

# Prevalence and Reasons for Consumption of Energy Drinks among Adolescents and Young Adults in Jeddah, Saudi Arabia

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## Abstract

**Objective:** The aim of this study was to investigate how frequently male and female school and university students consumed energy drinks, their reasons for drinking them, and the extent of their knowledge about the beverages.

**Methods:** A self-administrated questionnaire was used to collect data from 4355 students (ages 12-26 years).

**Results:** Nearly 60% of the students consumed at least one can of an energy drink per week, and 63.3% drank two to four cans per week. Code Red was the most popular brand consumed (52.8%). Thirty-nine percent of the students consumed energy drinks in the afternoon, and 68.7% drank them because they enjoyed the flavor.

**Conclusion:** More than half of the participants consumed energy drinks at least once per week. Students' knowledge and practices regarding energy drinks need improvement so they will understand the drinks' contents and their impacts on health. Food labels should mention the total amount of caffeine and provide clear information to consumers about appropriate limits and the risks of excessive consumption.

**Keywords:** energy drinks, consumption, students, motivation for use, knowledge, practices

## 1. Introduction

Energy drink consumption has increased worldwide since 1997 (Kenndy & Scholey, 2004; Boyle & Castillo, 2006). Energy drinks are marketed in more than 140 countries around the world, and they represent the largest growing beverage market in the United States, topping \$9 billion in 2011 and expected to reach \$14.98 billion in 2019 (Nitzke et al., 2011; Malinauskas et al., 2007; National Association of Convenience Stores, 2010; Fleenor, 2016). Advertising is broadly designed to attract new consumers, and it mainly focuses on children, adolescents, and young adults (Babu et al., 2008).

Energy drink manufacturers heavily rely on advertising to promote their products across all media channels to increase their sales (Smit et al., 2006). Many companies employ mobile workers to distribute free product samples at sports events, especially those for extreme sports like race car driving, waterfall kayaking, and parasailing, which they may also sponsor (O'Brien et al., 2008). Advertising for energy drinks typically emphasizes a physically active lifestyle (Yeomans et al., 2002; Kapner, 2008).

Energy drinks contain 24 to 33g of sugar (glucose) per unit; although some types are sugar free (Malinauskas et al., 2007). The drinks also deliver up to 300mg of caffeine from added and natural sources such as guarana (*Paullinia cupana*), which contains caffeine, theobromine, and theophylline. One gram of guarana contains 40-80mg of caffeine, and it is described as having a longer half-life in the body due to its interactions with other plant ingredients. The amount of caffeine added from guarana may exceed the total dose listed in the contents of the energy drink (Pronsky, 2004; Gunja & Brown, 2012). Consequently, the total amount of caffeine can be higher than the beverage label indicates (Ward et al., 2014).

Caffeine plays an important role in increasing alertness, improving memory, and enhancing a person's mood (Malinauskas et al., 2007). However, caffeine also has many side effects on human health, including increasing the heart rate and the levels of dopamine and epinephrine, predisposing consumers to hypertension, promoting insomnia and dehydration, increasing urination, and causing gastrointestinal upset (Gunja & Brown, 2012; Ward

et al., 2014; Warburton et al., 2001). Caffeine intoxication can occur when more than 300mg is consumed; the equivalent of two to three cans of energy drink (Ward et al., 2014). Avic et al. (2013) reported a 28-year-old man admitted to the emergency department with ventricular tachycardia after he drank three 250ml cans of energy drink before playing basketball for 5 hours. He died 3 days later after a sudden cardiac arrest.

Energy drinks contain herbal extracts other than guarana, such as ginseng and ginkgo biloba. They also contain B vitamins; amino acids such as taurine; amino acid derivatives such as carnitine; and sugar derivatives like glucuronolactone and ribose (Boyle & Castillo, 2006). The ingredients of energy drinks may interact, with potential interactions occurring between taurine and other amino acids and between caffeine and some herbal extracts (Ballistreri & Corradi-Webster, 2008).

