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FREQUENCY AND SELF-REPORTED ADVERSE EFFECTS OF ENERGY DRINK CONSUMPTION AMONG UNIVERSITY STUDENTS: A CROSS-SECTIONAL STUDY FROM PESHAWAR

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ABSTRACT

Background:

University students are increasingly turning to energy drinks, and the use of these beverages has been associated with academic pressure, peer influence, and lifestyle habits within the context of this particular demographic. These drinks have been linked to multiple negative health outcomes, but. Knowing how, why, and the health implications of their use is important to inform student health initiatives.

Objectives:

To determine the frequency of energy drink consumption among university students, assess the self-reported adverse effects, and explore the reasons behind their use.

Methods:

This was a cross-sectional study conducted in different universities of Peshawar. A structured self-administered questionnaire was used to collect data from a cross-sectional survey of 400 university students. Participants were assigned to either frequent (n=185) or infrequent (n=120) users. Data were analysed using SPSS version 22. Descriptive statistics are displayed as frequencies and percentages, and chi-square tests were used to determine associations with a p-value of <0.05 considered significant.

Results:

305 participants reported the use of energy drinks. Frequent consumption was more common among males (67.6%) and hostel residents (56.8%). Sleep disturbance (67.6%), headache (59.5%), and palpitations (45.9%) were significantly more prevalent in frequent consumers compared to infrequent users. The most cited reasons for consumption were to stay awake (42.6%) and for fun (44.2%), both showing significant group differences (p<0.05).

Conclusion:
Energy drink consumption is common among university students, particularly males and hostel residents. Frequent use is significantly associated with adverse health effects. Awareness programs are needed to educate students about the potential risks of excessive energy drink consumption.
Keywords: *Energy drink, university, student, adverse effect, Peshawar*

INTRODUCTION

Energy drinks (EDs) are caffeinated drinks that typically contain between 80-300 mg caffeine per serving, as well as sugar, taurine, B-vitamins, and herbal extracts [1]. They are marketed chiefly as products that increase alertness, stamina, and cognitive performance. In the last two decades, their use has grown among university learners and adolescents due to academic pressure, peer pressure, and marketing [2,3]. Culturally and geographically, the percentage of stimulant use, specifically ED, among university students broadly varies between 30% and more than 80% worldwide [4, 5].

Similarly, among university students in Pakistan as well, the prevalence of ED use is increasing, with studies reporting a range between 34 % and 50 % of consumption [6]. Despite facing negative effects like insomnia, anxiety, and palpitation, a study at a private university in Karachi reported that 52% of medical students used EDs, primarily to enhance focus/ concentration, particularly in exam times [7]. Many college students, despite increased consumption, do not recognise the potential health risks of EDs. These risks are sleep issues, elevated heart rate, dehydration, anxiety, and caffeine addiction [8-10]. On top of that, the high sugar and acidity content of EDs also leads to dental erosion and metabolic changes. Though there is increasing awareness in the international discourse regarding the use of EDs by youth, there is particularly no existing data in Pakistan about how and which demographics of university students in Pakistan are specifically affected by consumption of such products and how it is impacting their lives [11-13].

As energy drinks have been linked to negative effects, the increasing prevalence of energy drink use within populations of university students represents a public health concern. While global interest exists, findings on the prevalence and effects of energy drink consumption within Pakistani schools and colleges are limited. Considering that university students are likely to use these drinks for prolonged consciousness or focusing, or in response to academic pressure, it is important to consider what physical and psychological effects may result from these habits. On top of that, students may not recognise, or may fail to realise the health risks of, regular consumption, including insomnia, cardiovascular symptoms, anxiety, and dependence on caffeine. So, this research is needed to not only describe the prevalence of energy drink use among Pakistani university students but also to compare this across demographic groups as well as associated negative effects. This information can be useful for health practitioners, educators, and policymakers in raising awareness campaigns, student health services, and institutional policies that advocate for the safest approach to consumption and minimise the harms associated with high-energy drink consumption.

OBJECTIVES:

To evaluate the frequency and self-reported adverse effects of energy drinks among university students.

MATERIALS AND METHODS:

Study design, duration, and setting: This cross-sectional study was conducted from May to July 2024, in different department of University of Peshawar.

