

Perceptions and Usage of Energy Drinks Effects Among Medical and non-medical University Students in Lahore, Pakistan

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Abstract

Energy drinks often contain excessive caffeine, which can lead to increased heart rate, high blood pressure, anxiety, sleep disturbances, and dependence with frequent consumption and risk of heart problems. High sugar content in many energy drinks increases the risk of obesity, tooth decay, and type 2 diabetes. Therefore, the study aimed to evaluate perceptions of energy drinks, consumption habits, and the negative health impacts of these drinks among both medical and non-medical students at the Universities in Lahore, Pakistan, and to determine whether the field of study is an influential factor in reasons for use and symptoms. The main variables were the prevalence of energy drink consumption, the brand used, the mode of introduction, frequency of use, reasons for use, adverse effects, and gender differences between medical and non-medical students. A self-administered questionnaire was used in a cross-sectional survey of 1,549 students at universities in Lahore, Pakistan, with chi-square analyses used to assess associations between variables. Among 1,549 participants, 48.8% reported ever taking energy drinks, with Red Bull as the most commonly consumed brand (39.2%). The most frequent mode of introduction was friends and family (41.5%), with staying awake being the most frequent reason to use (29.4%). There was higher consumption among non-medical students than among medical students. Non-medical students reported more consumption of energy drinks than medical students. The most common reason for consumption overall was to stay awake (29.4%), with medical students more likely to use energy drinks for physical activities (27.4%) and academic performance (17.2%) than non-medical students, who were more likely to report staying awake (35.4%) and cognitive enhancement (21.7%). Field of study was significantly associated with both reasons for use ($\chi^2 = 21.051$, $p = 0.001$) and adverse effects experienced ($\chi^2 = 15.418$, $p = 0.031$). Of all who have ever used the drink, 76.1% experienced at least one of the adverse effects, with the most common being anxiety (32.4%), and males used energy drinks considerably more often than females ($p < 0.001$). This is one of the first Pakistani studies to compare energy drink consumption and health effects among medical and non-medical university students. The convenience sample of students from Lahore limits the ability to generalize to all Pakistani students. Future research with nationally representative samples should also explore the moderating effect of health literacy on energy drink consumption behavior in both student groups.

Keywords: Energy Drinks; Adverse Effects; University Students;ts, Medical Students; Pakistan; Caffeine Consumption.

Highlights

- The rates of energy drink consumption are much higher among non-medical students and males than among others.
- Introduction is mainly through social circles (friends and family), and staying awake was the most prominent reason for use.
- Health effects are incredibly negative, with more than 76% of users complaining of symptoms like anxiety.
- Field of study is an important predictor of the causes of consumption and of the exact health effects it has on the human body.

1. Introduction

Energy drinks are commercialized beverages containing high levels of caffeine and other stimulant ingredients such as taurine, B vitamins, sugars, guarana, ginseng, and herbal extracts, unlike other caffeinated beverages such as coffee and tea (Alsunni A. A., 2015) (Yunusa, 2011). The amount of caffeine in energy drinks can range from 50 to 505 mg per can or bottle, with concentrations of 2.5 to 171 mg per fluid ounce (Reissig, 2009) Taurine is one of the most common amino acids in the body, which is found in concentrations of about 4000 mg/L in most energy drinks (Rubio, 2022). Although moderate levels of caffeine (up to 400 mg per day) are considered safe in adults, the multiple stimulant components in energy drinks produce complex interactions that need to be better understood to evaluate potential health consequences (Temple, 2017). Energy drinks are often fortified with excessive amounts of B vitamins (such as vitamin B12 at more than 5,000% and vitamin B6 at more than 360% of the recommended daily intake). B vitamins are water-soluble, so excess intake is excreted in the urine, with no risk of overdose, but there is also no additional benefit for those already consuming the recommended daily intake (Dobrek, 2025). Positive outcomes associated with energy drink consumption include acute