Evidence that consumption of energy drinks can significantly improve physical and mental performance is limited (Kennedy & Scholey, 2004). For example, the drinks do not appear to enhance driving abilities when a person is tired (Reyner & Horne, 2002) or to decrease mental fatigue during long periods of concentration (Kennedy & Scholey, 2004). Most of the literature on energy drinks consumption by children and adolescents reports adverse effects on health, including seizures, diabetes, cardiac abnormalities, and mood and behavioral disorders (Seifert et al., 2011; Gallimberti et al., 2013). There is an increasing incidence of caffeine toxicity from energy drink consumption, particularly from adolescents (Gunja & Brown, 2012).

In Saudi Arabia, research on the consumption of energy drinks by students at different education levels is limited. A survey of 843 students between the ages of 13 and 18 years showed that 80% of adolescents drink energy drinks at least once per week, with males consuming more than females (90%, 68%) (Musaiger & Zagzoog, 2005). Another study by Musaiger and Zagzoog (2014) found that 55% of Saudi adolescents consumed energy drinks one or more times each week. In a study conducted in the three main cities of Saudi Arabia (Riyadh, Jeddah, and Al Khobar), Al-Hazzaa et al. (2011) showed that 16.3% of male adolescents between 14 and 19 years drank energy drinks more than three times a week. However, none of these studies examined a large and representative sample of youth and young adults. Therefore, the aim of this study was to report on the prevalence of energy drink consumption and the reasons for this consumption among 12- to 26-year-old living in Jeddah city, in western Saudi Arabia.

This study included male and female intermediate, high school, and university students in Jeddah city who consumed energy drinks. It evaluated their reasons for drinking the beverages and assessed their knowledge about energy drinks.

## **2. Methods**

### *2.1 Study Sample*

The participants enrolled in this study were male and female students between 12 and 26 years of age at intermediate and high schools and universities in Jeddah, which is located in western Saudi Arabia. A multistage, stratified, cluster random sampling technique was used to recruit the study sample. The minimum sample size was determined within  $\pm 0.05$  of the total population with a 95% confidence level. The sample size was then increased by 10%-15% to account for missing data.

The sample collection consisted of two stages, schools intermediate ( $\leq 12-14$  years of age) and high schools (15-18 years old) and universities ( $\geq 18-26$  years old). In the first stage, a systematic, random sampling procedure was used to select 16 schools (either private or public) from an official list of all Jeddah city sectors. Based on the size of the student population in each school, two or three classes from each level were collected, for a total of six or nine classes for each of the three grades in the intermediate and high schools. The total sample sizes were 717 males and 731 females in intermediate school and 731 males and 733 females in high school.

The first-stage selection procedure was adapted to suit university students for the second stage. Four universities were selected (two private and two public) for males and females. Random classes from each college and level from 1 to 4 were selected. Twenty students from each group were included in the study. A total of 728 and 715 surveys were collected from male and female university students, respectively. The data were gathered from 1 March 2014 to 31 December 2014. Approval for the study was obtained from the Ethical Committee of King Abdul Aziz University.

### *2.2 Study Tools*

A self-administrated questionnaire was used to collect the data. A pilot sample of 60 students (30 males and 30 females) from all educational levels was used to develop and revise the questionnaire. The questionnaire was composed of three main sections. The first section focused on demographic information, including sex, age, education level, type of education, and nationality. The second section included multiple choice questions about

the frequency of energy drink consumption and the reasons that students consumed or did not consume energy drinks. Other items in the questionnaire were the time of day that energy drinks were consumed and the brands that were chosen most often. The third section included several questions about the students' general knowledge and attitude about energy drinks.

### 2.3 Data Analysis

Data were analyzed using SPSS program version 22 (SPSS, Inc, Chicago, IL, USA). Descriptive statistics are presented as means  $\pm$  standard deviations (SD) or proportions. An alpha value less than 0.05 were considered statistically significant. T-test and one-way ANOVA were applied to determine differences between the groups. A chi-squared test was used to define the significance of the association between study factors.

