

ORIGINAL ARTICLE

Knowledge, Attitudes, and Behaviors of Faculty of Medical Students on Energy Drinks

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Main Points

- It has been observed that male students use EDs more than female students.
- There was a significantly prevalent opinion that EDs increased sports and mental performance among the students.
- The most common reason for consuming EDs among our participants was for trial purposes.
- It is noteworthy that EDs consumption increases as the level of parental education increases.
- It has been revealed that students have a serious lack of knowledge about EDs.

Abstract

This study aimed to determine the knowledge, attitudes, and behaviors of medical faculty students regarding energy drinks, which are consumed frequently and have various health consequences. The study was conducted with 397 students between May 1 and May 31, 2021. A questionnaire consisting of four parts prepared by the researchers was administered to the students online using Google Forms. The questionnaire was designed to reveal students' sociodemographic characteristics, smoking and alcohol use, and knowledge, attitudes, and behaviors regarding energy drinks. Data analysis was performed with the Statistical Package for the Social Sciences 20.0 package program, and values of $p < .05$ were considered statistically significant. The average age of participants was 21.22 ± 3.12 years, and it was found that 234 (58.9%) of the students had consumed energy drinks, while 163 (41.1%) had not. Eighty-three (35.5%) of the students consuming energy drinks and 47 (28.8%) of those not consuming energy drinks stated that they knew the contents of such beverages ($p = .104$). Our study thus revealed that a significant percentage of students had experience with energy drinks. There is an opinion among students that the consumption of energy drinks increases sports performance. At the same time, it was seen that the students had a serious lack of knowledge about energy drinks.

Key words: Alcoholic beverages, caffeine, energy drinks, habits, medical students

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Introduction

Energy drinks (EDs) generally contain water, caffeine, carbohydrates (glucose, maltodextrin, and sucrose), taurine, glucuronolactone, L-carnitine, vitamins (B group vitamins and vitamin C), minerals, electrolytes (sodium, potassium, and phosphorus), and plant extracts (guarana, yerba mate,

ginseng, and ginkgo biloba) and are non-alcoholic beverages (Ghosh, 2015; Zucconi et al., 2013). Energy drinks appeared in Austria in 1987 and in the United States in 1997 and spread rapidly around the world (Seifert et al., 2011). It has been reported that they are now available in more than 140 countries, and the consumer targets of these beverages are children, teenagers, and young adults

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(Seifert et al., 2011). As a marketing strategy, ED brands argue that they provide instant energy, reduce fatigue, and improve performance. It has been determined that adolescents commonly use energy drinks. In addition, individuals who are active in sports use EDs to increase their sports performance and students use energy drinks to increase their academic performance during exam periods (Al & Elshatarat, 2017; Kopacz et al., 2013; Musaiger & Zagzoog, 2013).

Studies have found the rate of ED consumption among university students to be between 51.9% and 81.4% (Borlu et al., 2019; Buxton & Hagan, 2012; Marczynski, 2011; Usman et al., 2015). In a study conducted by the European Food Safety Commission in 16 European Union member countries in 2011, the frequency of ED consumption (at least once in the last 1-year period) was determined as 68% in the age group of 10 – 18, 30% over the age of 18, and 18% under the age of 10 (Zucconi et al., 2013). It was determined that there is regular consumption of EDs at the rate of 28% in the age group of 12 – 14 and 34% in the age group of 18 – 24 in the United States (Seifert et al., 2011). A study conducted in Italy reported that the use of EDs by adolescents increased significantly from 17.8% in the sixth grade to 56.2% in the eighth grade (Gallimberti et al., 2013).

In Turkey, the Ministry of Agriculture and Rural Affairs defined EDs as beverages that provide energy to the human body due to their carbohydrate contents and that may contain vitamins, minerals, and other compounds, the limits of which are determined by specific product properties. Maximum limits are caffeine of 150 mg/L, taurine of 800 mg/L, glucuronolactone of 20 mg/L, and inositol of 100 mg/L (Tarım ve Köyişleri Bakanlığı, 2021).

The American Pediatric Association recommends not exceeding 100 mg of caffeine per day in the age group of 12 – 18 years (Centers for Disease Control and Prevention, 2021). The negative effects of EDs on health are due to the substances they contain and particularly, excessive quantities of caffeine. Excessive caffeine intake increases the risk of palpitations, hypertension, central nervous system stimulation, nausea, vomiting, metabolic acidosis, and convulsions (World Health Organization, 2021). The high sugar contents of EDs have been identified as a risk factor for obesity, and the acidic pH is a risk factor for dental (De Sanctis et al., 2017; Pinto et al., 2013). In addition, frequent consumption of EDs was associated with behavioral problems such as substance abuse, fighting, bullying others, smoking, and drinking alcohol (Holubcikova et al., 2017).

