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Assessment of the Impact of Energy Drink Consumption on Nutritional Status of Undergraduate Students in Ogun State, Nigeria

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Abstract

Background: *Energy drink consumption is increasingly common among adolescents and young adults, particularly university students in Nigeria. The potential nutritional implications of these beverages, which are often high in sugar and calories, warrant investigation.*

Objectives: *This study aimed to assess the impact of energy drink consumption on the nutritional status of undergraduate students in Ogun State, Nigeria, with particular focus on its contribution to daily caloric intake and potential associations with Body Mass Index (BMI).*

Method: *A descriptive cross-sectional study was conducted between April and June 2024 among undergraduate students at a federal tertiary institution in Ogun State. A multi-stage sampling technique was used to select 250 students across 10 academic departments. Data were collected using a validated, semi-structured, self-administered questionnaire addressing socio-demographic characteristics, energy drink consumption patterns, and influencing factors. Anthropometric measurements were obtained following standardized procedures, and BMI was calculated. Data were analyzed using SPSS version 26.0, with statistical significance set at $p < 0.05$.*

Result: *The majority of respondents (44.4%) were aged 20-22 years, followed by 23-25 years (26.8%), 17-19 years (21.2%), and ≥25 years (7.6%). BMI categorization showed that 74%were within the normal weight range, 11.2% were underweight, 12% were overweight, and 2.8% were obese. Regarding energy drink consumption, 32.8% reported intake several times a month, 14.8% consumed once per week, and 7.2% consumed daily. The variety of available flavors (22%) were a key motivator for consumption. No statistically significant association was found between frequency of energy drink consumption and BMI categories ($p = 0.051$).*

Conclusion: *Energy drink consumption is prevalent among university students in Ogun State, driven in part by flavor preferences. However, this study found no significant short-term impact on nutritional status as measured by BMI. Longitudinal studies are recommended to assess potential long-term health effects of regular energy drink consumption.*

Introduction

Over the past three decades, there has been a global increase in the rate of overweight and obesity. While genetic factors may contribute to the development of obesity, the recent dramatic increase in the rate of obesity suggests that behavioral and environmental factors have also played a role (1). The most frequent causes of weight increase are dietary and lifestyle modifications, but new studies suggest that beverage additives may also be a significant factor (2). This nutritional shift affects undergraduate students, the majority of whom are late adolescents and young adults (3). According to Omage and Omuemu (4), the shift from adolescence to adulthood is a crucial time for the establishment of behavioral patterns that influence chronic diseases and long-term health. The majority of Nigerian undergraduate students do not have optimal nutritional condition; in fact, immediate attention is required. Since they make up the majority of Nigerians, undergraduates—adolescents and young adults—are probably going to be the most impacted (5).

Energy drinks in this study refer to non-alcoholic or mildly alcoholic beverages that contain stimulants such as caffeine, taurine, guarana, ginseng, B vitamins, and sugar or artificial sweeteners. They are marketed to boost energy, enhance alertness, and improve physical and mental performance. Energy drinks, both domestically and imported, are popular among adolescents as well as young adults in Nigeria, particularly university students (6). Energy drinks are widely available and suitable for all age groups, as their sale is not currently subject to tight regulations. However, in some countries, their sale has been prohibited due to concerns regarding their high caffeine content (7). According to Picard-Masson *et al.*, (8) these rules may include labeling products with a "high caffeine content," recommending a daily maximum intake, stating that energy drinks shouldn't be combined with alcohol, or even outright forbidding their sale. There is not much information available on the consumption patterns of energy drinks in Nigeria or how they could influence customers' caloric intake. Therefore, this study ascertains the possible contribution of frequently used energy drinks on the amount of calories required by undergraduate students in Ogun State's higher education institutions.

Method

Study area, design and period

The consumption of energy drinks and nutritional status among undergraduate students attending federal government-owned universities in Ogun State were examined using a cross-sectional and descriptive study methodology. This study was carried out in Ogun State, Nigeria. Ogun state lies in the south west part of Nigeria. It has 20 local governments with a total of 3,751,140 (2006 census). The study engages with students from 10 colleges with different departments and programs under them. The target population for this study consisted of only undergraduates in the institution and were assessed during their second semester.

