

## A survey on the consumption of energy drinks and the evaluation of related adverse effects among young people in Nigeria

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### Abstract

This study investigates energy drink consumption and associated adverse effects among Nigerian youth. With the rising popularity of energy drinks, concerns about potential health risks have emerged. Limited population-based data exists regarding energy drink habits and their consequences in this demographic. A cross-sectional design surveyed 359 participants aged 10-29 in various Nigerian urban centers. Age groups were used to classify the participants, and assessments were made of their energy drink usage habits, knowledge about them, and side effects. Ethical principles were followed, ensuring anonymity and voluntary participation. The study found that 59.6% of participants consumed energy drinks, often during studying (43.5%) or daily use (35.0%). Most consumed fewer than 5 cans per month (74.3%), with 31.8% reporting adverse effects, such as increased heart rate and nervousness. Health conditions were observed among both consumers and non-consumers, but causality was not established. Adverse psychological and physical effects were reported, with a higher prevalence among consumers. This research highlights consumption patterns and the health effects of energy drinks among Nigerian youth. Further research is needed to confirm causality. Informed decision-making regarding energy drink consumption, particularly among young individuals, is crucial. These insights can inform policymaking and health campaigns, promoting responsible consumption and youth well-being.

**Keywords:** Energy drinks; Adverse effects; Young people; Caffeine; Nigeria

### 1. Introduction

Among young people in Nigeria, energy drinks are rising in popularity. Due to the abundance of energy-stimulating products on the market and the ease with which young people can obtain them, the risks associated with energy drink consumption are receiving a lot of media attention. If it is not consumed responsibly or according to instructions, energy drinks may cause side effects.

Young people's consumption of energy drinks has raised questions because of potential caffeine toxicity [1]. In addition, the sugar present in the drinks can be high, which can trigger the processes of non-communicable disease development mainly amongst predisposed individuals. As an example, nutritional transition and sedentary life fashion, energy drink consumption is suspected to be associated with an expanded probability of alcohol-related troubles amongst drinkers [2].

Young people often consume energy drinks to boost their energy levels, but these beverages pose potential risks to the nervous system. A typical serving of energy drinks, approximately 500 ml, contains a substantial amount of sugar (54 g), equivalent to over 13 teaspoons. The issue lies in the high concentrations of labeled and unlabeled caffeine, along with additional ingredients like guarana, ginseng, and taurine, which can lead to unpredictable interactions [3, 4]. The tolerance development to energy drinks over time is noted, requiring increased consumption to counter this tolerance.

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Globally, there is a growing demand for energy drinks among young individuals, with consumption patterns occasionally exceeding recommended caffeine thresholds. Prevalence is notable, with up to 70% of individuals in Ghana consuming one to three cans daily, raising public health concerns in various countries, including Canada and the United States. Consumption patterns vary by gender and age, favoring males and young adults in some regions [5, 6, 7, 8]

While some studies highlight the potential beneficial effects of energy drink consumption on behavior and performance, safety concerns arise due to adverse effects. Atropine reactions linked to high caffeine intake, such as agitation, anxiety, trouble sleeping, tremors, and even death in rare cases, are associated with energy drinks. Regular consumption poses particular dangers for individuals predisposed to cardiovascular diseases, leading to serious health issues like high blood pressure and rapid heartbeat. It's crucial to note that the harmful effects of energy drinks outweigh the positive ones [9, 10, 11].

There aren't enough population-based surveys available right now to determine how common energy drink side effects are, particularly among young people. There is little information available about consumers' consumption habits regarding energy drinks in Nigeria, as well as any possible negative effects. Previous studies imply that young people may readily get energy drinks, but there is little research on why they do so and if they are aware of the possible health risks [10]. The current study sought to evaluate the adverse effects of energy drink consumption among a population-based sample of young people in Nigeria by assessing the consumption pattern of the drink.

This study holds significance as it aims to provide valuable insights into the consumption patterns of energy drinks and their associated adverse effects among young people in Nigeria. The findings could contribute to informed policymaking, public health awareness campaigns, and targeted interventions to promote responsible consumption habits, mitigate potential health risks, and improve the overall well-being of the youth population.

