ASSESSMENT OF NUTRITIONAL STATUS AND CONSUMPTION PATTERN OF ENERGY DRINKS AMONG UNDERGRADUATE STUDENTS IN FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA

BY

FOWOWE, DEBORAH AYOMIDE

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A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE AWARD OF

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DECLARATION

I, Fowowe Deborah Ayomide of the department of Nutrition and Dietetics in the Federal University of Agriculture, Abeokuta (FUNAAB) with the matriculation number 2019/2684 declare that the project on Assessment of Nutritional Status and Consumption Pattern of Energy Drinks Among Undergraduates in Federal University of Agriculture Abeokuta supervised by Professor I. O. Olayiwola and was carried out by me.

……. …….

Fowowe Deborah Ayomide Date

CERTIFICATION

This is to certify that this research project was carried out by Fowowe, Deborah Ayomide with matriculation number 2019/2684 and is approved in partial fulfilment of the requirement for the award of the degree of Bachelor of Science in Nutrition and Dietetics, College of Food Science and Human Ecology, Federal University of Agriculture, Abeokuta, under our supervision.

……... ……..…….

Prof. (Mrs.) I. O. Olayiwola Date
(Project Supervisor)

……... ……..…….

Dr. C. A. Oladoyinbo Date
(Ag. HOD, Nutrition & Dietetics)

DEDICATION

This project is dedicated to the Almighty God who saw me through my course of study and also to my beloved parents Mr. and Mrs. Fowowe and siblings. May God continually be with them and be their guide. Amen.

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ABSTRACTS

Energy drinks are carbonated drinks that contain large amounts of caffeine and sugar with additional ingredients such as B vitamins and amino acids. The study assesses energy drink consumption patterns and nutritional status among undergraduate students at the Federal University of Agriculture, Abeokuta, Ogun State. With rising public health concerns about energy drink consumption among youth, the research aims to inform evidence-based interventions and policies to foster a healthier campus environment. The broad objective of this study is to assess the nutritional status of and consumption pattern of energy drinks among undergraduate students in the Federal University of Agriculture, Abeokuta, Ogun State. This descriptive, cross-sectional study involved 400 students selected from five colleges in the university. Data were collected on socio-demographic and socio-economic characteristics, consumption patterns, and anthropometric measurements (weight, height, and waist circumference) using a semi-structured questionnaire. Energy drink consumption frequency was measured with a modified food frequency questionnaire. Data analysis, conducted using SPSS and Microsoft Excel, included frequencies, percentages, means, standard deviation, and chi-square tests. The study revealed that most respondents were aged 21-24 years, with 57.0% male and 43.0% female. Ethnic distribution showed 79.0% Yoruba and 11.5% Igbo. The Body Mass Index (BMI) of respondents indicated that 79.5% had a normal BMI, 10.5% were underweight, and 10.1% were overweight. Regarding consumption patterns, 16.0% of students consumed energy drinks daily, 10.8% several times a day, 17.3% once a week, and 33.3% rarely consumed them. Additionally, 67.5% did not combine energy drinks with alcohol, while 12.3% did. Price (20.5%) and brand reputation (16.3%) were the most influential factors when selecting an energy drink, followed by flavor (8.8%) and health concerns (5.3%). However, advertising, recommendations from friends and family, and easy availability played minor roles in decision-making, influencing less than 2.3% of respondents. Nutritional information and volume were the least influential factors, affecting just 1.0% and 0.3%, respectively. There was no significant association ($P>0.05$) between the respondents BMI and weekly energy drink consumption. The study highlights diverse consumption behaviors and preferences, emphasizing the need for increased health awareness regarding energy drink intake. These findings provide a foundation for further research and health education programs aimed at reducing potential risks and promoting healthier choices among university students.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Energy drinks are carbonated drinks that contain large amounts of caffeine and sugar with additional ingredients, such as B vitamins, amino acids (e.g. Taurine) and herbal stimulants such as Guarana (Wong, 2015). Energy drinks are non-alcoholic beverages that typically contain high levels of caffeine (>150 mg/L) and sugar in combination with other ingredients known to have stimulant properties (Bureau of Sugar and Drinks Association, 2015). Beverages marketed as "energy drinks (ED)" are non-alcoholic fluids that contain stimulants, mainly caffeine, and generally claim to provide an extra burst of energy to perform well through the day (Adepoju and Ojo, 2014). Energy drinks generally contain methylxanthines (including caffeine, B vitamins, carbonated water, guarana, yerba mate, acai, and taurine, plus various forms of ginseng, maltodextrine, inositol, carnitine, creatine, glucuronolactone, and ginkgo biloba (Salamon, 2011). A common ingredient in most energy drinks is caffeine (often in the form of guarana or yerba mate). They contain about three times the amount of caffeine as cola; for instance, cola contains 35 mg while a monster energy drink contains 120 mg. They have been found to improve attention and/or reaction time, increase energy and indices of alertness; and the combination of caffeine and glucose can ameliorate deficits in cognitive performance and subjective fatigue during extended periods of cognitive demand (McClellan *et al.*, 2017).

Beverages marketed as "energy drinks" contain stimulants, mainly caffeine and are marketed with the claims that they are mental and physical stimulants. The average consumer is attracted by the unusual claims of increased energy, alertness, and sports performance (Aslam *et al*., 2013).

Energy drinks have become ubiquitous on university campuses and recreational hot spots around the world. Energy drinks are marketed with colorful descriptions and provocative names that make them sound fun and exciting. “Rockstar, Monster, Full Throttle, Throw Down and Sobe” are just a sampling of the inviting products that fill store shelves. Marketing slogans are developed to stimulate interest in a product and distinguish it from its competition: “Get spiked” “Party like a Rockstar” and “Feel the freak” are slogans representing the marketing strategies of energy drink companies. The language and images of such advertising are not directed at mature adults. If anything, the marketing of energy drinks removes all ambiguity about whom these products are meant to appeal to: teens and young adults (Reissig *et al*., 2019). As a result, the consumption of energy drinks is likely to become even more common and socially acceptable.

Tertiary students have busy schedules and can be under great stress at times. One way they may combat the problem is by consuming energy drinks to cope (Ibrahim *et al*. 2014). As a result, some students may consume energy drinks more frequently than desirable and if energy drinks are used to replace meals, it may result in inadequate nutrient intakes leading to undesirable health consequences (Nawrot *et al*., 2013; King *et al.*, 2017; Breda *et al*., 2014). If students regularly meet their daily energy requirements mainly from energy drinks then they may not be meeting the recommended daily intakes for the macro and micronutrients apart from the B vitamins. This is, because, most energy drinks contain 500% to 2000% of the daily intake requirement for the B vitamins (Ruka *et al*., 2015; Adepoju and Ojo 2014). Oyewole and Odeleye (2017) in their study revealed that undergraduate students with poor dietary habits were more likely to experience fatigue, low energy levels, and increased susceptibility to illnesses. Furthermore, according to the study of Oguntona *et al.* (2018),

inadequate nutrient intake has been associated with poor cognitive function and academic performance among Nigerian undergraduates.

1.2 Problem Statement

The research aims to fill the vacuum in the literature by conducting an extensive assessment of the nutritional status and consumption patterns of energy drinks among undergraduate students within Federal University of Agriculture, Abeokuta, Ogun State. In recent years, the nutritional status and consumption patterns of energy drinks have become increasingly pertinent in the context of the health and well-being of individuals, particularly among the demographic of undergraduate students in tertiary institutions. Although energy drinks are very popular among young people, there aren't many thorough studies that look precisely at the nutritional effects and consumption patterns of this particular group. Different studies have focused on consumption by children (Shelina *et al*., 2016), knowledge and adverse effects of energy drinks consumption (Ali *et al*., 2022) and factors influencing consumption (Conrad *et al*., 2020) but only very few studies have assessed the nutritional status of the respondents alongside their consumption pattern.

The growing worry about the possible health concerns linked to energy drink intake, including negative impacts on sleep patterns, cardiovascular health, and general well-being, highlights the necessity for this kind of research. Furthermore, Ogun State provides a unique context for this study, given its diverse popularity

on and the distinctive sociocultural factors that may influence the nutritional choices and consumption patterns of undergraduate students.

1.3 Justification of the Study

This study is justified by the increasing public health concerns associated with the consumption of energy drinks, particularly among the youth. As undergraduate students represent a significant demographic within this age group, understanding their nutritional status and consumption patterns is crucial for formulating evidence-based public health interventions to address potential health risks.

The results of this study will offer factual data that can direct the formulation of regulations pertaining to the sale and distribution of energy drinks in educational settings. This data can be used by policymakers to create policies that encourage a healthier campus climate and reduce any possible health hazards related to excessive energy drink usage.

By offering a thorough examination of undergraduate students' energy drink use habits and nutritional status, the study will contribute to the corpus of scholarly literature. This work can improve knowledge of the wider effects of energy drink intake on young adults' health and well-being and be used as a reference for future study.

1.4 Research Objectives

1.4.1 Broad Objective

The broad objective of this study is to assess the nutritional status of and consumption pattern of energy drinks among undergraduate students in the Federal University of Agriculture, Abeokuta, Ogun State.

1.4.2 Specific Objectives

The specific objectives are to:

i. To describe the socio-economic and demographic characteristics of the respondents.
ii. To assess the anthropometric characteristics of the respondents.
iii. To assess the consumption pattern and frequency of consumption of energy drinks among the respondents.
iv. To assess the factors influencing consumption of energy drinks.
v. To determine the association between BMI (Body Mass Index) and quantity of energy drinks consumed weekly

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction to the Energy Drink Industry

In 1949, Dr. Enuf became the first company to provide energy drinks to the US market. The product was marketed as a healthier substitute for sugar-filled beverages. The fact that the drinks were vitamin-fortified contributed to this in part. About 1960, energy drinks made their debut in Europe and Asia. Some businesses have emerged since the energy drink known as "Lipovate D" became dominant in 1962, claiming the opportunity presented by the energy drink market. But until the Austrian businessman introduced the "Red Bull" product, they had no real impact. As a result, the energy drink market grew quickly, and today there are over 300 different varieties of energy drinks that are popular in the US alone (Bull, 2016).

2.2 Trends in the Energy Drink Market

Energy drink consumption is a global public health concern that primarily affects young adults and adolescents between the ages of 18 and 34 (Heckman *et al*., 2020; Ibrahim and Iftikhar, 2014). Healthcare professionals are still concerned about the negative effects associated with energy drinks, despite the fact that these products are frequently marketed as having natural ingredients that boost energy, attention, sports performance, and concentration time (McGraw, 2013).

The consumption of energy drinks has gained popularity quickly across all age groups and is currently the fastest-growing beverage product. In the US, for example, consumers are estimated to have spent $744 million on these products between June 2006 and June 2007 (Braganza and Larkin, 2007). Despite costing twice as much as conventional soft drinks, the amount of energy drinks consumed has increased significantly since the first one was introduced in Austria in 1987 and introduced in the

US in 1997 (Reissig *et al*., 2019). About 200 new energy drink brands were introduced in the US in just the years 2006 and 2007 (Clauson *et al*., 2008), and 1.5 billion cans of Red Bull, one of the most popular drinks, were sold in 2011 (Reissig *et al*., 2019). Many nations across the world have seen a comparable increase in the consumption of energy drinks. Energy drinks have been reported to be sold in over 140 countries worldwide (Seifert *et al*., 2011). In certain developed countries, there have been instances of fatalities frequently associated with aggressive energy drink intake. As a result, certain governments have been prompted to enact laws limiting their import and sale. For instance, nations including Uruguay, Denmark, France, Iceland, Norway, and Turkey have outlawed the sale of beverages with high caffeine and taurine content. Some nations, like Sweden, only allow energy drinks to be sold as pharmaceutical items at pharmacies. Warning labels must advise against large-scale usage, consumption with alcohol, and use by youngsters or pregnant women in Canada. But in many poor nations, including Ghana, the consumption and sale of energy drinks are still unregulated (Atsreh Buxton, 2014).

