*", **Nutrients** 10(2), 2018: 136.

Melo, G.A., Silva, P., Nakabayashi, J., Bandeira, M., Toral, N. & Monteiro, R., "*Family Meal Frequency and Its Association with Food Consumption and Nutritional Status in Adolescents: A Systematic Review"*, **PLOS ONE** 15(9), 2020: e0239274.

Mendez M., & Popkin B., "*Globalization, Urbanization and Nutritional Change in the Developing World*", **The Electronic Journal of Agricultural and Development Economics,** 1, 2004: 220-241.

Mentella M.C., Scaldaferri F., Ricci C., Gasbarrini A., & Miggiano G. A.D., "*Cancer and Mediterranean Diet: A Review*", **Nutrients** 11(9), 2019: 2059.

Mizia, S., Felińczak, A., Włodarek, D. & Syrkiewicz-Świtała, M., *"Evaluation of Eating Habits and Their Impact on Health among Adolescents and Young Adults: A Cross-Sectional Study"*, **International Journal of Environmental Research and Public Health** 18(8) 2021: 3996.

Mobolanle B., Kola-Raji B., & Odugbemi T., "*A Comparative Study of Nutritional Status of Adolescents from Selected Private and Public Boarding Secondary Schools in I badan, South Western Nigeria*", **Journal of Medicine in the Tropics** 19(1), 2017.

Morenga L., & Montez J., "*Health effects of saturated and trans-fatty acid intake in children and adolescents: Systematic review and meta-analysis*", **PLOS ONE**, 12, 2017: e0186672.

Morris, J., Briggs, M. & Zidenberg-Cherr, S., *"School-Based Gardens Can Teach Kids Healthier Eating Habits"*, **California Agriculture** 54(5), 2000: 40-46.

Mozaffarian D., Angell S., Lang T., & Rivera J., "*Role of Government Policy in Nutrition—Barriers to and Opportunities for Healthier Eating*", **BMJ** 361(1), 2018: k2426.

Mtintsilana A., Craig A., Mapanga W., Dlamini S., & Norris S., "*Association between Socio-Economic Status and Non-Communicable Disease Risk in Young Adults from Kenya, South Africa, and the United Kingdom*", **Scientific Reports** 13(1), 2023: 728.

Muscolo A., Mariateresa O., Giulio T., & Mariateresa R., "*Oxidative Stress: The Role of Antioxidant Phytochemicals in the Prevention and Treatment of Diseases*", **International Journal of Molecular Sciences** 25(6), 2024: 3264-3264.

Nemec K., "*Cultural Awareness of Eating Patterns in the Health Care Setting*", **Clinical Liver Disease** 16(5), 2020: 204--7.

Odunaiya N., Louw Q., & Grimmer K., "*Are lifestyle cardiovascular disease risk factors associated with pre-hypertension in 15--18 years rural Nigerian youth? A cross sectional study*", **BMC Cardiovascular Disorders**, 15, 2015.

Oduyoye O., Bello S., & Chinenye-Julius A., "*Prevalence of Overweight and Obesity Among In-School Adolescents in a Selected District in Southwest Nigeria*," **ActaSATECH** 13(2), 2021: 126-139.

Oguejiofor O.C, Odenigbo C.U., & Odenigbo U.M., "*The Emerging Epidemic of Cardiovascular Risk Factors in the Nigerian Population: A Call for Intervention*", **Nigerian Journal of Cardiology** 9(1), 2012: 3-6.

Ogungbesan S., "*Stakeholders' Engagement as a Strategy toward Optimizing Voluntary Tax Compliance: A Case Study of the Nigerian Tax Administration*", **International Journal of Research and Innovation in Applied Science IX** 2024: 294-302.

Okagua J., Alex-Hart B., & Jaja T., "*Overweight and obesity status of school adolescents in Portharcourt, southern Nigeria*", **Nigerian Journal of Medicine** 25(1), 2016: 53-59.

