

**STUDIES ON SOME FACTORS INFLUENCING BODY MASS INDEX (BMI) IN
EVBOBIKE COMMUNITY , EKEHWAN ROAD , BENIN CITY.**

BY

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**DEPARTMENT OF ANATOMY,
SCHOOL OF BASIC MEDICAL SCIENCES,
UNIVERSITY OF BENIN , BENIN CITY ,
EDO STATE , NIGERIA.**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF ANATOMY, SCHOOL OF
BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE,
NIGERIA.**

**IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF
BACHELOR OF SCIENCE (B.Sc.) DEGREE IN ANATOMY**

SUPERVISED BY: DR.E .E IGHALO

CERTIFICATION

I, **IHAZA OLUWAFEMI CLEMENT**, hereby wish to certify that the research work presented in this dissertation for the award of bachelor of science (B.Sc) degree in Anatomy is the result of an independent research done by me under the supervision of **Dr. E. E ighalo** and any assistance given was duly acknowledged. I also certify that this dissertation has not been submitted anywhere else in part or in full for any other examination or institution. All literatures and other sources of information consulted, cited or used in this research have been duly acknowledged in references.

DR.E.E IGHALO

(SUPERVISOR)

DATE

Dr. A.B. ENIOGERU

(HEAD OF DEPARTMENT)

DATE

EXTERNAL EXAMINER

DATE

DEDICATION

This work is dedicated to God almighty for keeping me alive throughout my academic sojourn and especially throughout the duration of this research.

ACKNOWLEDGEMENT

All praise be to God almighty for making me capable of this achievement. I would like to express my sincere gratitude to my supervisor, **Dr.E.E Ighalo** , for his invaluable guidance, support, and encouragement throughout this work.

My sincere appreciation goes to the authors of the studies included in this review, whose research has contributed significantly to the advancement of knowledge in the field.

I will specially like to thank my parent Mr. Patrick Ihaza and Mrs. Patience Ihaza for all they have done for me, during the course of this program and otherwise.

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ABSTRACT

This study examined the influence of sex, age, ethnicity, diet, on Body Mass Index (BMI) among residents of Evbobike community, Ekenwan town, Edo State, Nigeria. Two Hundred and Fifty (250) participants were assessed, consisting of twenty-four (130) males and twenty-six (120) females across different ethnic groups including Bini, Esan, Yoruba, Hausa-Fulani, Igbo, Urhobo, and Fulani. Height and weight were measured using standard anthropometric methods, and BMI was calculated as weight (kg) divided by the square of height (m²). The majority of individuals falling within the WHO-defined normal range(55.2%). , The mean BMI of males was significantly higher than of the females ($p = 0.03770 < 0.05$), this demonstrate a statistical sexual dimorphism in BMI within the Evbobike community in Evbobike both sexes appeared equally exposed to nutritional determinants such as diet and lifestyle. However,males showed greater with cases of both severe underweight . The Hausa , Bini and Esan ethnic groups now have significantly higher BMI values. The p -value = 0.013 (< 0.05) indicates that BMI difference across are statistically significant. The BMI increases steadily across age groups, the p value is <0.05 , which indicate statistical significance difference in BMI across age groups. Older participant have higher BMI on average. The distribution 7.6% underweight, 55.2% normal, 25.2% overweight, and 12% obese illustrates a double burden of malnutrition. The coexistence of underweight and obesity within the same community is a hallmark of nutritional transition, where food insecurity exists alongside increased consumption of calorie-dense diets.In conclusion, this study provides clear evidence that age, gender and race are significant factors influncing BMI in the studied population The findings call for integrated interventions addressing nutrition, lifestyle, and economic realities to promote healthier BMI distribution in the community.

CHAPTER ONE

1.0 Introduction

1.1 Background of the Study

Body Mass Index (BMI), also known as the Quetelet Index, is a measure of body weight scaled according to height. It provides a simple numerical value that allows health professionals to discuss weight problems more objectively with their patients. Although BMI was originally designed for statistical purposes, it has become widely used in both clinical and public health settings as a means of classifying sedentary individuals with average body composition (Romero-Corral et al., 2008).

BMI provides a simple numeric measure of a person's *thickness* or *thinness*, allowing health professionals to discuss weight problems more objectively with their patients. BMI was designed to be used as a simple means of classifying average sedentary (physically inactive) populations, with an average body composition. For such individuals. According to the World Health Organization, a BMI of 18.5–24.9 indicates normal weight, values below 18.5 indicate underweight, 25.0–29.9 indicates overweight, and ≥ 30 indicates obesity. These ranges are applied globally, though their predictive accuracy for health risks can vary by age, sex, and ethnicity (Winter, MacInnis, & Wattanapenpaiboon, 2014; Janssen, Katzmarzyk, & Ross, 2002). BMI remains a convenient, inexpensive, and non-invasive tool, but it does not distinguish between fat and muscle mass, making it less accurate for athletes or older individuals (Romero-Corral et al., 2008).

In Nigeria, most reference values for BMI are based on Caucasian populations, despite evidence that race, ethnicity, and sex strongly influence BMI outcomes (Okoseimiema & Obomanu-Tamunotonjo, 2022). Studies show that cultural factors, dietary habits, and physical activity patterns can shape differences in body weight across ethnic groups (Akinpelu, Oyewole, & Adekanla, 2015). For example, some Nigerian populations view larger body sizes as desirable, which may contribute to higher rates of overweight and obesity (Maruf, Akinpelu, & Udoji, 2014).

Sexual dimorphism also plays a role in BMI variation, as men tend to have more lean muscle mass while women have higher body fat composition due to hormonal differences. These

differences contribute to varying risks for conditions such as central obesity, hypertension, and metabolic syndrome (Okafor et al., 2011; Okosun et al., 2022). In Nigeria, obesity has been shown to correlate strongly with hypertension, diabetes, and poor lipid profiles, even in rural communities (Odenigbo et al., 2011). Furthermore, increased BMI has been associated with reduced physical and mental quality of life among obese individuals (Osuji et al., 2015)

The environment that an individual lives plays an important role in determining his or her BMI. Fawehinmi & Oladipo (2004) stated that, individuals living in stable and resourceful environments tend to have a higher BMI when compared to those in stressful or war areas. Furthermore, early-life nutrition can influence BMI later in life, as fetal undernutrition has been linked to non-insulin dependent diabetes and cardiovascular diseases (Fawehinmi & Oladipo, 2004; Zhou et al., 2020). Hereditary predisposition plays a key role in evaluating BMI and obesity can be inherited.

The social and financial status of an individual can influence his BMI. People that have higher-income tend to have higher BMI especially, when they live a sedentary lifestyle and consume high calorie-dense foods. According to Guldan (2020), people with lower income may experience undernutrition. This may be as a result of lack of funds. Anekwe et al. (2020) reported that these disparities contribute to variations in BMI across different Ethnic and social groups.

There are some health risks associated with abnormal BMI values (Kobo et al., 2019). Okolo and Mahmood (2020) reported that, high BMI is associated to increased risks of diabetes, cardiovascular diseases, hypertension, and premature death. Contrawise, a low BMI is associated with malnutrition, osteoporosis, and weakened immune function. Health complications can be prevented if an individual manages his BMI by adjusting his food intake and engage in sports or physical activities (American Diabetes Association, 2019). Several research works have been done on BMI, but then, the public perception and knowledge about weight status often do not agree with actual BMI classifications. Many individuals misclassify themselves, with overweight or obese individuals believing they have a normal weight, which can hinder weight management efforts.

