



Energy drink consumption among medical students in Jordan – prevalence, attitudes, and associated factors: a cross-sectional study

Nuha W. Qasem, MD, Omar M. Al-omoush, MBBS, MRCGP, Zaid M. Al Ammouri, MD, Nour M. Alnobani, MD, Mohamed M. Abdallah, MD, Abdullah N. Khateeb, MD, Michael H. Habash, MD, Ruba A. Hrout, MD

Background: Energy drinks (ED) are popular beverages that contain high levels of caffeine, sugar, and other supplements, such as vitamins, which are marketed to enhance mental alertness and physical performance. Studies have shown that energy drink consumption is prevalent among medical students. Therefore, this study aimed to assess the prevalence, attitudes, and factors associated with energy drink consumption among medical students in Jordan.

Materials and methods: A cross-sectional study was conducted among medical students from six public universities in Jordan. A total of 307 students were included in the study, and data were collected using an expert-validated questionnaire. The collected data were analyzed using SPSS version 25.

Results: The study found that 50% of the sample had consumed ED, half of them started consuming them at the age of 16–18, and learned about them from friends. The primary reasons for consuming ED were to stay awake at night and the majority of them increase their consumption during exams to increase alertness. Regular energy drink consumption was significantly associated with being a student at the university located in the south governorate of Jordan ($P=0.021$), living alone ($P=0.000$), drinking alcohol ($P=0.049$), drinking coffee daily ($P=0.043$), and consuming more than 10 cans of soft drinks weekly ($P=0.001$). However, sex, age, academic achievement, and smoking status had no significant association with regular energy drink consumption. Students with regular energy drink consumption experienced daytime sleepiness, decreased concentration, fatigue, and reduced performance more than students with no regular energy drink consumption.

Conclusion: The prevalence of energy drink consumption among medical students in Jordan is high, with factors such as social influences, lifestyle behaviors, and academic pressure being significant contributors. This study highlights the need for interventions to promote healthy behaviors and raise awareness about the potential harms of ED among medical students.

Keywords: attitude, energy drink, Jordan, knowledge, medical students

Introduction

Energy drinks (ED) are beverages that contain stimulant compounds such as caffeine and sugar, in addition to other ingredients such as vitamin-B, amino acids, and herbal stimulants^[1]. Most ED have caffeine content of as much as 35–160 mg (highly caffeinated as per the EU definition)^[2] and 37 g (equivalent to almost nine teaspoons) of processed sugar per 8-ounce serving^[3]. They are available in different types and flavors and are marketed for their ability to provide an extra boost, promote wakefulness, increase attention, maintain alertness, provide cognitive and

HIGHLIGHTS

- Half of Jordanian medical students consume energy drinks.
- Half of the consumers begin at ages 16–18, often influenced by friends.
- Consumption rises during exams for increased alertness, and to stay awake at night.
- Regular usage linked to living alone, alcohol, coffee, and soft drink intake.
- Regular users experience decreased concentration, fatigue, and reduced performance.

Internal Medicine and Family Medicine Department, Faculty of Medicine, Hashemite University, Zarqa, Jordan

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*Corresponding author. Address: The Hashemite University, 330127, Zarqa 13133, Jordan. Tel.: +96 279 980 2520. E-mail: nuhaqasem@hu.edu.jo (N.W. Qasem).

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mood enhancement, improve athletic performance,^[4] and promote feelings of pleasure^[5], making them attractive to medical students.

Long-term consumption of large amounts of these products can lead to adverse effects such as nervousness^[6], irritability^[7], anxiety^[8,9], insomnia^[1,6–11], tremors^[6,10,12], fatigue^[13], headaches^[6,9,10], stomach upset^[6,10], abdominal pain^[9,10], constipation^[9], palpitations^[1,6,7,11,12,14], dizziness^[9], flushing^[10], and increased micturition^[1,10]. Energy drink consumption has also been linked to increased potential for other high-risk behaviors such as smoking^[1,15–17], alcohol drinking^[7,15,18,19], illicit drug use, unsafe sexual practices, and fighting^[20]. Recent studies have linked the consumption of ED to poor dietary habits, unhealthy

behaviors such as video gaming, the use of unhealthy weight control programs, and substance abuse^[20]. Also, taking into consideration the ‘highly caffeinated’ designation for most available ED, other caffeine-related disorders are expected as per the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), which lists caffeine intoxication, caffeine withdrawal, other caffeine-induced disorders (e.g. anxiety and sleep disorders), and unspecified caffeine-related disorder^[21].

The prevalence of energy drink use varies widely, ranging from as low as 29.3% among students in government universities in Riyadh, Saudi Arabia^[22], to as high as 87% among medical and dental students in Nigeria^[23].

