



Research Article:

Energy Drinks: knowledge and Practice Among Non-Medical University Students

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Abstract

Background: Despite their adverse impacts on human health, energy drinks (EDs) are becoming more and more popular, especially among young adults, due in part to the advertisement campaigns of manufacturing companies. This study aims at assessing the consumption practice of EDs among students at non-medical colleges along with their knowledge about EDs. **Methods:** The study design was cross-sectional in which an online questionnaire was distributed among students at non-medical colleges at the University of Mosul. The questionnaire included questions about knowledge and the practice of consumption of EDs in participants. The collected data were analyzed and presented as frequencies and percentages, in addition to assessing the correlation between knowledge and various characteristics of the students. **Results:** A total of 1039 students completed the questionnaire, more than one-third were in the 4th year. More than 80% of the participants knew what EDs were but only 30% were knowledgeable about their ingredients. Although the majority were aware that EDs have negative effects, only 45% knew that EDs cause insomnia. More than 70% of the students did not drink EDs, and among those who admitted drinking, one-third declared consuming 1-3 times monthly and more than two-thirds preferred sugar containing products. Helping to study was the main motive behind drinking as reported by the students while disliking EDs was the main reason given by those students who do not consume EDs. Gender, weekly income and being a consumer of EDs were found to have significant effects on the knowledge of the students. **Conclusions:** The level of knowledge was found to be low, which necessitates increasing the awareness of the public through official campaigns and warning labels on EDs.

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1. Introduction

Beverages and drinks advertised as “energy drinks” contain different stimulants and are mainly marketed for the purpose of stimulating mental and physical functions of their consumers (1). Increased energy, improved sport performance and alertness are the main attractive points for energy drinks (EDs) consumers (2,3).

The first introduction of “Red Bull” was in April 1987 and this was followed by appealing advertisements to spread EDs all over the world. EDs gained popularity recently and

especially among young adults and adolescents (3,4). EDs are caffeinated drinks which contain large amounts of sugars, carbohydrates, stimulants and other supplements (5). Ingredients like taurine, vitamin B combinations and herbal products are added to EDs to serve as energy enhancers (6).

Increased popularity, excessive consumption and rapid spread of EDs among young adults had negatively affected the individuals’ health and wellbeing (7). There are many concerns regarding the safety of EDs consumption, and different side effects are reported that affect many organs and body systems (8,9). Many studies (3,10–12) reported palpitation, tremor, insomnia, agitation, increased blood pressure, obesity, gastric upset and peptic ulcer as adverse effects of increased caffeine and EDs consumption. In a study conducted by Milazzo et al. (13) on Air Force personnel, about one percent of EDs consumers stated that

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they needed seeing a doctor or going to hospital due to side effects they were suffering as a result of EDs consumption.

With all these documented adverse effects, high consumption rates among the younger population and the huge advertisement campaigns of the ED companies, knowledge and awareness of the population about the risks of EDs is crucial (14).

The present study aimed to evaluate the awareness regarding EDs intake and their consumption in a sample of non-medical students at the University of Mosul in Mosul, Iraq.

2. Methods

A cross-sectional study was conducted among non-medical university students to assess students' knowledge and consumption practice regarding EDs. An online self-administered questionnaire was distributed among the students from 13 to 20, October 2022. The present study was focusing on students studying at non-medical colleges in the University of Mosul and this was the criterion for the students to be included in the study. The participation in the current study was completely voluntary and this was cleared in detail to the participants on the front page of the questionnaire, which also included a description of the study and its aim.

The questionnaire was adapted from different published questionnaires (15–17). A three-page Google Form questionnaire was distributed online through social networking groups among students in different non-medical colleges at the University of Mosul. The first page consisted of questions to collect information about age, sex, home location and other personal characteristics of the participants. The second page contained questions to

evaluate students' knowledge about energy drinks (EDs ingredients, effects and other). The last page was used to assess EDs consuming patterns among students and to check students' motives to drink or to avoid EDs. Details of the questions on each page are presented in the Results section.