The community of Evbobike, like many rural and semi-urban communities in Nigeria, presents a unique setting for studying the interplay between race and sex on BMI. It is a community characterized by ethnic diversity, traditional food practices, and a lifestyle that balances manual

labor with emerging modern influences. Unlike urban centers where Western diets and sedentary lifestyles are more common, communities like Evbobike provide insight into how indigenous diets, levels of physical activity, and cultural practices shape BMI differently across racial groups and sexes. Furthermore, with the increasing globalization of diets and lifestyles, rural communities are undergoing transitions that may affect body composition and overall health outcomes.

Studying the relationship between race, sex, diet and BMI in Evbobike is therefore not only of academic importance but also of public health relevance. By identifying patterns in BMI across different racial groups and between males and females, this study may highlight risk factors for malnutrition, obesity, or metabolic disorders in the community. Such findings can contribute to the design of culturally sensitive health interventions, nutritional education programs, and preventive strategies tailored to the needs of specific subpopulations.

1.2 Statement of the Problem

Body Mass Index (BMI) is an important indicator of nutritional status and overall health. Abnormal BMI values are linked to increased risks of hypertension, diabetes, and cardiovascular diseases. In many Nigerian communities, lifestyle changes and dietary habits have contributed to varying BMI outcomes. However, limited data exists describing how BMI differs across age, sex, and race in the study area, making it difficult to implement targeted health interventions. This study therefore seeks to investigate BMI variations across these demographic categories in order to support evidence-based decision making in public health planning.

1.3 Objectives of the Study

The primary objective of this study is to identify factors influencing Body Mass Index (BMI) among residents of the Evbobike community, Edo State.

The specific objectives are:

- i. To measure the weight, height, and calculate the BMI of male and female subjects in Evbobike community.
- ii. To compare the BMI across various age group in evbobike community.

- iii. To compare BMI between males and females in order to identify any sexual dimorphism.
 - iv. To assess ethnic variations in BMI among different groups within the community.
5. To assess the prevalence (underweight, normal, overweight and obese) of BMI categories within the Evbobike community

1.4 Research Questions / Hypotheses

The study will be guided by the following research questions:

- i. What is the distribution of BMI among the Evbobike population, and how does this distribution vary across different age, sex, and race?
- ii. How does the relationship between cultural norms about body size and BMI affect individuals' perceptions and health outcomes in Evbobike?
- iii. What is the prevalence and distribution of BMI categories (underweight, normal, overweight, obese) within the Evbobike community?

1.5 Significance of the Study

This study is significant for several reasons. On an academic level, it will fill a critical gap in the existing body of literature by providing a detailed, empirical analysis of a specific Nigerian community. The findings will also provide valuable, evidence-based data for health policymakers in Edo State, enabling them to design and implement nutritional programs and interventions that are tailored to the specific needs and challenges of the Evbobike population. The study's detailed health profile will empower local leaders and healthcare providers with the information needed to address the most pressing public health challenges in their community, thereby fostering a healthier and more informed citizenry.

1.6 Scope of the Study

The study is geographically delimited to the Evbobike community, located in Ovia North-East Local Government Area of Edo State, Nigeria. The study population will include residents aged 16 to 70 years. The research will focus on a comprehensive set of variables influencing BMI. The study is limited to measuring and comparing BMI across age groups, sex, and ethnic

backgrounds among individuals in the study area. It does not assess other health indicators such as blood pressure, dietary intake analysis, or physical activity levels.

1.7 Operational Definition of Terms

For consistency and clarity, the following terms are operationally defined for the purpose of this study

Body Mass Index (BMI): A measure of body fat based on weight in kilograms divided by height in meters squared (kg/m^2).

Underweight: BMI less than 18.5.

Normal Weight: BMI between 18.5 and 24.9.

Overweight: BMI between 25.0 and 29.9.

Obesity: BMI 30.0 and above.

Ethnicity: A cultural identity group to which an individual belongs.

Age Group: A classification of individuals based on age ranges such as below 20 years, 20-40 years, and above 40 years.

Evbobike Community: A settlement in the Ovia North-East Local Government Area of Edo State, Nigeria. The study will focus on its residents.

CHAPTER TWO

2.0 Literature Review

2.1 Definitions and Conceptualization of BMI and Adiposity

Body Mass Index (BMI) is a measure of a person's weight in relation to their height, calculated as weight in kilograms divided by height in meters squared (kg/m^2) (PhenX Toolkit, 2025). Developed in the 19th century by the Belgian mathematician Adolphe Quetelet, it was originally intended as a tool for population-level health surveillance, not as a diagnostic measure for individuals (World Obesity Federation, 2025). Despite its widespread use, BMI is considered a crude estimate of adiposity because it does not distinguish between fat mass, muscle mass, and bone density (Engineering National Academies of Sciences *et al.*, 2023). For example, a highly muscular athlete may have a high BMI without having excessive body fat. Furthermore, BMI does not account for the distribution of fat, which is a critical determinant of health risk. Central obesity, or abdominal fat, is a more reliable predictor of cardiovascular and metabolic disease risk than overall BMI. Despite these limitations, BMI remains the most practical, inexpensive, and non-invasive tool for assessing nutritional status in large-scale population studies (Wu *et al.*, 2024).

The Socio-Ecological Model provides a comprehensive framework for understanding the determinants of health behaviors, including those that influence BMI. It posits that an individual's health is a result of the complex interplay between multiple levels of influence, ranging from the immediate personal sphere to broader societal structures (Abiona *et al.*, 2025).

The model is typically organized into five nested levels:

The Individual Level encompasses a person's internal characteristics, such as their knowledge, attitudes, beliefs, self-efficacy, and skills. For BMI, this includes a person's nutritional knowledge, their belief in their ability to exercise, or their perception of their own body size (Fiveable, 2025). Interpersonal Level considers the influence of an individual's social networks, including family, friends, and peers. For example, a person's dietary habits can be shaped by family meal patterns, and their body image perception can be influenced by social norms (Olumakaiye *et al.*, 2010). Community Level includes the settings in which people live and work, such as schools, workplaces, and local neighborhoods. The availability of recreational

spaces or the proximity of fast-food restaurants within a community can directly impact physical activity and dietary choices (Oyeyemi *et al.*, 2012). Organizational/Structural Level includes institutions like local governments, healthcare systems, and schools. This level influences health through policies and practices, such as the implementation of school feeding programs or the availability of public health clinics (Federal Ministry of Health and Social welfare, 2025). The outermost, Societal/Policy Level encompasses broad societal factors such as cultural norms, economic conditions, and national policies. For BMI, this includes national nutrition policies, food subsidies, or the marketing of unhealthy foods, all of which shape the food environment and health behaviors at a macro level (Morgan and Fanzo, 2020).

The utility of the SEM is that it discourages a simplistic approach to health interventions. It illustrates that focusing solely on individual-level education (a "downstream" approach) may be ineffective if the "upstream" societal and community-level factors, such as food price inflation or a lack of safe walking spaces, are not also addressed. Applying this model to the Evbobike community allows for a nuanced analysis of how a person's BMI is not just a result of personal choices but is also a symptom of their broader living conditions and the structural environment.