Several studies have reported that the most common factors associated with energy drink consumption were being male^[1,14,16,17,24–27], single, in a nonmedical field of study^[2,5], with alcohol consumption^[7,15,18,19], and higher working or studying hours^[12].

Reported reasons for consuming ED in previous studies were to stay awake longer^[1,4,12–14,27–29], boost energy^[6,28,30], study and perform better on exams^[1,6,7,13,27,29,30], increase physical performance in sports^[18,28], enjoy leisure time with friends^[1], and for the pleasant taste^[8]. Curiosity was the main motivation to try them for the first time^[1,4,18].

The most common reasons for not consuming ED were lack of curiosity to try them^[14], fear of or experienced unpleasant previous side effects^[13,14,7], and not being in need of extra energy^[14].

A study among medical students in a private university in Karachi, Pakistan showed that although many respondents knew the components of ED, few knew the exact amount of caffeine in a single can^[30]. Proper knowledge of the physiological effects of energy drink consumption was not high among medical students from the University of Palermo, Italy despite having high knowledge regarding the components of these beverages^[7]. Friends^[1,4,16,30] and media advertisements or television programs^[1,30] were the main sources of information about ED.

Previous research studied the pattern of energy drink consumption among university students in Jordan. However, this is the first study that is specifically concerned about medical students’ energy drink consumption in Jordan; prevalence, knowledge, and factors associated with their consumption. This aims to contribute to the development of targeted educational interventions that enhance students’ awareness of the potential impact of these beverages on their overall health. Additionally, the findings may serve as a foundation for healthcare policies for promoting healthier lifestyle choices among medical students, ultimately supporting a culture of well-being and optimal academic performance within this demographic.

Methods and Materials

Study design and setting

A cross-sectional study was conducted among medical students in six Jordanian universities, three of them in the central governorate, two in the north governorate, and one in the south governorate of Jordan. The study outcomes are expected to find the prevalence of ED consumption among medical students, knowledge and attitudes toward ED, and predictors of their consumption. Any medical student from both sexes who was enrolled in any of the six public universities of Jordan from the

first to sixth year of study, and who was willing to fill out the questionnaire was included in this study. This study has been documented in accordance with the strengthening the reporting of cohort, cross-sectional, and case-control studies in surgery (STROCCS) criteria^[31].

Sample size

The sample size was calculated based on the following formula^[32]:

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

where n = sample size,

Z = Z statistic for a level of confidence,

P = expected prevalence or proportion

(in proportion of one; if 20%, $P = 0.2$), and

d = precision

(in proportion of one; if 5%, $d = 0.05$).

Jordanian students’ ED consumption is 40% based on a recent study in 2021^[29]. Hence, the sample size to achieve a precision of $\pm 5\%$ with a 95% CI was 369, which was not achieved in the time available for data collection according to the timetable of the study, a total of 307 respondents filled out the questionnaire.

Data collection tools

A validated, constructed, anonymous, confidential, and self-administered questionnaire was employed to measure different, underlying constructs. It was carefully designed to avoid leading or biased questions. The questionnaire was distributed electronically through social media platforms such as Facebook and WhatsApp groups during the period from 1 December 2022 to 18 February 2023. The questionnaire was designed to cover all medical students from the first year to the sixth year in the selected universities. The questionnaire inquired about personal, socio-demographic characteristics, history of previous health problems, and history of other habits such as smoking, physical activity, drinking alcohol, coffee, tea, and soft drinks, as well as daily study hours and preferred timing of study. History of ever use, inspiration for starting ED, regular use during the 2 months preceding the study, frequency of use, the cause of selecting ED, and any reported adverse effects were also inquired. Variables that were addressed to predict ED consumption include habit status, university location, academic achievement, academic year, working status, marital status, and living arrangements. The ‘experienced side effects with ED consumption’ construct consisted of 11 questions. The scale had a high level of internal consistency, as determined by a Cronbach’s alpha of 0.875. In the knowledge section, one construct, ‘knowledge about ED contents’, consisted of five questions. The scale had a high level of internal consistency, as determined by a Cronbach’s alpha of 0.574. Another construct, ‘knowledge about health effects of ED consumption’, consisted of 17 questions. The scale had a high level of internal consistency, as determined by a Cronbach’s alpha of 0.924.

Ethical approval

Ethical approval for this study was obtained from an Institutional Review Board committee on 16 January 2023. At the

commencement of the questionnaire, participants' informed consent was integrated.

Data management

The collected data was analyzed using SPSS (Statistical Package for Social Science) version 25. Descriptive statistics such as mean and SD were used for quantitative/continuous data while frequencies and percentages were used for qualitative/categorical data. The χ^2 test was employed to assess differences between categorical variables. The independent sample *t*-test and one-way ANOVA were conducted to identify independent determinants. A *P*-value of <0.05 was considered statistically significant with a confidence level of 95%.