2.3 Composition of Energy Drinks

The presumption that bioactive substances other than carbohydrates, carbon dioxide, phosphates, and alcohol—in certain cases—are present in energy drinks is significantly more complex. Calories and caffeine are the main components of most energy drinks, along with other substances like taurine, herbal extracts, and occasionally B vitamins that are thought to increase energy (Yunusa and Ahmad, 2012). In a study conducted in Western Africa to ascertain the composition of 23 energy drinks available in Ghana, the screened drinks responded favorably to the reducing sugar test, indicating that each product contained high amounts of those sugars. These amounts typically ranged from 9 to 11 grams per 100 grams of soft drinks, or roughly 44 calories per serving. Reducing

sugars was linked to a comparable study conducted in Nigeria, even though sucrose predominated in the majority of soft drinks produced and sold there. According to their research, the hydrolysis of sucrose into either glucose or fructose as a result of exposure to temperature changes or acidic environments could be the cause of the sugars found in soft drinks. This suggested that even while reducing sugars might not be an ingredient in these soft beverages, their processing setup and marketing exposures could cause sucrose to hydrolyze and release reducing sugars. According to Darkwah *et al*. (2020) and Godwill *et al*. (2015), the positive result on the test for lowering sugars suggests that these soft drinks contain a significant amount of sugar. Apart from its sweet flavor, sugar is known to be the body's and the bloodstream's currency of energy. It has also been discovered that sugar makes up a significant portion of human breast milk, which makes its physiological significance essential (Rubio *et al*., 2016). However, it has been found that simple sugars, such as fructose and glucose, breakdown quickly, raising blood sugar levels quickly. According to Malik *et al*. (2010), failure of the compensatory mechanism that brings the blood sugar level back to normal can lead to obesity and raise the risk of diabetes and other cardiac problems.

Energy drinks have a high energy content, so it's important to monitor how much of them you consume to lessen your risk of experiencing any of the negative side effects that go along with them. It's also general knowledge that the majority of soft drinks have carbon dioxide content (Teague *et al*., 2019). Carbon dioxide that has been dissolved is frequently seen in the composition of carbonated soft drinks. Because carbon dioxide serves as a preservative and disinfectant in food goods, its presence in energy drinks determines their extended shelf life. For example, the presence of carbon dioxide in food aids in the reduction of oxygen concentration, which in turn prevents the growth of aerobic microorganisms and, in the context of energy drinks, lengthens the product's

shelf life (Amit *et al*., 2017). Once more, carbon dioxide reacts with water to generate carbonic acid, which lowers pH and gives soft drinks an acidic flavor. According to Bajpai *et al*. (2018), the pH drop creates an unsuitable environment for the growth of non-acidophilic microorganisms. While modest amounts of carbon dioxide may not be harmful to human health, prolonged exposure to it can be highly harmful. According to reports, an excess of CO2 in the human body can lead to acidosis, a condition where the blood's pH falls below 7.35. The process of redeeming takes place in order to negate this condition. But as the exposure increases significantly, the compensatory mechanisms get overwhelmed, which results in a central nervous system malfunction (Chu and Xiong, 2012). This suggested that in order to ensure that products comply to improving consumers' health, manufacture and consumption of energy drinks should be controlled.

Soft drinks may contain less than 0.5% of alcohol by volume, while being deemed non-alcoholic in several studies (Seward and Nethercote, 2015). Also, it's widely acknowledged that tea, coffee, dairy products, and "alcohol" don't belong in the category of energy drinks. According to Nti *et al*. (2014), the majority of energy drinks sold in Ghana adhere to nonalcoholic criteria, satisfying international norms. Because alcohol is used as a solvent for various flavorings, it can be found in some energy drinks. According to Darkwah *et al*. (2020), the lack of alcohol in locally produced and promoted energy drinks from Ghana suggests that a sizable portion of the populace, with younger people falling into the linear spectrum, can consume them. Studies have shown that alcohol consumption is highly detrimental to human health, particularly in young adults (Aarons *et al*., 2019). According to reports, young people are less likely to develop serious chronic illnesses such pancreatitis, hepatitis, gastritis, and liver cirrhosis that are linked to alcohol consumption (Newbury-Birch *et al*., 2019). However,

heavy drinking among youth may make them more vulnerable to these conditions and could harm their developing brains, which could result in a problem with their cognitive abilities later in life (Crews *et al*., 2014).

It doesn't seem like phosphate is a major ingredient in energy drinks. For example, tests in Ghana revealed that cola beverages included high quantities of phosphate, whereas other energy drinks that weren't cola contained no phosphate at all (Darkwah *et al*., 2020). This pattern indicates that phosphate is a common element in the majority of cola-based drinks. Their findings support a paper by Moser *et al*. (2015), which claims that while energy drinks appear to be a major source of phosphorus in the diet, there is actually no reason for concern over this nutrient. However, cola-based energy drinks have roughly 37 mg of phosphorus, indicating that, in contrast to other soft drinks, cola beverages have a large amount of phosphates. The presence of phosphate in the soft drinks containing cola suggests that phosphoric acid, which is crucial for extending food items' shelf lives, improving flavor, preserving moisture, and enhancing color, was a crucial ingredient in the creation of locally produced and sold energy drinks (Wickham, 2014). The formation of the cell membrane and nucleic acid, the production of ATP (adenosine triphosphate), the mineralization of bones, the formation of urine buffers, and other biological processes all depend on phosphorus. However, excessive exposure to phosphorus can lead to hypocalcemia, an electrolyte imbalance characterized by low blood calcium levels, and other diseases related to bone impairment (Tani *et al*., 2017). In order to lower the risk of these negative effects, people should minimize their use of soft drinks that have a positive phosphate response. Energy drinks are intended to be consumed before or during exercise to prevent dehydration, supply carbohydrates, provide electrolytes, and occasionally contain caffeine. They belong to the functional

beverage category, which also includes sports and nutraceutical drinks (Van Biervliet, 2019).

2.4 Factors That Influence Energy Drink Consumption

Energy drink usage is linked to living away from home. According to a study by Chang *et al*. (2017), living away from home was associated with the usage of energy drinks among undergraduate students. Reduced parental supervision, associated lifestyle changes, and dangerous behaviors like substance misuse may have contributed to this. Research has indicated that parents are not in favor of their children using energy drinks because to their awareness of the potential negative consequences of these drinks and their ability to affect access to EDs (Chang *et al*., 2017; Visram *et al*., 2017). Since energy drinks have been shown to support the development of social interactions, a sense of belongingness influences young consumers (Chang *et al*., 2017; Visram *et al*., 2017). This discovery may impact substance usage, peer pressure, and associated consumption patterns and quantities. According to Chang *et al*. (2017), the main justification for using energy drinks was maintaining focus at work. Advertisements, however, are another factor in the usage of energy drinks. It is well known that when faced with difficult jobs, people have always looked for a "boost." Energy drinks have been popular, and their marketing strategy caters to those needs (Higgins, 2014). These drinks are promoted as improvements for endurance, energy, alertness, and sports performance (Higgins *et al*., 2015). According to Visram *et al*. (2017), two important aspects impacting the purchasing decisions of teenagers and young adults are the relatively low cost and the extensive availability of energy drinks.

Taste, brand loyalty, and the purported health benefits of energy drinks are important elements that contribute to their appeal and consumption. Understanding the complexity

of young people's and children's consumption decisions is necessary for policies and interventions to effectively address this issue (Visram *et al*., 2016).

2.5 Health Impact of Energy Drink Consumption

According to recent research, the most vulnerable period for the effects of environmental or nutritional factors is during the fetal stage. Due to negative fetal programming, the result of such unfavorable exposure leads to worsened chronic health outcomes in both childhood and adulthood (Luo *et al*., 2018; Newbold *et al*., 2017; Sullivan and Grove, 2015). Caffeine is one of the many substances that have been shown to affect fetal programming (Chen *et al*., 2014). It has been suggested that a complex interplay between genetic and environmental variables influences obesity, even though the underlying etiology of the condition is still unknown (Newbold *et al*., 2017). There is a theory that suggests disturbed sleep patterns could be the cause of adult health issues and diseases. Moreover, it has been suggested that a result like low birth weight reflects the condition of the previous prenatal environment. Therefore, poor fetal development sets the stage for an increased risk of non-communicable diseases such type 2 diabetes, hypertension, and coronary heart disease (Barker *et al*., 2016).

2.6 Cardiovascular Problems and Their Link to Energy Drinks

The intake of energy drinks has been associated with a wide range of acute and chronic cardiovascular problems. Aortic dissection, postural orthostatic tachycardia syndrome, sudden cardiac death, endothelial dysfunction, supraventricular arrhythmia, ventricular arrhythmias, coronary artery spasm, coronary artery thrombosis, Takotsubo cardiomyopathy, ST-segment elevation myocardial infarction (STEMI), elevated blood pressure, increased heart rate, endothelial dysfunction, and hypertensive heart disease, coronary artery disease, atherosclerosis, cerebrovascular disease, peripheral arterial disease are among them (Higgins *et al*., 2015).

2.6.1 Elevated Blood Pressure

While some reports suggest that certain ingredients in energy drinks, like taurine and L-carnitine, may be beneficial for a condition like hypertension, others contend that other ingredients, like caffeine, guarana, and ginseng, have increased the risk of acute hypertension (Wassef *et al*., 2017). Nonetheless, the understanding of caffeine use and its associated hemodynamic effects is consistent with the second argument (Higgins and Babu, 2013). It has been shown that stimulating the neurological system can raise blood pressure and heart rate. This could be due to elevated levels of catecholamines, dopamine, and plasma rennin resulting from acute caffeine ingestion (Heckman *et al*., 2020; Robertson *et al*., 2018). This is especially true for athletes who drink energy drinks, probably prior to exercise, as the effects on hemodynamics are increased. Typically, these effects might extend for up to five hours (Papaioannou *et al*., 2016).

According to a study where participants were randomly assigned to consume energy drinks or a control, after a 24-hour period, the subjects who consumed energy drinks had higher mean arterial pressure, diastolic blood pressure, and systolic blood pressure readings than the control group (Franks *et al*., 2012). Furthermore, a causal link between taurine and caffeine and hypertension has been demonstrated. Doerner *et al*. (2015) provided evidence for this in a study wherein healthy participants with a mean age of 28 who took energy drinks containing caffeine and taurine experienced a significant rise in peak systolic rate one hour after ingesting the energy drink. While the aforementioned research supports the impact of energy drinks on consumers' acute blood pressure, it is possible that normal, healthy people are not significantly affected by them. For those who have a history of hypertension, the situation is different. Additionally, case studies of kids who grew up using energy drinks continuously have been documented (Usman and Jawaid, 2012). Even at somewhat high levels of daily consumption, caffeine may

have long-lasting effects on blood pressure in individuals who use it regularly (Fletcher *et al*., 2017).

2.6.2 Increased Heart Rate

Grasser *et al*. (2014) demonstrated a significantly greater heart rate among Red Bull energy drink users compared to water drinkers in order to establish a correlation between an elevated heart rate and energy drink intake. As high as ninety minutes (3.7 ± 0.7 beats per minute) were recorded (Grasser *et al*., 2014). When another study found that the average heart rate increased from 78 to 85 beats per minute, they confirmed the findings (Elitok *et al*., 2015).

2.6.3 Supraventricular Arrhythmia

The combination of chemicals in energy drinks may cause arrhythmias, but caffeine intake has been connected to enhanced supraventricular arrhythmia in particular (Sanchis-Gomar *et al*., 2015). It was unclear, though, whether people who experienced atrial fibrillation after eating energy drinks were genetically predisposed to arrhythmia or if the energy drinks themselves were the source of the episodes in a study including young adults (Turagam *et al*., 2015). A healthy 13-year-old boy with no history of illness or drug use experienced an episode of atrial fibrillation with a startling heart rate of 130 beats per minute during physical activity five days prior to consuming energy drinks. This incident occurred because atrial fibrillation is one of the rarest conditions among pediatric patients. The youngster may have had a lengthy half-life for caffeine since he regularly drank caffeinated energy beverages.