The life-course theory emphasizes that health and disease outcomes in adulthood are closely related to experiences and exposures earlier in life (Ferraro *et al.*, 2003). It operates on the concept of a "chain of risk," where adversity at one stage can alter a person's life trajectory, leading to adverse health outcomes later on (Ferraro *et al.*, 2003). In the context of BMI, this framework suggests that an individual's weight status is a cumulative result of their lifetime experiences, not just a snapshot of their current behaviors. For instance, studies show a strong link between childhood overweight and the likelihood of becoming obese in adulthood, with the correlation being stronger for those who were overweight during adolescence (Afolabi *et al.*, 2004). For women, a rise in BMI in their 30s is often linked to childbearing and exiting the "marriage market" (Ferraro *et al.*, 2003). While this study is cross-sectional and cannot track individuals over time, the life-course perspective provides a vital interpretative lens. It suggests that data collected on early-life factors, such as maternal health and childhood feeding practices, can provide a more complete picture of the adult BMI distribution in Evbobike, as it may be influenced by historical events like undernutrition that have set the stage for later weight gain.

The energy-balance model is the fundamental physiological principle governing body weight. It states that weight is determined by the relationship between "ENERGY IN" (calories consumed

through food and beverages) and "ENERGY OUT" (calories burned through metabolism and physical activity) (Dombrowski *et al.*, 2012). When energy intake exceeds energy expenditure over time, a caloric surplus is created, leading to weight gain as the excess is stored as fat. Conversely, a caloric deficit results in weight loss (Fiveable, 2025). The model is crucial because it provides the biophysical foundation for the study, establishing that all the socioeconomic, environmental, and behavioral factors ultimately influence BMI by acting on either the "ENERGY IN" or "ENERGY OUT" side of the equation (Nixon *et al.*, 2012).

Two key behavioral theories are useful for understanding the psychological drivers of diet and physical activity (Dombrowski *et al.*, 2012). The Health Belief Model (HBM) focuses on an individual's perceptions of health risks and benefits. It posits that a person is more likely to engage in a health-promoting behavior if they perceive themselves to be susceptible to a disease, view the disease as severe, and believe that the recommended action is beneficial and has manageable barriers (Nixon *et al.*, 2012). In Evbobike, this could mean an individual is more likely to exercise if they believe they are at risk for diabetes, see it as a serious condition, and feel confident that exercising will help them manage their weight without undue cost or inconvenience.

The Theory of Planned Behavior (TPB), on the other hand, suggests that a person's intention to perform a behavior is the most immediate predictor of that behavior (Annesiand Powell, 2024). This intention is shaped by three main factors: the individual's attitude toward the behavior, their perception of what social norms dictate, and their perceived behavioral control (i.e., their belief in their ability to perform the behavior successfully) (Oyeyemi *et al.*, 2012). These models are important because they shift the focus from what people should do to what they are psychologically primed to do, offering a framework for understanding and potentially influencing their choices (Wu *et al.*, 2024).

2.1.1 Causal And Correlational Thinking

The study is a cross-sectional correlational design, which means it can identify associations between variables but cannot definitively prove causality (Adamou *et al.*, 2024). This is a critical distinction to maintain throughout the analysis and interpretation of the findings. For instance, while a study may find a strong correlation between income and BMI, it cannot establish whether low income causes higher BMI or if health conditions related to a high BMI restrict a person's

earning potential (Templin *et al.*, 2019). The analysis must therefore consider key methodological issues such as confounding, mediation, and effect modification.

Confounding occurs when a third variable influences both the exposure and the outcome, creating a spurious association. Mediation describes a process where one variable influences another through an intermediate variable (e.g., socioeconomic status influences BMI by first affecting dietary patterns) (Ozodiegwu *et al.*, 2020). Effect modification describes a situation where the relationship between two variables differs across different subgroups (e.g., the correlation between education and BMI may be different for men and women) (Byiringiro *et al.*, 2022; Ozodiegwu *et al.*, 2020).

2.2 Overview of Body Mass Index (BMI)

Body Mass Index has a rich history that begins not in medicine, but in mathematics. It was invented in the 19th century by Adolphe Quetelet, a Belgian mathematician and sociologist, who sought a simple formula to describe obesity at the population level (World Obesity Federation, 2025). Quetelet was not a physician and was reportedly clear that BMI was not intended to be a measure of individual health or body fat (World Obesity Federation, 2025). For decades, BMI was a little-known tool. The medical community did not widely regard overweight and obesity as a population-wide health risk until the late 20th century, with a 1969 study finding that both patients and physicians considered deviations from weight standards to be "almost meaningless" (Flegal, 2023). The medicalization of BMI accelerated in the 1990s, when a BMI category for obesity was adopted by the World Health Organization (WHO) and subsequently by the U.S. government (Flegal, 2023). Today, BMI is the backbone of most national and international epidemiological surveys, serving as a powerful and cost-effective screening tool for monitoring trends in overweight and obesity (Engineering National Academies of Sciences *et al.*, 2023).

The continued use of BMI in public health and clinical settings is due to its significant advantages. It is simple to calculate, requires only basic equipment (a scale and a stadiometer), and is therefore highly cost-effective and non-invasive (Engineering National Academies of Sciences *et al.*, 2023). Its simplicity makes it ideal for large-scale surveys and for quickly screening individuals in clinical practice (Wu *et al.*, 2024).

However, BMI has significant limitations that must be acknowledged for a responsible analysis. It is a crude estimate of adiposity because it cannot distinguish between fat mass and lean body

mass (muscle and bone), which are both denser than fat tissue (Flegal, 2023). For example, a person with a high muscle mass, like a professional athlete, may have a high BMI but a low percentage of body fat, leading to a misclassification of their health status. More importantly, BMI does not account for the location of body fat (Wu *et al.*, 2024). Visceral fat, which accumulates around the organs, is a greater risk factor for chronic diseases like diabetes and heart disease than subcutaneous fat, but BMI cannot differentiate between the two (Muscogiuri *et al.*, 2023). For these reasons, many health organizations now recommend a more comprehensive assessment for individuals, incorporating measures like waist circumference, waist-to-hip ratio, and body fat percentage from methods like dual-energy X-ray absorptiometry (DEXA) or bioelectrical impedance analysis (BIA) (Federal Ministry of Health and Social welfare, 2025; World Obesity Federation, 2025).

2.2.1 Standard Cut-offs and Local Adaptation

For adults aged 20 and over, the WHO defines BMI categories using a standard set of cut-offs that are largely universal across populations, Underweight (BMI below 18.5), Normal Weight (BMI between 18.5 and 24.9), Overweight (BMI between 25.0 and 29.9) and Obesity (BMI of 30.0 or greater) (World Obesity Federation, 2025).

For children and adolescents aged 5-19, BMI is interpreted differently using sex- and age-specific percentile cut-offs from a reference population, as their body composition changes rapidly with growth (PhenX Toolkit, 2025). Underweight (Less than the 5th percentile), Normal Weight (5th to less than the 85th percentile), Overweight (85th to less than the 95th percentile) and Obesity (95th percentile or greater) (Adeomi *et al.*, 2021).

A critical consideration for the Evbobike study is the need for local adaptation. The original BMI classifications were based on data from a predominantly White, European population (Wu *et al.*, 2024). Evidence suggests that different ethnicities may have different health risks at the same BMI (Engineering National Academies of Sciences *et al.*, 2023). For example, studies on South Asian and Polynesian populations have shown that they are at increased health risk at lower BMI values, suggesting the need for population-specific thresholds (Wu *et al.*, 2024). The findings of this study on the BMI distribution in the Edo State population can provide valuable data for determining if locally or regionally adapted cut-offs are necessary in the future.