Inclusion and exclusion criteria

Inclusion Criteria: Undergraduate students enrolled in full-time academic programs at the selected federal tertiary institution in Ogun State. Students who were available and willing to participate during the second semester of the 2023/2024 academic session. Also, respondents who provided informed written consent after being fully briefed on the objectives and procedures of the study.

Exclusion Criteria: Students who declined to participate or withdrew their consent at any stage of the data collection process. Incomplete questionnaires or improperly recorded anthropometric data were excluded from final analysis to ensure data quality and reliability.

Sample Size determination and sampling technique

The sample size (N) for this study was determined using the formula: $N = Z^2 \times P \times q \div d^2$, where the confidence interval (Z) is 1.96 (a constant), and the degree of freedom (d), representing the margin of error, is 0.05. The prevalence (P) of underweight among undergraduates in Ogun State is 13.4% (20), which when converted gives $P = 13.4 \div 100 = 0.134$. Consequently, $q = 1 - P = 1 - 0.134 = 0.866$. Substituting these values into the formula: $N = (1.96)^2 \times 0.134 \times 0.866 \div (0.05)^2$, we get $N = (3.841 \times 0.134 \times 0.866) \div 0.0025 = 0.44573 \div 0.0025 = 178.29$. To account for possible attrition, a total of 250 respondents were included in this study.

A multi-stage sampling technique was used to choose 250 undergraduate candidates in total. Out of the ten (10) colleges, five (5) colleges were chosen at random for the first stage.

In the second round, two departments were chosen at random from each of the five colleges. Two (2) departments were chosen from each of the five (5) colleges, and twenty-five (25) students were chosen at random from each of the ten (10) selected departments.

Data collection

Data collection was conducted by a team of four, two (2) trained research assistants who were final-year students in the department of Nutrition and Dietetics and the principal investigators who are the authors. Prior to fieldwork, the assistants underwent a one-day orientation and training session facilitated by the principal investigators. This training focused on the purpose of the study, ethical considerations, proper administration of the questionnaire, anthropometric measurement techniques, and respondent engagement strategies to ensure uniformity in data gathering. The questionnaire was pre-tested on a sample of 20 undergraduate students from a neighboring tertiary institution (college of education) but not included in the main study. Based on feedback, minor revisions were made to improve the structure and comprehensibility of certain items. The language of administration was English, as it is the official language of instruction in Nigerian tertiary institutions. Data collection took place during the second semester, which was strategically chosen to ensure that students were settled on campus and available to participate. Respondents completed a validated semi-structured, self-administered questionnaire that captured sociodemographic characteristics, energy drink consumption patterns, and other lifestyle-related variables. We measured the anthropometric assessment, participants' weight and height were measured using a calibrated digital weighing scale and a stadiometer, respectively. All measurements were taken twice and the average value recorded to minimize measurement errors. Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). All instruments were regularly checked for accuracy and zero error during each day of data collection. An energy drink consumption pattern and frequency questionnaire, adapted from Hasan et al., (9) was used to gather data from the respondents.

Data analysis

Before analysis, the results from the questionnaire were coded, and sorted, and then descriptive statistics employing frequencies and percentages were used to examine the data. While mean standard deviation was used to communicate continuous variables, frequency and percentages were used to express categorical data. The null hypothesis was tested using inferential statistics (Chi square) at the $p<0.05$ level of significance. The data analysis was conducted using SPSS 26.0, the Statistical Package for Social Sciences.

Ethical consideration

The questionnaires were administered to respondents on approval by ethical committee of the Ogun state hospital, Ijaye Abeokuta, reference Number: SHA/RES/VOL.23/ 079. Before collecting the data, informed consent of respondents was obtained and purpose of the study was explained to them. Participation in the study were voluntary and a respondent had the right to withdraw if he/she wishes to do so. Information provided was treated confidentially and respondent's anonymity was adequately maintained.