Results

A total of 307 medical students from six medical schools in Jordan participated in the study. More than half of the students were from a single university situated in the middle governorate of Jordan (55%), in their clinical years (57.7%), and were female (53.7%). Most of the participants were single (97.4%), lived with their families (82.4%), were Jordanians (87%), had monthly pocket money of 150 JDs or less (70.7%), and did not work alongside their studies (96.1%), Table 1.

A total of 26.7% of the participants preferred to study at night, and 59.6% studied more than 3 h daily. Moreover, 74.5% had a grade point average above 3 (out of 4).

Of the total sample, only 33.9% practice physical exercise regularly, 28.7% smoke occasionally or regularly, 4.6% drink alcohol, 60% drink coffee on a daily basis, 60% drink tea on a daily basis, 60% did not drink soft drinks regularly, and 5.9% had chronic medical illnesses.

Half of the sample had ever consumed ED. The majority of students who consume ED do not drink them regularly (70.8%) and increase their consumption during times of exams (80.5%). Regular ED consumption was reported by 34.2% of female and 24.4% of male ED users. Almost half of them started using them at age 16–18 (48.7%) and inspiration for their first-time use was from friends (46.1%). The reasons behind their consumption were mainly to enhance mental performance (64.9%), stay awake at night (70.1%), reduce fatigue (51.3%), improve mood (50.6%), and for the pleasant taste (50.6%). These intended goals were achieved most of the time by only 31.2% of ED users as shown in Table 2.

As shown in Table 3, factors significantly associated with regular use of ED included being a student at the university located in the south governorate of Jordan (*P*=0.021), living alone (*P*=0.000), drinking alcohol (*P*=0.049), drinking coffee daily (*P*=0.043), and consuming more than 10 cans of soft drinks weekly (*P*=0.001). Other variables like sex, age, marital status, academic year, academic achievement, study hours, monthly pocket income, working status, smoking status, and regular tea consumption have no significant associations with regular ED consumption.

Ninety percent of students who had never tried ED and 83.5% of nonregular users cited potential medical harms and side effects as the reason, 73.9% were satisfied with traditional caffeinated beverages such as coffee and tea for energy booster, while more than half of them do not know much about ED (56.9%) (Table 4).

Table 1

Sociodemographic and behavioral characteristics of the participants.

	<i>n</i> (%)
University	
University 1 (middle governorate)	169 (55)
University 2 (middle governorate)	66 (21.5)
University 3 (middle governorate)	18 (5.9)
University 4 (north governorate)	12 (3.9)
University 5 (north governorate)	21 (6.8)
University 6 (south governorate)	21 (6.8)
Academic year	
First year	25 (8.1)
Second year	49 (16)
Third year	56 (18.2)
Fourth year	36 (11.7)
Fifth year	76 (24.8)
Sixth year	65 (21.2)
Sex	
Male	142 (46.3)
Female	165 (53.7)
Marital status	
Single	299 (97.4)
Engaged	5 (1.6)
Married	3 (1)
Nationality	
Jordanian	267 (87)
Non-Jordanian, from Arab countries	35 (11.4)
Non-Jordanian, from non-Arab countries	5 (1.6)
Chronic medical illness	
No	289 (94.1)
Yes	18 (5.9)
Monthly pocket money (JD)	
< 50 JDs	47 (15.3)
50–100 JDs	95 (30.9)
100–150 JDs	75 (24.4)
150–200 JDs	53 (17.3)
> 200 JDs	37 (12.1)
Working alongside studies	
No	295 (96.1)
Yes	12 (3.9)
Whom do you live with?	
Alone	34 (11.1)
With family	253 (82.4)
With friends	20 (6.5)
GPA	
3 or below	59 (19.2)
above 3	172 (56)
Did not answer	76 (24.8)
Do you smoke? (Including hookah, cigarettes, and vape)	
No, I have never smoked	204 (66.4)
No, I am ex-smoker	15 (4.9)
Yes, occasionally	43 (14)
Yes, regularly	45 (14.7)
Do you drink alcohol?	
No	289 (94.1)
Yes	14 (4.6)
Prefer not to disclose	4 (1.3)
Do you drink coffee? How regularly?	
Rarely	79 (25.7)
Yes, occasionally	39 (12.7)
Yes, daily but less than 1 cup	28 (9.1)
Yes, daily 1–2 cups	93 (30.3)
Yes, daily 3–4 cups	49 (16)
Yes, daily > 4 cups	19 (6.2)