2.2.2 Measurement Protocols

To ensure the validity and reliability of the data, the measurement of height and weight must adhere to standardized protocols. These procedures are critical for minimizing measurement error and ensuring that the data is comparable to other studies (PhenX Toolkit, 2025). The PhenX Toolkit and NHANES provide detailed guidelines for anthropometric measurements.

Key elements of a standardized protocol include:

Equipment: The use of a calibrated digital scale for weight and a stadiometer for height. Scales should be calibrated daily and the calibration results logged (PhenX Toolkit, 2025).

Participant Preparation: Participants should be asked to remove shoes, heavy clothing, and any items from their pockets (e.g., cell phones, wallets). For height measurements, hair accessories or headwear that may interfere with the measurement should be removed (Muscogiuri *et al.*, 2023; PhenX Toolkit, 2025).

Standardized Positioning: For height, the participant must stand erect with their feet together and their head aligned in the Frankfort horizontal plane (a line from the ear canal to the lower border of the eye orbit parallel to the floor). For weight, the participant should stand still in the center of the scale with their weight evenly distributed (World Obesity Federation, 2025).

Duplicate Measurements: To minimize observer error, duplicate measurements should be taken for both height and weight. A third measurement is required if the first two differ significantly (e.g., >1.0 cm for height or >200 grams for weight), and the average of the two closest measurements is used (Muscogiuri *et al.*, 2023).

Recording: Measurements should be recorded in a consistent format (e.g., kilograms and meters) and verified for accuracy (PhenX Toolkit, 2025). Adhering to these protocols is crucial for a community-based study in Evbobike, where a variety of technicians may be involved in data collection. Training, retraining, and the use of standardized equipment and forms will be essential to ensure data quality.

2.3 Epidemiology of BMI

The global epidemiology of BMI reveals a rapid and concerning increase in the prevalence of overweight and obesity. From 1990 to 2022, the worldwide prevalence of obesity has more than doubled in adults and quadrupled in children and adolescents. In 2022, nearly 880 million adults were living with obesity, and this number, combined with the 159 million children affected, brings the total to over one billion people (WHO, 2025a). Concurrently, the proportion of people who are underweight has declined, making obesity the most common form of malnutrition in most countries (O'Hare, 2024). This dramatic shift is not confined to high-income nations; the prevalence of overweight is rising rapidly in low- and middle-income countries as well, creating a truly global public health crisis (O'Hare, 2024).

Sub-Saharan Africa, including Nigeria, is increasingly facing the double burden of malnutrition (Wojcicki, 2014). While undernutrition, particularly among children, remains a major challenge, adult and childhood overweight and obesity rates are rising rapidly (Adeomi *et al.*, 2021). A key finding in some studies is a seeming paradox: there are inverse associations between the prevalence of adult overweight/obesity and child undernutrition at a national level. This suggests that countries undergoing a nutrition transition have not yet reached a level of economic development where the double burden is highly prevalent in individual households (Adeomi *et al.*, 2021). However, this situation is rapidly changing, and a growing incidence of overweight and obesity in developing countries has been noted. The shift from traditional diets to Westernized, energy-dense foods, combined with reduced physical activity, is a key driver of this trend (Afolabi *et al.*, 2004).

2.4 Rural And Urban Patterns and Nutrition Transition

The nutrition transition in Africa is strongly characterized by a rural-to-urban divide. In general, urban populations tend to have higher rates of overweight and obesity compared to their rural counterparts (Umuerrri *et al.*, 2017). This is because urban environments often offer greater access to processed, high-energy foods and have living and working conditions that promote sedentary behavior (Beddington *et al.*, 2017). Nigeria is a clear example of this trend, with studies in Delta State finding that the prevalence of obesity and overweight was significantly higher in urban areas compared to rural ones (Umuerrri *et al.*, 2017). However, this urban advantage in health is not always straightforward. As urbanization accelerates, the "triple

burden" of malnutrition, undernutrition, micronutrient deficiencies, and over-nutrition can be seen in the same urban settings (Beddington *et al.*, 2017).

The Evbobike community is located in the Ovia North-East Local Government Area, which is in close proximity to Benin City, a major urban center. It is therefore reasonable to hypothesize that the Evbobike community is experiencing the early to middle stages of the nutrition transition. The community is likely grappling with the dual challenge of persistent undernutrition alongside a growing prevalence of overweight and obesity (Olumakaiye *et al.*, 2010). A study on primary school pupils in Edo State corroborates this, finding a "worrisome prevalence of over-nutrition" (14% obesity) coexisting with pockets of undernutrition (Ogboghodo *et al.*, 2023). The expected patterns for Evbobike are a significant urban-like prevalence of overweight and obesity, driven by socioeconomic and dietary changes associated with its semi-urban location (Byiringiro *et al.*, 2022; Federal Ministry of Health and Social welfare, 2025; Ogboghodo *et al.*, 2023).

2.5 Categories of Factors Influencing BMI

2.5.1 Socioeconomic and Demographic Factors

The current evidence from Nigeria suggests that the country is at a transitional stage where this relationship is rapidly changing, making it a critical area for investigation. BMI generally increases with age throughout adulthood, peaking in middle age before leveling off or declining in later life (Ferraro *et al.*, 2003). A Nigerian study found that overweight and obesity were most prevalent among middle-aged (40-64 years) individuals (Umuferri *et al.*, 2017). A consistent pattern in Nigeria and globally is that women, particularly middle-aged women, have a higher prevalence of obesity than men (Mshelia-Reng *et al.*, 2023). A study on civil servants in Nigeria found that while overweight was slightly higher in males, obesity was significantly more prevalent in females (47.7% vs. 38.3%) (Sanusi *et al.*, 2015).

This makes a study in Evbobike particularly important for testing where this specific community falls on this socio-economic-epidemiological gradient. Measurement of wealth can be done through a household asset index (e.g., ownership of a car, television) (Ozodiegwu *et al.*, 2020). A higher level of education is often associated with a lower BMI, particularly in women (Ozodiegwu *et al.*, 2020). A Nigerian study on students found that good nutritional knowledge was associated with a healthier BMI profile and a lower prevalence of both underweight and obesity (Sart *et al.*, 2023). However, this relationship can be complex; some studies have found

that higher education is associated with a lower BMI in developed countries but may show the opposite trend in low-income countries (Abiona *et al.*, 2025).

For women, a higher parity (the number of children a woman has had) is often associated with a higher BMI, as is being married (Segun *et al.*, 2024). Studies have shown that family size can also be a significant predictor, though findings can vary (Akinsola *et al.*, 2018; OgbeandIkogho, 2025). The shift from rural to urban living is a significant driver of the nutrition transition (Byiringiro *et al.*, 2022). Studies in Nigeria have consistently shown that urban dwellers have a higher prevalence of overweight and obesity compared to their rural counterparts (Umuerri *et al.*, 2017). Migration from African nations to high-income countries is also strongly associated with weight gain, reflecting a similar process of acculturation to new diets and sedentary lifestyles (Umuerri *et al.*, 2017).