Total EDs knowledge score was calculated by collecting the correct answers for the questions in the knowledge section, by giving one mark for each correct answer and zero mark for incorrect answers. Because the knowledge section consisted of 18 questions, the total EDs knowledge score could have varied between zero and eighteen. Depending on the total EDs knowledge score students were grouped into 2 groups, those having sufficient knowledge and those with insufficient knowledge (median split method was used for this purpose (18)).

Data from the completed questionnaires was cleaned and processed by using Microsoft Excel. The final statistical analysis was performed by using SPSS, version 28. *P*-value less than or equal to 0.05 was considered as indicator for the significance of the results.

3. Results

A total of 1039 students from non-medical colleges participated in this study, with the majority (88.9%) being aged between 21 and 23 years. Female students were more than males in this study (59% females and 41% males) and 4th class students were ranked first compared to other year groups. Slightly more than one-third of the sample admitted sleeping for more than 8 hours. **Table 1** summarizes these socio-demographic characteristics of the study sample.

Table 1. Socio-demographic characteristics of the participants

Variables (N=1039)	Frequency (%)
Age Group	
Between 18 and 20 years	52 (5.0)
Between 21 and 23 years	924 (88.9)
More than 23 years	63 (6.1)
Sex	
Male	426 (41.0)
Female	613 (59.0)
Home Location	
Within the city	785 (75.6)
Countryside	254 (24.4)
Class	
1 st class	161 (15.5)
2 nd class	192 (18.5)
3 rd class	302 (29.0)
4 th class	384 (37.0)
Weekly Salary	
Less than 20 USD	661 (63.6)
Between 20 and 35 USD	268 (25.8)
More than 35 USD	110 (10.6)
Sleeping Pattern	
Regular (continuous sleeping during night)	408 (39.3)
Irregular (intermittent sleeping during night)	631 (60.7)
Sleeping Duration	
Less than or equal to 8 hours per night	671 (64.6)
More than 8 hours per night	368 (35.4)

The majority of respondents (83.3%) knew what energy drinks are but less than half of them were aware that EDs contain caffeine (43%) or that they could help staying awake (45.8%). Interestingly, 86.5% of the students recognized that EDs cannot improve mood. Most of the participating

students (92.6%) admitted to knowing that EDs could have harmful effects on the body. These and the other responses of the students to the questions in the knowledge section of the questionnaire are presented in **Table 2** along with the correct answer for each question.

Table 2. Responses of the participants to questions in the knowledge section

Q	Items (N=1039)	Answers	
		Yes n (%)	No n (%)
Q1	Knowing EDs	865 (83.3) ^a	174 (16.7)
Q2	Knowing the ingredients of EDs	310 (29.8) ^a	729 (70.2)
Q3	Caffeine is constituent of EDs	447 (43.0) ^a	592 (57.0)
Q4	Taurine is constituent of EDs	131 (12.6) ^a	908 (87.4)
Q5	Sugar is constituent of EDs	472 (45.4) ^a	567 (54.6)
Q6	Ginkgo biloba is constituent of EDs	52 (5.0) ^a	987 (95.0)
Q7	Vitamins are constituents of EDs	154 (14.8) ^a	885 (85.2)
Q8	Physical performance enhanced by EDs	332 (32.0) ^a	707 (68.0)
Q9	Focus/studying ability improved by EDs	211 (20.3) ^a	828 (79.7)
Q10	Staying awake is an effect of EDs	476 (45.8) ^a	563 (54.2)
Q11	Weight gain can result from EDs	214 (20.6) ^a	825 (79.4)
Q12	Metabolism stimulated by EDs	41 (3.9) ^a	998 (96.1)
Q13	Mood improved by EDs	140 (13.5)	899 (86.5) ^a
Q14	EDs could produce other effects	240 (23.1) ^a	799 (76.9)
Q15	Harmful effects could result from EDs	962 (92.6) ^a	77 (7.4)
Q16	Blood pressure elevated by EDs	728 (70.1) ^a	311 (29.9)
Q17	Blood sugar affected by EDs	917 (88.3) ^a	122 (11.7)
Q18	Heart rate affected by EDs	907 (87.3) ^a	132 (12.7)