enhancements in alertness, reaction time, attention and physical performance, largely due to the effects of caffeine and glucose. But negative effects related to excessive or habitual use include anxiety, insomnia, palpitations, hypertension, headache and gastrointestinal symptoms; more severe adverse effects include arrhythmias, heart attack, and sudden cardiac death, which have been reported in case studies (Higgins, 2010). The consumption of energy drinks has increased dramatically over the past 20 years, with almost 500 new brands introduced globally in 2006 (Reissig C. J., 2009). Such products are sold aggressively, even claiming to boost energy, alertness, physical stamina, and academic performance. University students, who tend to have academic pressure, prolonged study time, and abnormal sleeping patterns, are thought to be one of the most susceptible groups to consume energy drinks (Alsunni, 2015), (Jacob, 2013). The available literature is mostly based on the Western world, and little information is available on the South Asian population. In Pakistan, especially in large cities like Lahore, lifestyle changes, increased academic stress, and the impact of global trends in marketing energy drinks may transform energy drink consumption habits. The lack of localized data makes it difficult to accurately assess the magnitude of the issue and to develop an effective method for awareness and prevention. The current study was conducted to assess and compare the level of awareness, knowledge, practices, and health effects of energy drinks among medical and non-medical university students living in Lahore, Pakistan. Data was collected from 1549 participants to identify awareness gaps between the two groups and to design and promote effective awareness sessions.

2. Materials and Methods

2.1. Study Design and Sample Information

A cross-sectional comparative study among medical and non-medical university students was conducted in Lahore, Pakistan, to assess and compare their knowledge, attitudes, practices, and awareness of the health effects and consumption of energy drinks (Reid, 2015). The study included undergraduate students enrolled in public and private universities. Prior ethical approval for data collection was obtained from the relevant Institutional Review Board.

The calculated minimal sample size was around 384 participants (95% confidence level, 5% margin of error), and 1549 students were involved to increase statistical reliability. Participants were recruited using convenience sampling. Students who were present at the time of data collection and willing to participate were invited to complete the survey (Lwanga, 1991).

Data were collected using a structured, self-administered questionnaire based on a previously published study on the consumption of energy drinks by university students (Reid, 2015). The questionnaire measured demographic characteristics, consumption patterns, and adverse effects. For the present study, it was changed to assess knowledge, attitudes, practices, and perceived health effects related to the use of energy drinks among medical and non-medical university students in Lahore, Pakistan. The instrument's reliability was determined through a pilot test before it was distributed to other users. Inclusion criteria included undergraduate medical and non-medical students aged 17 years or older who provided informed consent. The final analysis excluded students under 17 years of age, postgraduate students, students who declined to participate in the study, and students who failed to answer the questions or completed them incorrectly. The study was participatory; participation was anonymous and confidential.

2.2. Statistical analysis

The data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Demographic variables and responses (frequency and percentages) were used to describe the knowledge, attitudes, practices, and health effects of consuming energy drinks. The Chi-square test was used to assess the relationship between categorical variables and to compare medical students and non-medical students. A p-value of less than 0.05 was taken to be significant (Aslam, 2013).

3. Results and Discussion

3.1. Characteristics of Respondents

A total of 1,549 students participated in the study as shown in Table 1. The largest proportion belonged to the 20–24 age group (43.6%), followed by the 17–19 age group (41.9%), reflecting the predominance of younger students. Males constituted a slight majority (52.5%) compared with females (47.5%). Most respondents were single (81.7%). In terms of academic background, medical students represented the majority (57.8%), while non-medical students accounted for 42.2%. Regarding year of study, fourth-year students comprised the largest group (44.1%), followed by third-year students (28.0%) and fifth-year students (27.8%).

Table 1: Demographic characteristics of the participants

Characteristics	Category	n%
Age group (years)	17-19	648 (41.9)
	20-24	675 (43.6)
	25-29	195 (12.6)
	30 or above	29 (1.9)
Gender	Male	812 (52.5)
	Female	735 (47.5)
Marital Status	Single	1264 (81.7)
	Married	283 (18.3)
Type of Degree	Medical	894 (57.8)
	Non-Medical	653 (42.2)
Year of Study	3rd	434 (28.0)
	4th	683 (44.1)
	5th	430 (27.8)

3.2. Energy Drink Brand Preferences

As shown in Table 2, out of the 1,549 respondents, 771 reported the brand of their preferred energy drink. Overall, Red Bull was the most frequently cited brand (39.2%), followed by Monster (33.2%), Shark (10.4%), Full Throttle (4.7%), XS (1.8%), Battery (1.0%), and other brands (9.7%). Red Bull was the leading choice among both males (39.9%) and females (38.4%). Monster ranked second for both genders (33.8% and 32.5%, respectively). Notably, females showed a slightly higher preference for Shark than males (12.6% vs. 8.5%). However, the differences in brand preference between genders were not statistically significant ($\chi^2 = 4.445$, $df = 6$, $p = 0.617$).