2.5.2 Dietary Factors (Intake And Patterns)

The nutrition transition is largely driven by changes in dietary habits. Traditional diets, often based on starchy staples, are being replaced by energy-dense, nutrient-poor, processed foods.

While the energy-balance model is a simple concept, measuring its components is complex. A study on urban market women in Nigeria found that their mean energy intake was 164% of the recommended dietary allowance, and this energy intake was positively correlated with BMI (Afolabi *et al.*, 2004). Additionally, a significant proportion of pupils in Edo State rely on carbohydrate-rich foods, raising concerns about the nutritional adequacy of their diets (Ogboghodo *et al.*, 2023). This suggests that not only is energy intake a concern, but the composition of that energy is shifting towards a greater proportion of refined carbohydrates and fats (Petrikova *et al.*, 2023).

The consumption of fast food is high among young people in Nigeria, with convenience and value for money being strong motivators (Mukoru *et al.*, 2023). This is a clear indicator of the dietary transition, where traditional home-cooked meals are being replaced by energy-dense, high-fat, high-sugar options. The rise of supermarkets and the aggressive marketing of packaged foods in urban environments exacerbates this trend (Petrikova *et al.*, 2023). Despite the clear health benefits, the intake of fruits and vegetables in Nigeria is often low, particularly among older adults due to factors like chewing difficulties. The low consumption of fruits and

vegetables, which have low energy density, is a significant factor influencing the high prevalence of overweight and obesity (KayodeandAlabi, 2020).

A flawed meal pattern, characterized by skipping breakfast and replacing meals with snacks, has been observed in Nigerian adolescents. A study on undergraduates found that the majority consumed snacks daily. Frequent snacking, particularly on high-energy foods, is a significant factor in the development of overweight and obesity (KayodeandAlabi, 2020). The pattern of infant feeding during the first 1,000 days of life has a significant influence on a child's growth trajectory and future risk of obesity (OgbeandIkogho, 2025). The evidence suggests that exclusive breastfeeding can have a protective effect against the development of childhood obesity. A study on nursing mothers in Ekiti State found that while a large proportion engaged in exclusive breastfeeding, there was no correlation between this practice and the mothers' BMI, suggesting a complex relationship (Ijarotimi, 2010).

2.5.3 Physical Activity and Sedentary Behavior

The "ENERGY OUT" side of the energy balance model is equally important, and it is also undergoing significant changes as a result of the nutrition transition. Physical activity is a critical intervention for curbing rising obesity rates. However, the patterns of physical activity in Africa differ from those in high-income countries. While a large portion of total physical activity in low- and middle-income countries is derived from work and transport, leisure-time physical activity is low (Muti *et al.*, 2023).

Modernization has led to a reduction in energy expenditure due to the mechanization of work and transport (Ebersole *et al.*, 2008). A study on Nigerian university students found a high prevalence of sedentary behavior, with students spending prolonged periods of inactivity, particularly in the afternoons and evenings. This prolonged sedentary behavior, which is distinct from physical inactivity, is associated with a range of health problems (Adewoyinand Ayo-Ajayi, 2025). The built environment plays a significant role in influencing physical activity. Factors such as workability, the availability of recreational spaces, and the quality of pedestrian pathways can all influence BMI (Oyeyemi *et al.*, 2012). A Nigerian study found that poor neighborhood aesthetics and distant access to commercial facilities were associated with being overweight (Mbada *et al.*, 2009). The type of occupation an individual has can be a strong predictor of BMI. A study on oil and gas workers in the Niger Delta found a high prevalence of obesity, with a mean BMI of

30.14 kg/m²(Onigbogi *et al.*, 2022). This suggests that sedentary, high-stress occupations may be a significant driver of weight gain, as opposed to physically demanding jobs in agriculture or manual labor.

2.5.4 Health Status and Biological Factors

Evidence suggests a moderately strong genetic influence on BMI, with heritability estimates for weight and BMI around 50% (Luke *et al.*, 2001). While the familial patterns of body size are consistent, environmental factors play a significant role in determining the actual prevalence of obesity (Mbada *et al.*, 2009). A family history of cardiovascular disease was found to be a significant determinant of obesity among oil and gas workers in Nigeria (Onigbogi *et al.*, 2022).

The relationship between chronic illnesses and BMI is complex. While conditions like HIV and tuberculosis (TB) are often associated with undernutrition and wasting, particularly when untreated, access to effective treatment can lead to weight gain. This creates a complex dynamic where improving health outcomes (e.g., survival from HIV/TB) may be inadvertently contributing to a rise in BMI (World Food Programme, 2025).

For women, reproductive factors are significant determinants of BMI. Pregnancy, postpartum weight retention, and menopause can all influence weight (Adamou *et al.*, 2024). A Nigerian study found a significant association between parity and BMI, with higher parity linked to a higher BMI (Adebamowo *et al.*, 2023).

A high burden of infections and parasitic diseases, often linked to poor water, sanitation, and hygiene (WASH), can lead to persistent diarrhea and reduced nutrient absorption, thereby contributing to undernutrition. This is an indirect but important factor that must be considered when analyzing the overall nutritional status of a community (Adebamowo *et al.*, 2023).

2.5.5 Psychological and Behavioral Factors

A bidirectional association exists between obesity and mental health conditions like depression and anxiety (Rajanand Menon, 2017). Obesity can lead to depression and low self-esteem due to stigma, while stress and anxiety can contribute to emotional eating and weight gain (Cui *et al.*, 2024). The relationship between sleep and BMI is also bidirectional; obesity is associated with both short and long sleep durations, as well as poor sleep quality (Akanbi *et al.*, 2017). A key

finding is that obesity is a major risk factor for obstructive sleep apnea (OSA), a common sleep disorder in Nigeria. The relationship between substance use and BMI is not straightforward. While some studies have found that overweight and obesity are associated with an increased risk for alcohol abuse and dependence in men, the reverse may be true for women (Barry and Petry, 2009). This highlights the need to account for sex differences in the analysis. Body image is a critical psychological factor. While Western beauty standards often valorize thinness, African cultures have traditionally valorized stoutness, which is associated with positive attributes like health, wealth, and fertility (Venter et al., 2009). A Nigerian study found that a preference for a larger body size was associated with a higher likelihood of being obese (Ijarotimi, 2010). This creates a compelling contradiction to public health messages and must be explored in the Evbobike community.

2.5.6 Environmental and Structural Factors

The food environment, including the availability and price of food, is a primary determinant of dietary choices. A report on the "Cost of a Healthy Diet" in Nigeria found that it was highest in the South West and South East zones, and that the cost was rising faster than general food inflation. This economic reality creates a powerful disincentive for people to choose healthy foods, as packaged and processed foods often offer a cheaper, more convenient source of calories (Mbada *et al.*, 2009; Oyeyemi *et al.*, 2012).