According to national data from the United States, 10,068 cases of admission to the emergency department in 2007 and 20,783 cases in 2011 were due to EDs (Mattson, 2013). In addition, the American national poisoning hotline was called 4854 times for reasons related to EDs in the 1-year period of 2010 – 2011 (Mattson, 2013). In this study, we aimed to determine the knowledge, attitudes, and behaviors of medical school students regarding EDs, which are frequently consumed and have various consequences for health.

Methods

This study was carried out with the cooperation of Kahramanmaraş Sütçü İmam University and Gaziantep University Faculty of Medicine students in Kahramanmaraş and Gaziantep provinces

between May 1 and May 31, 2021. Students from these schools in all years of study, from the first through the sixth year, were eligible to be included in the research. The universe of our study consists of Kahramanmaraş Sütçü İmam and Gaziantep medical school students of 2534. When the sample size is calculated based on 50% frequency for cases where the prevalence is not known, it turns out to be 334 with a 5% margin of error and a 95% CI. The aim is to reach 367 people by considering the possible losses for various reasons. Permission was obtained from the Dean's Office of the Faculty of Medicine, and the representatives of the semester and the student's contact information were reached. The students were informed about the study, and 397 students who gave their consent were included.

The questionnaire prepared by the researchers, consisting of four parts, was administered to the students online via Google Forms. The first part included some questions to determine the sociodemographic characteristics of the students (age, gender, year of study, parental education levels). In the second part, questions were asked about smoking and alcohol use. In the third part, statements about EDs were included, which were prepared from the available literature. Answers to these statements were scored on a 3-point Likert-type scale ("I agree," "I do not agree," "I have no idea"). The final part of the questionnaire included questions designed to reveal attitudes and behaviors regarding EDs.

Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences 20.0 program (IBM SPSS Corp., Armonk, NY, USA). In the analysis of the data, frequency, mean, and standard deviation values were determined. Values of $p < 0.05$ were considered statistically significant. The compatibility of the variables with normal distribution was evaluated with the Kolmogorov – Smirnov test. The Student's t and Mann – Whitney U tests were used to reveal the differences between two groups.

Permission for this study was obtained from the Kahramanmaraş Sütçü İmam University Faculty of Medicine's Scientific Research Ethics Committee (date: January 22, 2021, number: 04) following the Declaration of Helsinki (Seoul 2008). Necessary permission was also obtained from the deans of Kahramanmaraş Sütçü İmam University and Gaziantep University Faculty of Medicine.

Results

The mean age of the participants was 21.22 ± 3.12 years (median: 20.0; min – max: 18 – 46) and 229 (57.7%) were female, while 168 (42.3%) were male. Furthermore, 136 students (34.3%) were in the first year of their studies, 65 (16.4%) were in their second year, and 65 (16.4%) were in their third year. It was determined that 66 (16.6%) of them smoked cigarettes and 69 (17.4%) consumed alcohol. The sociodemographic data of the students are presented in Table 1.

It was determined that 234 (58.9%) students had consumed EDs before and 163 (41.1%) of them had not consumed EDs. In the last 15 days, 11 (4.7%) ED users stated that they had consumed EDs once, 7 (3.0%) stated as twice, and 2 (0.9%) stated three or more times. As locations for ED consumption, 109 (46.6%) ED users reported drinking the beverages at home and 65 (27.8%) in cafes. As for ED consumption times, 104 (44.4%) reported any