Oladosu G., Onabanjo O., Amoda S., Olajide B., & John E., "*Nutritional status and Micronutrients Adequacy of food consumed by Adolescents in School in Abeokuta, Ogun state*", **Nigerian Journal of Nutritional Sciences** 43, 2022: 227-238.

Orehek, E. & Ferrer, R., "*Parent Instrumentality for Adolescent Eating and Activity*", **Annals of Behavioral Medicine** 53(7), 2018: 652-664.

Osayomi, T., *"Being Fat Is Not a Disease but a Sign of Good Living': The Political Economy of Overweight and Obesity in Nigeria*", **Ghana Journal of Geography** 12(1), 2020: 99-114.

Park A. & Smyth M., "*Tobacco: A Challenge for Pediatric and Adult Health*", **The Lancet Public Health** 6(7), 2021: e441-e442.

Petrikova I., Bhattacharjee R., & Fraser P., "*The 'Nigerian Diet' and Its Evolution: Review of the Existing Literature and Household Survey Data*", **Foods** 12(3), 2023: 443.

Pineda E., Gressier M., Li D., Brown T., Mounsey S., Olney J., & Sassi F., "*Review: Effectiveness and Policy Implications of Health Taxes on Foods High in Fat, Salt, and Sugar*", **Food Policy** 123, 2024: 102599-102599.

Popkin B.M., "*Nutrition transition and the global diabetes epidemic*", **Current Diabetes Reports,** 15, 2015: 64.

Quelly, S., *"Helping with Meal Preparation and Children's Dietary Intake: A Literature Review"*, **The Journal of School Nursing** 35(1), 2018: 51-60.

Qutteina Y., Hallez L., Raedschelders M., De Backer C., & Smits T., "*Food for Teens: How Social Media Is Associated with Adolescent Eating Outcomes*", **Public Health Nutrition** 25(2), 2021: 1--31.

Ragelienė, T. & Grønhøj, A., *"The Influence of Peers' and Siblings' on Children's and Adolescents' Healthy Eating Behavior. A Systematic Literature Review"*, **Appetite** 148, 2020: 104592.

Raut S., Dirghayu K.C., Singh D.R., Dhungana R.R., Singh M., & Sunuwar D.R., "*Effect of Nutrition Education Intervention on Nutrition Knowledge, Attitude, and Diet Quality among School-Going Adolescents: A Quasi-Experimental Study*", **BMC Nutrition,** 10(1), 2024.

Raut, S., KC, D., Singh, D., Dhungana, R., Singh, M. & Sunuwar, D., *"Effect of Nutrition Education Intervention on Nutrition Knowledge, Attitude, and Diet Quality among School-Going Adolescents: A Quasi-Experimental Study"*, **BMC Nutrition** 10(1), 2024.

Riggi E., Baccini M., Camussi E., Gallo F., Anatrone C., Pezzana A., Senore C., Giordano L., & Segnan N., "*Promoting Healthy Lifestyle Habits among Participants in Cancer Screening Programs: Results of the Randomized Controlled Sti.Vi Study*", **Journal of Public Health Research** 11(3), 2022: 2499-8176.

Ruani M.A., Reiss M.J., & Kalea A.Z, "*Diet-Nutrition Information Seeking, Source Trustworthiness, and Eating Behavior Changes: An International Web-Based Survey,*" **Nutrients** 15(21), 2023: 4515.

Ruopeng A., "*Effectiveness of Subsidies in Promoting Healthy Food Purchases and Consumption: A Review of Field Experiments*", **Public Health Nutrition** 16(7), 2012: 1215-1228.

Samtiya M., Aluko R., Dhewa T., & Moreno-Rojas J. M., "*Potential Health Benefits of Plant Food-Derived Bioactive Components: An Overview*", **Foods** 10(4), 2021: 839.

Sanyaolu A., Okorie C., Qi X., Locke J., & Rehman S., "*Childhood and Adolescent Obesity in the United States: A Public Health Concern*", **Global Pediatric Health,** 6, 2019: 1-11.