2.6.4 Coronary Artery Spasm

The sarcoplasmic reticulum of vascular smooth cells is capable of withstanding a fast calcium outflow. The release of catecholamines, which has been connected to high caffeine goods like energy drinks, is the cause of this (Holmgren *et al*., 2014; Scott *et*

al., 2017). According to Heckman *et al*. (2020), taurine is known to have a regulating effect on calcium signaling, which can disrupt the concentration of calcium on either side of the cell wall if it reaches hazardous levels. An instance included a 19-year-old man who showed up at a medical facility's emergency room. His symptoms included feeling cold, being clammy, and having trouble breathing. Neither was he an alcoholic nor a smoker. Furthermore, he had no past medical issues linked to coronary heart disease. Despite this, he had started training weights and drinking two to three cans of energy drink every day. He did not experience any recurrent episodes of chest pain while taking his medicine and refraining from energy drinks after receiving therapy and being monitored for an additional five days (Scott *et al*., 2017).

2.6.5 Coronary Artery Thrombosis

Energy drink intake has also been connected to coronary artery thrombosis. It's likely that consuming beer and energy drinks together makes the situation worse. An African American male, 24, who was in good condition and had no family history of coronary artery disease, presented to the hospital emergency room ten hours earlier with palpitations, nausea, and severe chest pain in the retrosternum. He acknowledged consuming alcohol (VODKA) mixed with three cans of energy drinks during a party, but he denied using illegal substances. The symptoms appeared one to two hours after ingesting the mixture. It was also observed that two additional individuals of comparable age displayed comparable symptoms following ingestion of the identical alcohol-energy drink combination. Following an angiography, it was found that a sizable thrombus filled over 70% of the left coronary artery's diameter and most of its length. Additionally, the left anterior descending coronary artery was blocked by another thrombus (Benjo *et al*., 2015). These circumstances suggest that energy drinks,

whether they include alcohol or not, may be linked to the development of coronary artery thrombosis.

2.7 Potential Effects of Sugar in Energy Drinks

As for the other factors that contribute to metabolic syndrome, such as genetics, exercise, nutrition, and environment, there is currently evidence linking sugar beverage consumption to the condition. However, in the 1930s, sugar was first written off as a factor in diabetes and obesity. Additionally, there has historically been a correlation between obesity and the rise in sugar consumption and the steadily declining cost of sugar (Johnson *et al*., 2017). Sugar is a powerful natural reward with hedonic and homeostatic consequences that are similar to addiction (Greenberg and St. Peter, 2021; Olszewski *et al*., 2019). Weight gain is a possible outcome of adding sugar to EDs (Mattioli *et al*., 2018). This is conceivable as the lack of fullness that liquid Eds offer can encourage eating of solid meals. Sugars from drinks like EDs also cause beta cells to malfunction, making it difficult for the body to secrete enough insulin to regulate blood glucose levels. This is particularly true when the body is exposed to high sugar levels for extended periods of time (Ibrahim and Iftikhar, 2014). Moreover, EDs may demineralize because to their low pH, which increases the risk of tooth erosion (Ibrahim and Iftikhar, 2014).

2.8 Perceptions Surrounding Energy Drink Consumption

Despite the fact that energy drinks have been linked to potential side effects, the majority of users are ignorant of these impacts. According to a Taiwanese survey, a significant percentage of undergraduate students had a bad opinion of alcohol, tobacco, and betel nut products. But fewer of the same respondents—that is, less than half (45.9%) of them—were found to have a bad opinion of energy drinks. Additionally, it was said that respondents who drank energy drinks thought they had the following advantages over

non-users: "improve alertness, boost academic, work, and sports performance, and promote health and social relationship." This also included the discovery that consumers of energy drinks thought they were generally more beneficial than non-users (Chang *et al*., 2017).

2.9 Related Consumption Patterns

Because energy drinks are a relatively new type of functional drink, consumption rates are lower in some places, such Taiwan (Chang *et al*., 2017). Energy drinks with high caffeine content have been shown to promote themselves as a means of boosting alertness and decreasing weariness (Howard and Marczinski, 2017; McCusker *et al*., 2016). Energy drinks have gained popularity due to the practice of combining them with drugs or alcohol, which goes against the manufacturers' stated purpose (Marczinski, 2017). When reaction times are measured, it has been found that the likelihood of a slowdown of the motor response increases with alcohol consumption. The practice of combining energy drinks with other substances, like alcohol, has gained popularity; yet, research indicates that a mere 15.3% of energy drink consumers really mix alcohol and energy drinks. It was also discovered that people used energy drinks in public and private settings associated to social events like parties, sports, and other gatherings. Parents may have an impact on their intake, but peer pressure has also been found to have an impact on consumption and influence how it is used. This is a result of the urge for young people to "fit in" or "look tough," which is linked to the desire to fit in (Chang *et al*., 2017; Visram *et al*., 2017).

2.10 Advertisement and Marketing

Energy drink sales are driven by gendered marketing that frequently makes references to their connection to sports. The reason why fewer girls than boys drink energy drinks could be due to this perceived tendency toward masculinity in ads. It is important to

note that healthcare providers must provide accurate information about energy drink usage as well as counter-health education aimed at individuals in order to significantly improve the behavior of those who consume them (Visram *et al*., 2016). Given the energy drink industry's marketing strategy, its customer base—particularly young people—may be uninformed or completely ignorant about the nutritional value and possible health concerns of the beverage (Kumar *et al*., 2015). In fact, a research carried out in Northern England found that the marketing mix—price, product, place, promotion, parents, peers, and policy—was the center of traditional marketing. The study's participants were aware of certain brands that were thought to offer good value for money. The majority of brands are widely obtainable, particularly the less expensive ones, but in addition, store promotions increased sales (Visram *et al*., 2017).

2.11 Nutritional Status

The phrase "nutritional status" refers to a person's total state of health and well-being in regard to their food and nutrition. It entails evaluating how well the body uses, absorbs, and processes nutrients (Larson-Meyer *et al*., 2018).

2.12 Components of Nutritional Status

a. **Macronutrient Intake**: Analyzing the consumption of macronutrients such as proteins, lipids, and carbohydrates—offers insights on the energy balance and the components necessary for a number of physiological processes.
b. **Micronutrient Intake**: Vitamins and minerals are examples of micro-nutrients that are essential for immune system support, metabolic processes, and general health.
c. **Body Composition**: When evaluating nutritional status, body composition—which includes the distribution of fat and lean mass—is frequently taken into account. The waist-to-hip ratio, body fat percentage,

and body mass index (BMI) are popular metrics used to assess nutritional status and body composition.

d. Status of Hydration: Sustaining nutritional balance requires consuming enough fluids (Careiro *et al*., 2016).

2.13 Methods of Nutritional Assessment

1. **Dietary Surveys:** Food diaries, surveys, and recall tests can all be used to analyze eating habits in order to quantify nutrient consumption and spot dietary patterns. This approach yields useful data on the kinds and amounts of food eaten. Understanding people's eating patterns, nutritional status, and general health depends heavily on dietary assessment (Slimani *et al*., 2015). It entails the methodical gathering and assessment of dietary information in order to ascertain the type and amount of food and drink that people, or groups of people, consume. Accurate dietary assessment techniques are critical for creating successful interventions and policies to support optimal nutrition and prevent chronic diseases, given the rise in the prevalence of diet-related diseases and the growing understanding of the critical relationship between diet and health (Slimani *et al*., 2015).

   Researchers and medical professionals now have access to cutting-edge methods and instruments for gathering precise and trustworthy data thanks to recent developments in the field of dietary assessment. The quick development of technology, including wearable, web-based platforms, and mobile applications that track food intake in real time, has been the driving force behind these developments. Apps for smartphones, for example, let users track portion sizes, log how much food and drink they consume, and examine the nutritional value of their meals. Furthermore, physiological characteristics linked to food intake,

such as chewing patterns, frequency of swallowing, and energy expenditure, can be measured by wearable devices with sensors, offering a more thorough understanding of eating behaviors (Coates *et al*., 2017).

For scientific, clinical, and public health goals, precise and trustworthy data on an individual's food and beverage intake must be collected using dietary assessment tools (Naska *et al*., 2017). These methods offer important insights into people's nutritional status and health outcomes by helping to assess dietary patterns, nutrient intake, and adherence to dietary requirements. To improve the precision and effectiveness of dietary evaluation, a number of instruments and techniques have been created and improved over time (Boushey C.J., Spoden M., 2017).

The food diary or food log is a frequently used tool for nutritional assessment. Using this strategy, people log how much food and drink they consume over a predetermined amount of time, typically a few days. Food diaries offer comprehensive information on portion sizes, preparation techniques, and eating occasions and can be self-reported or assisted by expert interviewers. Technological progress in recent times has resulted in the creation of digital food diaries or mobile applications that facilitate convenient dietary intake logging for individuals (Kirkpatrick *et al*., 2022). To enable precise nutrient measurement, these technologies frequently have features like databases and barcode scanners (Gemming *et al*., 2013). The 24-hour dietary recall is another popular instrument that asks participants to list every food and drink they have in the preceding 24 hours. Usually, this approach is used in conjunction with organized interviews led by skilled interviewers who ask pointed questions about precise information and serving quantities. It has been discovered that

accuracy is increased when the interviewer uses the multiple-pass technique, in which the recall is conducted several times to guarantee thorough data capture. Web-based and mobile applications have been created to improve the efficiency and accuracy of 24-hour recalls by enabling users to record their intake remotely and decreasing the need for in-person interviews.

Another common technique used in nutritional assessment is the food frequency questionnaire (FFQ). A list of foods with predetermined frequency options (e.g., portions per day, per week) makes up the fat free quarters (FFQs). People list the typical frequency at which they consume each food item. FFQs can reveal long-term eating trends and are very simple to conduct. Nevertheless, they depend on people's recollections and might be biased by recall. In order to improve recall accuracy, attempts have been undertaken to create computer-based FFQs that make use of interactive elements and visual assistance (Gemming *et al*., 2013). Technological developments have also brought forth novel instruments for nutritional evaluation. In image-based dietary assessment methods, participants take pictures of their snacks or meals both before and after they eat them. These photos can be used to create a visual record of nutritional consumption by identifying food items and estimating portion sizes using computer vision algorithms. Furthermore, wearable technology with sensors can track physiological aspects of food consumption, like chewing habits and energy expenditure, providing quantifiable measurements of eating habits (Vu *et al*., 2017).

2. **Biochemical Markers:** Blood tests and biochemical markers, including blood nutrient levels, offer objective information on the body's nutritional state.

Assessing lipid profiles, vitamin D status, and iron levels are typical examples (Holen *et al*., 2016).

3. **Clinical Examination:** Healthcare practitioners evaluate physical indicators and symptoms associated with nutritional status during a clinical examination. This could include the state of the skin, the health of the hair and nails, and the existence of particular clinical indicators linked to dietary deficits (Jarvis, 2023).
4. **Anthropometric Measurements:** Measurements of an anthropometric nature, such as height, weight, and circumferences, provide information about growth and body composition. When evaluating nutritional status, especially in relation to undernutrition or obesity, these parameters are crucial. Quantitative measurements of the human body can be made without making physical touch. Anthropometric measures are commonly used to identify malnutrition. According to the Centers for Disease Control and Prevention (CDC), anthropometry provides a valuable assessment of children's, adolescents', and adults' nutritional health. It explains how specific devices are used to collect the data needed to assess the health and growth rate of the human body. Teens and young adults' body measures can be used to assess their nutritional status, general health, and likelihood of contracting illnesses in the future. Height, weight, body mass index, skinfold thickness, hip, waist, and limb circumferences to determine adiposity, and so on are the basic measurements in anthropometry (Casadei, K., and Kiel, 2021).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Design

A cross-sectional study and descriptive study design was applied.

3.2 Study Area and Location

This study was carried out in Ogun State, Nigeria. The study location was the Federal University of Agriculture, Abeokuta. The university has 10 colleges with different departments and programs under them. The university colleges include: College of Agricultural Management and Rural Development (COLAMRUD), College of Animal Science and Livestock Production (COLANIM), College of Environmental Resources Management (COLERM), College of Physical Sciences (COLPHYS), College of Biological Sciences (COLBIOS), College of Plant Science and Crop Production (COPLANT), College of Engineering (COLENG), College of Veterinary Medicine (COLVET), College of Food Science and Human Ecology (COLFHEC) and College of Entrepreneurial and Developmental Studies (COLENDS)

3.3 Study Population

The target population for this study consisted of undergraduates in the Federal University of Agriculture, Abeokuta.