### *Objectives*

- To examine the consumption patterns of energy drinks among young people in Nigeria.
- To assess the awareness levels of energy drinks and their potential side effects among the study participants.
- To explore the various contexts in which energy drinks are consumed by Nigerian youth.
- To investigate the frequency of energy drink consumption and identify any patterns of high consumption.
- To analyze the reported adverse effects associated with energy drink consumption among the surveyed population.
- To examine the potential associations between energy drink consumption and various health conditions, psychological effects, physical symptoms, and behavioral patterns among the study participants.

### **1.1. Research Questions**

- What are the prevailing consumption patterns of energy drinks among young individuals in Nigeria, and how do these patterns vary across demographic factors?
- What is the level of awareness among Nigerian youth regarding energy drinks and their potential side effects, and how does this awareness relate to consumption habits?
- In what contexts are energy drinks predominantly consumed by young people in Nigeria, and do these contexts vary by age or gender?
- What is the frequency of energy drink consumption among the surveyed population, and are there identifiable subgroups with particularly high consumption rates?
- What are the reported adverse effects experienced by individuals after consuming energy drinks, and are these effects more pronounced in certain demographic groups?
- Are there significant associations between energy drink consumption and health conditions, psychological effects, physical symptoms, and risky behaviors among Nigerian youth, and how do these associations manifest?

By investigating young people's attitudes toward energy drink consumption and identifying the dynamics that sustain this conduct, the study employs the Social Cognitive Theory's Reciprocal Determinism framework. This theory highlights the complex interplay between personal attributes, behavior, and environmental influences. This exploration sheds light on the cognitive dimensions that shape young individuals' inclination towards energy drinks, serving as a foundation for informed health education strategies.

This study utilized convenient sampling methodologies and centered on the demographic of individuals aged between 10 and 29 years, residing in diverse urban centers across Nigeria. Notably, the study refrained from scrutinizing explicit

energy drink brands or formulations. However, it is imperative to acknowledge that the generalizability of the outcomes to broader population segments could potentially be circumscribed by these delineated parameters.

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## 2. Materials and methods

This research utilized a cross-sectional design to gather data on the performed variables all at once and provide a snapshot of how chosen variables were represented in a convenience sample of Nigerian youth. The subjects were selected by the inclusion and exclusion standards established for this research project, and they were assessed for outcome and exposure simultaneously.

The inclusion criteria for being a participant in this study included being aged between 10-29 and residing in Nigeria. There was a target population of over 85 million young people aged 10-29 years living in the six geopolitical zones of Nigeria. The participants included a convenience sample of young people in various cities and communities of the country. Participants were not excluded based on educational level, tribe, employment status, and gender. Participants were classified into age groups 10 – 14 years, 15 – 19 years, 20 – 24 years, and 25 – 29 years.

The population in this research are habitants in Nigeria. According to the United Nations World Population Prospects [12], the number of people in Nigeria is estimated to be 218,541,212, and the percentage of young is estimated to be 39.2% (over 85 million) of this population. To determine the sample size, an online calculator was used with a 5% margin error and 95% confidence level to arrive at 367 young people. However, due to time constraints, the study was able to reach out to 359 participants.

Young people from various cities and towns in Nigeria especially those who were enrolled in senior secondary and higher educational institutions were used for the study. The likelihood that these students would consume energy drinks was taken into consideration when choosing young people for educational institutions. In light of the high levels of academic pressure, it is assumed that students in senior secondary and higher education are more likely to use energy drinks to stay awake while studying, to work on projects for extended periods, and to enhance their performance in exercise, training, and other activities. Given that the primary goal of the study is to determine the usage of energy drinks among young people, as well as the prevalence of adverse effects among energy drink users, students are expected to be better informants than any other part of this demographic.

Data was collected using survey questionnaires through Google online forms and printed forms completed by participants in a convenient sampling way. Respondents were requested by the researcher to answer to whether they were willing to participate.

The SPSS software Version 25.0 was used to enter, tabulate, and interpret all data.

First, acceptable standard deviations and mean values were estimated along with frequencies and percentages for descriptive questions. Study participants were divided into two categories based on their consumption of energy drinks: those who don't drink them and those who do.

According to the ethical principles of the 2013 Helsinki Declaration, that have been reviewed [13], the survey's data were collected through anonymous survey questions. These principles include respect for people as individuals, the right to make informed decisions, awareness of vulnerable groups, and more. Written consent was therefore an integral component of the questionnaire. The individual has the right to refuse participation or to leave the research at any moment without consequence.