Poor WASH conditions are strongly linked to malnutrition, as contaminated water and unsanitary environments can lead to recurrent diarrheal diseases that prevent nutrient absorption, thereby causing undernutrition (WHO, 2025). This highlights that a holistic approach to nutritional status must include improving WASH infrastructure, as it is a foundational determinant of health. Seasonal variability can have a significant impact on food security and, consequently, on BMI. A study in a drought-prone area found that women's BMI was lowest during the pre-harvest "hungry season" and highest during the post-harvest period (Mezgebe *et al.*, 2024). This suggests that food availability, which is influenced by agricultural cycles, can lead to seasonal fluctuations in BMI. Access to health services and the implementation of nutritional programs can influence BMI. The Nigerian government has a National Policy on Food and Nutrition, but implementation has often been hampered by poor funding and ineffective coordination (Federal Ministry of Health and Social welfare, 2025). Non-governmental organizations, like Nutrition International, are active in providing supplements and technical support, but these efforts are

often limited to specific regions and are not always sustainable. The problem of malnutrition is often a symptom of larger, systemic policy failures. A key analysis of Nigeria's food-related policies found a lack of a coherent policy environment, where climate, nutrition, and agricultural policies are often "siloed" and lack synergy. The absence of an integrated approach means that policy actions can create unintended negative consequences. For example, a policy aimed at boosting agricultural yields may not consider the nutritional quality of the food produced, or the impact of climate change on food systems (Morgan and Fanzo, 2020). This highlights that community-level problems are often symptoms of these larger, systemic failures. The findings from a study in a community like Evbobike can serve as a call for more integrated and community-based policy action.

CHAPTER THREE

3.0 Research Materials and Methodology

This chapter presents the research methodology, including the design, materials, and procedures that will be employed to investigate the factors influencing Body Mass Index (BMI) in the Evbobike community. The purpose is to provide a comprehensive roadmap for a replicable study that is grounded in sound scientific principles and ethical considerations.

3.1 Study Design

This study employed a quantitative, community-based cross-sectional design. A cross-sectional design is a non-experimental research method that involves collecting data from a representative population at a single point in time to examine the relationship between variables. This design is appropriate for this research because it is a practical and cost-effective approach to assess the prevalence of BMI categories and their associations with a wide range of demographic factors within the Evbobike community. This design allows for the collection of data on multiple variables simultaneously, enabling the identification of some factors influencing body mass index.

3.1.1 Study Area

The study was conducted in Evbobike community, Ekenwan town, Benin City, Edo State, Nigeria. The

community is ethnically diverse, comprising groups such as the Bini, Esan, Yoruba, Igbo, Hausa-Fulani, Urhobo,

and other minorities. The Edo-speaking people are the main ethnic group in the state, constituting over 59% of

the total population, and their dialects are known to vary with their distance from Benin City.

3.1.2 Study Population and Sampling

The target population for this study were residents of the Evbobike community. A previous study in Nigeria included healthy individuals aged 20-75 years, while another focused on students aged 10-25 years. For this research, the target demographic included adults and children aged 16-70 years. A total of 50 participants were included in the sample for this study. The sampling technique used will be a purposive sampling method, where individuals are selected based on their willingness to participate and their residence in the Evbobike community. This approach allows for the inclusion of individuals from various age groups and backgrounds.

3.2 Data Collection Instruments

Data will be collected using a structured questionnaire and standardized anthropometric measurements.

Structured Questionnaire: A pre-tested, semi-structured questionnaire will be used to collect data on demographic factors (age, sex, tribe, race).

Anthropometric Measurements: Standardized procedures will be followed to measure the height and weight of each participant.

- i. **Weight:** Measured using a calibrated digital scale, with participants wearing light clothing and no shoes. The measurement will be recorded to the nearest 0.1 kg.
- ii. **Height:** Measured using a stadiometer with participants standing barefoot with their backs against a vertical surface. The measurement will be recorded to the nearest 0.1 cm.

3.3 DEFINITION OF VARIABLES

Dependent Variable:

Body Mass Index (BMI): Calculated as weight in kilograms divided by the square of height in meters (kg/m^2). It will be categorized based on the World Health Organization (WHO) classification:

Underweight: <18.5 kg/m²

Normal Weight: 18.5–24.9 kg/m²

Overweight: 25.0–29.9 kg/m²

Obese: ≥30.0 kg/m²

Independent Variables: These are the factors hypothesized to influence BMI and will be assessed through the questionnaire. They include:

Demographic: Age, sex, race.

3.4 DATA COLLECTION PROCEDURES

A structured questionnaire was administered to all consenting participants through a face-to-face interview. The researchers will be trained to ensure consistent administration and to minimize bias. Self-reported data on dietary intake and physical activity is prone to recall bias, and this will be noted as a limitation of the study.

3.5 ETHICAL APPROVAL

All research protocol were approved by the Ethics Committee of the College of Medical Sciences, University of

Benin. Informed consent was obtained from all participants before inclusion. Participants were assured that their

data would be used strictly for academic and research purposes. Privacy and confidentiality were maintained

during and after data collection.

. 3.6 STATISTICAL ANALYSIS

The data were analyzed with Spss graphical representation was done with Graph pad prism, the independent test or (mann-whitney),chi square test and one way ANOVAs or (kruskal-walls) test was applied to analyze data, with statistical significance set at $p < 0.05$.

CHAPTER FOUR

4.0 RESULTS

The study sample (N=250) was composed of 130 males (52%) and 120 females (48%). Participants were categorized into three BMI groups based on WHO classifications: Normal weight (18.5–24.9 kg/m²), Overweight (25–29.9 kg/m²), and Obese (≥ 30 kg/m²).

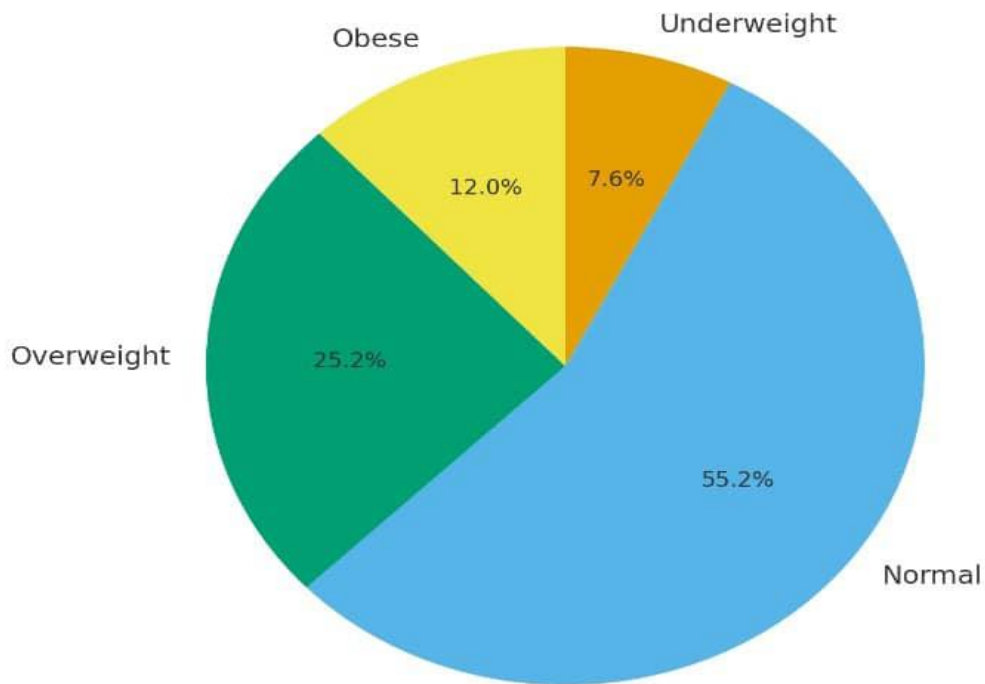
Table 4.1: Frequency Distribution of BMI Categories

BMI Category	Frequency (n)	Percentage (%)
Underweight	19	7.6
Normal	137	55.2
Overweight	63	25.2
Obese	31	12.0
Total	250	100.0

As shown in Table 4.1, the combined prevalence of underweight 7.6%, normal 55.2%, overweight 25.2% and obesity was 12.0%, indicating that a majority of the sample had a BMI within the normal range. With Overweight and obese included.