^a correct answer

Only 28% of the participating students in this study acknowledged practicing the habit of drinking EDs. Of those students who drink EDs (291 students), only 12.7% would

consume EDs every day. More than one-third (36.4%) of the students prefer drinking EDs at nighttime and 45.8% favor Tiger over other brands of EDs (**Table 3**).

Table 3. Responses of the participants to the questions in the practice section

Items	Frequency (%)
Drinking EDs (N=1039)	
Yes	291 (28.0)
No	748 (72.0)
Drinking frequency (N=291)	
Every day	37 (12.7)
More than once every week	84 (28.9)
Once every week	73 (25.1)
1 to 3 times per month	97 (33.3)
Number of cans used per month (N=291)	
More than 20 cans	21 (7.2)
10 – 20 cans	32 (11.0)
5 – 10 cans	65 (22.3)
Less than 5 cans	173 (59.5)
Time of the day to drink EDs (N=291)	
Anytime	138 (47.4)
With meals	21 (7.2)
At night	106 (36.4)
At morning	26 (8.9)
Preferred sugar content (N=291)	
Sugar drinks	208 (71.5)
Sugar-free drinks	83 (28.5)
Preferred EDs brand (N=291)	
Monster Energy	26 (8.9)
Tiger	133 (45.8)
Red Bull	87 (29.9)
Smart	17 (5.8)
Other	28 (9.6)
Reasons for choosing ED brand (N=291)	
Taste	153 (52.6)
Effect	91 (31.3)
Price	16 (5.5)
Other	31 (10.7)

Helping with studying and staying awake were recorded as the main reasons for drinking EDs in this study just behind “no specific reason” (Figure 1). Only 31% of the consuming students reported experiencing side effects from

drinking EDs (Figure 2). Insomnia, palpitation, nervousness and anxiety were the most common reported side effects while chest pain and sweating were the least reported (Figure 3).

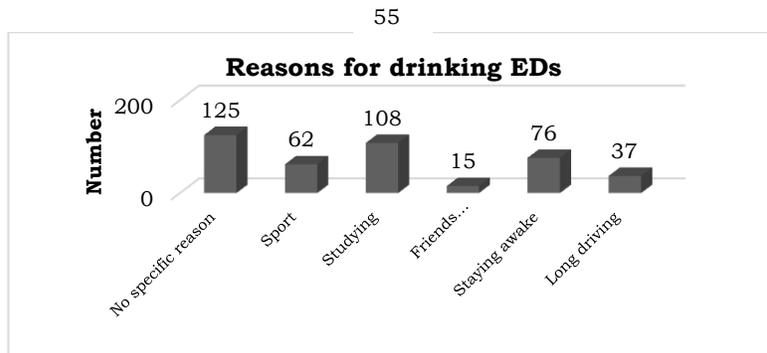


Figure 1. Reasons stated by the students for drinking EDs (more than one answer was permitted per participant)