Result

Socio-Economic and Demographic Characteristics of the Respondents

Several key socio-demographic factors were looked at, providing insight into the respondents' varied traits. There was a noticeable variance in the respondents' age distribution. A significant percentage, 44.4%, was between the ages of 20 and 22, while 26.8% was between the ages of 23 and 25. A smaller but significant group consisted of people who were 17–19 years old (21.2%), and people who were 25 years old and older (7.6%). The respondents' varied age distribution reflects a wide range of life phases. There was an almost equal distribution of genders, with 51.6% of men and 48.4% of women. The dataset is guaranteed to provide a comprehensive perspective by the balanced gender representation. The interviewees' religious affiliations were primarily Christian (69.6%), with Islam coming in second at 30%. Just 0.4% of people identified as members of a faith other than their own. This distribution demonstrates how diverse the population under study was in terms of religion. The respondents' intellectual backgrounds ranged widely throughout various educational stages. The larger (38.8%) population were in their fourth year, followed by the first year students (24.4%), the second year students were 17.6 percent, the fifth year students were 11 percent, while the third year students were7.6 percent of the population. There is a range of seniority levels among the participants, as seen by this uneven distribution. In

terms of accommodation, 31.2% of respondents lived on campus, while 68.4% of respondents lived off campus. Just 0.4% of respondents said they lived with their parents or other family members. The distribution of houses highlights the respondents' varied living arrangements. When it came to extracurricular involvement (involvement in sports, clubs and other activities outside the class room), 26.8% of respondents said they participated in extracurricular activities, while 73.2% said they did not. This discrepancy in respondents' extracurricular involvement reflects their varied interests and activities outside of the classroom and indicates different levels of engagement.

Anthropometric Characteristics of the Respondents

The anthropometric characteristics of the respondents, providing valuable insights into their physical measurements and overall body composition. The average weight of the respondents was 61.304 kg, indicating the central tendency of the weight distribution. BMI, calculated from weight and height in table 1, provides an assessment of body fatness.

Table 1: BMI Category of the Respondents

BMI Category	Frequency	Percent
Underweight (BMI < 18.5 kg/m^2)	28	11.2
Normal (BMI: 18.5 – 24.9 kg/m^2)	185	74
Overweight (BMI: 25.0 – 29.9 kg/m^2)	30	12
Obese (BMI > 30 kg/m^2)	7	2.8
Total	250	100

Consumption Pattern and Frequency of Consumption of Energy Drinks among the Respondents

This sheds light on the respondents' varied patterns of energy drink usage and provides a thorough picture of their routines, frequency, amounts, and related behaviors. Thirty-one percent of the respondents did not drink energy drinks at all, indicating a sizeable section of the population that does not drink this product. The consumers' frequency of consumption varied: 32.8% indulged several times a month, 14.8% chose to consume once a week, while 7.2% of the respondents, a smaller but significant group, indicated daily consumption, indicating that occasional rather than habitual ingestion was more common in the population questioned.

When it came to quantity, the statistics showed that 39.6% of people only drank one can of energy drink a day, while 9.2% drank two. The majority of respondents moderated their weekly consumption, as seen by 54.4% of them who lowered their intake to fewer than five drinks per week. When the timing of consumption was examined, the results showed a variety of preferences. Energy drinks were commonly ingested in the afternoon (36.4%) and evening (24%), which is consistent with their possible use as study aids or supplies of evening energy. The percentage of people who drank energy drinks in the early morning (3.2%) and midday (5.2%) was lower than the overall percentage, suggesting that this was not a frequent practice.

Convenience stores were preferred by 59.2% of respondents based on their purchasing habits, demonstrating the accessibility and availability of energy drinks in these establishments. A concentration of sales in physical convenience stores was indicated by the lesser share of purchasing channels accounted for by supermarkets, internet merchants, and other sources. About 15.2% of respondents coupled energy drinks with alcohol or other substances, which is a worrying finding because it suggests that there may be health hazards involved with combination intake. A range of use durations was also noted, with 14.8% of respondents having drank energy drinks for 4-6 years and 22.4% of respondents for 1-3 years, indicating a consistent pattern of consumption among these groups. Finally, the amount spent on energy drinks varied; 42.4% of users spent less than $1 a week, suggesting that a sizable percentage of the market can afford it. On the other hand, 18.4% of the segment's weekly spending was in the$1–$2, indicating a significant amount of money spent on this beverage. The frequency of energy drink consumption among the respondents in table 2 was recorded, indicating the respondents' preference for some brands over others.