Table 1.
Students' Sociodemographic Data and Its Relation to ED Use Case

Parameter	Variable	n (%)	ED Users, n (%)	ED Non-users, n (%)	p
Age	18	50 (12.6)	30 (60)	20 (40)	.345*
	19	60 (15.1)	37 (61.7)	23 (38.3)	
	20	89 (22.4)	53 (59.6)	36 (40.4)	
	21	44 (11.1)	21 (47.7)	23 (52.3)	
	22	53 (13.4)	27 (50.9)	26 (49.1)	
	23 and above	101 (25.4)	66 (65.3)	35 (34.7)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Gender	Male	168 (42.3)	130 (77.4)	38 (22.6)	<.001*
	Female	229 (57.7)	104 (45.4)	125 (54.6)	
	Total	397 (100)	234 (58.9)	163 (41.1)	
Class/grade	1.	136 (34.3)	82 (60.3)	54 (39.7)	.757*
	2.	65 (16.4)	35 (53.8)	30 (46.2)	
	3.	65 (16.4)	38 (58.5)	27 (41.5)	
	4.	45 (11.3)	28 (62.2)	17 (37.8)	
	5.	52 (13.1)	28 (53.8)	24 (46.2)	
	6.	34 (8.6)	23 (67.6)	11 (32.4)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Habitation	Family	228 (57.4)	127 (55.7)	101 (44.3)	.002*
	Hostel	73 (18.4)	36 (49.3)	37 (50.7)	
	With friends	49 (12.3)	33 (67.3)	16 (32.7)	
	Others	47 (11.8)	38 (80.9)	9 (19.1)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Smoking	Yes	66 (16.6)	64 (97.0)	2 (3.0)	<.001*
	No	331 (83.4)	170 (51.4)	161 (48.6)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Alcohol use	Yes	69 (17.4)	66 (95.7)	3 (4.3)	<.001*
	No	328 (82.6)	168 (51.2)	160 (48.8)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Mother's education level	Middle school and below	185 (46.6)	88 (47.6)	97 (52.4)	<.001*
	High school and above	212 (53.4)	146 (68.9)	66 (31.1)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	
Father's education level	Middle school and below	116 (29.2)	59 (50.9)	57 (49.1)	.035*
	High school and above	281 (70.8)	175 (62.3)	106 (37.7)	
	Total	397 (100.0)	234 (58.9)	163 (41.1)	

*Chi-square.
ED = energy drinks.

time, 40 (17.1%) during exam periods, 34 (14.5%) while drinking alcohol, 24 (10.3%) when sleepy, and 17 (7.3%) before engaging in sports. As the reasons for consuming EDs, 97 (41.5%) reported consuming them for trial purposes, 48 (20.5%) because they provide energy to the body, and 71 (30.3%) because they liked the taste and smell. As the source of information on EDs, 97 (41.5%) of the participants reported obtaining information from the ED

labeling and 53 (22.6%) from the internet. The attitudes and behaviors of the students regarding EDs are presented in Table 2.

Considering usage rates by gender, it was determined that 130 (77.4%) of men and 104 (45.4%) of women consumed EDs. Thus, men consumed EDs at a significantly higher rate than women ($p < .001$). Although the consumption of EDs was most frequent

Table 2.
Attitudes and Behaviors of Students About ED

Parameter	Variable	n (%)
Using ED before	Yes	234 (58.9)
	No	163 (41.1)
Number of uses of ED in the last 15 days	None	214 (91.5)
	1	11 (4.7)
	2	7 (3.0)
	3 and above	2 (.9)
ED place of consumption	Home	109 (46.6)
	Cafe	65 (27.8)
	Friend house	74 (31.6)
	School	41 (17.5)
ED consumption time	Anytime	104 (44.4)
	Before sports	17 (7.3)
	When I'm thirsty	3 (1.3)
	When I'm sleepy	24 (10.3)
	During exam periods	40 (17.1)
	When I drink alcohol	34 (14.5)
	While driving	10 (4.3)
	Others	31 (13.2)
	Reason for using ED	Attempt
	Because it provides energy to the body	48 (20.5)
	For smell and taste	71 (30.3)
	For body building	1 (.4)
	To miss sleep	43 (18.4)
	To mix with alcohol	32 (13.7)
	Due to friend's use	14 (6.0)
	To lose weight	0 (.0)
	Others	23 (9.8)
Source of information on ED	Information note on beverage	97 (41.5)
	TV ads	35 (15.0)
	friends using ED	50 (21.4)
	Internet	53 (22.6)
	Family members	8 (3.4)
	Others	59 (25.2)

ED, energy drinks.

in the age group of 23 and over (25.4%), the rate of consumption was found to be statistically similar across age groups ($p = .345$). First-year students (34.3%) had the highest rate of consumption, but these rates were also statistically similar across the years ($p = .757$). It was determined that students whose mothers and