Schultze F., Gao X., Virzonis D., Damiati S., Schneider M., & Kodzius R., "*Air quality effects on human health and approaches for its assessment through microfluidic chips*", **Genes** 8, 2017: 244.

Seligman H., Laraia B., & Kushel M., "*Food insecurity is associated with chronic disease among low-income NHANES participants*", **Journal of Nutrition,** 140(2), 2010: 304-310.

Senbanjo, Oshikoya K., Odusanya O., & Njokanma O., "*Prevalence of and Risk Factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria*", **Journal of Health, Population and Nutrition** 29(4), 2011.

Shibiru T., Arulandhu A., Belete A., Etana J., & Amanu W., "*Prevalence and Factors Associated with Alcohol Consumption Among Secondary School Students in Nekemte, Ethiopia: A Cross-Sectional Study*", **Substance Abuse and Rehabilitation** 14, 2023: 35-47.

Siddiqui, S. A., Zannou, O., Karim, I., Kasmiati, Awad, N., Gołaszewski, J., Heinz, V. & Smetana, S., *"Avoiding Food Neophobia and Increasing Consumer Acceptance of New Food Trends—a Decade of Research"*, **Sustainability** 14(16), 2022: 10391.

Silva P., "*Food and Nutrition Literacy: Exploring the Divide between Research and Practice*", **Foods** 12(14): 2023: 2751.

Sinai T., Axelrod R., Shimony T., Boaz M., & Kaufman-Shriqui V., "Dietary Patterns among Adolescents Are Associated with Growth, Socioeconomic Features, and Health-Related Behaviors", **Foods**, 10(12), 2021: 3054.

Sluijs E. van., Ekelund U., Crochemore-Silva I., Guthold R., Ha A., Lubans D., Oyeyemi A., Ding D. & Katzmarzyk P., "*Physical Activity Behaviors in Adolescence: Current Evidence and Opportunities for Intervention*", **The Lancet** 398(10298), 2021.

Smith L., & Foxcroft D., "*The effect of alcohol advertising, marketing and portrayal on drinking behavior in young people: Systematic review of prospective cohort studies*", **BMC Public Health** 9, 2009: 51.

Smith R., Kelly B., Yeatman H., & Boyland E., "*Food Marketing Influences Children's Attitudes, Prefrences and Consumption: A Systematic Critical Review*", **Nutrients** 11(4), 2019: 875.

Solana O., Ogunwale O., Ogungbayi G., Uthman-Akinhanmi Y., & Olaleru I., "*Childhood obesity: Assessing the prevalence during child development periods (5-12 years) in Yewa community, Ogun state, Nigeria*", **Indian Journal of Health and Wellbeing** 11(4-6), 2020: 208-212.

Sommer I., Griebler U., Mahlknecht P., Thaler K., Bouskill K., Gartlehner G., & Mendis S., "*Socioeconomic Inequalities in Non-Communicable Diseases and Their Risk Factors: An Overview of Systematic Reviews*", **BMC Public Health** 15(1), 2015.

Soriano J., Kendrick P., Paulson K., Gupta V., Abrams E., Adedoyin R., & Adhikari T., "*Prevalence and Attributable Health Burden of Chronic Respiratory Diseases, 1990--2017: A Systematic Analysis for the Global Burden of Disease Study 2017*", **The Lancet Respiratory Medicine** 8(6), 2020: 585-596.

Steenson S. & Buttriss J., "*The challenges of defining a healthy and 'sustainable' diet*", **Nutrition Bulletin** 45, 2020: 206-222.

Sudhinaraset M., Wigglesworth C., & Takeuchi D., "*Social and Cultural Contexts of Alcohol Use: Influences in a Social-Ecological Framework*", **Alcohol Research: Current Reviews** 38(1), 2016: 35-45.

Suk W., Ahanchian H., Asante K.A., Carpenter D., Diaz-Barriga F., Ha E.H., & Huo X., "*Environmental Pollution: An Under-Recognized Threat to Children's Health, Especially in Low- and Middle-Income Countries*", **Environmental Health Perspectives** 124(3), 2016.