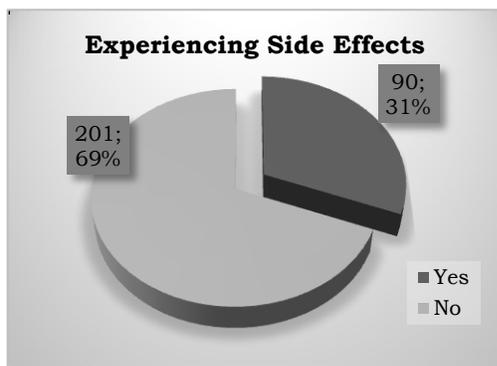


Figure 2. Students who experienced side effects from EDs

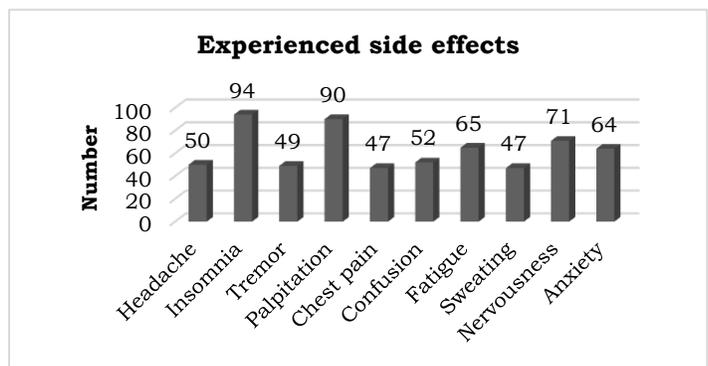


Figure 3. Individual side effects experienced by students from EDs

Figure 4 shows the reason given by those students who reported not using EDs in this work. Not liking the taste and

knowing the side effects came first while experiencing the side effects came last.

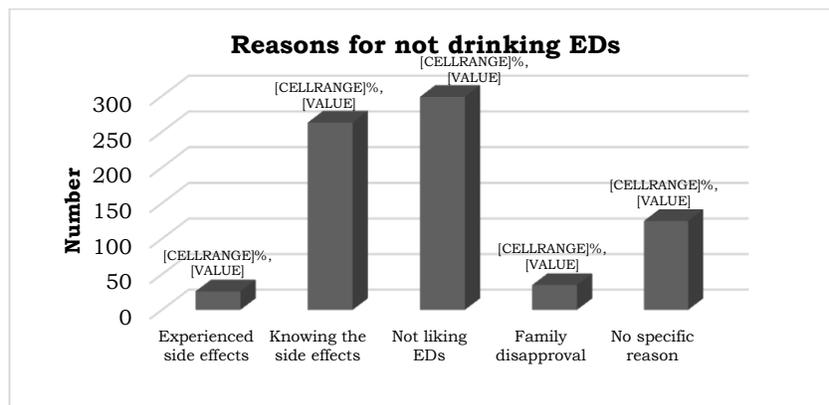


Figure 4. Reasons stated by the participants who did not drink EDs (bars are labeled by percentage, number)

The total EDs knowledge score for the students ranged between 1 and 17 with mean ± SD of 7.31 ± 2.62, and a

median of 7. According to the median split method, those students who scored higher than the median were

considered to have sufficient knowledge, and they constituted less than half of the sample (42.1%) as shown in

Table 4.**Table 4.** Distribution of students according to their level of knowledge of EDs.

Knowledge level	N (%)
Insufficient knowledge	602 (57.9)
Sufficient knowledge	437 (42.1)

Male students had significantly higher mean knowledge score than females, and those students with weekly income between 20 and 35 USD had significantly higher knowledge score than the other income groups. Consuming EDs was associated with significantly higher knowledge scores, while in the group of students who reported not drinking EDs, those who chose experiencing side effects previously as their reason not to drink had the highest mean knowledge scores (**Table 5**).

Table 5. Total knowledge score differences among the socio-demographic groups of the participants