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## 3. Result

From Table 1, respondents' ages ranged from 10 to 29 (with a total of 2 (0.6%) participants falling into the 10 to 14-year-old age range, 98 (27.3%) participants falling within the 15 to 19-year-old age range, 166 (46.2%) participants also falling inside the 20 to 24-year-old age range, and 93 (25.9%) participants of the study sample falling within the 25 to 29-year-old age range. Male respondents made up a total of 139 (38.7%) of the study sample respondents, while female respondents made up a total of 220 (61.3%) (See Figure 4.1).

For Employment status, a total of 46 (12.8%) of participants were Employed, a total of 71 (19.8%) participants were Job seekers, a total of 124 (34.5%) of participants indicated that they were Self-employed, while 118 (32.9%)

participants indicated they were students. For Marital Status, a total of 24 (6.7%) respondents indicated that they were married while 335 (93.3%) respondents of the study sample were single.

**Table 1** Social Demographics of Respondents

Demographic		Frequency	Percent (%)
<b>Age Group</b>			
	10 – 14	2	0.6
	15 – 19	98	27.3
	20 - 24	166	46.2
	25 - 29	93	25.9
<b>Sex</b>			
	Male	139	38.7%
	Female	220	61.3%
<b>Employment Status</b>			
	Employed	46	12.8
	Job seeker	71	19.8
	Self-employed	124	34.5
	Student	118	32.9
<b>Marital Status</b>			
	Married	24	6.7
	Single	335	93.3

**Table 2** Young People's Knowledge of energy drinks and their side effects

Questions		Frequency	Percentage (%)
Do you know what an Energy Drink is?	Maybe	1	0.3%
	No	6	1.7%
	Yes	352	98.1%
	Total	359	100.0%
Do you know that energy drinks have side effects?	Maybe	25	7.0%
	No	49	13.6%
	Yes	285	79.4%
	Total	359	100.0%

Additional descriptive information was collected based on respondents' understanding of energy drinks and their ingredients, about their social demographics. Table 2 shows that 352 (98.1%) respondents know what an energy drink is, 6 (1.7%) respondents gave a No answer to knowing what an energy drink is while 1 (0.3) respondent is unsure of knowing what an energy drink is. Table 2 also shows participants' responses to knowing if energy drinks have side effects: a total of 285 (79%) respondents indicated a Yes to knowing that energy drinks have side effects, a total of 49 (13.6%) respondents indicated a No while a total of 25 (7.0%) respondents are unsure whether energy drinks have side effects.

**Table 3** Classification of Respondents based on energy drink use

Do you consume energy drinks?	Frequency	Percent
No	145	40.4
Yes	214	59.6
Total	359	100.0

Questions regarding the respondents' consumption of energy drinks were posed to them (Table 3). A total of 214 (59.6%) respondents identified themselves as users and consumers of energy drinks. Additionally, 145 (40.4%) respondents were identified as not using energy drinks based on their responses. The survey findings reveal that a notable proportion of respondents, 59.6%, reported consuming energy drinks. This suggests that energy drink consumption is relatively common among the surveyed population.

**Table 4** Energy drink consumer's occasion for using energy drinks

On what occasion do you use energy drinks?	Frequency	percentage %
No need for special occasions	75	35.0%
Doing sports	41	19.2%
Studying/before exams	93	43.5%
At parties	35	16.4%
Not Applicable	29	13.6%
For sexual activities	1	0.5%
Having work requiring mental alertness	1	0.5%
when handling stressful work	1	0.5%
After rigorous work	1	0.5%
during menstruation	1	0.5%
For drinking sake	1	0.5%
Hang out	1	0.5%
hard work	1	0.5%
No specific time	1	0.5%
When I'm drained	1	0.5%
When the need for energy is crucial	1	0.5%
Whenever I have fatigue	1	0.5%

For occasions, when respondents use energy drinks, results of the multiple-choice questions are summarized in Table 4. Energy drink users of the study sample often use energy drinks for the following: studying and before exams (93, 43.5%), doing sports (41, 19.2%), at parties (35, 16.4%) and other occasions including sexual activities and menstruation among others (12, 6.0%). A total of 75 (35.0%) respondents also indicated that they don't need a special occasion to take energy drinks.