3.4 Sample Size Determination

Sample size was determined using Sloven's formula as shown below;

Sample size (n) = $\frac{N}{1 + N\ (e^2)}$

Where,

(N) = Total population size of subjects = 19357

(n) = Sample size

e = Desired level of precision (Singh and Masuku 2015)

(d) = degree of freedom = 0.05

Substituting the values in the above formula, the sample size equals

$$n = \frac{19357}{1+19357\ (0.05)2}$$

$$n = \frac{19357}{19358\ (0.05^2))}$$

$$n = \frac{19357}{48.395}$$

n = 399.9 approximately 400

3.5 Sampling Techniques and Procedures

A multi-stage sampling method was used for the data collection procedure.

Stage 1: At the first stage, 5 colleges were selected using a simple random sampling technique out of the 10 colleges.

Stage 2: At the second stage, a simple random sampling was used to select 50% of departments from each of the 5 colleges.

Stage 3: In the third stage, 80 students were selected at random from each of the departments selected.

COLLEGES SELECTED: COLVET, COLANIM, COLERM, COLPHYS, COLBIOS

3.6 Data Collection Procedure

A validated semi-structured and self-administered questionnaire was used to obtain data. The questionnaire was divided into four sections.

3.6.1 Socio-Demographic and Socio-Economic Characteristics

A semi-structured questionnaire was used in collecting data on the socio-demographic and socioeconomic characteristics of respondents.

3.6.2 Anthropometric Characteristics

The respondent's anthropometric characteristics - weights, heights and waist were assessed following standard procedures (WHO STEPS Surveillance 2017).

- **Height**

  The heights of the respondents were measured with the use of a portable heightometer. The respondents were asked to remove their foot-wears and heavy clothing such as cardigan, wristwatches etc. They were told to stand on the board with their backs against the measuring device and facing the interviewer, ensuring that their heels, buttocks, shoulders, and head touch the surface. Their feet were kept together and their arms resting naturally at their sides. Then, the height measured was recorded in meters.

- **Weight**

The weights of the respondents were measured using the bathroom weighing scale by placing the scale on an even surface to ensure accurate measurement. The participants were asked to remove their foot-wears, and any clothing that can influence their weight and bring about inaccurate measurement. The respondents were asked to stand still, face forward, place arms on the side and the weight was determined and recorded in kilograms.

- **Body mass index**

Their body mass index was determined using BMI formula (**weight/height kg/m^2**). This was used to measure if they are underweight, normal, overweight and obese.

- **Waist circumference**

Their waist circumferences were measured with light clothing, that is, by taking the tape rule round at the narrowest point of the waist. The participants were asked to wrap the tension tape around themselves and then the tape will be positioned at the midpoint of the last palpable rib and the top of the hip bone, making sure to wrap the tape over the same spot on the opposite side. It was ensured that the tape is horizontal across the back and front of the participant and as parallel with the floor as possible. Waist

circumference was measured and the measurement was read at the level of the tape to the nearest 0.1 cm, making sure that the measuring tape is snug but not tight enough to cause compression of the skin (WHO STEPS Surveillance 2017).

3.6.3 Consumption Pattern of Energy Drinks

A questionnaire modified from Semih *et al.,* (2016) was used to collect data on the consumption pattern of energy drinks of the respondents.

3.6.4 Factors Influencing Consumption of Energy Drinks

A questionnaire modified from Nowak and Jasionowski (2016) was used to collect data on the factors influencing the consumption of energy drinks among the respondents.

3.7 Statistical Analysis

The data received from the questionnaire was coded and sorted prior to analysis and was analyzed. Descriptive statistics using frequencies, percentages, bar and pie chart, cross-tabulations, mean, and standard deviation was also be used to analyze socio-economic and demographic characteristics. Categorical data was expressed as frequency and percentages while continuous variables were expressed as mean and standard deviation. Statistical Package for Social Sciences (SPSS 22.0) was used for the data analysis. Inferential statistics such as chi-square was used to describe the association between anthropometric characteristics such as BMI and quantity of energy drinks consumed weekly among respondents.

3.8 Informed Consent

Prior to the study, permission to embark on the study was obtained from the Department of Nutrition and Dietetics, Federal University of Agriculture, Abeokuta. Signed informed consent were obtained from the respondents after introducing and explaining the study and its objectives to the respondents.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic and Demographic Characteristics of the Respondents

Table 1 presents an analysis of the socio-demographic and economic characteristics of 400 respondents. The age distribution shows that the majority of respondents fall within the 21-24 years age group, representing 44.5% of the sample. This is followed by the 17-20 years age group, which constitutes 35.3% of the respondents. A smaller proportion, 18.3%, is in the 25-28 years category, while only 2% are aged between 29-32 years.

In terms of gender, the sample is slightly skewed towards males, who make up 53% of the respondents, while females represent 47%. When looking at religious affiliations, a significant majority, 79%, identify as Christians, while 20.8% are Muslims, and a negligible 0.3% belong to other religions.

Ethnicity data reveals that a predominant 79.5% of the respondents are Yoruba, followed by 11.5% who are Igbo, and 1.5% who are Hausa. The remaining 7.6% belong to other ethnic groups. The respondents are also spread across different academic levels, with the highest representation in the 300-level (23.8%) and 200-level (22.5%). Other levels include 100-level (17.5%), 400-level (19.3%), 500-level (11.3%), and 600-level (5.8%).

In terms of housing, the vast majority (86.3%) live off-campus, while 12.5% reside on-campus, and a small 1.3% live with their parents or family. Finally, the marital status of the respondents indicates that 87.3% are single, while 3.3% are married, and another 3.3% are cohabiting. A small portion, 6.3%, falls into other categories of marital status. This data provides a comprehensive overview of the respondents' socio-demographic and economic characteristics.

Table 1: Socio-Demographic and Economic Characteristics of the Respondents

Variables	Frequency (F)	Percentage (%)
Age group		
17 – 20	141	35.3
21 – 24	178	44.5
25 – 28	73	18.3
29 – 32	8	2.0
Total	400	100
Gender		
Male	212	53.0
Female	188	47.0
Total	400	100
Religion		
Christianity	316	79.0
Islam	83	20.8
Others	1	0.3
Total	400	100
Ethnicity		
Yoruba	318	79.5
Igbo	46	11.5
Hausa	6	1.5
Others	30	7.6
Total	400	100
Level		
100	70	17.5
200	90	22.5
300	95	23.8
400	77	19.3
500	45	11.3
600	23	5.8
Total	400	100
Sponsorship		
Self	41	10.3
Parents	354	88.5
Government scholarship	1	0.3
Others	4	1.0
Total	400	100

Table 1 Cont'd: Socio-Demographic and Economic Characteristics of the Respondents

Variables	Frequency (F)	Percentage (%)
Monthly income		
Less than or equal 10,000	74	18.5
10,001 - 20,000	100	25.0
20,001 - 30,000	74	18.5
30,001 - 40,000	58	14.5
40,001 - 50,000	37	9.3
50,001 - 100,000	37	9.3
Above 100,000	20	5.0
Total	400	100
Housing situation		
On-campus	50	12.5
Off-campus	345	86.3
Living with parents/family	5	1.3
Total	400	100
Extracurricular activities		
No	295	73.8
Yes	105	26.3
Total	400	100
Marital Status		
Single	349	87.3
Married	13	3.3
Cohabiting	13	3.3
Others	25	6.3
Total	400	100

4.2 Anthropometric Characteristics of the Respondents

The anthropometric data of the respondents provides valuable insights into their physical characteristics. Table 2 presents the weight, height, waist circumference, and Body Mass Index (BMI) of the respondents. The average weight of the respondents is 60.13 kg, with a standard deviation of 9.31 kg, indicating some variability around the mean. Heights range with an average of 1.674 meters, and the waist circumference averages at 74.39 cm, both with relatively low standard deviations, suggesting less variability. The BMI, calculated as weight divided by the square of height, has a mean of 21.46 kg/m², which is within the normal range, though there is notable variation as indicated by the standard deviation of 2.98 kg/m². The minimum and maximum values show a wide range, especially in waist circumference and BMI, with some respondents having quite low or high measurements, indicating a diverse sample in terms of body size.

In Table 3 the BMI categories of the respondents are analyzed, showing that a majority (79.5%) fall within the normal weight range. A smaller percentage (10.5%) are underweight, while 7.8% are classified as overweight. Obesity is relatively rare in this population, with only 1.8% in Obesity Grade 1 and 0.5% in Obesity Grade 2, highlighting that most respondents have a healthy BMI.

Table 4 assesses waist circumference, a key indicator of health risk. For males, 96.2% are classified as having a "Least Risk" waist circumference, with only 3.8% falling into the "Increased Risk" category. Among females, 80.3% are in the "Least Risk" category, while a higher percentage (19.7%) are at "Increased Risk." This difference between genders suggests that females in this sample may have a slightly higher tendency towards abdominal fat, which is a risk factor for metabolic diseases. Overall, the tables

reflect a predominantly healthy population, with a majority maintaining normal weight and low-risk waist circumferences.

Table 2: Anthropometric Characteristics of the Respondents

	Weight (kg)	Height (m)	Waist circumference (cm)	BMI (kg/m^2)
Mean ± S. D.	60.13 ± 9.31	1.67 ± 0.09	74.39 ± 9.19	21.46 ± 2.98
Minimum	39.50	1.39	24.50	11.28
Maximum	94.00	2.00	120.80	37.18

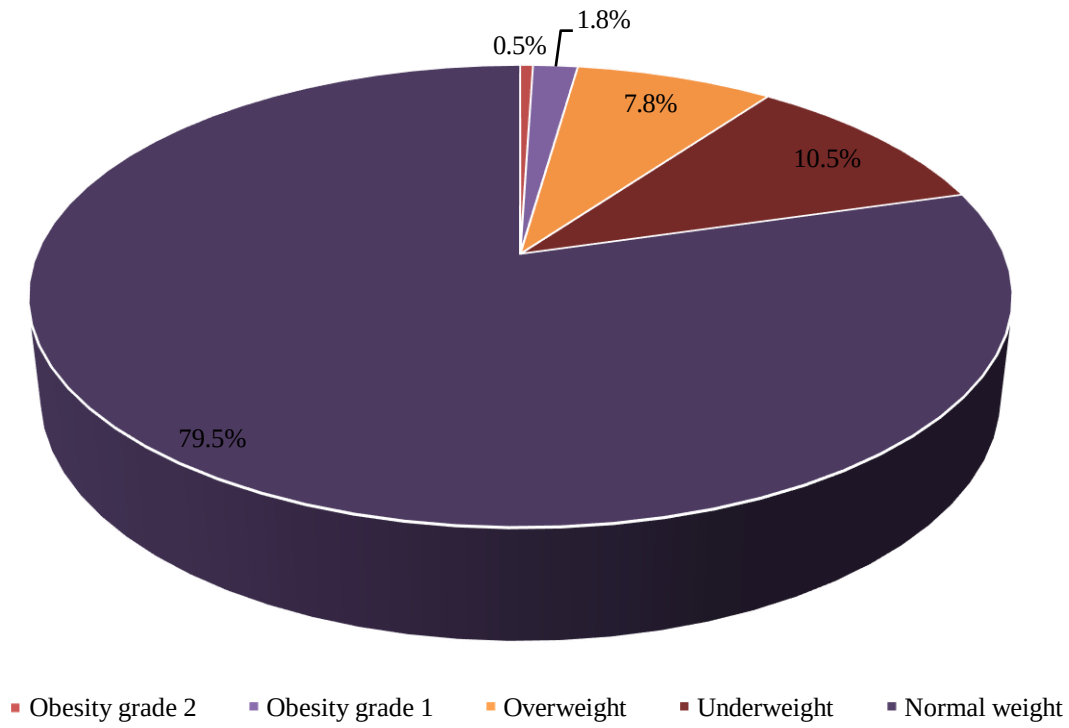

Figure 1: Nutritional Status of Respondents

Table 3: Waist Circumference Assessment

	Male		Female	
Waist Circumference Status	**Frequency (F)**	**Percentage (%)**	**Frequency (F)**	**Percentage (%)**
Least Risk	204	96.2%	151	80.3%
Increased Risk	8	3.8%	37	19.7%
Total	212	100.0%	188	100.0%

4.3 Consumption Pattern and Frequency of Consumption of Energy Drinks Among the Respondents

The tables provide a comprehensive overview of the energy drink consumption patterns among respondents. A significant portion, 33.3%, consume energy drinks rarely, while 19.0% never consume them. However, 16.0% of respondents consume energy drinks daily, and 10.8% several times a week, indicating that a notable segment of the population regularly consumes these beverages. Most respondents (60.3%) do not consume energy drinks daily, but among those who do, 20.3% drink 1-3 per day. Weekly consumption patterns show that 63.3% consume fewer than five energy drinks, with very few exceeding this amount.