Swinburn B.A., Kraak V.I, & Allender S., "*The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission Report*." **The Lancet**. 2019, 393(10173):791-846.

Taillie L., Busey E., Stoltze F., & Carpentier F., "*Governmental Policies to Reduce Unhealthy Food Marketing to Children*", **Nutrition Reviews** 77(11), 2019: 787-816.

Telama R., Yang X., Leskinen E., Kankaanpää A., Hirvensalo M., Tammelin T., Viikari J. & Raitakari O., "*Tracking of Physical Activity from Early Childhood through Youth into Adulthood*", **Medicine & Science in Sports & Exercise** 46(5), 2014: 955-962.

Thapsuwan S., Phulkerd S., Chamratrithirong A., Gray R.S, Jindarattanaporn N., Loyfah N., Thongcharoenchupong N. & Pattaravanich U., "*Relationship between Consumption of High Fat, Sugar or Sodium (HFSS) Food and Obesity and Non-Communicable Diseases*", **BMJ Nutrition, Prevention & Health**, 2024: e000794.

Tindall A., Petersen K., Skulas-Ray A., Richter C., Proctor D., & Kris-Etherton P., "*Replacing Saturated Fat with Walnuts or Vegetable Oils Improves Central Blood Pressure and Serum Lipids in Adults at Risk for Cardiovascular Disease: A Randomized Controlled-Feeding Trial*", **Journal of the American Heart Association** 8(9), 2019.

Toorang F., Sasanfar B., Esmaillzadeh A., & Zendehdel K., "*Adherence to the DASH Diet and Risk of Breast Cancer*", **Clinical Breast Cancer**, 2021.

Trübswasser, U., Talsma, E., Ekubay, S., Poelman, M., Holdsworth, M., Feskens, E. & Baye, K., *"Factors Influencing Adolescents' Dietary Behaviors in the School and Home Environment in Addis Ababa, Ethiopia"*, **Frontiers in Public Health** 10, 2022.

Tsochantaridou, A., Sergentanis, T., Grammatikopoulou, M., Merakou, K., Vassilakou, T. & Kornarou, E., *"Food Advertisement and Dietary Choices in Adolescents: An Overview of Recent Studies"*, **Children** 10(3), 2023: 442.

Vaida, N., *"Prevalence of Fast Food Intake among Urban Adolescent Students"*, **The International Journal of Engineering and Science** 2(1), 2013: 353-359.

Varman, S., Cliff, D., Jones, R., Hammersley, M., Zhang, Z., Charlton, K. & Kelly, B., *"Experiential Learning Interventions and Healthy Eating Outcomes in Children: A Systematic Literature Review"*, **International Journal of Environmental Research and Public Health** 18(20), 2021: 10824.

Verdonschot, A., Follong, B., Collins, C., Vet, E., Haveman-Nies, A. & Bucher, T., *"Effectiveness of School-Based Nutrition Intervention Components on Fruit and Vegetable Intake and Nutrition Knowledge in Children Aged 4–12 Years Old: An Umbrella Review"*, **Nutrition Reviews** 81(3), 2022: 304-321.

Webster J., Pillay A., Suku A., Gohil P., Santos J., Schultz J., Wate J., Trieu K., Hope S., Snowdon W., Moodie M., Jan S. & Bell C., "*Process Evaluation and Costing of a Multifaceted Population-Wide Intervention to Reduce Salt Consumption in Fiji*", **Nutrients** 10(2), 2018: 155.

Weihrauch-Blüher S., Schwarz P., & Klusmann J.H., "*Childhood Obesity: Increased Risk for Cardiometabolic Disease and Cancer in Adulthood*", **Metabolism** 92, 2019: 147--52.

Wirthlin, R., Linde, J., Trofholz, A., Tate, A., Loth, K. & Berge, J., *"Associations between Parent and Child Physical Activity and Eating Behaviors in a Diverse Sample: An Ecological Momentary Assessment Study"*, **Public Health Nutrition** 23(15), 2020: 2728-2736.