Table 2: Frequency of Consumption of Energy Drinks Among the Respondents

Energy Drink	Never	Everyday	1-3 times/week	4-6 times/week	More Than Once Per Day
LUCOZADE BOOST	49%	14%	16%	14%	6%
LUCOZADE ORIGINAL	20%	20%	26%	18%	16%
EVIRON (Can)	32%	18%	19%	17%	14%
CLIMAX (Can)	16%	26%	20%	26%	12%
CLIMAX (Bottle)	27%	8%	42%	10%	12%
CHI VERA(Can)	36%	12%	16%	26%	10%
POWER HORSE (Small)	19%	27%	17%	26%	11%
LUCOZADE SPORT	32%	9%	26%	24%	8%
FEARLESS	37%	14%	22%	17%	10%
POWER HORSE (Big)	40%	12%	20%	17%	11%
MONSTER	20%	15%	40%	12%	12%
MACA	12%	15%	22%	40%	10%
SUPA KOMANDO	18%	40%	14%	20%	8%
PREDATOR	20%	12%	14%	14%	40%
BULLET	10%	20%	45%	14%	10%
RED BULL	19%	19%	13%	43%	6%

Factors Influencing Consumption of Energy Drinks

This provides a more detailed knowledge of the intricate decision-making processes and reasons why the respondents consume energy drinks. One of the main motivators is the diversity of flavors available (22%) which suggests that customers have a preference for a wide range of taste experiences. This desire for a variety of flavors implies that the energy drinks' sensory appeal has a big impact on their decision. Simultaneously, health and safety concerns (10.8%) are reasons, representing a segment of the consumer base that places a high value on their health and takes into account any possible risks related to these drinks. Analyzing the main driving forces behind consumption, the data shows a complex picture. Enhancing energy and alertness (12.4%) shows that there is a need for these drinks in everyday life and that people seek them out for their practical advantages. Furthermore, a hedonistic component can be seen in the desire for taste and enjoyment (12.4%), which highlights the importance of pleasure and sensory experience in influencing consumption decisions.

Moreover, the examination of nutritional information (21.6%) shows a discriminating consumer base that actively interacts with the drinks' composition and content. This implies a degree of health consciousness, where people base their decisions on the nutritional content of the drinks. Furthermore, the fact that 45.6% of respondents were aware of the possible health hazards connected to energy drinks suggests that a sizable portion of the population was knowledgeable about these issues. This knowledge, along with the fact that a sizable percentage (44.8%) is worried about these hazards, emphasizes the need for more focused education and awareness efforts about the possible consequences connected to consuming excessive amounts of energy drinks.

The impact of marketing and advertising (24%) highlights the ability of marketing methods to persuade changes in consumption habits. This research highlights the necessity of responsible marketing strategies and laws to prevent consumers from being overly persuaded to make decisions that could endanger their health.

Relationship between Consumption Pattern of Energy Drinks and Anthropometric Characteristics

This presents the relationship between the frequency of consumption of energy drinks and different Body Mass Index (BMI) categories, including underweight, normal weight, overweight, and obese. The p-value associated with this rela-

tionship is 0.051, indicating that there is no statistically significant relationship between the frequency of energy drink consumption and BMI categories ($p > 0.05$). It was observed in table 3, that individuals with varying BMI categories consume energy drinks at different frequencies. For instance, individuals with normal weight tend to consume energy drinks more frequently across all categories compared to underweight, overweight, or obese individuals. However, the differences in consumption frequency among different BMI categories are not statistically significant according to its p-value.

Table 3: Relationship between Consumption Pattern of Energy Drinks and Anthropometric Characteristics

	BMI Category				p-value	Decision
Frequency of Consumption	**Underweight**	**Normal**	**Overweight**	**Obese**	0.051	NS
Daily	0%	6%	1%	0%		
Once per week	0%	14%	1%	0%		
Several times a month	4%	21%	5%	2%		
Rarely	3%	9%	2%	0%		
Never	3%	24%	4%	1%		

NS: Non-significant

Discussion

Energy drinks are non-alcoholic beverages with the promise of providing an extra energy boost for daily tasks. These are carbonated drinks with high levels of sugar and caffeine combined with mixes of unusual botanical extracts, B vitamins, and amino acids to provide short-term energy and mental clarity boosts for users. This study's objective was to evaluate undergraduate students at a government-owned university in Ogun State's energy drink intake and its impact on their nutritional status. The majority of respondents in this study are of normal weights while less than one-quarter are underweight. This is in agreement with results from other studies (10, 11).