The timing of consumption varies, with the afternoon being the most common time (27.3%), followed by the evening (15.5%) and early morning (15.3%). Convenience stores are the preferred purchasing location for 61.5% of respondents, while supermarkets/hypermarkets are the second choice at 14.8%. Only a small percentage (0.3%) purchase energy drinks online or at gas stations. Additionally, 67.5% of respondents do not mix energy drinks with alcohol or other substances, although 12.3% do, which could pose health risks. The duration of consumption varies, with 29.5% having consumed energy drinks for 1-3 years, while 19.0% are relatively new consumers, having started within the past year. Spending on energy drinks is generally moderate, with 38.5% spending less than or equal to ₦1,000 weekly, while only a small percentage (3.3%) spend between ₦7,001 and ₦10,000.

Table 4: Consumption Pattern of Energy Drinks Among Respondents

Variables	Frequency (F)	Percentage (%)
How frequently do you consume energy drink		
Daily	64	16.0
Several times a week	43	10.8
Once a week	69	17.3
Several times a month	15	3.8
Rarely	133	33.3
Never	76	19.0
How many energy drinks do you consume per day (On average)		
0	241	60.3
1 – 3	81	20.3
4 – 6	2	0.5
Total	324	81.0
How many energy drinks do you consume per week (On average)		
Less than 5	253	63.3
6 – 10	53	13.3
11 – 15	16	4.0
More than 15	2	0.5
Total	324	81.0
When do you typically consume energy drinks		
Early morning	61	15.3
Mid-morning	25	6.3
Afternoon	109	27.3
Evening	62	15.5
Night	58	14.5
Early morning and Afternoon	1	0.3
Mid-morning and Afternoon	1	0.3
Mid-morning and Evening	1	0.3
Afternoon and Evening	3	0.8
Afternoon and Night	2	0.5
Evening and Night	1	0.3
Total	324	81.0
How do you primarily purchase energy drinks		
Convenience stores	246	61.5
Supermarkets/hypermarkets	59	14.8
Online retailers	1	0.3
Gas stations	1	0.3
Others	17	4.3
Total	324	81.0

Table 4 Cont'd: Consumption Pattern of Energy Drinks Among Respondents

Variables	Frequency (F)	Percentage (%)
Do you combine energy drink with alcohol or any other substances		
No	270	67.5
Yes	49	12.3
No response	5	1.20
Total	324	81.0
How long have you been consuming energy drink		
Less than a year	76	19.0
1-3 years	118	29.5
4-6 years	54	13.5
More than 6 years	52	13.0
No response	24	6.0
Total	324	81.0
Weekly spending on energy drink		
Less than or equal 1,000	154	38.5
1,001 - 3,000	59	14.8
3,001 - 5,000	49	12.3
5,001 - 7,000	21	5.3
7,001 - 10,000	13	3.3
No response	24	6.0
Total	324	81.0

4.3.1 : Frequency of Consumption of Energy Drinks Among the Respondents

The figures present a detailed analysis of the frequency of energy drink consumption among respondents, categorized by specific brands. The data indicates that a majority of respondents rarely or never consume most of the energy drink brands listed. For instance, brands like "Big Shock," "Dragon (Small)," and "Blitz" have a 100% non-consumption rate, meaning no respondents reported consuming these drinks even once. Similarly, other brands such as "Rock Boom (Bottle)" and "Full Throttle" also show a 100% non-consumption rate.

Among the more popular brands, "Fearless" stands out, with 62.0% of respondents never consuming it, but a significant 31.3% reported consuming it 1-3 times, and 4.8% consuming it 4-6 times, indicating it is one of the more frequently consumed energy drinks. "Predator" also shows relatively higher consumption, with 73.3% never consuming it, but 24.8% consuming it 1-3 times, and 1.8% consuming it 4-6 times.

On the other hand, drinks like "Lucozade Boost" and "Monster" are somewhat more commonly consumed, with 16.8% and 13.3% of respondents respectively consuming them 1-3 times. However, daily consumption of any energy drink is rare, with "Fearless" having the highest rate at 1.8%. Consumption more than once per day is almost negligible across all brands, with only "Fearless" and "Carabao (Can)" showing a minimal presence in this category (0.3%).

The data also highlights that several brands have an overwhelming majority of respondents who have never consumed them, such as "Rock Star," "Gladiator," and "Tiger," each with a 99% or higher non-consumption rate. This trend suggests that while a few brands like "Fearless" and "Predator" have some regular consumers, the vast

majority of energy drink brands are rarely consumed by the respondents, indicating either a lack of popularity or limited availability