### 3. Results

A total of 4355 students were enrolled in this study, with equal percentages of males and females. Students were fairly equally distributed between three levels of education (intermediate, high school, and university), as shown in Table 1. Most students were Saudis (87.6%), and the rest (12.4%) were non-Saudis of different nationalities.

Table 1. Demographic characteristic of study participants

Variable	Groups	N (%)
Sex	Male	2176 (50)
	Female	2179 (50)
Age	12-14	954 (21.9)
	15-17	1688 (38.8)
	18-20	958 (22.0)
	21-23	561 (12.9)
	24-26	194 (4.5)
	Intermediate	1448 (33.2)
Education level	High	1464 (33.6)
	University	1443 (33.1)
	Public	3470 (79.7)
Type of education	Private	885 (20.3)
	Saudi	3815 (87.6)
Nationality	Non-Saudi	540 (12.4)
	First year (general)	356 (8.2)
University students' majors	Science	92 (2.1)
	Health science	377 (8.7)
	Humanities	231 (5.3)
	Engineering	176 (4.0)
	Administration	198 (4.5)

The prevalence of students who reported consuming energy drinks at least once per week was 59.9% and 40.1% of students never consumed energy drinks. Students who did not drink energy drinks attributed their decision to unhealthy effects on the body (69.1%), unappealing flavor (15.3%), or never having the opportunity to try it (21.2%).

A high proportion (63.3%) of respondents reported that they drank two to four cans of energy drinks per week, and 34.4% drank one can per week. Nearly half (52.8%) of the students who consumed energy drinks indicated that they usually drank Code Red. The other brands of energy drinks that students consumed included Red Bull (34.2%), Bison (25.1%), and Power Horse (14.3%).

With regard to the time of day that students used energy drinks, most students (90.9%) drank them during the day, and nearly equal percentages drank them in the evening and early morning (10.8% and 9.4%, respectively). When the participants were asked for their reasons for drinking energy drinks, 83.9% responded that they needed energy, and 68.7% cited the drinks' appealing flavor.

Table 2. Consumption of energy drinks among participants

Variable	N (%)
<b>Consumption of energy drinks</b>	
Yes	2607 (59.9)
No	1748 (40.1)
<b>Reasons for not drinking energy drinks (more than one choice)</b>	
Health effects	1208 (69.1)
Never tried it before	370 (21.2)
Unappealing flavor	267 (15.3)
Other healthy choices were available	220 (12.3)
Parental restrictions	106 (6.0)
<b>Approximate number of cans consumed per week</b>	
1	897 (34.4)
2-4	1651 (63.3)
5-7	31 (1.2)
≥8	28 (1.1)
<b>Type of energy drinks consumed (more than one choice)</b>	
Red Bull	891 (34.2)
Power Horse	373 (14.3)
Bison	655 (25.1)
Code Red	1377 (52.8)
Bom Bom	65 (2.5)
Bugzi	101 (3.9)
Monster	69 (2.6)
Rockstar	12 (0.5)
Burn	24 (0.9)
<b>Consumption time (only drinkers-more than one choice)</b>	
Early morning	244 (9.4)
During the day	2369 (90.9)
Evening	281 (10.8)
<b>Reason for drinking energy drink (only drinkers-more than one choice)</b>	
Enjoyable flavor	1791 (68.7)
Need energy (in general)	2187 (83.9)
Reduce fatigue	414 (15.9)
Keep me awake	737 (28.3)
Let me drive for a long period of time	169 (6.5)
Friends and commercial influence	225 (8.6)
For studying or doing a major project	103 (4.0)
<b>Did you suffer any adverse effects from energy drink consumption?</b>	
Yes	599 (23.0)
No	2008 (77.0)
<b>Are you doing any exercise?</b>	
Yes	1718 (65.9)
No	889 (34.1)
<b>Do you drink energy drinks while doing exercise?</b>	
Yes	583 (22.4)
No	2024 (77.6)
<b>Is it sold at your health club?</b>	