Table 3.
Students' Answers to Information Questions About ED

Proposition	I agree, n (%)	I do not agree, n (%)	No idea, n (%)
I know what's in the ED content	130 (32.7)	137 (34.5)	130 (32.7)
ED contains caffeine	283 (71.3)	97 (24.4)	17 (4.3)
ED contains vitamins	128 (32.2)	164 (41.3)	105 (26.4)
ED has no side effects	12 (3.0)	66 (16.6)	319 (80.4)
ED is harmful to health	280 (70.5)	90 (22.7)	27 (6.8)
ED raises blood pressure	253 (63.7)	137 (34.5)	7 (1.8)
ED causes heart palpitations	318 (80.1)	77 (19.4)	2 (.5)
ED makes you gain weight	169 (42.6)	186 (46.9)	42 (10.6)
ED increases sports performance	180 (45.3)	148 (37.3)	69 (17.4)
ED increases mental performance	123 (31.0)	179 (45.1)	95 (23.9)
ED increases memory	54 (13.6)	267 (67.3)	76 (19.1)
ED causes sleep disturbance	253 (63.7)	133 (33.5)	11 (2.8)
ED causes fainting	111 (28.0)	240 (60.5)	46 (11.6)
ED causes dental diseases	185 (46.6)	194 (48.9)	18 (4.5)
ED increases restlessness and tension	180 (45.3)	177 (44.6)	40 (10.1)
ED causes sudden death	221 (55.7)	155 (39.0)	21 (5.3)
ED can cause dizziness	216 (54.4)	162 (40.8)	19 (4.8)
ED can cause headaches	214 (53.9)	152 (38.3)	31 (7.8)
ED may vomit	210 (52.9)	167 (42.1)	20 (5.0)
ED can cause kidney disease	192 (48.4)	188 (47.4)	17 (4.3)
ED can cause allergies	249 (62.7)	133 (33.5)	15 (3.8)
ED meets the daily water needs	14 (3.5)	113 (28.5)	270 (68.0)

ED, energy drinks.

fathers had attained education at the high school level and above were significantly more likely to consume EDs than those whose parents were graduates of secondary school or below ($p < .001$, $p = .035$, respectively). The rate of ED consumption was 97.0% among smokers and 95.7% among those who consumed alcohol.

Table 4.
The Answers of the Students Who Use and Dont Use ED to the Questions About ED

Proposition	ED Users			ED Not-users			p*
	I agree, n (%)	I do not agree, n (%)	No idea, n (%)	I agree, n (%)	I do not agree, n (%)	No idea, n (%)	
I know what's in the ED content	83 (35.5)	80 (34.2)	71 (30.3)	47 (28.8)	50 (30.7)	66 (40.5)	.104
ED contains caffeine	181 (77.4)	14 (6.0)	39 (16.7)	102 (62.6)	3 (1.8)	58 (35.6)	<.001
ED contains vitamins	89 (38.0)	70 (29.9)	75 (32.1)	39 (23.9)	35 (21.5)	89 (54.6)	<.001
ED has no side effects	9 (3.8)	196 (83.8)	29 (12.4)	3 (1.8)	123 (75.5)	37 (22.7)	.016
ED is harmful to health	163 (69.7)	21 (9.0)	50 (21.4)	117 (71.8)	6 (3.7)	40 (24.5)	.108
ED raises blood pressure	164 (70.1)	–	70 (29.9)	89 (54.6)	–	74 (45.4)	.002
ED causes heart palpitations	201 (85.9)	–	33 (14.1)	117 (71.8)	–	46 (28.2)	.001
ED makes you gain weight	109 (46.6)	30 (12.8)	95 (40.6)	60 (36.8)	12 (7.4)	91 (55.8)	.008
ED increases sports performance	106 (45.3)	48 (20.5)	80 (34.2)	74 (45.4)	21 (12.9)	68 (41.7)	.096
ED increases mental performance	84 (35.9)	60 (25.6)	90 (38.5)	39 (23.9)	35 (21.5)	89 (54.6)	.005
ED increases memory	22 (9.4)	63 (26.9)	149 (63.7)	32 (19.6)	13 (8.0)	118 (72.4)	<.001
ED causes sleep disturbance	152 (65.0)	11 (4.7)	71 (30.3)	101 (62.0)	0 (.0)	62 (38.0)	.009
ED causes fainting	68 (29.1)	36 (15.4)	130 (55.6)	43 (26.4)	10 (6.1)	110 (67.5)	.008
ED causes dental diseases	112 (47.9)	16 (6.8)	106 (45.3)	73 (44.8)	2 (1.2)	88 (54.0)	.015
ED increases restlessness and tension	99 (42.3)	36 (15.4)	99 (42.3)	81 (49.7)	4 (2.5)	78 (47.9)	<.001
ED causes sudden death	145 (62.0)	12 (5.1)	77 (32.9)	76 (46.6)	9 (5.5)	78 (47.9)	.008
ED can cause dizziness	130 (55.6)	18 (7.7)	86 (36.8)	86 (52.8)	1 (.6)	76 (46.6)	.002
ED can cause headaches	132 (56.4)	26 (11.1)	76 (32.5)	82 (50.3)	5 (3.1)	76 (46.6)	.001
ED may vomit	133 (56.8)	17 (7.3)	84 (35.9)	77 (47.2)	3 (1.8)	83 (50.9)	.002
ED can cause kidney disease	119 (50.9)	14 (6.0)	101 (43.2)	73 (44.8)	3 (1.8)	87 (53.4)	.035
ED can cause allergies	152 (65.0)	12 (5.1)	70 (29.9)	97 (59.5)	3 (1.8)	63 (38.7)	.067
ED meets the daily water needs	12 (5.1)	166 (70.9)	56 (23.9)	2 (1.2)	104 (63.8)	57 (35.0)	.011