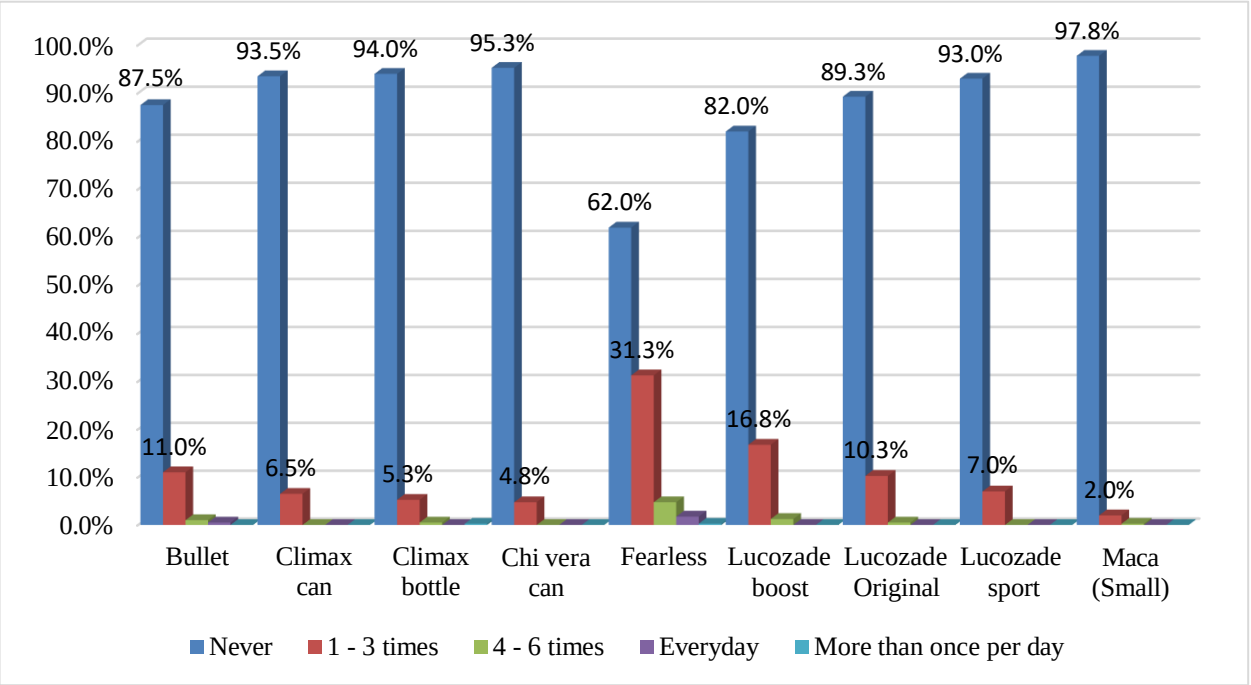

Figure 2a: Frequency of Consumption of Energy Drinks

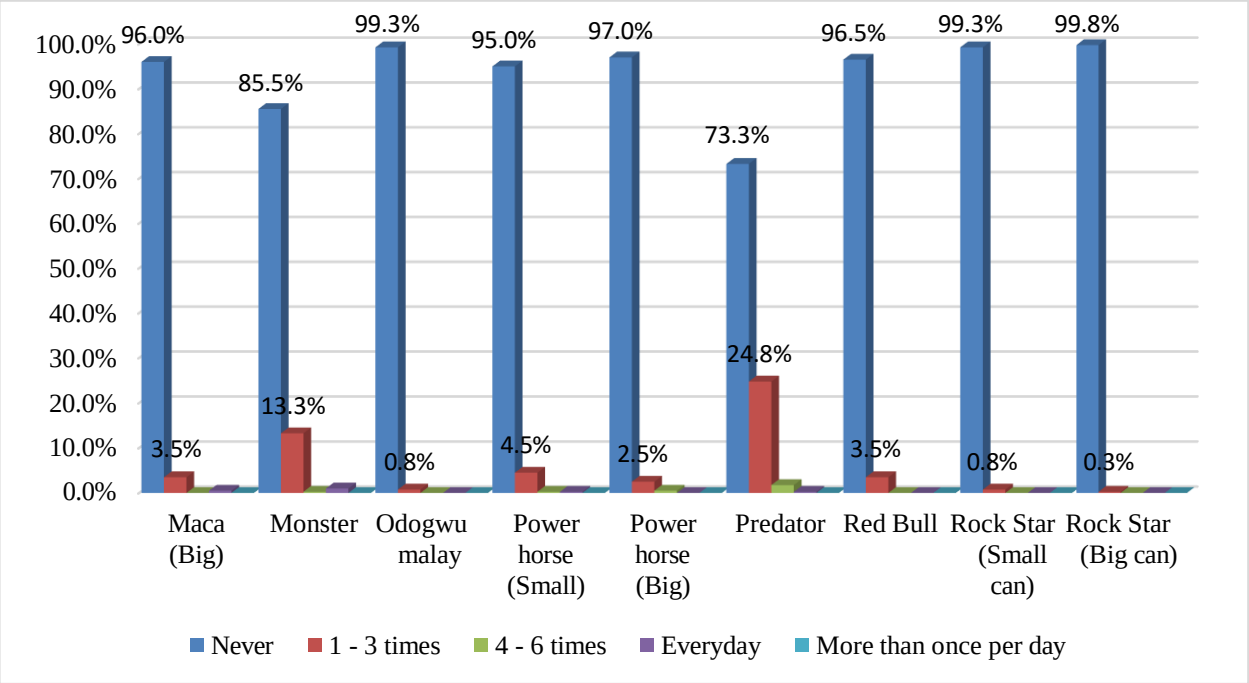

Figure 2b: Frequency of Consumption of Energy Drinks

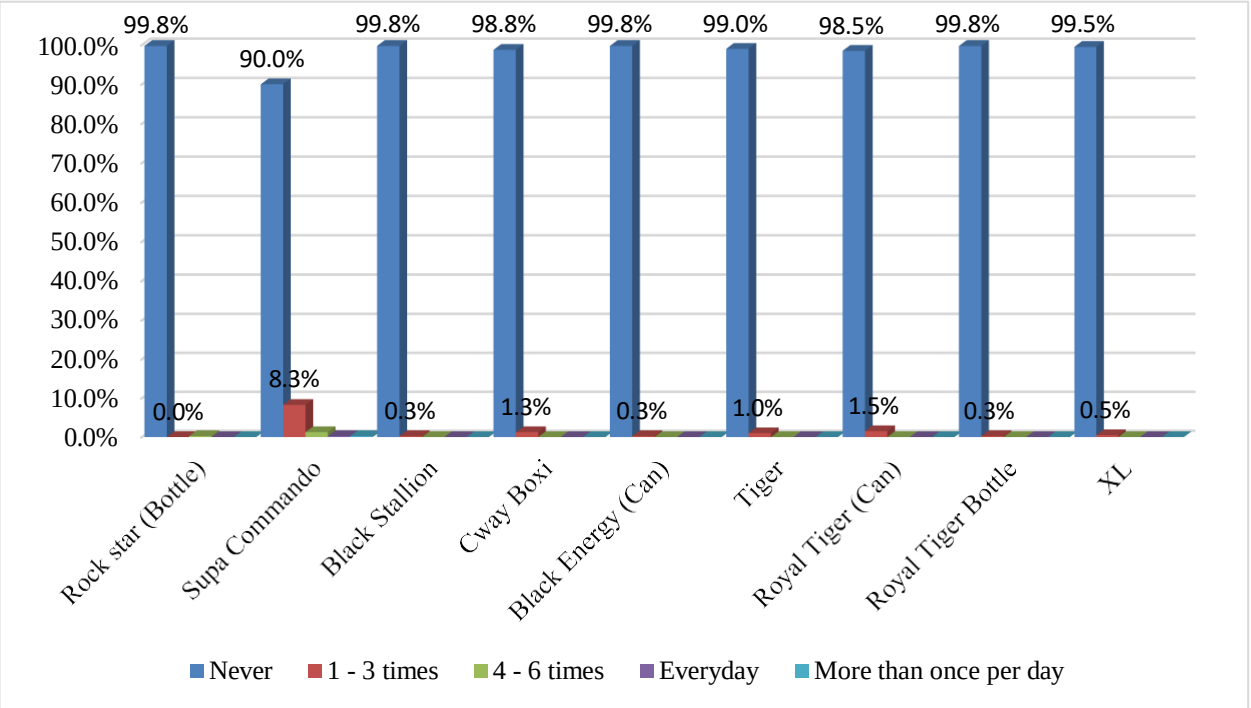

Figure 2c: Frequency of Consumption of Energy Drinks

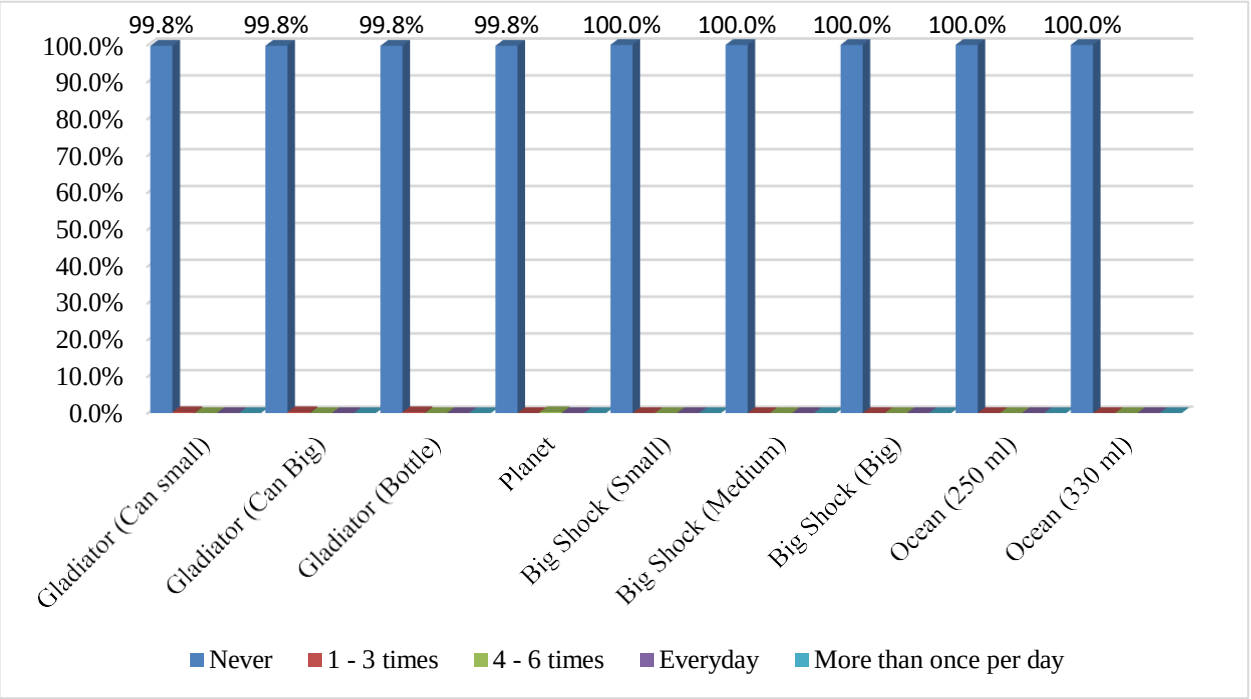

Figure 2d: Frequency of Consumption of Energy Drinks

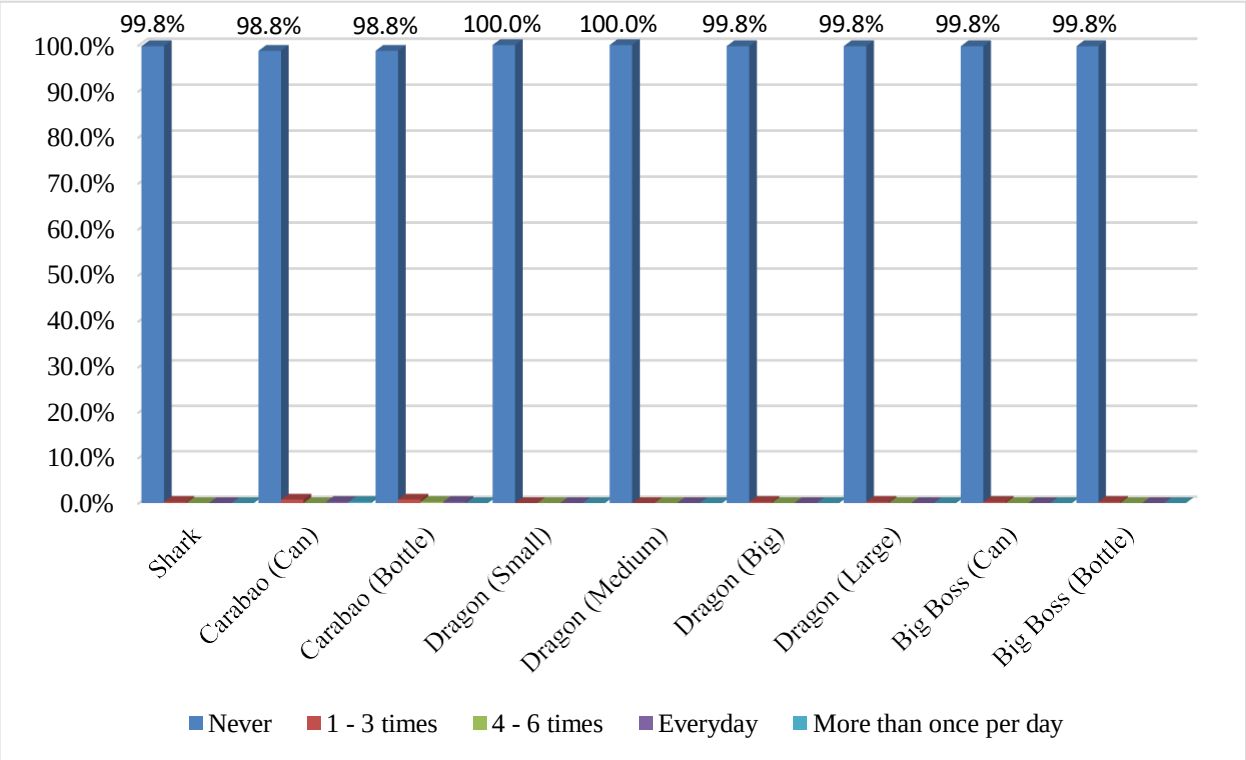

Figure 2e: Frequency of Consumption of Energy Drinks

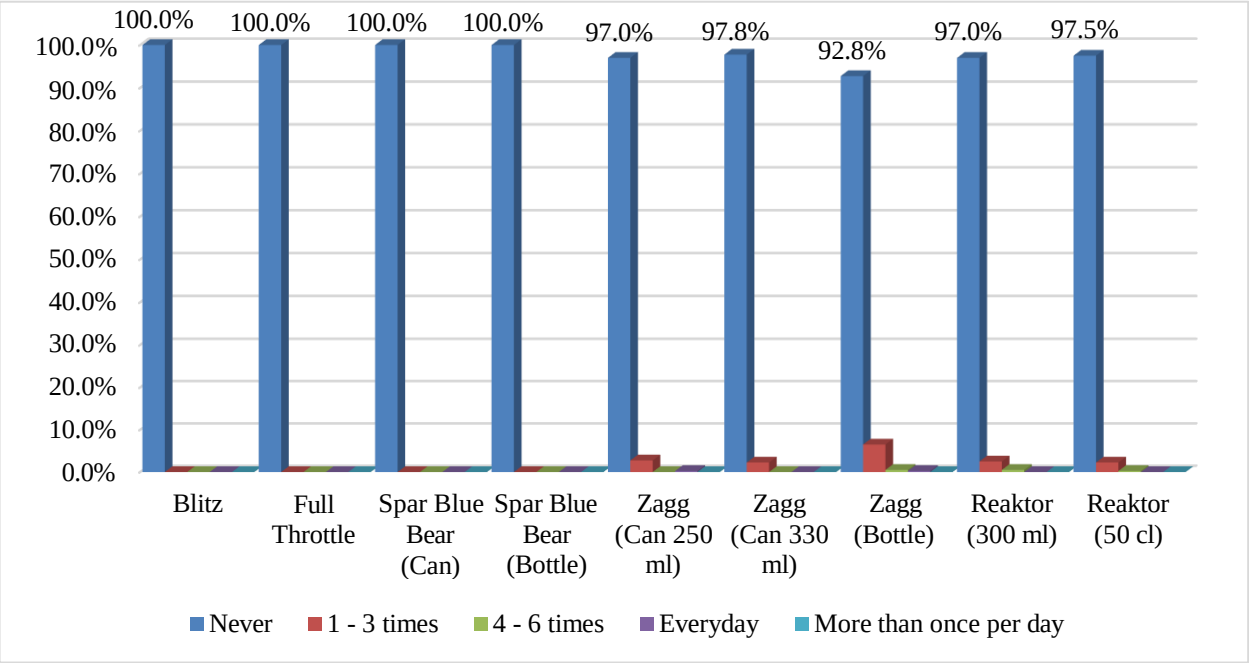

Figure 2f: Frequency of Consumption of Energy Drinks

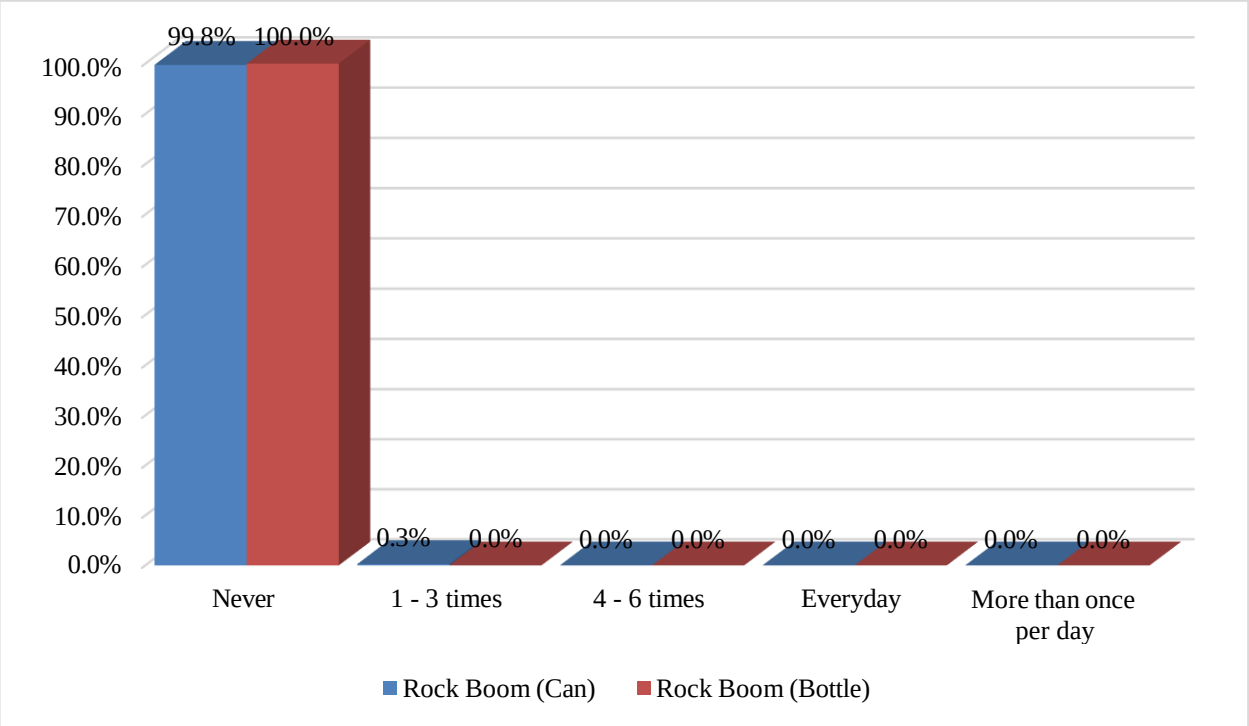

Figure 2g: Frequency of Consumption of Energy Drinks

4.4 Factors Influencing Consumption of Energy Drinks

A detailed grasp of the intricate decision-making processes and driving forces behind the respondents' usage of energy drinks may be seen in Table 6