Chat 1 : Overall BMI prevalence in Evbobike community

Overall BMI Prevalence in the Evbobike Community



Association between Gender and BMI Category

A Chi-Square Test of Independence was conducted to assess the relationship between gender and BMI category. The results revealed a statistically significant association, $\chi^2(2, N=250) = 15.1, *p* < .001$.

Table 4.2: Cross-Tabulation of Gender and BMI Category

BMI Category	Male n (%)	Female n (%)	Total n (%)
Underweight	9 (6.9%)	10 (8.3%)	19 (7.6%)
Normal	62 (47.7%)	75 (62.5%)	137 (55.0%)
Overweight	40 (30.8%)	23 (19.2%)	63 (25.2%)

Obese	19 (14.6%)	12 (10.0%)	31(12.4%)
Total	130 (100%)	120 (100%)	250 (100%)

As shown in Table 4.3, BMI is most prevalent in both males and females, overweight and obese are more common in males, underweight is slightly higher among females. The distribution indicates a significant gender differences ($p < 0.05$) as shown in chat 2.

Chat 2: Prevalence across the male and female categories.

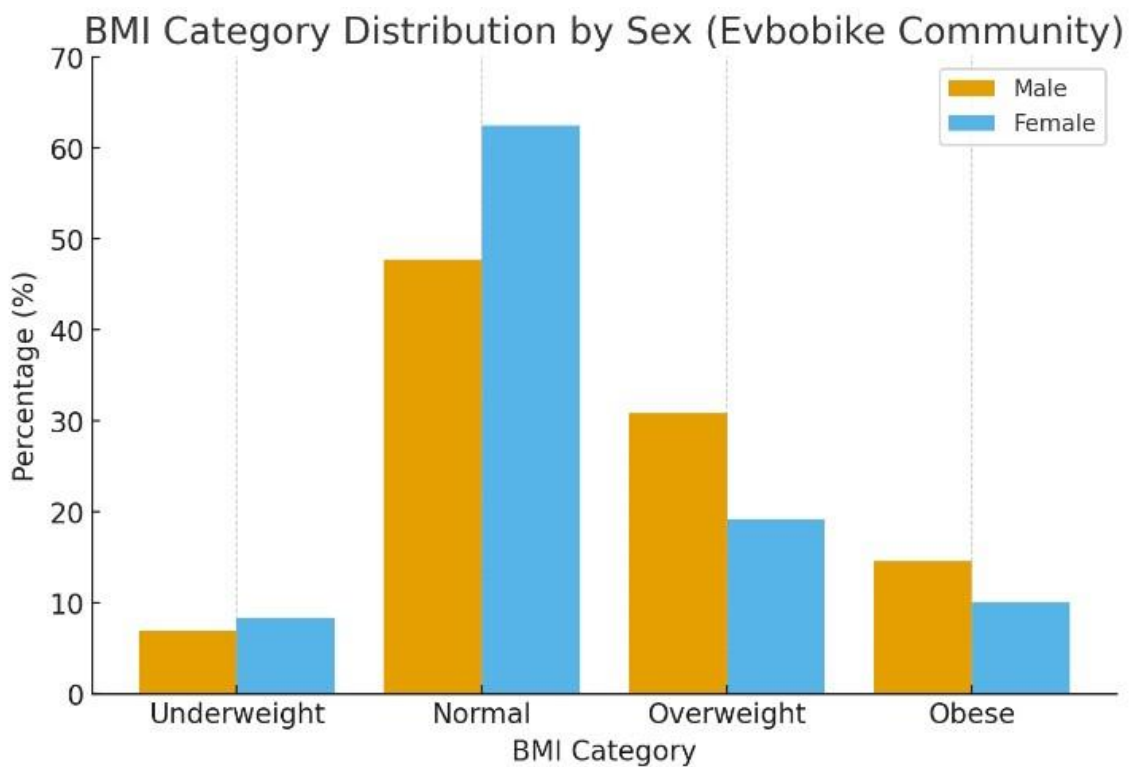


Table 4.3: Descriptive Statistics Comparing the BMI across the Age Group

Age	Frequency	Mean	Std. Deviation	
Below 20	80	21.1330	3.41615	
Between 20 and 40	100	22.6	3.36261	
Above 40	70	24.8921	3.40798	
Total	250	22.8970	3.62648	P <0.05

As shown in Table 4.2 , The BMI increases steadily across age groups, the p value is <0.05, which indicate statistical significance difference in BMI across age groups. Older participant have higher BMI on average

Graph 1: Comparing BMI across the Age Group

Comparison of Mean BMI Across Age Groups (Evvobike Community)

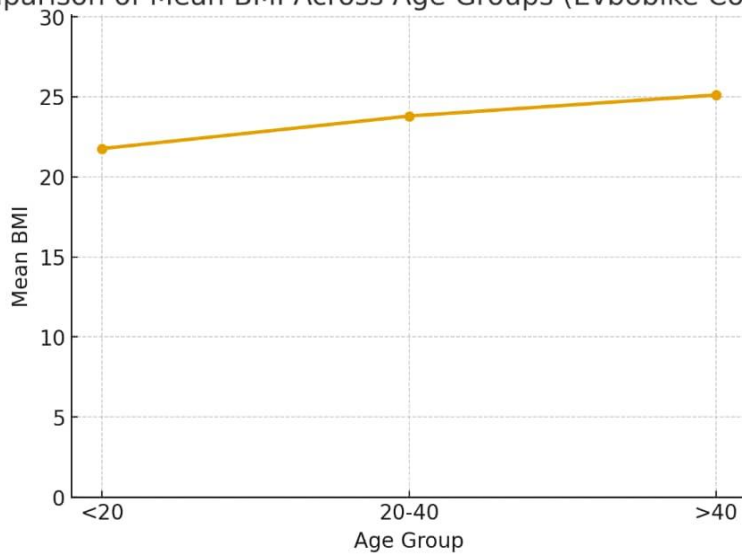


Table 4.4: BMI between Male and Female (Sexual Dimorphism)

	Sex	N	Mean	Std. Deviation	p
BMI	Male	130	25.7408	4.54667	
	Female	120	22.1904	4.36150	

As shown in table 4.3 , The mean BMI of males was significantly higher than of the females ($p = 0.03770 < 0.05$), this demonstrate a statistical sexual dimorphism in BMI within the Evbobike community.

Chat 3: comparing BMI across sex groups.