Table 2. Types of energy drinks mainly consumed by current users, by sex (n=771)

Type of Energy Drinks	Male	Female	Total n (%)
Red Bull	165 (39.9)	137 (38.4)	302 (39.2)
Monster	140 (33.8)	116 (32.5)	256 (33.2)
Shark	35 (8.5)	45 (12.6)	80 (10.4)
Full throttle	18 (4.3)	18 (5)	36 (4.7)
XS	8 (1.9)	6 (1.7)	14 (1.8)
Battery	4 (1)	4 (1.1)	8 (1)
Others	44 (10.6)	31 (8.7)	75 (9.7)
Total	414 (100)	357 (100)	771 (100)

$\chi^2 (6) = 4.445, p = 0.617$

3.3. Mode of Introduction to Energy Drinks

Among 1,549 respondents, 784 provided their responses regarding their introduction to energy drinks (Table 3). Introduction was most often done through friends and family (41.5%), supermarkets or stores (24.6%), advertisements (22.4%), social settings (10.3%), and other (1.1%). Males were more often introduced to energy drinks by their friends and relatives (44.2% vs. 38.3%), whereas females were more often introduced to energy drinks through social settings (11.8% vs. 9.0%) and ads (23.1% vs. 21.9%). Nevertheless, the differences in genders were not found statistically significant ($p = 0.143$).

Table 3: Mode of Introduction to Energy Drinks

Mode of Introduction	Male	Female	Total n (%)	p-value
Advertisements	92 (21.9%)	84(23.1%)	176 (22.4%)	0.143
At the store	103 (24.5%)	90(24.8%)	193 (24.6%)	
Friends & Family	186 (44.2%)	139(38.3%)	325 (41.5%)	
Social Settings	38 (9.0%)	43(11.8%)	81 (10.3%)	
Other	2 (0.5%)	7 (1.9%)	9 (1.1%)	
Total	421 (100%)	363(100%)	784 (100%)	

3.4. Pattern of use among current users

Out of 771 users of the energy drinks, the largest proportion (35.5%) of the users reported taking one to five drinks per average month, then six to ten drinks (33.3%), eleven to twenty drinks (24.3%), twenty-one to forty drinks (6.0%), and forty or more drinks (0.9%). The significant gender difference in monthly consumption was statistically significant, with males more likely to drink more per month than females ($X^2 = 13.638$, $df = 4$, $p = 0.009$). In terms of frequency of use, most of the students used energy drinks one to three days (33.2%) followed by four to six days (36.8%), seven to twelve days (18%), twelve to twenty days (11%), and twenty or more days (0.9%). Males were far more likely to drink energy drinks on more days of the month than the females ($X^2 = 20.879$, $df = 4$, $p < 0.001$). In terms of the number of drinks

taken per sitting, most students reported having 1 drink (42.1%), less than 1 drink (23.8%), 2 drinks (24.5%), or 3 or more drinks (9.6%). The number of drinks consumed per sitting did not show a statistically significant gender difference ($X^2 = 3.543$, $df = 3$, $p = 0.315$). At the age of initiation, the majority of the respondents started using energy drinks between the ages of 6 to 10 years (28.8%), then between 11 and 15 years (33.3%), and between 16 and 20 years (31.1%), which means that the initiation is mostly made in childhood and in the early adolescent years. Compared with other caffeinated products, the predominant product amongst the respondents was soft drinks (34.7%), followed by tea (32.9%) and coffee (24%).

3.5. Reasons for use of energy drinks

According to Table 4, out of the 773 ever users who answered this question, the most common reasons why people consumed the energy drinks was to stay awake (29.4%), sports participation (22.1%), mental enhancement (20.6%), studying or completing a major project (16%), energy boost (9.2%), and weight control (2.7%). Comparisons of medical and non-medical students showed differences in the reasons of use. Medical students (27.4%) were more likely to consume for sports than non-medical students (15.8%), and non-medical students (35.4%) were more likely to stay awake than medical students (24.7%). Non-medical students also had a slightly higher mental enhancement, whereas the difference between the two groups in the study and energy boost was relatively low. In general, the field of study was statistically significant and correlated with the reasons for consuming energy drinks ($X^2 = 21.051$, $df = 5$, $p = 0.001$).

Table 4. Reasons for Using Energy Drinks

Reasons for using	Medical Students	Non-Medical students
Sports	118 (27.4)	53 (15.8)
Staying awake	108 (24.7)	119 (35.4)
Mental enhancer	86 (10.3)	73 (21.7)
Studying	75 (17.2)	49 (14.6)
Energy boost	41 (9.4)	30 (8.9)
Weight control	9 (2.1)	12 (3.6)

($X^2 = 21.051$, $df = 5$, $p = 0.001$).