Yes	912 (35.0)
No	1695 (65.0)
<b>Do you mix energy drinks with other products?</b>	
Yes	576 (22.0)
No	2031 (78.0)
<b>What do you think of its price?</b>	
Underpriced	121 (4.7)
Fair	1833 (70.3)
Overpriced	653 (25.0)
<b>Is it sold in your studying location?</b>	
Yes	380 (14.6)
No	2227 (85.4)

Table 2 shows that 22.0% of the students mixed energy drinks with other products like pain-killers, such as paracetamol (acetaminophen) products that contain caffeine, or other drinks and flavors used in making nonalcoholic cocktails. Over 70.3% of the students thought that the price of the energy drinks they used was fair, while 25.0% thought they were too expensive. Moreover, 77.6% of the students did not drink energy drinks when they exercised. Students acquired energy drinks mostly at outlets shop, with fewer buying them at health clubs or schools (35.0% or 14.6%, respectively).

Table 3. Students' knowledge and practices regarding energy drinks

Knowledge and practices	Male (n=2176) N (%)	Female (n=2179) N (%)	P-value
<b>Do you read the food label of energy drinks?</b>			
Yes	311 (14.3)	762 (35.0)	0.05
No	1865 (85.7)	1417 (65.0)	
<b>Do you think that energy drinks contain caffeine?</b>			
Do not know	163 (7.5)	384 (17.6)	0.05
Yes	757 (34.8)	682 (31.3)	
No	1256 (57.7)	1113 (51.1)	
<b>Do you think that energy drinks contain sugar?</b>			
Do not know	127 (5.8)	97 (4.5)	0.23
Yes	1992 (91.5)	1876 (86.0)	
No	57 (2.6)	206 (9.5)	
<b>Do you think that energy drinks contain herbs?</b>			
Do not know	354 (16.2)	289 (13.3)	0.36
Yes	287 (13.2)	342 (15.7)	
No	1535 (70.6)	1548 (71.0)	
<b>Do you consider energy drinks to be the same as sport drinks?</b>			
Do not know	127 (5.8)	635 (29.2)	0.05
Yes	1539 (70.7)	821 (37.7)	
No	510 (23.5)	723 (33.1)	
<b>Do you consider energy drinks to be the same as soft drinks?</b>			
Do not know	115 (5.3)	259 (13.4)	0.42
Yes	642 (29.5)	398 (18.3)	
No	1419 (65.2)	1522 (69.8)	

<b>Are energy drinks proper for children?</b>			
<b>Do not know</b>	<b>214 (9.8)</b>	<b>252 (11.6)</b>	
<b>Yes</b>	<b>842 (38.7)</b>	<b>743 (34.1)</b>	
<b>No</b>	<b>1120 (51.4)</b>	<b>1184 (54.3)</b>	<b>0.32</b>
<b>Are energy drinks safe during pregnancy or lactation?</b>			
<b>Do not know</b>	<b>364 (16.7)</b>	<b>176 (8.1)</b>	
<b>Yes</b>	<b>158 (7.3)</b>	<b>17 (0.8)</b>	
<b>No</b>	<b>1654 (76.1)</b>	<b>1986 (91.1)</b>	<b>0.05</b>
<b>Do energy drinks have any side effects on health?</b>			
<b>Do not know</b>	<b>159 (7.3)</b>	<b>39 (1.8)</b>	
<b>Yes</b>	<b>919 (42.2)</b>	<b>1896 (87.0)</b>	
<b>No</b>	<b>1098 (50.5)</b>	<b>244 (11.2)</b>	<b>0.05</b>

Table 3 presents comparisons between male and female students regarding knowledge and attitudes about energy drinks. Most students (85.7% of males, 65.0% of females) did not read the food label of energy drinks ( $P<0.05$ ). More than half of the students (57.7% of males, 51.1% of females) did not know that energy drinks contain caffeine ( $P<0.05$ ), and 70% of both male and female students did not know that energy drinks contain herbs. However, a large majority (91.5% males, 86.0% females) were aware that the drinks contain sugar.