The price of the drinks (20.5%) emerges as the primary driver, indicating that cost is a significant consideration for many consumers when selecting an energy drink. This is closely followed by brand reputation (16.3%), suggesting that brand loyalty and perceived quality also play essential roles in consumer choice. Consequently, the variety of available flavors (8.8%) indicates a partial inclination towards diverse taste experiences among consumers. This preference for flavor diversity suggests that the sensory appeal of energy drinks influences their choice. Concurrently, health and safety concerns (5.3%) are noteworthy, reflecting a subset of consumers who prioritize their well-being and consider the potential risks associated with these beverages. Examining the primary motivations for consumption, the data reveals a multifaceted landscape. Boosting energy and alertness (24.0%) signifies a practical need for these beverages, indicating that consumers turn to them for functional benefits. Additionally, staying awake or combating fatigue (11.3%) demonstrates that energy drinks are often used for their stimulant properties to enhance alertness and fight tiredness. A small proportion of the respondents (6.3%) indulge for the pleasure of taste and enjoyment. Furthermore, the consideration of nutritional information (31.3%) illustrates a discerning group of consumers who actively engage with the content and composition of the drinks. This suggests a level of health consciousness, where individuals make informed decisions based on the nutritional value provided by the beverages. From examination, only a very small proportion (19.3%) of the respondents take energy drink to perform specific activities the larger proportion (61.8%) doesn’t indulge for the sake of activities.

Additionally, the awareness of potential health risks associated with energy drinks (68.5%) indicates a considerable level of knowledge within the surveyed population. This awareness, coupled with the fact that a significant portion (50.0%) is concerned about these risks, highlights a need for more targeted education and awareness campaigns regarding the potential dangers associated with excessive energy drink consumption.

Table 5: Factors Influencing Consumption of Energy Drinks

Variables	Frequency (F)	Percentage (%)
Which factors influences your decision when choosing energy drinks		
Brand reputation	65	16.3
Price	82	20.5
Flavors available	35	8.8
Advertising and marketing	7	1.8
Recommendations from friends/families	6	1.5
Ingredients and nutritional information	4	1.0
Health and safety concerns	21	5.3
Volume of drink	1	0.3
Easy availability	9	2.3
Two or more factors	94	23.5
Total	324	81.0
What prompts you to take energy drink		
To boost energy and alertness	96	24.0
To improve physical performance	13	3.3
To stay awake or combat fatigue	45	11.3
For the taste and enjoyment	25	6.3
Peer pressure or social influence	2	0.5
Marketing and branding	1	0.3
To cope with stress or pressure	13	3.3
To improve focus and concentration	5	1.3
To enhance athletic performance	3	0.8
To enhance sexual activity	1	0.3
Two or more factors	120	30.0
Total	324	81.0
Do you take energy drinks for particular activities or occasions		
No	247	61.8
Yes	77	19.3
Total	324	81.0
Do the nutritional details on the energy drink labels influence your decision-making when purchasing them		
No, it doesn't impact my decision	89	22.3
I glance at it, but not a major factor	110	27.5
Yes, I consider it carefully	125	31.3
Total	324	81.0

Table 5 cont'd: Factors Influencing Consumption of Energy Drinks

Variables	Frequency (F)	Percentage (%)
To what extent does the price of energy drinks influence your decision-making process		,
Not a major influence	86	21.5
A moderate influence	138	34.5
A significant influence	100	25.0
Total	324	81.0
Are you aware of potential health risks associated with consuming energy drinks		
No	50	12.5
Yes	274	68.5
Total	324	81.0
Are you concerned with the potential health risks associated with consuming energy drinks		
No, it doesn't concern me	124	31.0
Yes, it concerns me	200	50.0
Total	324	81.0
Do you feel advertising and marketing strategies for energy drinks influence their consumption		
No, not really	65	16.3
Yes, to some extent	157	39.3
Yes, a lot	102	25.5
Total	324	81.0

4.5 Association Between Respondents' Body Mass Index (BMI) and Quantity of Energy Drink Consumed Weekly

Table 7 - provides insights into the relationship between respondents' Body Mass Index (BMI) categories and their average weekly consumption of energy drinks. The data helps to understand if there is any significant association between BMI and the frequency of energy drink consumption.

There was no significant association (P> 0.05) between the respondents BMI and weekly energy drink consumption.

In contrast to studies where significant associations have been identified between BMI and sugary beverage consumption, this study's findings suggest that energy drink consumption does not vary significantly with BMI. For instance, previous research has often demonstrated that higher BMI is associated with greater consumption of sugary drinks, including energy drinks, due to their high sugar content, which can contribute to weight gain (Fagherazzi *et al*., 2013). This association is typically explained by the role that sugary beverages play in increasing caloric intake without contributing to satiety, leading to weight gain and higher BMI over time.

However, the absence of a significant association in this study could be attributed to several factors. One possibility is that the sample size or demographic characteristics may differ from those in other studies, leading to different consumption patterns. Additionally, other lifestyle factors not accounted for in this study, such as overall diet quality, physical activity levels, or metabolic differences, could overshadow the impact of energy drink consumption on BMI (Hu, 2013).

The findings of this study align with other research that has failed to establish a direct link between energy drink consumption and BMI. For instance, an investigation by

Bleich *et al*. (2014) found no significant association between BMI and the consumption of sugary drinks among certain populations, suggesting that other factors may be more influential in determining BMI. This indicates that while sugary drinks, including energy drinks, may contribute to caloric intake, their impact on BMI is complex and possibly influenced by a broader range of dietary and behavioral factors.

In summary, this study's results contribute to the ongoing discussion about the relationship between beverage consumption and BMI, suggesting that energy drink consumption may not be a significant determinant of BMI in the population studied. This contrasts with some research that highlights a stronger link between sugary drink intake and higher BMI, underscoring the need for further research to explore these relationships in different populations and settings.

Table 6: Association Between Respondents' Body Mass Index (BMI) and Quantity of Energy Drink Consumed Weekly

BMI Category	How many energy drinks do you consume per week (On average)						
	Less than 5	6 - 10	11 - 15	More than 15	Total	X^2	P-Value
Underweight	82.5%	12.5%	5.0%	0.0%	100.0%		
Normal weight	82.1%	13.5%	3.8%	0.6%	100.0%		
Overweight	83.9%	9.7%	6.5%	0.0%	100.0%		
Obesity Grade 1	71.4%	28.6%	0.0%	0.0%	100.0%	3.480	.991
Obesity Grade 2	100.0%	0.0%	0.0%	0.0%	100.0%		
Morbid obesity	0.0%	0.0%	0.0%	0.0%	0.0%		
Total	82.2%	13.3%	4.0%	0.5%	100.0%		

4.6 Discussion

The study titled "Assessment of Nutritional Status and Consumption Pattern of Energy Drinks Among Undergraduate Students in the Federal University of Agriculture, Abeokuta" investigates the socio-economic and demographic characteristics, anthropometric measurements, and energy drink consumption patterns among undergraduate students.

This study found that most respondents are within the 21-24 years age group, with a slightly higher proportion of males consuming energy drinks compared to females. Comparing this study to Semih Uzundumlu *et al*. (2016), whose results showed a greater participation rate among females (53%), there is a difference in the genders participating in it. This difference is also seen in research by Brenda *et al*. (2017), Shery *et al*. (2013), Oladejo and Victoria (2014), and Brenda *et al.* (2017), who studied college students in the USA and found that women dominated at 53%, 68%, and 51.1% of the sample. The results of this study are corroborated by the research of Christina (2015), Douglas, and Nkporbu (2018).

The average age in this study is comparable to studies by Brenda *et al*. (2017), Ali *et al*. (2022), Usman *et al*. (2022), Kobik (2022) (whose study reported an average age of 25.5 years), Ernesto *et al*. (2016) (whose study reported an average age of 20.4 years), and Alabbad *et al*. (2019) (whose study reported an average age of 20.2 years). One possible explanation for this discovery and similarities could be the common demographic of young people enrolled in school. The results of the ethnicity analysis showed a notable Yoruba ethnic group predominance, which makes sense given that the study was conducted in the largely Yoruba-populated southwest of Nigeria.

According to this study, 25% of the participants had a monthly salary of #10,001 to 20,000 which is in opposition to a survey conducted at OAU, Ile-Ife (Idumah *et al*.,

2020), where the majority of respondents (49.6%) reported receiving less than #10,000 per month from their stipend.

The study's respondents' housing circumstances corroborate with those of Towhid and Marjia (2019), who found that the majority of respondents (69.2%) resided off campus, and Ibrahim *et al*. (2021), who found that 69% of respondents lived off campus. This result are at odds with Nameer's (2016) study, which found that the majority of respondents (54.2%) resided on school property. Engaging in extracurricular activities demonstrated that the results of Nameer (2016) and this study concur that only a small percentage of respondents actively participated in extracurricular activities.

This study's mean weight, height, and BMI are comparable to those of Kobik's (2022) study, which had mean values of 61.6 kg, 1.64 m, and 23.19 kg/m2, respectively.The anthropometric analysis in this study shows that most respondents fall within the normal weight range, with very few classified as overweight or obese. Less than 25% of research participants are underweight, whereas the remainder have normal weights. This is consistent with Christina's (2015) study, which found that 60.8% of people had normal weight and 5.8% were underweight. Underweight, normal weight, overweight, and obesity prevalence are 12.6%, 70.9%, 14.8%, and 1.7%, respectively, in a comparable study (Ali, 2015).

The findings of Christina (2015) and Ali (2022) studies, as well as the levels of overweight and obesity discovered in this study, are not surprising considering that obesity has been identified as a growing issue among many individuals in developing nations.

The consumption patterns revealed that a significant portion of students rarely or never consume energy drinks, while a notable segment consumes them regularly. These findings are consistent with research by Reissig, Strain, and Griffiths (2009), who

reported that energy drink consumption is prevalent among young adults, particularly in college settings, where the need for increased energy and alertness is high due to academic pressures.

In contrast, studies conducted in other regions, such as the work by Rath (2012), have shown a higher frequency of energy drink consumption among college students, especially in countries where these drinks are aggressively marketed. The differences in consumption patterns could be attributed to cultural, economic, and regulatory factors that influence the availability and perceived necessity of energy drinks in different populations.

The price of energy drinks and brand reputation are significant factors in the decision-making processes and driving forces behind their usage, this is in line with Ali's (2018) study which found price to be a significant factor when selecting favorite brands of energy drinks.