**Table 5** Energy drink usage

How many cans do you usually drink (per month)?	Frequency	Percentage %
10–20 cans	12	5.6%
5–10 cans	38	17.8%
Less than 5	159	74.3%
More than 20 cans	5	2.3%
Total	214	100.0%

Energy drink consumers were asked on how many cans they consume in a month. Table 5 shows that most of the respondents 159 (74.3%) have less than 5 cans per month. A total of 38 (17.8%) respondents use 5-10 cans per month, 12 (5.6%) respondents of the users consume 10- 20 cans per month and 5 (2.3%) consume more than 20 cans per month.

The majority of respondents (74.3%) reported consuming less than 5 energy drink cans per month, indicating infrequent or occasional consumption. A significant portion (17.8%) consumed between 5 and 10 cans per month, while a smaller group (5.6%) consumed 10–20 cans per month. A minority (2.3%) reported consuming more than 20 cans per month, suggesting relatively high and potentially excessive consumption.

**Table 6** Participants' answer to having side effects from energy drink consumption

Have you ever had any side effects after Energy Drink consumption?	Frequency	Percentage %
Yes	68	31.8%
No	126	58.9%
Maybe	20	9.3%
Total	214	100.0%

Energy drink users were asked on whether they ever experienced any side effects after consuming energy drinks. Table 6 shows that a total of 126 (58.9%) responded that they have never experienced any side effects after consuming energy drinks. 68 (31.8%) respondents said they experienced side effects after consuming energy drinks and 20 (9.3%) respondents were unsure whether they experienced adverse effects from taking energy drinks.

Approximately one-third of the respondents (31.8%) reported experiencing side effects after consuming energy drinks. A majority (58.9%) indicated that they had not experienced any side effects, while a smaller group (9.3%) responded with "Maybe," suggesting uncertainty or occasional side effects.

**Table 7** Participants' experiences with side effects commonly associated with energy drink consumption

Adverse effect	Statistics	Energy drink consumers					Energy drink non-consumers				
		Never	Rarely	Sometimes	Fairly often	Very often	Never	Rarely	Sometimes	Fairly often	Very often
Sleep disturbance	Frequency	113	14	60	11	16	91	7	34	7	6
	Percentage %	52.8%	6.5%	28.0%	5.1%	7.5%	62.8%	4.8%	23.4%	4.8%	4.1%
Severe thirst	Frequency	129	24	41	17	3	96	11	27	9	2
	Percentage %	60.3%	11.2%	19.2%	7.9%	1.4%	66.2%	7.6%	18.6%	6.2%	1.4%
Headache	Frequency	66	13	93	28	14	45	7	64	16	13
	Percentage %	30.8%	6.1%	43.5%	13.1%	6.5%	31.0%	4.8%	44.1%	11.0%	9.0%
Heart palpitation	Frequency	144	25	24	18	3	111	11	14	6	3
	Percentage %	67.3%	11.7%	11.2%	8.4%	1.4%	76.6%	7.6%	9.7%	4.1%	2.1%
Diabetes	Frequency	197	10	5	2	0	133	8	3	1	0
	Percentage %	92.1%	4.7%	2.3%	0.9%	0.0%	91.7%	5.5%	2.1%	0.7%	0.0%
Have hypertension	Frequency	192	12	8	2	0	132	7	3	1	2
	Percentage %	89.7%	5.6%	3.7%	0.9%	0.0%	91.0%	4.8%	2.1%	0.7%	1.4%
Heart disease	Frequency	196	8	6	2	2	128	11	5	1	0
	Percentage %	91.6%	3.7%	2.8%	0.9%	0.9%	88.3%	7.6%	3.4%	0.7%	0.0%
Constipation	Frequency	123	16	66	5	4	87	12	36	8	2
	Percentage %	57.5%	7.5%	30.8%	2.3%	1.9%	60.0%	8.3%	24.8%	5.5%	1.4%
Anxiety	Frequency	120	23	54	12	5	96	11	29	5	4