Most of the male students (70.7%), but significantly fewer female students (37.7%) considered energy drinks to be sport drinks ( $P<0.05$ ); while 65.2% of male students and 69.8% of female students knew that energy drinks differ from soft drinks.

Around half of the students (51.4% of males, 54.3% of females) viewed energy drinks as inappropriate for children, and most students (76.1% of males, 91.1% of females) viewed energy drinks are not being appropriate for women during pregnancy and lactation ( $P<0.05$ ). The majority of female students (87%) but less than half of the male students (42.2%) knew that energy drinks may cause health side effects.

Table 4. Comparison between male and female respondents regarding intake of energy drinks

Characteristics	Energy drink consumption		P-value
	Yes	No	
<b>Sex</b>			
<b>Male</b>	1533(35.2)	643 (14.8)	0.05
<b>Female</b>	1044 (24.0)	1135 (26.0)	
<b>Education level</b>			
<b>Intermediate school</b>			
Male	523 (36.1)	194 (13.4)	
Female	391 (27.0)	340 (23.5)	
<b>High school</b>			
Male	499 (34.1)	232 (15.8)	0.05
Female	397 (27.1)	336 (23.0)	
<b>University</b>			
Male	505 (35.0)	223 (15.5)	
Female	292 (20.2)	423 (29.3)	

Results presented in Table 4 show that the daily consumption of energy drinks was higher for male students than for female students (35.2% and 24.0%, respectively;  $P<0.05$ ). Moreover, males were more likely to consume energy drinks than females at all educational levels ( $P<0.05$ ).

A positive relationship existed between consuming energy drinks and participants' age ( $P<0.05$ ), with consumption being higher as the students' age increased. The same relationship occurred with education level and the grade level of the students, with consumption being higher as education level and class increased.

Moreover, there was a significant relationship between energy drink consumption and participants' sex ( $P < 0.05$ ), with male students being more likely to drink energy drinks than female students. There was a relationship between students' university majors and their energy drink consumption ( $P < 0.05$ ), with consumption amounts being lower among those studying science or medical science.

#### 4. Discussion

The current study reports the prevalence of energy drink consumption among adolescents and youth in Saudi Arabia. The results show that energy drink consumption is popular among students in Jeddah city and has become a regular daily choice for many. Most of the participants (59.9%) reported consuming at least one can of an energy drink per week. Energy drink consumption is predicted to develop very rapidly in Saudi Arabia because more than two-thirds of the Saudi Arabia population is under 29 years old (Murphy, 2011). Business Monitor International (Business Monitor International, 2012) predicted that the market for energy drinks in Saudi Arabia would double between 2012 and 2016. The prevalence reported in the present study is similar to Malinauskas et al. (2007) who reported that 51% of American university students consume one can of an energy drink per week. In other studies, 64.9% of Argentinean youth (Ballistreri & Corradi-Webster, 2008) and 62.2% of Ghana university students (Buxton & John, 2012) consumed energy drinks, while 30% of American secondary students drank them (Terry-McElrath et al., 2014).

The consumption of energy drinks was higher among male students compared with female students. Moreover, our results indicated that males were more likely than females to consume energy drinks at all educational levels. Similar findings have been reported for young Americans (Miller, 2008).

Saudi Arabia has many local manufacturers of energy drinks, such as Bugzi, Bom Bom, and Code Red. Code Red was the most popular choice for participating students (52.8%). Red Bull, Bison, and Power Horse are imported items and were favored by 34.2%, 25.1%, and 14.3% of the sample, respectively. Seventy percent of the students thought that the price of the energy drinks was fair. The students tended to drink local brands, which are less expensive and can be afforded with the students' pocket money.