The findings of this study, along with the research conducted by Mohammed (10) and Christina (11), do not come as a surprise considering that obesity has been identified as a growing issue among adult populations in developing nations. The rising incidence of obesity-related chronic disorders makes this trend unacceptable. When used frequently in addition to regular meals, energy drinks represent a major source of additional energy that may cause unintended weight gain (6, 12).

According to this study, which included over half of the respondents, energy drink intake is prevalent among undergraduates. Energy drinks are now readily available and accessible in nearby stores as well as on college campuses thanks to the quick growth in production and marketing. An increasing number of teenagers and young people are consuming energy drinks these days. Research by Sanctis *et al*. (13) and Yunusa *et al*. (14) revealed a similar pattern, with each study reporting a significant prevalence of energy drink (41.1% and 66.1 % respectively) intake among its participants. Additionally, a study done among the University of Port Harcourt medical and dental students revealed an alarmingly high prevalence of energy drink (80.1%) intake (15) while Nuss *et al.* (16) documented the opposite event at 24% energy drink consumption

When evaluating the frequency of energy drink intake, the study's weekly energy drink consumption is comparable to that of Christina *et al*. (11) who found that 23% of respondents drank energy drinks weekly. However, when compared to daily intake, the study participants' weekly consumption is higher. When compared to Ernesto Cabezas-Bou *et al.* (17) this report is also higher.

A broader comprehension of the complicated decision-making procedures and incentives underlying energy drink intake among the participants in this investigation demonstrated that the flavor experienced from consuming energy drinks is a determinant in their selection of energy drink consumption, with price being of little consequence as long as

the taste fulfilled their expectations. Similar results on respondents' preference for energy drinks influenced by taste were noted in (10). But according to Mohammed *et al.* (10) the cost was just as significant as flavor when selecting energy drink brands.

This study documented the respondents' practices of mixing energy drinks and alcohol; however, Ibrahim *et al*. (18) study found that fewer respondents in Kano acknowledged doing the same. This might be the case because respondents are unlikely to acknowledge drinking alcohol even if they do so to comply with local cultural standards. After all, it is considered a sacrilege and not an acceptable beverage in Kano.

Because they tend to improve alertness, job, and academic performance as well as health and social interactions, energy drinks are seen as advantageous (7). The benefits that participants in this study expected to experience from consuming energy drinks were staying awake, increasing energy and alertness, and enhancing physical performance. A sizable portion of respondents cited increased energy and alertness as their main motivation, which suggests that there is a need for these drinks in everyday life and that customers seek them out for their practical advantages. Another significant factor influencing the respondents' decisions in this study was peer pressure, as 34% of them admitted to being persuaded to drink energy drinks by their peers. According to a previous study (19), college students frequently drank energy drinks, especially if they didn't get enough sleep, needed extra energy generally, needed it for big course projects or exam preparation, or needed it while driving for extended periods of time. This result was also observed in this study, when a sizable percentage of the participants used energy drinks to increase their energy and alertness as well as to stay awake for their academic endeavors.

Conclusion

One of the study's limitations was that the respondents' nutrient intake was not evaluated to determine whether or not they were replacing their meals with energy drinks. This could have affected the respondents' anthropometric indices, particularly their weight gain, given that the majority of the respondents had normal body mass indices. Refreshment and flavor were found to be motivators for respondents' high-energy drink use in this study. Since a sizable portion of survey participants admitted to combining energy drinks with other drugs and alcohol, focus groups may be used in future research to better investigate the potential usage of energy drinks with other drugs and alcohol. Despite the high prevalence of energy drink consumption among students, the study found no statistically significant relationship between consumption frequency and BMI categories ($p = 0.051$). This suggests that while energy drink consumption is prevalent, it may not directly impact weight status in the short term. Given the potential long-term health implications of frequent consumption, further research is recommended to explore its broader effect on dietary habits and health.

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