To boost energy and alertness was major motivators for the use of energy drinks in the current study. Taste and enjoyment were non-major motivators for the use of energy drinks in the current study. This result is contrast to that of Conrad *et al*. (2020), who discovered that 67% of people who drank energy drinks did so for flavor.

There was no significant association ($P>0.05$) between the respondents BMI and weekly energy drink consumption.

The lack of a significant association between BMI and energy drink consumption, as identified through the Pearson Chi-Square test, contrasts with the findings of other studies that have established a link between high sugar consumption (often from energy drinks) and increased BMI.

For instance, Fagherazzi *et al*. (2013) found a significant association between sugary beverage consumption and weight gain, which was linked to an increased risk of obesity

and related metabolic conditions. Similarly, Hu (2013) highlighted the role of sugary drinks in contributing to higher caloric intake, leading to weight gain and elevated BMI over time.

The absence of a significant association in this study may be due to several factors, including the relatively low frequency of energy drink consumption among the respondents or the potential influence of other dietary and lifestyle factors that were not accounted for in the analysis.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

To sum up, this study has offered an in-depth exploration of the diverse facets of the population we surveyed. The demographic analysis presented an accurate picture of the sample population, including age groups, gender distributions, religious affiliations, and family structures. For example, the data showed a narrow margin of male dominance in gender participation, with 53% males and 47% females; additionally, a sizable portion of respondents (44.5%) belonged to the age range of 21-24 years, indicating a predominate age group in the study. This demographic diversity not only reflects the complexity of our society but also highlights the necessity for tailored, targeted approaches in both product development and marketing strategies.

Important health information was obtained from anthropometric measures; the participants' average height of 1.6740 m and weight of 60.1349 kg suggested an average build. The range of weight categories was demonstrated by the various BMI classifications: 10.5% were classed as "Underweight," 79.5% as "Normal," 7.8% as "Overweight," and 2.3% as "Obese." These numbers provide important health-related information by illuminating the prevalence of various weight statuses among the respondents.

Intriguing consumer habits were also discovered through the examination of energy drink usage trends. It was discovered that the attractiveness of brands such as 'Lucozade Original' and 'Lucozade Boost' varied considerably, indicating that a marketing approach that was universally applicable would not be successful in the energy drink sector. Rather, it is critical to adopt a customized strategy that takes into account the distinct interests of various customer categories. Furthermore, by establishing

competitive pricing strategies and guaranteeing accessibility across different income levels, firms can benefit from an awareness of the socio-economic variables impacting consumer choices for energy drinks.

5.2 Recommendations

Based on the findings of the study regarding the anthropometric characteristics and energy drink consumption patterns of respondents, several recommendations can be made to enhance public health and consumer awareness. Firstly, it is essential to implement educational campaigns aimed at increasing awareness of the potential health risks associated with energy drink consumption, particularly among the youth demographic, which comprises a significant portion of the surveyed population. These campaigns should focus on promoting healthier lifestyle choices, emphasizing the importance of balanced nutrition and the risks linked to high caffeine and sugar intake.

Additionally, stakeholders in the beverage industry should consider developing healthier alternatives to traditional energy drinks, such as lower-sugar or caffeine-free options, to cater to the growing health-conscious segment of consumers. Implementing transparent labeling that clearly outlines nutritional information can empower consumers to make informed decisions.

Moreover, given the notable percentage of respondents classified as underweight or at risk due to waist circumference, nutritional counseling and support services should be made readily available on campuses. This would provide students with resources to maintain a healthy diet and lifestyle, ultimately fostering a holistic approach to health and wellness.

Lastly, further research is recommended to explore the underlying factors influencing energy drink consumption across diverse populations. This could provide deeper

insights into behavioral trends and help tailor public health interventions more effectively. Overall, these recommendations aim to promote a healthier, more informed consumer base while addressing the potential risks associated with energy drink consumption.

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APPENDIX

QUESTIONNAIRE

FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA

COLLEGE OF FOOD SCIENCE AND HUMAN ECOLOGY

NUTRITION AND DIETETICS DEPARTMENT

Dear Respondent,

The researcher is a final year student of the Federal University of Agriculture, Abeokuta (FUNAAB), who is conducting a research on "**ASSESSMENT OF NUTRITIONAL STATUS AND CONSUMPTION PATTERN OF ENERGY DRINKS AMONG UNDERGRADUATES IN FEDERAL UNIVERSITY OF AGRICULTURE ABEOKUTA".** This questionnaire is designed to gather information on the above topic. Your participation and cooperation by providing sincere responses to the questionnaire will greatly assist me in this research. Your information will be kept confidential and used solely for the purpose of this study.

Informed Consent

I ……., hereby consent to filling this questionnaire (Respondent's signature)

Questionnaire Number …….

Section A: Socio-Demographic and Socio-Economic Information

Instruction: Please kindly tick appropriately [√] and write appropriate answers in the space provided.

1. Age (years): .....

2. Gender: (1) Male [ ] (2) Female [ ]

3. Religion: (a) Christianity [ ] (b) Islam [ ] (c) Others (**please specify**) ……

4. Ethnic group: (1) Yoruba [ ] (2) Igbo [ ] (3) Hausa [ ]

(4) Others……..

5. Level (1) 100 [ ] (2) 200 [ ] (3) 300 [ ] (4) 400 [ ] (5) 500 [ ] (6) 600[ ]

6. Sponsorship: (1) Self [ ] (2) parents [ ] (3) government scholarship [ ]

(4) others.....

7. Monthly Income: ≤ #10,000 [ ] #10,001-#20,000 [ ]

#20,001-#30,000[ ] #30,001-#40,000 [ ] #40,001-#50,000 [ ]

#50,001-#100,000 [ ] Above #100,001 [ ]

8. Housing Situation: (1) On-campus (2) Off-campus (3) Living with parents/family

9. Are you involved in any extracurricular activities or clubs in the university? (1) Yes

(2)No

10. Marital status: (1) Single (2) Married (3) Divorced (4) Cohabiting (5) Widowed

(6) Others .....

SECTION B: ANTHROPOMETRIC CHARACTERISTICS

	1st Reading	**2nd Reading**	**Average**
Weight (kg)			
Height (m)			
Waist circumference (cm)			

BMI (kg/m²) = ……..…...

SECTION C: CONSUMPTION PATTERN AND FREQUENCY OF CONSUMPTION OF ENERGY DRINKS

1. How frequently do you consume energy drinks?

(1) Daily (2) Several times a week (3) Once a week

(4) Several times a month (5) Rarely (6) Never

2. On average, how many energy drinks do you consume per day? _____

3. On average, how many energy drinks do you consume per week? _____

4. When do you typically consume energy drinks? (Select all that apply)

(1) Early morning (2) Mid-morning (3) Afternoon (4) Evening (5) Night (6) Not applicable

5. What are your preferred brands of energy drinks? _____

6. What flavors of energy drinks do you prefer? _____

7. What is your primary method of purchasing energy drinks?

(1) Convenience stores (2) Supermarkets/hypermarkets (3) Online retailers

(4) Gas stations (5) Other (please specify) _____

(6) Not applicable

8. Do you combine energy drinks with alcohol or any other substances?

(1) Yes (2) No (3) Not applicable

9. For how long have you been consuming energy drinks?

(1) Less than a year (2) 1-3 year (3) 4-6 years (4) More than 6 years (5) Not applicable

10. How much do you spend on energy drinks per week? Please select one option:

[ ] ≤#1,000 [ ] #1,001-#3,000 [ ] #3,001-#5,000 [ ] #5,001-#7,000 [ ] #7,001-#10,000 [ ]

Above#10,000. Not applicable [ ]

The following asks how often or frequent you take the following energy drinks. Please kindly write appropriate answers in the space provided.

Keys:

0 = Never. 1= Once 2= Twice. 3= Thrice. 4=Four times 5= Five times 6= Six times 7= Seven times

Energy Drink	Net Content	0 -7 times a week	Tick if consumed more than once per day	Quantity Consumed
BULLET	250 ml			
CLIMAX (Can)	33 cl			
CLIMAX (Bottle)	25 cl			
CHI VERA (Can)	25 cl			
FEARLESS	500 ml			
LUCOZADE BOOST	12.5 cl			
LUCOZADE ORIGINAL	38 cl			
LUCOZADE SPORT	45 cl			
MACA (Small)	40 cl			
MACA (Big)	600 ml			
MONSTER	44 cl			
ODOGWU MALAY	330 ml			
POWER HORSE (Small)	250 ml			
POWER HORSE (Big)	355 ml			
PREDATOR	40 cl			
RED BULL	250 ml			
ROCKSTAR(Small can)	250 ml			
ROCK STAR (Big can)	500 ml			
ROCK STAR (Bottle)				
SUPA COMMANDO	30 cl			
BLACK STALLION	50 cl			
CWAY BOXI	400 ml			
DARK BLUE CAN	250 ml			
BLACK ENERGY (Can)	250 ml			
TIGER	250 ml			
ROYAL TIGER (Can)	250 ml			
ROYAL TIGER (Bottle)	250 ml			
XL	250 ml			
GLADIATOR (Can)	250 ml			
GLADIATOR (Can)	473 ml			
GLADIATOR (Bottle)	250 ml			
DARK BLUE (Can)	250 ml			
DARK BLUE (Can)	250 ml			
DARK BLUE (Can)	330 ml			
DARK BLUE (Bottle)	500 ml			
BIG SHOCK	250 ml			

BIG SHOCK	330 ml			
BIG SHOCK	550 ml			
OCEAN	250 ml			
OCEAN	330 ml			
SHARK	250 ml			
CARABAO (Can)	330 ml			
CARABAO (Bottle)	500 ml			
DRAGON	250 ml			
DRAGON	300 ml			
DRAGON	330 ml			
DRAGON	500 ml			
BIG BOSS (Can)	330 ml			
BIG BOSS (Bottle)	350 ml			
BLITZ	250 ml			
FULL THROTTLE	473 ml			
SPAR BLUE BEAR (Can)	250 ml			
SPAR BLUE BEAR (Bottle)	1l			
ZAGG (Can)	250 ml			
ZAGG (Can)	330 ml			
ZAGG (Bottle)	50 cl			
REAKTOR	300 ml			
REAKTOR	50 cl			
ROCK BOOM (Can)	250 ml			
ROCK BOOM (Bottle)	320 ml			

SECTION D: FACTORS INFLUENCING CONSUMPTION OF ENERGY DRINKS.

1. Which factors influence your decision when choosing energy drinks? (Select all that apply)

(1) Brand reputation (2) Price (3) Flavors available (4) Advertising and marketing

(5) Recommendations from friends/family (6) Ingredients and nutritional information

(7) Health and safety concerns (8) Volume of drink

(9) Easy availability (10) Other (please specify) _____

(11) Not applicable

2. What prompts you to consume energy drinks? (Select all that apply) (Select all that apply)

(1) To boost energy and alertness (2) To improve physical performance

(3) To stay awake or combat fatigue (4) For the taste and enjoyment

(5) Peer pressure or social influence (6) Marketing and branding

(7) To cope with stress or pressure (8) To improve focus and concentration

(9) To enhance athletic performance (10) To enhance sexual activity

(11) Other (please specify) _____

(12) Not applicable

3. Do you drink energy drinks for particular activities or occasions?

(a) Yes (b) No (c) Not applicable

4. If yes, please specify _____

5. Do the nutritional details on energy drink labels influence your decision-making when purchasing them?

(1) Yes, I consider it carefully (2) I glance at it but not a major factor

(3) No, it doesn't impact my decision (4) Not applicable

6. To what extent does the price of energy drinks influence your decision-making process?

(1) A significant influence (2) A moderate influence (3) Not a major influence

(4) Not applicable

7. Are you aware of any potential health risks associated with consuming energy drinks?

(1) Yes (2) No

8. If yes, Are you concerned with the potential health risks associated with consuming energy drinks?

(1) Yes, it concerns me (2) No, it doesn't concern me

9. Do you feel that the advertising and marketing strategies for energy drinks influence their consumption?

(1) Yes, a lot (2) Yes, to some extent (3) No, not really