Woodruff, S. & Kirby, A., "*The Associations among Family Meal Frequency, Food Preparation Frequency, Self-Efficacy for Cooking, and Food Preparation Techniques in Children and Adolescents"*, **Journal of Nutrition Education and Behavior** 45(4), 2013: 296-303.

Wu Y., Wang S., Shi M., Wang X., Liu H., Guo S., Tan L., Yang X., Wu X. & Hao L., "*Awareness of Nutrition and Health Knowledge and Its Influencing Factors among Wuhan Residents*", **Frontiers in Public Health** 10, 2022.

Wu Z., & McGoogan J., "*Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases from the Chinese Center for Disease Control and Prevention*", **JAMA** 323(13), 2020: 1239-1242.

Xie J., Wang M., Long Z., Ning H., Li J., Cao Y., Liao Y., Liu G., Wang F., & Pan A., "*Global Burden of Type 2 Diabetes in Adolescents and Young Adults, 1990-2019: Systematic Analysis of the Global Burden of Disease Study 2019*", **BMJ**, 379, 2022: e072385.

Xiong T., Wu Y., Hu J., Xu S., Li Y., Kong B., & Zhang Z., "*Associations between High Protein Intake, Linear Growth, and Stunting in Children and Adolescents: A Cross-Sectional Study*", **Nutrients** 15(22), 2023: 4821-4821.

Yang, M., Wang, H. & Qiu, F., *"Neighbourhood Food Environments Revisited: When Food Deserts Meet Food Swamps"*, **The Canadian Geographer / Le Géographe Canadien** 64(1), 2019.

Yuyun M.F., Sliwa K., Kengne A.P., Mocumbi A.O., Bukhman G., "*Cardiovascular Diseases in Sub-Saharan Africa Compared to High-Income Countries: An Epidemiological Perspective*", **Global Heart** 15(1), 2020: 15.

Zarocostas J., "*Need to increase focus on non-communicable diseases in global health, says WHO*", **BMJ** 341, 2010: c7065.

Zhang, X., "*Effects of Omega-3 Intake on Adolescent Health*", **Highlights in Science Engineering and Technology**, 19, 2022: 89-98.

Ziso, D., Chun, O. & Puglisi, M., "*Increasing Access to Healthy Foods through Improving Food Environment: A Review of Mixed Methods Intervention Studies with Residents of Low-Income Communities"*, **Nutrients** 14(11), 2022: 2278.

Zorbas, C., Palermo, C., Chung, A., Iguacel, I., Peeters, A., Bennett, R. & Backholer, K., *"Factors Perceived to Influence Healthy Eating: A Systematic Review and Meta-Ethnographic Synthesis of the Literature"*, **Nutrition Reviews** 76(12), 2018.

Online Materials/Websites

American Cancer Society, *"The Global Cancer Burden,"* **American Cancer Society,** 2019. https://www.cancer.org/about-us/our-global-health-work/global-cancer-burden.html

American Heart Association, "*Understand Your Risks to Prevent a Heart Attack,"* **American Heart Association**, 2018. https://www.heart.org/en/health-topics/heart-attack/understand-your-risks-to-prevent-a-heart-attack

Cox A. & Jeffcoat K. "*Nurturing Independence: Building Kitchen Skills and Support for Teens.* **NWPF Nutrition.** 2024.

FMOH, "*Federal Ministry of Health*", Accessed August 2024. https://www.health.gov.ng/

GBD 2019 Diseases and Injuries Collaborators. "*Global Burden of 369 Diseases and Injuries, 1990--2019: A Systematic Analysis for the Global Burden of Disease Study 2019.*" **The Lancet**, 396(10258), 2020, 1204-1222.