*Chi-square.
ED, energy drinks.

There was a significant relationship between smoking and alcohol use and ED use ($p < .001$ and $p < .001$ for both). Relationships between participants' consumption of EDs and sociodemographic data are presented in Table 1.

While 130 (32.7%) of the participants reported having information about the contents of EDs, 283 (71.3%) of them stated that EDs contained caffeine and 128 (32.2%) stated that they contained vitamins. The answers given by the participants to the questions about the knowledge of EDs are presented in Table 3. Eighty-three (35.5%) of the ED users and 47 (28.8%) of the non-ED users stated that they knew what EDs contained ($p = .104$).

Specifically, 181 (77.4%) of the ED users stated that these beverages contained caffeine and 89 (38.0%) of them stated as vitamins. Of those who did not consume EDs, 102 (62.6%) stated that they contained caffeine and 39 (23.9%) of them stated as vitamins. The answers of the students who consumed and did not consume EDs to the questions about knowledge of EDs are presented in Table 4.

A total of 280 (70.5%) participants stated that EDs are harmful to one's health. Specifically, 163 (69.7%) of ED users and 117 (71.8%) of those who did not use EDs stated that EDs are harmful to one's health.

Examining the answers to questions about health problems, 253 (63.7%) of the students stated that EDs could increase blood pressure, 318 (80.1%) heart palpitations, 192 (48.4%) kidney disease, and 185 (46.6%) dental disorders (Table 3).

Comparing the use of energy drinks, it was determined that 164 (70.4%) of ED users and 89 (54.6%) of non-ED users thought that EDs could increase blood pressure. Of the ED users, 201 (85.9%) stated that these beverages could cause heart palpitations, 152 (65.0%) sleep disorders, 112 (47.9%) dental disorders, and 119 (50.9%) kidney disease. Of those who did not use EDs, 117 (71.8%) stated that these beverages could cause heart palpitations, 101 (62.0%) sleep disorders, 73 (44.8%) dental disorders, and 73 (44.8%) kidney disease (Table 4).

Of the students using EDs, 84 (35.9%) stated that ED consumption increased mental performance, 106 (45.3%) sports performance, and 22 (9.4%) memory. Of the students who did not use EDs, 39 (23.9%) stated that ED consumption increased mental performance, 74 (45.4%) sports performance, and 32 (19.6%) memory (Table 4).

Of the students using EDs, 132 (56.4%) stated that consumption of EDs could cause headaches, 133 (56.8%) vomiting, and 130 (55.6%) dizziness. Of those who did not use EDs, 82 (50.3%) stated that consumption of EDs could cause headaches, 77 (47.2%) vomiting, and 86 (52.8%) dizziness (Table 4).

Discussion

Today, EDs are frequently consumed by children, teenagers, and young adults without knowing that they may have adverse health effects. In our study, 70.5% of the students thought that EDs were harmful to health. Despite this, more than half stated that they had used EDs before, especially male students who used cigarettes and alcohol and whose parents had a higher education level were using EDs more frequently. In addition, students using EDs believed that it increased mental and sports performance and strengthened memory.