Table 1

(Continued)

	n (%)
Do you practice physical exercises on regular basis?	
No	203 (66.1)
Yes	104 (33.9)
Do you drink tea? How regularly?	
Rarely	60 (19.5)
Yes, occasionally	57 (18.6)
Yes, daily but less than 1 cup	44 (14.3)
Yes, daily 1–2 cups	91 (29.6)
Yes, daily 3–4 cups	31 (10.1)
Yes, daily > 4 cups	24 (7.8)
Do you drink soft drinks? How regularly?	
Rarely	87 (28.3)
Occasionally	94 (30.6)
Yes, <5 cans/week	76 (24.8)
Yes, 5–10 cans/week	37 (12.1)
Yes, > 10 cans/week	13 (4.2)
How many hours do you study per day?	
Less than 2 h	29 (9.4)
2–3 h	95 (30.9)
4–5 h	113 (36.8)
6 + h	70 (22.8)
When is the best time for you to study in most of the days?	
Does not matter	128 (41.7)
Daytime	97 (31.6)
At night	82 (26.7)
Have you ever consumed energy drinks?	
No	153 (49.8)
Yes	154 (50.2)
Total	307 (100)

Only 7.2% of them reported the intention to try consuming them, while 34.6% were not sure and may try them in the future. The intention to consume ED in the future among nonusers was higher among students who study 6 h or more daily ($P=0.011$), smoke regularly ($P=0.048$), and drink coffee on a daily basis ($P=0.001$).

As shown in Table 5, complaints reported significantly higher by students who regularly consume ED included daytime sleepiness ($P=0.001$), decreased concentration ($P=0.000$), fatigue ($P=0.003$), reduced performance ($P=0.000$), dizziness ($P=0.003$), headache ($P=0.006$), reduced appetite ($P=0.002$), and ‘sometimes’ muscle twitching ($P=0.004$).

Most students had knowledge that ED contain caffeine and sugar (94.5 and 93.8%, respectively), while only 40% knew that they contain amino acids, less than one-third knew that they contain B vitamins, and almost one-fourth knew that they contain herbal supplements, as shown in Table 6. The mean knowledge score about the harmful effects of ED was 10.54 (min. 0, max. 17, SD: 4.283), with no statistically significant difference observed using the independent samples test between students who had ever tried vs. who had never tried them ($P=0.228$) nor between students who consume them regularly or not ($P=0.554$).

Discussion

The present study investigated the patterns of ED consumption among medical students in Jordan and explored the factors associated with consumption as well as potential adverse effects.

Table 2

Patterns of ED consumption among medical students.

	n (%)
How many cans of energy drinks do you consume per week?	
I do not drink them regularly	97 (63.0)
1–2	20 (13.0)
3–4	18 (11.7)
5–6	12 (7.8)
7–10	6 (3.9)
> 10	1 (0.6)
What makes you consume energy drinks?	
To enhance mental performance	100 (64.9)
To stay awake at night	108 (70.1)
Insufficient sleep	65 (42.2)
Pleasant taste	78 (50.6)
To reduce fatigue	79 (51.3)
To improve mood	78 (50.6)
To quench thirst	37 (24.0)
Do you usually get the intended goal from their consumption?	
No, I do not get the intended goal in most of the times	30 (19.5)
Yes, sometimes	76 (49.4)
Yes, most of the times	48 (31.2)
Where do you usually drink energy drinks in most of the times?	
At social gatherings	23 (14.9)
At home	105 (68.2)
At university	23 (14.9)
At the gym	2 (1.3)
At work	1 (0.6)
The time of the day energy drinks are usually consumed	
First food in the morning	8 (5.2)
In the morning after breakfast	6 (3.9)
Afternoon	35 (22.7)
In the evening after dinner	43 (27.9)
Anytime	62 (40.3)
Do you consume energy drinks more than usual in the following situations?	
Times of exams	124 (80.5)
Practicing sports (like football, aerobics, etc.)	30 (19.5)
Other situations	30 (19.5)
At what age have you taken an energy drink for the first time?	
Less than 10 years	5 (3.2)
10–12 years	4 (2.6)
13–15 years	24 (15.6)
16–18 years	75 (48.7)
19–21 years	42 (27.3)
22 years or beyond	4 (2.6)
How did you know about energy drinks for the first time?	
Advertisement	38 (24.7)
From friends	71 (46.1)
Saw it in the supermarket and tried it	45 (29.2)
Do you consume Energy drinks regularly?	
No	109 (70.8)
Yes	45 (29.2)
Total	154 (100)

The findings provide valuable insights into the prevalence, motivations, knowledge, and health-related outcomes of ED consumption in this specific population.