Variable	Knowledge score	
	Mean (SD)	P-value
N = 1039		
Age Group¹		0.169
Between 18 and 20 years	7.96 (2.77)	
Between 21 and 23 years	7.27 (2.63)	
More than 23 years	7.43 (2.22)	
Sex²		< 0.001^s
Male	7.78 (2.68)	
Female	6.99 (2.52)	
Home location²		0.300
Within the city	7.36 (2.64)	
Countryside	7.17 (2.55)	
Class¹		0.334
1 st class	7.09 (2.59)	
2 nd class	7.11 (2.58)	
3 rd class	7.42 (2.68)	
4 th class	7.42 (2.59)	
Weekly Salary¹		0.039^s
Less than 20 USD	7.16 (2.65)	
Between 20 and 35 USD	7.59 (2.53)	
More than 35 USD	7.58 (2.61)	
Sleeping Pattern²		0.085
Regular	7.49 (2.77)	
Irregular	7.20 (2.51)	
Sleeping Duration²		0.612
Less than or equal to 8 hours	7.28 (2.64)	
More than 8 hours	7.37 (2.57)	
Drink EDs²		< 0.001^s
Yes	8.05 (2.76)	
No	7.03 (2.50)	
N = 291		
Drinking frequency¹		0.154
Every day	8.30 (2.89)	
More than once every week	8.37 (2.52)	
Once every week	7.42 (2.85)	
1 to 3 times per month	8.14 (2.81)	
N = 748		
Reasons not to drink¹		< 0.001^s
Side effects experienced	8.46 (2.47)	
Side effects knowledge	7.63 (2.50)	
Not liking EDs	6.90 (2.43)	
Family objection	7.40 (2.27)	
Others	5.66 (2.14)	

¹One-Way ANOVA, ²Independent_Samples T test, ^sSignificant results

4. Discussion

This study was conducted with the aim of assessing the level of knowledge of energy drinks among the students at non-medical colleges along with their practices with regard to these products. This segment of the society was targeted because most of the advertising campaigns of EDs are directed to the youth (19) claiming that EDs can enhance physical performance and sporting ability in addition to increasing focus and concentration for studying. Such campaigns deliberately fail to mention that EDs contain ingredients that could have harmful effects on the body and therefore studies like this are necessary.

The sample size in this study was significantly higher than that in a Polish study (16) which only included 131 students and higher than in an Italian study (15). Although there was a difference in the distribution of our responding students from different year groups in the non-medical colleges, the percentages in this study could be considered within the same range especially when compared to the Polish study where 1st year alone constituted about 70% of the studied sample. The rather similar distribution of year groups in this study could help in generalizing its results and recommendation to all university students. The difference between the percentages of the 1st year group and the 18-20 years old group could be due to the fact that the city of Mosul was occupied for 3 years by terrorist groups and many young people lost this period from their school years, putting older students in lower year groups in colleges.

Even though a significant fraction of the studied sample in this work admitted to knowing what EDs are, the proportion of those knowing the ingredients was rather low (about 30%), especially when compared to the Polish study (16) or the Italian study (15) where 78.6% and 75% respectively knew EDs' constituents. The same applies for the physiological effects of EDs where the knowledge of students in this study was lower than that in the Polish or Italian study. This difference in the knowledge could be attributed to the fact that the students in the two European studies were from medical colleges and that they study EDs in their curriculum.

The high percentage of students knowing what EDs are but with less knowledge about their ingredients or effects could be explained that those students have heard previously about EDs but did not bother to understand what they are and how they affect the body exactly. Also, the effect of this question on the total knowledge is negligible being only one question out of the 18 items which contributed to the total knowledge score. This negligible effect is confirmed by the higher proportion of students with inadequate than those with adequate knowledge.

The percentage of EDs consumers in this study was much lower than that in a study conducted in Kuwait (20) in which 58.3% of the young adult sample were drinking EDs. Such difference in consumption could be the result of the higher living standards and income of the Kuwaiti population compared to the Iraqi students, especially when about two-thirds of our participating students were spending less than 20 USD weekly. Nighttime consumption was very common in this study and is much higher than the 0% nighttime consumers in a Saudi study (3) which also surveyed non-medical students. The higher consumption at night may be due to gatherings with friends in cafes at this

time and to the low level of knowledge recorded among our participants.