One of the goals of the present study was to evaluate the student's reasons for energy drink consumption. Most of the students (83.9%) consumed energy drinks for energy, and 68.7% because of the drinks' appealing flavor. Because most of the students used the drinks for energy, they drank them at any time during the day. The reasons included a need for energy or to offset insufficient sleep. Among American university students, insufficient sleep, driving long distances, studying, and undertaking major projects were the most important reasons for consuming energy drinks (Malinauskas et al., 2007). Such reasons were also reported in the current study to varying degrees.

The present study showed that male and female students lack knowledge about the active ingredients in energy drinks. Most (88.7%) knew that energy drinks contain sugar, but about 50% and 70% reported that they did not know that energy drinks contained caffeine and herbs, respectively. This lack of awareness might be because most of the students (75%) did not read the food label on cans of energy drinks. These data are in agreement with Musaiger and Zagzoog's (2014) findings that (49%) of Saudi adolescents did not know that energy drinks contain caffeine, and with findings of Jacob et al. (2013) that (95%) of UAE university students had no information on caffeine content of energy drinks. Caffeine in energy drinks and many other foods and beverages is a legal psychoactive drug available over the counter for children and adolescents worldwide (O'Connor, 2001; Holmgren et al., 2004). Caffeine might affect the daily food and beverage intake of children and adolescents as well as their preferences by acting on their brain reward and addiction center, which might differ between males and females (Oddy & O'Sullivan, 2009). Although the US Food and Drug Administration limits the caffeine content in soft drinks, which are categorized as food and drinks, no such regulation exists for energy drinks, which are classified as functional foods (Lee, 2011; US Food and Drug Administration, 2011).

Most teens do not realize the amount of caffeine they consume daily and how easy it is to become dependent on it. Many adults who are used to drinking coffee on a daily basis and abruptly stop consumption experience withdrawal symptoms such as headaches, trouble in concentrating, and mood swings. Some individuals are more sensitive to stimulants than others, and some teens may get a bad case of the jitters from very little caffeine. Other negative side effects include anxiety, panic attacks, increased blood pressure, bowel irritability, and increased gastric acid. Those who consume energy drinks too late at night may experience insomnia (Daryl, 2008).

In general, female students were significantly more knowledgeable than male students about the side effects of energy drinks on health and whether consumption is appropriate for children or during pregnancy and lactation. Findings in this study showed that the consumption of energy drinks was higher among male students than

among female students' at all three educational levels. In the present study, 23.0% participants reported that they experience adverse effects from consuming energy drinks, including nausea, restlessness, increased gastric acid, headache, dehydration, tooth cavity or enamel erosion, and kidney and heart pain.

With regard to students considering energy drinks to be same as sports drink, a highly significant difference existed between male and female students ( $P < 0.05$ ), with the majority of male students considering energy drinks to be a sports drink. The underlying reason for this difference might be because male students in Saudi Arabia more freely engage in sports in school and sports club than female students, and they might drink energy drinks during sports events.

Of the 65.9% of students doing regular exercise, 22.4% of them consumed energy drinks before or after engaging in exercise. This is because many fitness clubs sell energy drinks in their canteens. Energy drinks are not sports drinks, however, and their high level of carbohydrates slow the rate of fluid absorption, which may predispose individuals to dehydration during exercise (Nitzke et al., 2011).

In Saudi Arabia alcoholic beverages are banned, but mixtures of energy drinks are legal. It is currently a fashion among young people to drink cocktails that are prepared as refreshments or energy drinks. Some students (22.0%) in the current study reported that they mixed energy drinks with other products that contain extra caffeine to augment the drinks' effect.

## 5. Conclusion

In the present study, more than half of the participants consumed energy drinks at least once per week. Those who consume energy drinks were particularly motivated by their appealing flavor and the energy that the drinks provided. The most common reasons for consuming energy drinks were insufficient sleep or the need for concentration. Students' knowledge and practices regarding energy drinks need improvement so that they will understand the drinks' contents and their impacts on health. Further research should identify whether students recognize the total amounts of caffeine they consume during the day from all products aside from energy drinks. Food labels should mention the total amount of caffeine and provide clear information to consumers about appropriate limits and the risks of excessive consumption.

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## Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

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