Having ever consumed ED was reported by almost half of the sampled medical students in Jordan, a finding consistent with previous studies conducted in Saudi Arabia, Lebanon, Serbia, Pakistan, and Turkey^[1,5,24,26,30]. The majority of them were not regular consumers (70%), similar to the rate that was reported by other studies^[1,7,17]. Notably, a significant portion of ED users in

Table 3
Sociodemographic factors, behaviors, and their association with ED consumption among students who consume ED.

	Do you consume energy drinks regularly?		Total <i>n</i> (%)	<i>P</i>
	No <i>n</i> (%)	Yes <i>n</i> (%)		
Which university are you enrolled in?				0.021
University 1 (middle governorate)	61a (76.3)	19a (23.8)	80 (100)	
University 2 (middle governorate)	20a (58.8)	14a (41.2)	34 (100)	
University 3 (middle governorate)	11a (91.7)	1a (8.3)	12 (100)	
University 4 (north governorate)	5a (100)	0a (0)	5 (100)	
University 5 (north governorate)	9a (60)	6a (40)	15 (100)	
University 6 (south governorate)	3a (37.5)	5b (62.5)	8 (100)	
Which academic year are you currently enrolled in?				0.217
First year	7a (58.3)	5a (41.7)	12 (100)	
Second year	16a (69.6)	7a (30.4)	23 (100)	
Third year	18a (62.1)	11a (37.9)	29 (100)	
Fourth year	13a (76.5)	4a (23.5)	17 (100)	
Fifth year	27a (65.9)	14a (34.1)	41 (100)	
Sixth year	28a (87.5)	4b (12.5)	32 (100)	
GPA				0.199
3 or below	19a (61.3)	12a (38.7)	31 (100)	
above 3	64a (73.6)	23a (26.4)	87 (100)	
Basic vs. Clinical Years				0.122
Basic years	41a (64.1)	23a (35.9)	64 (100)	
Clinical years	68a (75.6)	22a (24.4)	90 (100)	
What is your sex?				0.179
Male	59a (75.6)	19a (24.4)	78 (100)	
Female	50a (65.8)	26a (34.2)	76 (100)	
What is your marital status?				0.291
Single	107a (71.3)	43a (28.7)	150 (100)	
Engaged	1a (100)	0a (0)	1 (100)	
Married	1a (33.3)	2a (66.7)	3 (100)	
What is your nationality?				0.28
Jordanian	96a (72.7)	36a (27.3)	132 (100)	
Non-Jordanian, from Arab countries	12a (57.1)	9a (42.9)	21 (100)	
Non-Jordanian, from non-Arab countries	1a (100)	0a (0)	1 (100)	
Do you have any chronic medical illness?				0.955
No	102a (70.8)	42a (29.2)	144 (100)	
Yes	7a (70)	3a (30)	10 (100)	
How many hours do you study per day?				0.613
Less than 2 h	12a (70.6)	5a (29.4)	17 (100)	
2–3 h	33a (64.7)	18a (35.3)	51 (100)	
4–5 h	42a (72.4)	16a (27.6)	58 (100)	
6+ h	22a (78.6)	6a (21.4)	28 (100)	
When is the best time for you to study in most of the days?				0.884
Does not matter	47a (72.3)	18a (27.7)	65 (100)	
Daytime	30a (71.4)	12a (28.6)	42 (100)	
At night	32a (68.1)	15a (31.9)	47 (100)	
Whom do you live with?				0.000
Alone	5a (29.4)	12b (70.6)	17 (100)	
With family	99a (77.3)	29b (22.7)	128 (100)	
With friends	5a (55.6)	4a (44.4)	9 (100)	
What is your monthly pocket money? (JD)				0.348
< 50 JDs	17a (73.9)	6a (26.1)	23 (100)	
50–100 JDs	38a (80.9)	9a (19.1)	47 (100)	
100–150 JDs	24a (66.7)	12a (33.3)	36 (100)	
150–200 JDs	15a (60)	10a (40)	25 (100)	
> 200 JDs	15a (65.2)	8a (34.8)	23 (100)	
Do you work alongside your studies?				0.073
No	105a (72.4)	40a (27.6)	145 (100)	
Yes	4a (44.4)	5a (55.6)	9 (100)	

Table 3
(Continued)