Having no specific reason was the most reported option for the question regarding the motivation behind drinking EDs in this study. This reason was not that popular in the Saudi study (3) in which "to keep friends company" was the most preferred reason, and consuming EDs as study aids was not that popular in the Saudi study. Liking the taste was the most chosen reason the Kuwait study whereas drinking EDs while studying was not common as well (20).

The reasons reported by students who do not consume EDs in this study came similar to those in the Italian study (15), where not liking the taste and knowing the side effects were the most common. A similar pattern for reasons presented by students for not drinking EDs was also observed in the Kuwaiti study (20).

With the low level of general knowledge regarding EDs and their effects, warning labels should be applied to these products before marketing in order to increase awareness of the society about harmful effects of the beverages and to give attention that these products are not suitable for patients with diabetes, hypertension, heart diseases, pregnant women and those below 18 years of age (20,21).

5. Conclusions

The popularity of energy drinks is increasing substantially, especially among the younger generation. Such an increase in consumption is not associated with proper knowledge regarding the effects of these beverages on health as demonstrated in this work. It was found that the general knowledge of the younger population regarding EDs is low, despite the finding that the knowledge is better among those who drink EDs. This should advise in favor of adding warning labels to these beverages and controlling their distribution.

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7. Conflict Of Interest

There is no conflict of interest.

8. References

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مشروبات الطاقة: المعرفة والممارسة بين طلاب الجامعة في الكليات الغير طبية

الخلاصة

الخلفية: على الرغم من الآثار السلبية لمشروبات الطاقة على صحة الإنسان فقد أصبحت أكثر شيوعاً ، خاصة بين الشباب ، ويرجع ذلك جزئياً إلى الحملات الإعلانية لشركات التصنيع. تهدف هذه الدراسة إلى تقييم ممارسة استهلاك مشروبات الطاقة بين الطلاب في الكليات غير الطبية مع تقييم معرفتهم حولها. **طرق العمل:** كان تصميم الدراسة مقطعيًا حيث تم توزيع استبيان عبر الإنترنت على طلاب الكليات غير الطبية في جامعة الموصل. تضمن الاستبيان أسئلة حول المعرفة وممارسة استهلاك مشروبات الطاقة في المشاركين. تم تحليل البيانات المجمعة وعرضها على شكل تكرارات ونسب مئوية ، بالإضافة إلى تقييم الارتباط بين المعرفة والخصائص المختلفة للطلاب. **النتائج:** أكمل ما مجموعه 1039 طالبًا الاستبيان ، وكان أكثر من ثلثهم في السنة الرابعة. كان أكثر من 80% من المشاركين يعرفون ماهية مشروبات الطاقة ولكن 30% فقط كانوا على دراية بمكوناتهم. على الرغم من أن الغالبية كانوا على دراية بأن مشروبات الطاقة لها آثار سلبية ، إلا أن 45% فقط عرفوا أنها قد تسبب الأرق. أكثر من 70% من الطلاب لم يشربوا مشروبات الطاقة، ومن بين أولئك الذين أقر بشربهم لمشروبات الطاقة أعلن الثلث أنهم يستهلكون 1-3 مرات شهرياً وأكثر من الثلثين يفضلون المنتجات المحتوية على السكر. المساعدة في الدراسة هي الدافع الرئيسي وراء استخدام مشروبات الطاقة كما أفاد الطلاب بينما كان عدم رغبتهم في مشروبات الطاقة هو السبب الرئيسي الذي قدمه الطلاب الذين لا يستهلكون. كما وجد أن الجنس والدخل الأسبوعي وكونك مستهلكاً لمشروبات الطاقة لها تأثير كبير على معرفة الطلاب. **الاستنتاجات:** وجد أن مستوى المعرفة منخفض بين الطلاب مما يستلزم زيادة وعي الجمهور من خلال الحملات الرسمية وعلامات التحذير على مشروبات الطاقة.

الكلمات المفتاحية: طلاب المجموعة الغير الطبية ، مشروبات الطاقة ، المعرفة والممارسة