Sample size:

The sample size for this cross-sectional analysis was determined using the standard equation $n=z^2 \cdot p \cdot (1-p)/d^2$, where p was taken as 63.9% based on a prior study in Pakistan [14]. Inclusion

of 10% of non-response gives the total sample size of 400.

Sampling techniques:
A convenience sampling technique was employed for data collection. The questionnaire was distributed via WhatsApp to university students in Peshawar who voluntarily agreed to participate.

Inclusion and exclusion criteria:
Both female and male students currently enrolled in various universities in Peshawar, who are willing to participate, will be included. Students with cardiovascular disease, epilepsy, and other chronic conditions will be excluded.

Data collection methods:
Data were collected using a pre-designed, self-administered questionnaire developed following a comprehensive literature review. It was broken out into four main sections. The first section comprised demographic information, including age, gender, faculty, and year of study. The second addressed consumption patterns such as frequency (frequent users: ≥ 1x/week, infrequent: 1x/month, non-consumers: none in past month) and preferred brands. The third looked at perceived reasons for use, such as wanting to stay awake, study, or perform better academically or athletically, to focus, or to socialise, among others. The fourth asked about negative side effects of consumption, including palpitations, insomnia, irritability, headaches, and stomach aches.
The questionnaire was tested with 20 students to ensure face validity and reliability. The questionnaire was then refined based on the responses received. The final version was then distributed online using Google Forms and posted on WhatsApp groups and social media pages of the universities. All participation was strictly voluntary, with data collected only from individuals who provided electronic informed consent before submitting any data.

Data analysis procedure:
Following data collection, the responses were downloaded from Google Forms into Microsoft Excel and later imported into IBM SPSS Statistics version 20 for analysis. Data were summarised using descriptive statistics. Descriptive statistics for the variables of interest, including counts and percentages of gender, consumption frequency, reasons for use, and self-identified negative effects of energy drinks, were calculated. Continuous variables, including age, were reported as mean ± standard deviation. To determine prevalence, energy drinkers were divided into frequent energy drinkers (reported using at least once a week), infrequent energy drinkers (reported using at least once in the last month but less than weekly), and non-energy drinkers (reported no use in the last month). The overall prevalence of energy drink use was determined by taking the total number of current users (i.e., frequent + infrequent) and dividing this by the total sample size, calculated as a percentage.
Chi-square tests were conducted to determine relationships between energy drink use and specific demographics or behaviours. Statistical significance was determined using a p-value of less than 0.05. Data were screened for missing values and outliers and were found to be suitable for analysis.

Ethical Approval:
Ethical approval was granted by the IREB department of Khyber Medical College, Peshawar.

RESULTS:
Graph 1: frequency of energy drink consumption
The pie chart presents the distribution of energy drink consumption among 400 participants. Frequent consumers constitute 46% (n=185), infrequent consumers account for 30% (n=120), and non-consumers represent 24% (n=95). The overall prevalence of energy drink consumption (frequent + infrequent consumers) was 76%.