Adverse effect	Statistics	Energy drink consumers					Energy drink non-consumers				
		Never	Rarely	Sometimes	Fairly often	Very often	Never	Rarely	Sometimes	Fairly often	Very often
	Percentage %	56.1%	10.7%	25.2%	5.6%	2.3%	66.2%	7.6%	20.0%	3.4%	2.8%
Depression	Frequency	145	18	40	7	4	99	11	24	5	6
	Percentage %	67.8%	8.4%	18.7%	3.3%	1.9%	68.3%	7.6%	16.6%	3.4%	4.1%
Nervousness	Frequency	131	22	45	14	2	88	16	33	4	4
	Percentage %	61.2%	10.3%	21.0%	6.5%	0.9%	60.7%	11.0%	22.8%	2.8%	2.8%
Loss of concentration	Frequency	130	27	39	15	3	94	14	27	7	3
	Percentage %	60.7%	12.6%	18.2%	7.0%	1.4%	64.8%	9.7%	18.6%	4.8%	2.1%
Vomiting	Frequency	128	25	50	8	3	83	17	32	12	1
	Percentage %	59.8%	11.7%	23.4%	3.7%	1.4%	57.2%	11.7%	22.1%	8.3%	0.7%
Muscle pain	Frequency	128	29	41	15	1	83	17	34	7	4
	Percentage %	59.8%	13.6%	19.2%	7.0%	0.5%	57.2%	11.7%	23.4%	4.8%	2.8%
Diarrhea	Frequency	137	22	45	10	0	87	14	34	6	4
	Percentage %	64.0%	10.3%	21.0%	4.7%	0.0%	60.0%	9.7%	23.4%	4.1%	2.8%
High blood pressure	Frequency	177	16	15	5	1	125	11	6	1	2
	Percentage %	82.7%	7.5%	7.0%	2.3%	0.5%	86.2%	7.6%	4.1%	0.7%	1.4%
Suicidal attempts	Frequency	185	10	12	3	4	120	12	6	5	2
	Percentage %	86.4%	4.7%	5.6%	1.4%	1.9%	82.8%	8.3%	4.1%	3.4%	1.4%
Dental problems	Frequency	161	17	27	7	2	110	12	15	8	0



Adverse effect	Statistics	Energy drink consumers					Energy drink non-consumers				
		Never	Rarely	Sometimes	Fairly often	Very often	Never	Rarely	Sometimes	Fairly often	Very often
	Percentage %	75.2%	7.9%	12.6%	3.3%	0.9%	75.9%	8.3%	10.3%	5.5%	0.0%
Hyperactive and risky behavior	Frequency	174	12	17	7	4	120	13	5	5	2
	Percentage %	81.3%	5.6%	7.9%	3.3%	1.9%	82.8%	9.0%	3.4%	3.4%	1.4%
Tooth decay	Frequency	179	15	15	2	3	123	7	8	5	2
	Percentage %	83.6%	7.0%	7.0%	0.9%	1.4%	84.8%	4.8%	5.5%	3.4%	1.4%
Constipation	Frequency	126	22	54	8	4	89	15	27	11	3
	Percentage %	58.9%	10.3%	25.2%	3.7%	1.9%	61.4%	10.3%	18.6%	7.6%	2.1%
Frequent urination	Frequency	120	18	50	19	7	94	12	27	10	2
	Percentage %	56.1%	8.4%	23.4%	8.9%	3.3%	64.8%	8.3%	18.6%	6.9%	1.4%
Itching and rash	Frequency	133	24	46	8	3	91	12	29	9	4
	Percentage %	62.1%	11.2%	21.5%	3.7%	1.4%	62.8%	8.3%	20.0%	6.2%	2.8%
Trouble breathing	Frequency	158	25	23	4	4	103	15	21	5	1
	Percentage %	73.8%	11.7%	10.7%	1.9%	1.9%	71.0%	10.3%	14.5%	3.4%	0.7%

The questionnaire utilized in this study included inquiries about respondents' experiences with the negative effects associated with the consumption of energy drinks. Frequencies were calculated to compare the occurrence of these side effects between individuals who had ever consumed energy drinks and those who had not (see Table 7). These calculations were based on a Likert-type scale with five possible outcomes: Never, rarely, sometimes, fairly often, and very often.

Table 7 summarizes participants' experiences with side effects commonly associated with energy drink consumption. The majority of respondents in both categories, i.e., energy drink consumers and non-consumers, reported never experiencing these side effects. However, among those who reported experiencing these side effects, the majority were individuals who consumed energy drinks. Notable side effects frequently reported by energy drink consumers included sleep disturbance, headache, heart palpitations, constipation, anxiety, depression, loss of concentration, dental problems, suicidal attempts, hyperactivity and risky behavior, and frequent urination.