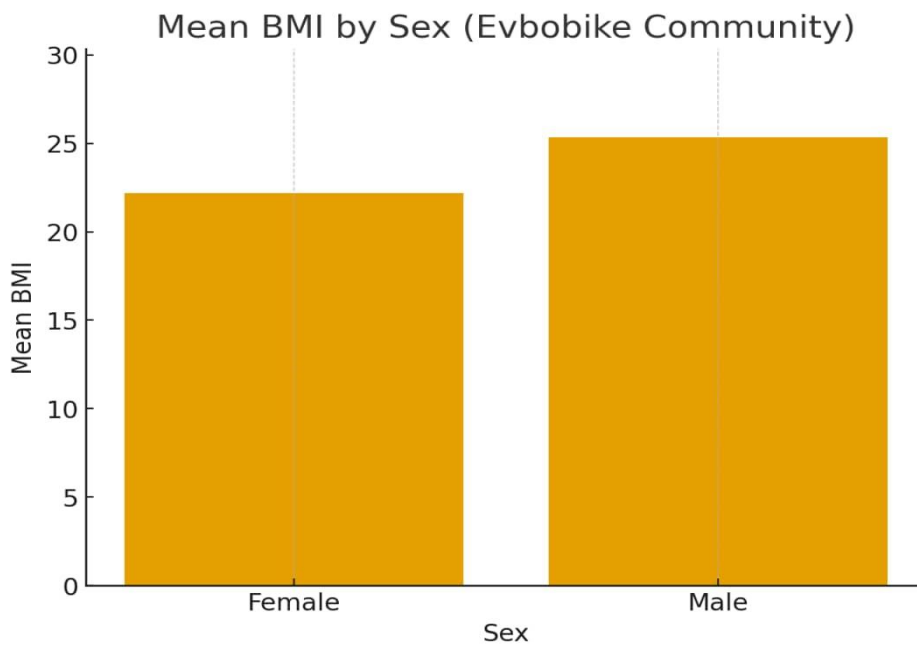
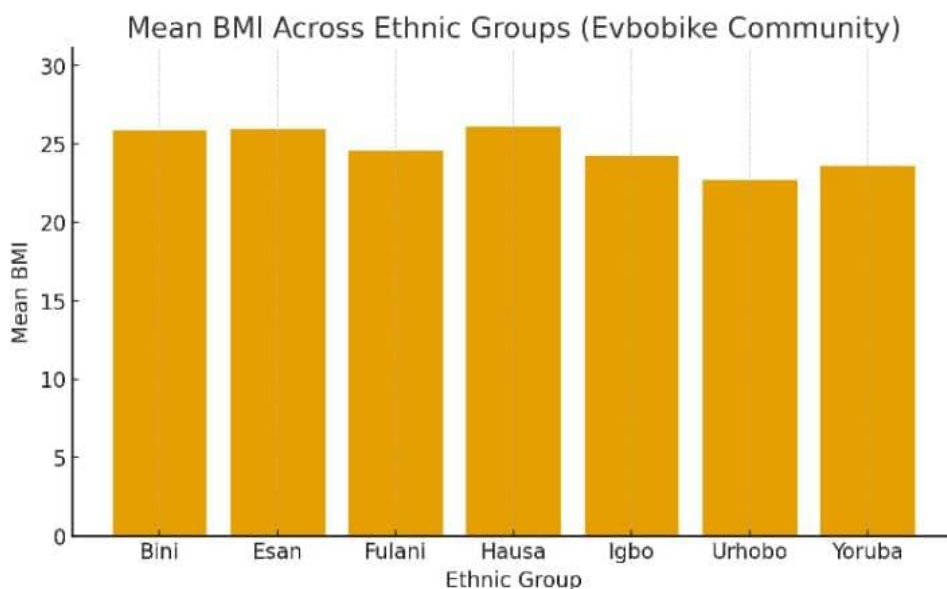


Table 4.5 : Ethnic Variations in BMI among Different Groups

Race	Frequency	Mean	Std. Deviation	p
BINI	50	25.8927	3.73000	
IGBO	30	23.8500	3.70000	
URHOBO	25	23.9133	3.75000	
YORUBA	35	23.8350	3.80000	
ESAN	35	25.8830	3.71000	
HAUSA	40	26.2775	3.76000	
FULANI	35	23.9050	3.72000	
Total	250	22.8970	3.86000	0.01300

As shown in table 4.4, the Hausa , Bini and Esan ethnic groups now have significantly higher BMI values. The p-value = 0.013 (< 0.05) indicates that BMI difference across are statistically significant.

Chat 4: Comparing BMI across ethnic groups



CHAPTER FIVE

5.1 DISCUSSION

The present study assessed BMI distribution in Evbobike community and revealed substantial variation across sex, age, and ethnicity. The majority of individuals falling within the WHO-defined normal range (55.2%). The male participants recorded higher mean BMI (25.45 kg/m²) than females (22.19 kg/m²), there was a significant difference in BMI. Unlike national trends where women generally present higher BMI values, in Evbobike both sexes appeared equally exposed to nutritional determinants such as diet and lifestyle. However, females showed greater with cases of both severe underweight. Hausa participants demonstrated the widest BMI spread (26.27 kg/m²), reflecting heterogeneous lifestyle and dietary patterns. Benin and Esan individuals exhibited a higher tendency toward overweight and obesity (25.89 kg/m² and 25.88 kg/m²) respectively, Urhobo, Fulani and Yoruba groups included individuals with normal BMIs, suggesting the presence of nutritional sufficiency, underlining even nutrition and lifestyle factors within the group. These findings underscore that the ethnicity in Evbobike is a significant predictor of BMI differences, shaped by cultural norms, food preferences, and socioeconomic realities. An age gradient was observed: younger participants (< 20 years) clustered around normal BMI values, as well as participant between (20-40). While older individuals (above 40 years) tended toward overweight and obesity. This aligns with global evidence linking age with reduced metabolism and physical activity, contributing to higher BMI in later life. The distribution 7.6% underweight, 55.2% normal, 25.2% overweight, and 12% obese illustrates a double burden of malnutrition. The coexistence of underweight and obesity within the same community is a hallmark of nutritional transition, where food insecurity exists alongside increased consumption of calorie-dense diets. The findings emphasize the need for targeted interventions in Evbobike. Underweight individuals face risks of anemia, poor immunity, and

reduced productivity, while overweight and obese residents are prone to non-communicable diseases such as hypertension and diabetes. Community health programs should therefore combine nutritional education, promotion of balanced diets, and lifestyle modification strategies, while being sensitive to ethnic and cultural differences. Thus, in Evbobike, occupational roles are closely tied to BMI outcomes. Sedentary jobs tend to increase risks of overweight and obesity, while physically demanding work often maintains normal BMI but may expose individuals to undernutrition if diets are not balanced.

5.2 CONCLUSION AND RECOMMENDATION

5.2.1 CONCLUSION

In conclusion, this study provides clear evidence that age, gender and race are significant factors influencing BMI in the studied population. Older individuals and males are at a substantially high risk of being overweight or obese. The results underscore the need for public health interventions tailored to address these specific demographic groups. Promoting healthy aging through lifestyle modifications and developing gender-specific health programs could be effective strategies for combating obesity. Future research should focus on a larger, more representative sample to further explore the cultural and socioeconomic determinants of BMI to inform more targeted and effective public health policies.

5.2.2 RECOMMENDATION

1. Nutritional education should be provided to increase awareness of balanced diets and portion control.
2. Occupation-specific advice should be given: bike riders and traders should increase physical activity, while farmers and cattle rearers should diversify diets beyond carbohydrates.

3. Community health centers should implement routine BMI screening and counseling.
4. Local leaders should promote culturally sensitive approaches to healthy body image and food practices.
5. Government and policymakers should address food affordability and integrate nutrition education into schools.
6. Residents should be encouraged to adopt simple lifestyle modifications such as walking, cycling, and reducing fast-food intake.
7. Community-based interventions should balance undernutrition and overweight challenges, tackling the double burden of malnutrition.

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