Graph 1: frequency of energy drink consumption

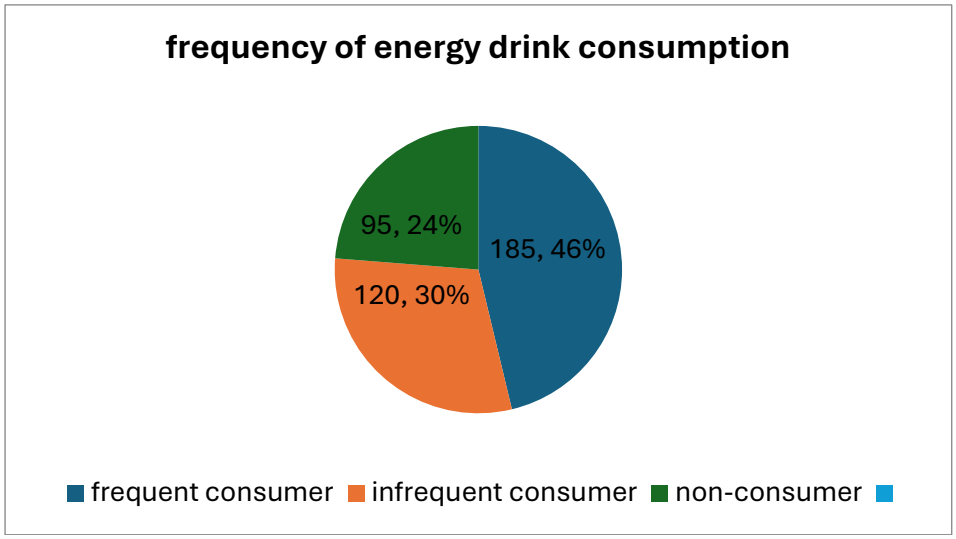

Table 1: Demographic Characteristics of Participants (n = 305)

Table 1 describes selected demographic characteristics of the study sample by frequency of use. Frequent consumers reported an average age of 21.8 ±1.9, while occasional consumers were on average 21.3 ±2.1.
The large majority of participants were male, with a higher proportion of males in both samples, and a higher percentage of males among frequent users (67.6%) than infrequent users (58.3%), but the gender difference was not statistically significant (p = 0.09 by independent-t-test).
No significant differences were found in departmental distributions (p = 0.87 by chi-square test). However, residence patterns showed significant variation, with frequent consumers more likely to live in hostels (56.8%) compared to infrequent consumers (50.0%) (p = 0.02 by chi-square test). These findings suggest that age and living environment may be associated with consumption frequency, while gender and academic department appear unrelated to consumption patterns in this study population.
More energy drink users in total were reported in the MBBS department (n=85), and among those, a higher proportion identified as regular users (27%). This could be interpreted that energy drinks are more popular among male students, students who study medicine or related fields, and students who live in hostels, possibly related to academic pressure, studying long into the night, and lifestyle independence.

Table 1: Demographic Characteristics of Participants (n = 305)

Demographics	Frequent Consumption (n=185)	Infrequent consumption (n=120)	Total	p-value
Age in years (mean ±SD)	21.8 ± 1.9	21.3 ± 2.1		**0.03**
Gender				0.09
Male	125 (67.6%)	70 (58.3%)	195 (63.9%)	
Female	60 (32.4%)	50 (41.7%)	110 (36.1%)	

Department				0.87
Engineer	45 (24.3%)	30 (25.0%)	75 (24.6%)	
MBBS	50 (27.0%)	35 (29.2%)	85 (27.9%)	
Social science	40 (21.6%)	25 (20.8%)	65 (21.3%)	
Economic	30 (16.2%)	15 (12.5%)	45 (14.8%)	
Urdu	20 (10.8%)	15 (12.5%)	35 (11.5%)	
Residence	21.8 ± 1.9			**0.02**
Hostel	105 (56.8%)	60 (50.0%)	165 (54.1%)	
Home	60 (32.4%)	60 (50.0%)	140 (45.9%)	

Table 2: Prevalence of self-reported adverse effects among frequent and infrequent energy drink consumers.
This table presents the type of adverse effects reported by energy drink users classified by frequency of use, either frequent or infrequent. Among those who had used the product frequently, sleep disturbance and headaches were the most common side effects, with 125 (67.6%) and 110 frequent users (59.5%) reporting these symptoms, respectively. Infrequent consumers (n=120) experienced fewer negative effects, also with sleeping issues and urination amongst the most commonly cited, at 41.7% and 33.3% respectively.
Chi-square testing demonstrated significant variation between groups for the majority of the side effects. Headache, palpitations, and sleep disturbances were, for example, significantly more likely to occur among frequent consumers of headache (p=0.003), palpitations (p=0.027), and sleep disturbances (p<0.001). These results indicate a possible dose- relationship between energy drink consumption and health complaints.