When examining the data further, we find that various adverse effects were reported by energy drink consumers. Sleep disturbance and severe thirst were relatively common, while headache and heart palpitations were reported to a somewhat lesser extent. Among non-consumers of energy drinks, these adverse effects appeared to be less prevalent compared to consumers. Sleep disturbance and severe thirst remained relatively common but occurred less frequently among non-consumers. Headache and heart palpitations were reported by non-consumers but were less common compared to consumers.

Additionally, the study revealed that the majority of energy drink consumers did not report having diabetes, hypertension, heart disease, or constipation. However, there were some reports of these health conditions among energy drink consumers, particularly in the "sometimes" and "fairly often" categories. Among non-consumers of energy drinks, the majority did not report having these health conditions either. Nevertheless, there were reports of these health conditions among non-consumers, particularly in the "sometimes" and "fairly often" categories.

Furthermore, a significant proportion of energy drink consumers reported experiencing adverse psychological effects, with anxiety, depression, and nervousness being reported to varying degrees. Loss of concentration was also reported but to a somewhat lesser extent. Among non-consumers of energy drinks, the majority did not report experiencing adverse psychological effects, including anxiety, depression, nervousness, and loss of concentration. However, some non-consumers also reported these effects, though less frequently than consumers.

Regarding adverse physical effects, the majority of energy drink consumers did not report experiencing vomiting, muscle pain, diarrhea, or high blood pressure. However, there were reports of these physical effects among energy drink consumers, particularly in the "sometimes" category, though they were less frequent in the "fairly often" and "very often" categories. Among non-consumers of energy drinks, the majority did not report experiencing adverse physical effects either. Nevertheless, there were some reports of these physical effects among non-consumers, particularly in the "sometimes" category, though they were less frequent in the "fairly often" and "very often" categories.

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#### 4. Discussion

Energy drinks have garnered significant attention among young people in recent years, sparking curiosity about their consumption patterns and potential health implications. This study delves into the consumption patterns of energy drinks among 359 participants recruited from Nigeria's six geopolitical zones. This investigation uncovers the contexts of consumption, the frequency of usage, and the correlated health effects, shedding light on the multifaceted nature of energy drink consumption in the younger demographic.

Demographically, the majority of respondents were female (61.3%), with the largest age group represented by individuals aged 15 – 19 (46.2%). Notably, a substantial portion (62.1%) of the participants were undergraduates from diverse Nigerian higher education institutions, reflecting the diverse educational backgrounds in the sample. Furthermore, Christianity stood out as the predominant religion (90.5%), and a significant proportion of participants were unmarried (93.3%).

Findings from this study reveal that energy drink consumption is prevalent among the surveyed population, with 59.6% of participants reporting consumption. This prevalence aligns with previous research on young adult energy drink consumption [14, 15], underscoring the influence of factors such as taste preferences, perceived benefits, and marketing in shaping consumption patterns. However, it is noteworthy that a substantial segment (40.4%) of respondents chose to abstain from energy drinks altogether, highlighting the diversity in preferences and motivations surrounding these beverages.

Exploring the participants' awareness of energy drinks and their associated side effects, a significant majority (98.1%) indicated their familiarity with energy drinks, a level of awareness consistent with prior studies [16]. Moreover, 79.4% of the participants were aware of the potential side effects, mirroring findings from Hardy et al. [17].

The study also delves into the various contexts in which energy drinks are consumed. Approximately 43.5% of young individuals reported using these beverages during study sessions or before exams, aligning with the notion that energy drink consumption is linked to academic activities [18]. Additionally, a significant portion (35.0%) consumed energy drinks without a specific occasion, indicative of daily use for the perceived benefits of alertness and energy, as observed by Heckman et al. [19]. Approximately 19.2% of this survey participants reported using energy drinks during sports activities, consistent with the use of these beverages as ergogenic aids by athletes, as highlighted in Souza et al.'s (2017) study [20].