3.6. Adverse effects of energy drinks

Among the 771 ever users who had consumed energy drinks, 76.1% reported at least one negative effect after consuming an energy drink as detailed in Table 5. The most common reported symptoms were anxiety (32.4%) and insomnia (15%), increased urination (11.9%), headache (6.4%), elevated heart rate (6.1%), jolt and crash (3.6%), and other symptoms (0.6%). Only 23.9% of ever users reported no adverse effects after consumption. Symptom differences were observed between medical and non-medical students. Non-medical students reported anxiety more often (35.7%) than medical students (29.9%), but insomnia, increased urination, raised heart rate, and headache were marginally more reported among medical students. The percentage of non-medical students who reported no adverse effects was also higher (25.3% vs 23.9%). In general, the field of study and the type of symptom experienced had a statistically significant relationship ($X^2 = 15.418$, $df = 7$, $p = 0.031$).

Table 5. Adverse effects of Energy Drinks

Symptoms experienced	Medical Students	Non-Medical Students
Insomnia	68 (15.6)	48 (14.3)
Anxiety	130 (29.9)	120 (35.7)
Increased urination	58 (13.3)	34 (10.1)
Elevated heart rate	33 (7.6)	14 (4.2)
Jolt and crash	16 (3.7)	12 (3.6)
Headache	31 (7.1)	18 (5.4)
None	99 (23.9)	85 (25.3)
Other	0 (0)	5 (1.5)

($X^2 = 15.418$, $df = 7$, $p = 0.031$)

The energy drink market has been expanding rapidly since the launch of Red Bull in Austria in 1987, with almost 500 new brands introduced in the global market in 2006 alone and global consumption growing 17% per year in 2006 (Reissig, 2008). University students have always been identified as one of the key target demographics in energy drink marketing worldwide. This study, the first survey on the use of energy drinks among Pakistani university students compared to non-medical students, shows that the use of energy drinks is a common behavior among tertiary-level students, with 48.8% of the students sampled indicating that they had ever used an energy drink. This is in line with the global rate of 42.9% reported in a recent systematic review and meta-analysis of 71 studies with undergraduate student populations worldwide (Protano, 2022) and falls within the wide range of reported numbers in the international literature. In similar settings, similar studies have found varying prevalence rates 51% among college students in the United States (Malinauskas, 2007), 36.1% in the United Arab Emirates (Faqeeh, 2025), 29.3% in Saudi Arabia (Alafif, 2021), 74.9%

among medical students in Saudi Arabia (Edrees, 2022), 42.89% in medical students in Karachi, Pakistan (Aslam, 2013). The prevalence in this study is quite low compared to the 86% reported by Reid et al. (2015) for Caribbean students, which is one of the highest prevalence rates recorded worldwide. The comparatively low prevalence in Pakistan in comparison with the Caribbean and some Middle Eastern groups may be due to cultural, religious, and socioeconomic factors peculiar to the situation in Pakistan, where the conservative social norms and religious influences can moderate the use of stimulant beverages among the youth. Red Bull was the most frequently used brand overall (39.2%), with Monster (33.2%) trailing, in line with global trends from similar studies, where these two brands usually dominate consumption among university students. There was no statistically significant gender difference in brand preference ($\chi^2 = 4.445$, $df = 6$, $p = 0.617$), indicating that the marketing of a particular brand is equally effective for both sexes in the population.

3.7. Novelty of Current Study

The new contribution of this study is the higher energy drink consumption among non-medical students compared to medical students, consistent with the international literature, which reported higher consumption among non-medical students (Islam, 2021). The field of study was significantly related to the causes of energy drink use ($X^2 = 21.051$, $df = 5$, $p = 0.001$). Medical students tended to use energy drinks more often for sports (27.4%) and to study (17.2%), whereas non-medical students tended to use them to stay awake (35.4%) and to get smarter (21.7%). This trend aligns with the global literature, which consistently cites academic pressure and the need to maintain long study hours as the primary factors driving the use of energy drinks among college students (Edrees, 2022). The intensive academic timetables, clinical placements, and exam stress of medical students seem to lead them to consume energy drinks more instrumentally, as directed performance aids for both exercise and study. In contrast, non-medical students seem to use energy drinks more generally to stay alert and enhance cognition. A study of medical students in Delhi found that, similar to other studies, the most frequent reason for using energy drinks was studying and exam preparation, and the peak was during exam periods (Hossain, 2025). It is also interesting to note that medical students consume more energy drinks during sports, and this is an area that needs to be researched further, considering that consumption of energy drinks during athletic activities bears certain cardiovascular risks such as high blood pressure, palpitations and tachycardia, which were reported in a study conducted on medical students in Iraq (Mahmood, 2024).