Global Asthma Network, "*The Global Asthma Report 2018*", **Global Asthma Network**, 2018. https://globalasthmareport.org/2018/resources/Global_Asthma_Report_2018.pdf

HealthBridge "*Tobacco Control & NCD Prevention*." **HealthBridge**, 2024. https://healthbridge.ca/tobacco-control-ncd-prevention

International Diabetes Federation, "*IDF Diabetes Atlas 10th Edition*," **International Diabetes Federation**, 2021: 1-180.

Lai Z.T. "*Blood Pressure Variability*." **PhD diss., Maastricht University**, 2021. https://doi.org/10.26481/dis.20200115tz

National Academies of Sciences, Engineering, and Medicine, "*Health-Care Utilization as a Proxy in Disability Determination*", **National Academies Press**, 2018.

National Cancer Institute, "*Cancer in Children and Adolescents*", **National Cancer Institute**, 2017. https://www.cancer.gov/types/childhood-cancers/child-adolescent-cancers-fact-sheet

National Cancer Institute, "*What Is Cancer?*," **National Cancer Institute**, 2021. https://www.cancer.gov/about-cancer/understanding/what-is-cancer

Nigeria Population Commission, ICF International, "*Nigeria Demographic and Health Survey 2018*", **Ngfrepository.org.ng**, 2018.

Ogun State Government, "*About Ogun State*", **Ogunstate.gov.ng**, 2024.

Ogun State Ministry of Health. "*Ogun State Strategic Health Development Plan (2010-2015)*." 2015. http://ngfrepository.org.ng:8080/jspui/handle/123456789/3210

Ogun state, "*Strategic Plan of Action for Nutrition 2021 -- 2025*", **Ogun State Ministry of Health, Nigeria**, 2021.

Pan American Health Organization, "*Noncommunicable Diseases*," **Pan American Health Organization**, 2022. https://www.paho.org/en/topics/noncommunicable-diseases

Placzek O. "*Socio-economic and demographic aspects of food security and nutrition*", **OECD Food, Agriculture and Fisheries Papers**, 150, 2021.

Reports

Sutton, S. "*Social Cognitive Theory - an Overview | Sciencedirect Topics*", **Sciencedirect.com**, 2019. https://www.sciencedirect.com/topics/medicine-and-dentistry/social-cognitive-theory

UNICEF, "*Key Barriers To Food Marketing Regulation Global Survey Results Of 24 Countries Acknowledgements*", **UNICEF**, 2023.

United Nations Children's Fund. "*Noncommunicable Diseases*." **UNICEF DATA**, 2021. https://data.unicef.org/topic/child-health/noncommunicable-diseases/

World Cancer Research Fund International and American Institute for Cancer Research. "*Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective*." **Choice Reviews Online,** 45(9) 2008: 45-5024.

World Health Organisation, "*Hypertension*." ***World Health Organization***, 2023. https://www.who.int/news-room/fact-sheets/detail/hypertension

World Health Organisation, "*Noncommunicable Diseases*: *Childhood Overweight and Obesity*", **World Health Organisation**, 2020. https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity

World Health Organization Regional Office for Africa, "*Chronic Respiratory Diseases*", **WHO Regional Office for Africa**, 2017. https://www.afro.who.int/health-topics/chronic-respiratory-diseases

World Health Organization Regional Office for Africa, "*Nigeria*", **World Health Organization**, 2019. https://www.afro.who.int/countries/nigeria

World Health Organization, "*Adolescent Health*," **World Health Organization**, 2023. https://www.who.int/health-topics/adolescent-health

World Health Organization, "*Adolescents: Health Risks and Solutions*," **WHO**, 2023, https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions

World Health Organization, "*Cancer,*" **World Health Organization**, 2022. https://www.who.int/news-room/fact-sheets/detail/cancer

World Health Organization, "*Diabetes,*" **World Health Organization**, 2023. https://www.who.int/news-room/fact-sheets/detail/diabetes

World Health Organization, "*Global Action Plan for Prevention and Control of NCDs 2013-2020*". **World Health Organization: Geneva**, 2013: 30

World Health Organization, "*Global Cancer Burden Growing, amidst Mounting Need for Services*," **World Health Organization**, 2024. https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing--amidst-mounting-need-for-services

World Health Organization, "*Global Report on Diabetes*", **Geneva: World Health Organization**, 2016.