Table 2: Prevalence of self-reported adverse effects among frequent and infrequent energy drink consumers

Adverse effects	Frequent consumption (n=185)	Infrequent consumption (n=120)	p-value
Headache	110 (59.5%)	35 (29.2%)	0.0001
Increased urination	95 (51.4%)	40 (33.3%)	0.003
Palpitations	85 (45.9%)	30 (25.0%)	0.0001
Sleep disturbance	125 (67.6%)	50 (41.7%)	0.0001
Abdominal pain	70 (37.8%)	25 (20.8%)	0.003
Difficulty breathing	41 (22.1%)	11 (9.1%)	0.003
Chest pain	23 (12.4%)	7 (5.8%)	0.001

Table 3: Stated reasons for energy drink use among frequent and infrequent consumers.
This table shows the reasons why respondents report consuming energy drinks, by frequency of use. The highest number of responses to this item was "just for fun" (130 respondents; 42.6%), followed by "Helping me stay up at night" (135 respondents; 44.2%). Fun and staying awake were also mentioned among infrequent users, 45.8% and 33.3% respectively.
Results of the chi-square analyses indicated that the majority of the items in the table below were significantly different between frequent and infrequent users, especially the items related to staying awake, p<.0001; and concentration/focus, p=.008. This suggests a stronger motivation to cope with academic demand or need for alertness

amongst those who use it more frequently.

Table 3: Stated reasons for energy drink use among frequent and infrequent consumers.

Reason for consumption	Frequent Consumption (n=185)	Infrequent Consumption (n=120)	Total	p-value
just for fun	80 (43.2%)	55 (45.8%)	135 (44.2%)	0.032
Helps me stay up at night	90 (48.6%)	40 (33.3%)	130 (42.6%)	0.001
Make me concentrate/focus better	68 (36.7%)	30 (25%)	98 (32.1%)	0.005
Helps me do better at sports	41 (22.1%)	15 (12.5%)	56 (18.3%)	0.008

DISCUSSION:

Among students of the universities of Peshawar, this study finds a high prevalence of energy drink consumption, 76% of students consume them, and almost half of these are regular consumers. This is by the recent global picture in university students, where extensive consumption of EDs is reported, especially among males and hostel-dwelling students, in other studies [15, 16]. The higher prevalence among males (67.6%) and hostel residents (56.8%) could be due to various social and environmental factors, such as peer influence, less parental supervision, and increased academic pressure [17,18].

Other main motivations for ED consumption were remaining awake 48.6%, increased focus or concentration 37.8%, and recreational 43.2%. These findings correlate with those from Sri Lanka, India, and Eastern Europe, in which, similar to our study, respondents cited related motivations for use based on academic pressures and social behaviour among students. [15, 19, 20]. The strong relationship of these motives with high use underlines the cognitive attractiveness and performance expectations linked to the use of EDs, which appear to overshadow the perceived health risks associated with use, as previously indicated in the literature [21].

Of significance, this study also concluded a statistically significant correlation, $p<.05$, between regular consumption of EDS and symptoms including: problems sleeping (67.6%), palpitations (45.9%), and stomach pains (37.8%). These symptoms are similar to those reported in related studies regarding the high caffeine and sugar content in EDs, which cause central nervous system over-stimulation and cardiovascular stress [22, 23]. Many of those same heavy users have also commonly reported diuresis, insomnia, and stomach discomfort as effects of caffeine [24].

But, despite the levels of awareness reported in other places, such as Bangladesh and India, many students continued to regularly consume EDs [16, 17]. This indicates a disconnect between knowledge and action that may be further enforced by the normalisation of EDs within youth culture, promiscuous marketing, and the lack of health education within the institutions [25, 26].

On top of that, the co-use of EDs and other stimulants or excessive use while studying is also a concerning trend. Research indicates that this trend may lead to increased risk of chronic dependence and health issues down the line, particularly when students engage in self-medicating as a means of coping with exhaustion and stress, typically without any professional direction [18, 24, 27].

The present findings highlight the critical importance of public health initiatives that attempt to mitigate the normalisation of ED use. University-specific awareness campaigns can work to challenge the misinformation regarding

cognitive enhancement while advocating for healthier alternatives [19, 26]. Also internationally, recommendations to help prevent such issues have included restricting access on campus or requiring more explicit labels on caffeine/sugar content [28].

CONCLUSION:

Energy drink consumption is common among university students, particularly males and hostel residents. Frequent use is significantly associated with adverse health effects. Awareness programs are needed to educate students about the potential risks of excessive energy drink consumption.

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