	Do you consume energy drinks regularly?			P
	No n (%)	Yes n (%)	Total n (%)	
Do you practice physical exercises on regular basis?				0.078
No	70a (76.1)	22a (23.9)	92 (100)	
Yes	39a (62.9)	23a (37.1)	62 (100)	
Do you smoke? (Including hookah, cigarettes, and vape)				0.057
No, I have never smoked	59a (75.6)	19a (24.4)	78 (100)	
No, I am ex-smoker	6a (60)	4a (40)	10 (100)	
Yes, occasionally	25a (80.6)	6a (19.4)	31 (100)	
Yes, regularly	19a (54.3)	16b (45.7)	35 (100)	
Do you drink alcohol?				0.049
No	102a (72.9)	38a (27.1)	140 (100)	
Yes	7a (58.3)	5a (41.7)	12 (100)	
Prefer not to disclose	0a (0)	2b (100)	2 (100)	
Do you drink coffee? How regularly?				0.043
Rarely or occasionally	40a (81.6)	9b (18.4)	49 (100)	
Daily	69a (65.7)	36b (34.3)	105 (100)	
Do you drink tea? How regularly?				0.149
Rarely or occasionally	45a (77.6)	13a (22.4)	58 (100)	
Daily	64a (66.7)	32a (33.3)	96 (100)	
Do you drink soft drinks (cola)? How regularly?				0.001
Rarely	30a (83.3)	6a (16.7)	36 (100)	
Occasionally	35a (81.4)	8a (18.6)	43 (100)	
Yes, <5 cans/week	26a (59.1)	18b (40.9)	44 (100)	
Yes, 5–10 cans/week	17a (70.8)	7a (29.2)	24 (100)	
Yes, > 10 cans/week	1a (14.3)	6b (85.7)	7 (100)	
Total	109 (70.8)	45 (29.2)	154 (100)	

our study and other similar studies^[6,29,30] reported increasing their consumption during exam periods, reflecting the perception that these beverages can enhance mental performance and help combat fatigue.

It is interesting to note that many students initiated their ED consumption during adolescence, particularly between the ages of 16–18, which goes in line with the results of other studies^[1,4,16], with peer influence playing a substantial role in their decision to try these beverages for the first time. Friends also

inspired students to try ED for the first time in studies from Saudi Arabia, Pakistan, and Bangladesh^[1,4,16,30]. This highlights the importance of social factors in shaping energy drink consumption behaviors among young individuals.

The reasons cited for ED consumption were multifaceted, with the desire to stay awake at night and enhance mental performance being prominent motivators (70.1 and 64.9%, respectively). Similar studies found also staying awake longer^[1,4,12–14,27–29] and improving mental performance^[1,6,7,27,29,30] as motivations for their consumption, which aligns with the expectation that medical students may turn to ED to enhance alertness and cognitive performance during periods of academic stress. Additionally, the pleasant taste of ED, aiming to reduce fatigue and improve mood were identified as significant factors influencing consumption by almost half of ED consumers. The pleasant taste was also reported as a reason for ED consumption by another study among Portuguese adolescents^[8]. However, it is worth noting that only a minority of ED users in our study reported consistently achieving their intended goals, suggesting that the perceived benefits may not always align with the actual effects experienced.

Among the students who had never tried ED, the most common reasons cited were concerns about potential medical harms and side effects (90%), as well as a preference for traditional caffeinated beverages like coffee and tea (73.9%), and not being in need for extra energy (71.9%). Previous studies also reported concerns about medical harms^[7,13,14] and lack of need for energy booster^[14] as common reasons for abstaining from ED.

Table 4
Reasons for ED consumption avoidance among ‘never used’ and ‘nonregular users’.

Reasons for not consuming ED	Never used	Nonregular users
	n (%)	n (%)
Potential medical harms and side effects	138 (90.2)	91 (83.5)
Their cost	34 (22.2)	37 (33.9)
I do not know much about them	87 (56.9)	40 (36.7)
There are no advantages for their use	101 (66)	53 (48.6)
Not in need for energy booster	110 (71.9)	63 (57.8)
Natural stimulants like coffee and tea are sufficient to boost my energy	113 (73.9)	81 (74.3)
Experienced side effects when used them	56 (36.6)	38 (34.9)
Unpleasant taste	54 (35.3)	25 (22.9)
Other reasons	32 (20.9)	
Total	153 (100)	109 (100)

Table 5
Health effects of ED use among medical students.