World Health Organization, "*Healthy Diet*," **World Health Organization**, 2020 https://www.who.int/news-room/fact-sheets/detail/healthy-diet

World Health Organization, "*Mental Health*," **World Health Organization**, 2024, https://www.who.int/health-topics/mental-health

World Health Organization, "*Noncommunicable Diseases*," **World Health Organization**, 2023. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

World Health Organization, "*Obesity*", **World Health Organization**, 2024. https://www.who.int/health-topics/obesity

World Health Organization, "*The Inequality Epidemic: Low-Income Teens Face Higher Risks of Obesity, Inactivity and Poor Diet*", **World Health Organization,** 2024.

World Health Organization, "*The Top 10 Causes of Death*." **World Health Organization**, 2020. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death

World Health Organization, "*The World Health Report 2002: Reducing Risks, Promoting Healthy Life*", **Geneva: World Health Organization**, 2002.

World Health Organization. "*Adolescent Health: The Missing Population in Universal Health Coverage*", **Geneva: WHO**, 2021.

World Health Organization. "*Background World Health Organization Regional Office for Africa Country Disease Outlook*", **World Health Organization**, 2023. https://www.afro.who.int/sites/default/files/2023-08/Nigeria.pdf

World Health Organization. "*Nigeria NCD Profile 2018*." **World Health Organization**, 2018.

World Health Organization. "*Noncommunicable Diseases*." **World Health Organization**, 2020. https://www.who.int/health-topics/noncommunicable-diseases

World Health Organization. "*Obesity and Overweight*." **World Health Organization**, 2024. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Textbooks

Drewnowski A., & Monsivais P., "*Taste, cost, convenience, and food choices: Present Knowledge in Nutrition*", **Academic Press**, 2020: 185-200.

Lassi Z., Moin A., & Bhutta Z., "*Nutrition in Middle Childhood and Adolescence," In Disease Control Priorities, Third Edition (Volume 8): Child and Adolescent Health and Development, edited by D. Bundy, N. de Silva, S. Horton, D. Jamison & G. Patton*, **Washington, DC: World Bank**, 2017: 133-146.

Malmquist S. & Prescott K., "*Nutrition and Diet: In Human Biology*", **Minneapolis: OpenStax**, 2022.

More J., "*Infant, Child and Adolescent Nutrition*", **CRC Press**, 2021. https://doi.org/10.1201/9781003093657

Nick B. & Bovet P., "*Noncommunicable Diseases"*. **Taylor & Francis**, 2023.

Pappan N. & Rehman A., "*Dyslipidemia*", **StatPearls**, 2023.

Singh A. & Nandy A., "*Lifestyle Diseases in Adolescents*: *Addressing Physical, Emotional, and Behavioral Issues*", **Bentham Science Publishers**, 2024.

Storad, C. "Your Circulatory System", **Minneapolis: Lerner Publishing Group**, 2017.

Thompson K., Barth M., & Gutschall M., "*Life Cycle Nutrition for Public Health Professionals*", **Springer Publishing Company**, 2024.

Theses/Dissertations

Rampalli K. K., "*Food Choice Decision-Making Among School-Going Adolescents Amidst the Nutrition Transition in Urban Accra, Ghana*", **PhD diss., University of South Carolina**, 2021.

Yılmaztürk N.H., "*A Phenomenological Study on Emotional Eating Experiences of Adolescents*", **PhD diss., Middle East Technical University**, 2024.

Daly A., "*Exploring Factors Associated with the Eating Behaviors and Influences on Food Choice in Irish Teens*", **PhD diss., Technological University Dublin**, 2022.

Lai Z.T., "Blood Pressure Variability**." PhD diss., Maastricht University**, 2021. https://doi.org/10.26481/dis.20200115tz