Regarding adverse effects, 76.1% of ever users indicated having at least one adverse effect, which is greater than the 62.2% of the ever users in the Caribbean study (Reid, 2015). The most frequently reported symptom was anxiety (32.4%), which contrasts with the Caribbean study in which restlessness was most frequent and Saudi studies in which the most frequent symptoms reported were a headache and increased urination (Alafif, 2021). In another study conducted in the United States, jolt and crash were reported to be the most common adverse effects, whereas headache predominated in European studies in contrast to these findings (Malinauskas, 2007) (Bashir, 2016). The type of adverse effects experienced was considerably related to the field of study ($X^2 = 15.418$, $df = 7$, $p = 0.031$). Anxiety was reported more often by non-medical students (35.7% than by medical students 29.9%), with a higher rate of insomnia, increased urination, increased heart rate, and headache reported by medical students. This divergence can be attributed to variation in the health literacy of the two groups in that medical students can be more sensitive to physiological symptoms like tachycardia and diuresis, whereas non-medical students may be more sensitive to psychological symptoms like anxiety. A study of medical students in Taif, Saudi Arabia revealed that medical students were more aware of the physiological side effects of energy drinks than non-medical students (Edrees, 2022). The same study carried out in Iraq showed that the rates of medical students who took energy drinks were found to have remarkably higher rates of cardiovascular symptoms such as high blood pressure and palpitations (Zakho, 2024). Interestingly, the prevalence of negative effects was also high in this sample but this did not seem to discourage the use.

Males were much more likely to use energy drinks in higher quantities per month ($X^2 = 13.638$, $df = 4$, $p = 0.009$), which is also in line with other studies that have found on various occasions that male gender is a consistent predictor of increased and more frequent use of energy (Qasem, 2022). The most prevalent entry point to energy drinks was friends and family (41.5%), which is opposite of the situation in the Caribbean study (advertisements were the most important way of introduction to energy drinks) (Reid, 2015) and this indicates that in Pakistan, friends and family networks are more dominant in the initiation of energy drinks than media. The second-largest city in Pakistan, Lahore, is an education hub and home to a large number of medical and non-medical students, making it a suitable place for this comparative study.

The implications of this study's findings for health policy and education in Pakistan are significant. The high variance in reasons for use and adverse effects between medical and non-medical students indicates that education interventions must be tailored to the needs and vulnerabilities of specific groups of students. The medical students need to be informed about the cardiovascular risks of using energy drinks during exercise, whereas non-medical students need to receive specific messages on the psychological impacts of caffeine (especially anxiety and disturbed sleep). Universities' health and wellness policies should also address the sale and advertising of energy drinks on campus. There are no existing

guidelines on the labeling, advertisement or sale of energy drinks in Pakistan and the results of this research give some initial data to the fact that there should be some measures to fill this gap at the national policy level, which is consistent with the advocacy of the need to implement regulation measures in similar studies in the region (Aslam, 2013) (Kaur, 2022). Research should be conducted on nationally representative samples from various cities in Pakistan and other countries to improve generalisability. Longitudinal studies should be conducted to explore the association of energy drinks and health. Health literacy should be explored in future studies as a moderating variable for consumption and its impact.

Conclusion

Energy drink consumption is prevalent among university students in Lahore, but non-medical students consume more. Field of study plays a major role in determining reasons for use and adverse health effects, with anxiety being the most reported adverse health effect overall. This raises the need for education programs that cater specifically to the different reasons for use and health needs of the two types of students. As this study was limited to university students in Lahore, future studies should use nationally and internationally representative samples to improve generalisability and include health literacy as a potential moderator of energy drink consumption behavior in both student groups.

Ethical Considerations: This research was conducted in accordance with the Declaration of Helsinki. This was done with ethical approval of the Institutional Review Board of University of Central Punjab, Lahore, Pakistan. Participation was voluntary and anonymous. All participants were informed and gave their consent before the data were collected.

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Conflict of Interest

There are no conflicts of interest that the authors declare.

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