Do you have any of the following complaints?	Do you consume energy drinks regularly?		Total n (%)	P
	No n (%)	Yes n (%)		
Daytime sleepiness				0.001
Rarely	40a (36.7)	5b (11.1)	45 (29.2)	
Sometimes	43a (39.4)	17a (37.8)	60 (39)	
Most of the times	26a (23.9)	23b (51.1)	49 (31.8)	
Decreased concentrations				0.000
Rarely	37a (33.9)	3b (6.7)	40 (26)	
Sometimes	47a (43.1)	20a (44.4)	67 (43.5)	
Most of the times	25a (22.9)	22b (48.9)	47 (30.5)	
Fatigue				0.003
Rarely	46a (42.2)	7b (15.6)	53 (34.4)	
Sometimes	45a (41.3)	23a (51.1)	68 (44.2)	
Most of the times	18a (16.5)	15b (33.3)	33 (21.4)	
Reduced performance				0.000
Rarely	49a (45)	6b (13.3)	55 (35.7)	
Sometimes	49a (45)	28a (62.2)	77 (50)	
Most of the times	11a (10.1)	11b (24.4)	22 (14.3)	
Insomnia				0.051
Rarely	48a (44)	12b (26.7)	60 (39)	
Sometimes	45a (41.3)	20a (44.4)	65 (42.2)	
Most of the times	16a (14.7)	13b (28.9)	29 (18.8)	
Dizziness				0.003
Rarely	68a (62.4)	17b (37.8)	85 (55.2)	
Sometimes	28a (25.7)	13a (28.9)	41 (26.6)	
Most of the times	13a (11.9)	15b (33.3)	28 (18.2)	
Muscle twitching				0.004
Rarely	73a (67)	17b (37.8)	90 (58.4)	
Sometimes	23a (21.1)	18b (40)	41 (26.6)	
Most of the times	13a (11.9)	10a (22.2)	23 (14.9)	
Headache				0.006
Rarely	47a (43.1)	10b (22.2)	57 (37)	
Sometimes	44a (40.4)	18a (40)	62 (40.3)	
Most of the times	18a (16.5)	17b (37.8)	35 (22.7)	
Gastric upset				0.094
Rarely	50a (45.9)	14a (31.1)	64 (41.6)	
Sometimes	37a (33.9)	15a (33.3)	52 (33.8)	
Most of the times	22a (20.2)	16b (35.6)	38 (24.7)	
Reduced appetite				0.002
Rarely	66a (60.6)	14b (31.1)	80 (51.9)	
Sometimes	31a (28.4)	18a (40)	49 (31.8)	
Most of the times	12a (11)	13b (28.9)	25 (16.2)	
Polyuria				0.203
Rarely	67a (61.5)	22a (48.9)	89 (57.8)	
Sometimes	29a (26.6)	13a (28.9)	42 (27.3)	
Most of the times	13a (11.9)	10a (22.2)	23 (14.9)	
Total	109 (70.8)	45 (29.2)	154 (100)	

However, it is concerning that a considerable percentage of nonusers (34.6%) expressed uncertainty about whether they might try ED in the future. Factors such as studying for 6 h or more daily, regular smoking, and daily coffee consumption were associated with a higher intention to try ED. These findings suggest that a subset of nonusers may be at risk of transitioning to ED consumption in the future, highlighting the importance of ongoing education and prevention efforts.

Several factors were identified by the present study that were significantly associated with ED consumption, including being a

Table 6
Medical students' knowledge about ED contents.

Which of these substances do you think are contained in energy drinks?	No	Yes	I do not know	Total
	n (%)	n (%)	n (%)	n (%)
Caffeine	6 (2)	290 (94.5)	11 (3.6)	307 (100)
Sugar	8 (2.6)	288 (93.8)	11 (3.6)	
B Vitamins	81 (26.4)	90 (29.3)	136 (44.3)	
Amino acids	63 (20.5)	124 (40.4)	120 (39.1)	
Herbal supplements	83 (27)	81 (26.4)	143 (46.6)	

student at the university situated in the southern governorate of Jordan, living alone, consuming alcohol, coffee intake on daily basis, and high soft drink consumption. Several studies found associations between ED and alcohol consumption^[7,15,18], and regular coffee intake^[5,7]. Additionally, in the literature many students mix alcohol and ED together^[5,7,8,18,19,24]. Alcohol mixed with energy drinks (AMED) results in various opposing effects including diminished body sway, fatigue, and sedation caused by alcohol, coupled with heightened subjective alertness. This combination may contribute to elevated instances of binge-drinking, intoxication, reduced awareness of intoxication, dehydration, and the risk of alcohol poisoning^[33]. Some studies found also an association between ED consumption and the habit of smoking^[1,15-17]. Our study and a similar study^[7] conducted among medical students from the University of Palermo, Italy failed to show this association, but the intention to try ED in the future was significantly more common among our students who smoke regularly.

The public university located in the southern governorate of Jordan houses the sole medical school in that region. Most students attending this college come from other Jordanian cities, so they live in student housing away from their families, and it was shown by the findings of our study and a similar study among medical students at Marmara University in Istanbul, Turkey^[18] that living away from the families had a significant association with ED use, which can explain why students of this university had significantly higher rate of ED consumption. These associations provide valuable insights into the demographic and behavioral characteristics of students at increased risk of regular ED consumption, which can inform the development of targeted prevention strategies.

Age, sex, academic year, and academic achievement were not significantly associated with ED consumption, similar to the findings of a study among medical students at Al Taif University, KSA^[11]. Also the lack of sex differences in ED consumption was reported in the literature^[23,34].