This research further uncovered that 16.4% of young individuals consume energy drinks at social gatherings and parties, a phenomenon consistent with previous studies that suggest the mixing of energy drinks with alcohol in social settings [21]. This finding raises concerns about potential health risks and increased alcohol consumption in these situations. Additionally, 13.6% of respondents mentioned that energy drinks were not relevant to them, reflecting a growing awareness of health concerns associated with energy drink consumption, as underscored in studies such as those by Malinauskas et al. [22].

Regarding the frequency of energy drink consumption among participants, a majority (74.3%) consume fewer than 5 cans per month, suggesting that, for many, energy drinks are not a regular part of their beverage choices. This trend aligns with the idea that these individuals use these beverages sparingly, often for specific occasions or when they need a quick energy boost [16].

However, it is pertinent to highlight that a significant portion (17.8%) reported consuming between 5 and 10 cans per month. This level of consumption could signify more regular use or a preference for energy drinks as a source of caffeine or stimulation. The smaller segments, comprising 5.6% consuming 10–20 cans per month and 2.3% consuming more than 20 cans per month, are of particular concern. Such high levels of consumption may be linked to heightened health risks and therefore warrant further investigation, as these patterns could potentially lead to adverse health effects [14].

In terms of adverse effects, approximately 31.8% of respondents reported experiencing side effects after consuming energy drinks, encompassing symptoms such as increased heart rate, nervousness, or gastrointestinal discomfort. This observation aligns with previous research that has highlighted potential health risks associated with energy drink consumption, particularly when consumed excessively or by individuals sensitive to caffeine [14].

Notably, 58.9% reported not experiencing any side effects, suggesting that many individuals either consume energy drinks in moderation or possess a lower sensitivity to the potential adverse effects associated with these beverages. The "Maybe" category (9.3%) signifies some uncertainty or occasional side effects among respondents, possibly indicating a group that could benefit from additional education and awareness regarding the potential risks and warning signs of adverse reactions linked to energy drink consumption.

Results of this finding also indicated varying degrees of health conditions, such as diabetes, hypertension, heart disease, and constipation, among both energy drink consumers and non-consumers. It is crucial to emphasize that these associations do not establish a direct causal relationship between energy drink consumption and these health conditions but rather highlight their co-occurrence within the surveyed population. Past research has explored the potential health implications of energy drink consumption, with studies investigating the impact of energy drinks on parameters like blood pressure and cardiovascular health [23, 24, 25].

Furthermore, adverse psychological effects, including anxiety, depression, nervousness, and loss of concentration, were reported by both energy drink consumers and non-consumers. However, these effects appeared to be more prevalent among energy drink consumers. Prior research has indicated associations between energy drink consumption and an increased risk of these psychological effects [26, 27]. Moreover, research has examined the impact of caffeine and other ingredients in energy drinks on cognitive functions and concentration, suggesting that excessive consumption may lead to decreased concentration and increased nervousness [28].

Both energy drink consumers and non-consumers reported various adverse physical effects, including gastrointestinal symptoms and changes in blood pressure. Nevertheless, it is essential to clarify that these findings do not establish a direct causal relationship between energy drink consumption and these physical effects but rather highlight their co-

occurrence within the surveyed population. Previous research has investigated potential gastrointestinal symptoms such as constipation and respiratory symptoms related to energy drink consumption [24, 28].

Lastly, this study revealed varying degrees of health and behavioral effects, including risky behaviors and dental health concerns, reported by both energy drink consumers and non-consumers. Again, it is vital to emphasize that these associations do not confirm a direct causal link between energy drink consumption and these effects but rather underscore their co-occurrence within the surveyed population. Previous research has explored the association between energy drink use and risky behaviors, including suicidal thoughts and hyperactivity [29, 19]. Moreover, some studies have investigated the impact of sugar and acidic ingredients in energy drinks on dental health, suggesting a potential connection between consumption and dental problems [30].

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## 5. Conclusion

In conclusion, this study provides comprehensive insights into energy drink consumption patterns among participants, highlighting the contexts of consumption, frequency, and associated health effects. While the current findings indicate various associations between energy drink consumption and health outcomes, it is essential to acknowledge that these relationships are complex, and further research is required to establish causality. The patterns identified underscore the importance of informed decision-making regarding energy drink consumption, particularly among young individuals who may be more susceptible to the potential risks associated with these beverages.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

The Authors declare no conflict of interest.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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