Students who reported regular ED consumption were significantly more likely to experience various complaints including daytime sleepiness, decreased concentration, fatigue, reduced performance, and various physical symptoms; mainly dizziness, muscle twitching, headache, and reduced appetite. Similar studies reported adverse effects such as nervousness^[6], irritability^[7], anxiety^[8,9], insomnia^[1,6-11], tremors^[6,10,12], fatigue^[13], headaches^[6,9,10], stomach upset^[6,10], abdominal pain^[9,10], constipation^[9], palpitations^[1,6,7,11,12,14], dizziness^[9], flushing^[10], and increased micturition^[1,10]. Noteworthy, even though most sampled students who reported regular ED consumption

mentioned increased energy and mental performance as the main motive to use ED, they reported reduced performance, daytime sleepiness, fatigue, and decreased concentration as perceived adverse effects of ED use. This is supported by the results of studies that revealed a significant association between ED consumption and poor academic performance^[18,35]. These findings suggest a potential link between regular ED consumption and adverse health outcomes, which warrants further investigation and underscores the importance of monitoring and addressing potential health risks associated with ED.

The study found that most students had knowledge that EDs contain caffeine and sugar. However, awareness about other components, such as amino acids and B vitamins, was less prevalent. This finding is consistent with previous studies conducted in Saudi Arabia, Nigeria, and Turkey, which reported inadequate knowledge among medical students regarding ED^[18,23,25]. This knowledge gap suggests the need for educational campaigns that provide comprehensive information about the composition and potential health effects of ED, especially among medical students who are doctors-to-be and expected to have adequate knowledge on health issues related to ED use, as well as to educate the public about that. It is noteworthy that the mean knowledge score about the harmful effects of ED did not significantly differ between students who had ever tried ED and those who had never tried them, nor between regular and nonregular consumers, a finding that was reported by similar studies among medical students^[18,34]. This suggests that knowledge alone may not be sufficient to deter ED consumption and highlights the importance of targeted interventions aimed at changing attitudes and behaviors.

Media and healthcare providers, particularly family physicians play an essential role in educating the public as well as medical students and teenagers about the health effects of ED. It is important also to convey messages about healthy behaviors to enhance energy and productivity among this vulnerable population.

Limitations

While the study provides valuable insights into the prevalence, attitudes, and factors associated with energy drink consumption among medical students in Jordan, there are several limitations that should be considered when interpreting the results. First, the study relied on self-reported data, which is subject to recall bias and social desirability bias. Second, the study was conducted in only six medical schools in Jordan, which limits the generalizability of the findings to other populations. Third, it is important to acknowledge the paucity of sensitivity analyses, which means that the generalizability of our findings may be influenced by unexplored factors or assumptions. Finally, the representativeness of the sample is also a potential limitation, as half of the participants were from one university, and the number of responses was limited because of the tight time frame of the study. Despite these limitations, this study contributes to our understanding of energy drink consumption practices among medical students and highlights the need for interventions to promote healthy behaviors in this population.

Conclusion

In conclusion, this study sheds light on the prevalence, attitudes, and factors associated with energy drink consumption among medical students in Jordan. The findings indicate that energy drink consumption is common among this population, with mental performance enhancement being the main motivation for their use. However, a significant proportion of students expressed concerns about the potential medical harms and side effects associated with ED, and ED consumers reported significant physical symptoms attributed to their use.

Sociodemographic and behavioral factors associated with ED consumption should be considered and tackled by interventions to promote healthy behaviors and raise awareness among medical students about the potential harms of energy drink use. Future studies could evaluate the impact of long-term use of ED and identify effective strategies to reduce ED consumption to mitigate the associated negative health effects.

Ethical approval

Ethical approval for this study was obtained from the Institutional Review Board committee of the Hashemite University on 16 January 2023 (No: 2300033).

Consent

This cross-sectional study was performed using a questionnaire that was distributed electronically through social media platforms such as Facebook and WhatsApp groups. A participant's informed consent was integrated at the commencement of the questionnaire.

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Author contribution

N.W.Q.: study design, data analysis and interpretation, manuscript writing, and editing; O.M.Al-o.: manuscript editing; Z.M. A.A.: study design, data collection, data analysis, and manuscript writing; N.M.A.: study design, data collection, and manuscript writing; M.M.A.: study design, data collection, data analysis, and manuscript writing; A.N.K.: study design, data collection, and manuscript writing; M.H.H.: study design, data collection, and manuscript writing; R.A.H.: study design, data collection, and manuscript writing.

Conflicts of interest declarations

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Data availability statement

Datasets generated and analyzed during the current study are available upon reasonable request.

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