In previous studies, the ED usage rates of university students were found to be 52.5% in Turkey, 51.9% in Pakistan, 62.2% in Ghana, and 81.4% in the United States (Borlu et al., 2019; Buxton & Hagan, 2012; Marcziński, 2011; Usman et al., 2015). In a study conducted in New Caledonia, 42.3% of adolescents (men: 48.4% and women: 37.1%) stated that they consumed EDs (Frayon et al., 2019). In a study conducted in 16 European Union member countries, the frequency of consumption of EDs (at least once in the last 1 year) was determined to be 68% in the age group of 10 – 18 and 30% over the age of 18 (Zucconi et al., 2013). It has been determined in many studies in the literature that male students consume EDs significantly more often than female students (Borlu et al., 2019; Degirmenci et al., 2018; Frayon et al., 2019; Hidiroglu et al., 2013). Similarly, our study determined that 58.9% of the students had consumed EDs before and that the rate of ED consumption was significantly higher among men (77.4%) than women (45.4%) ($p < .001$). Our study is thus in agreement with the findings in the literature. It should particularly not be overlooked that the use of EDs is significantly higher among adolescents and young adults. The fact that men are more active in terms of sports and believe that EDs have performance-enhancing

effects may be a factor that increases the rate of ED consumption among men compared to women. The fact that men engage in other risky behaviors (tobacco products and alcohol use) may also have contributed to this.

In our study, the rate of ED consumption was found to be similar across age groups and years of study ($p = .345$ and $p = .757$, respectively). In Norway, the rate of ED consumption among adolescent students was found to be higher in the 11th through 13th grades (15 – 19 years) than in the 8th through 10th grades (12 – 15 years) (Degirmenci et al., 2018). In a study conducted in Italy, it was reported that the consumption of EDs increased significantly according to the age of adolescents (Gallimberti et al., 2013). The fact that the rate of ED consumption did not increase with age or year of study in the present research may be due to the diversity of grade levels in university education in terms of age groups. In addition, the effect of medical education on the level of knowledge may have caused this similarity.

In our study, students whose parents had a higher education level were significantly more likely to consume ED than others ($p < .001$ for mother and $p = .035$ for father). The increased use of EDs by participants whose parents had higher educational levels may be due to generally increased behaviors of trying such products because these students had more social families.

Consumption of EDs has been associated with risky behaviors such as smoking, alcohol consumption, and substance abuse in young people (Holubcikova et al., 2017). In previous studies, it was determined that students who used cigarettes and alcohol had a significantly higher rate of using EDs than those who did not use cigarettes or alcohol (Borlu et al., 2019; Hidiroglu et al., 2013). In our study, a significant relationship was seen between the use of cigarettes and alcohol and the use of EDs. Thus, our study has results similar to those presented in the literature. Although cigarettes are still the most widely used tobacco products today, the use of other tobacco products has also increased. According to a study conducted with medical faculty students, 17.1% of the participants only smoked cigarettes, 11.2% used cigarettes and other tobacco products, and 5.1% only smoked hookah/water pipes (Kuş et al., 2019). Therefore, the use of cigarettes and other tobacco products should be evaluated. The fact that ED consumption is a risk factor for tobacco and alcohol usage should be examined, and preventive public health policies should be developed in this regard.

As the reasons for consuming EDs, 14.6% of university students in Pakistan stated that they used them to gain energy, 15.5% to study for exams, and 10.3% to reduce fatigue (Usman et al., 2015). In a study conducted in Ghana, it was determined that 58.9% of university students consumed EDs to replace the lost energy (Buxton & Hagan, 2012). The study conducted with students from grades 8 to 12 in Saudi Arabia determined that 58.4% of the participants consumed EDs for the smell or taste, 51.8% to try them, and 43.0% to provide energy to the body (Musaiger & Zagzoog, 2013). In our study, 41.5% of the students who consumed EDs stated that they had done so for trial purposes, 20.5% stated that EDs provided energy to the body, and 30.3% reported consuming EDs for the taste or smell. Among the studies in which the reasons for ED consumption were considered, the study population was taken as all participants in some studies and as only

those using EDs in other studies. According to the approach to population selection, the percentages of answers given may vary considerably. In the literature, consuming EDs because they provide energy or for the purpose of trying them remain at the forefront among other reasons, but taste and smell together with the idea of increasing mental or physical performance are other important factors.

In our study, as their sources of information on EDs, the students stated the labels on ED products (41.5%), their friends who used EDs (21.4%), and the internet (22.6%). University students in Pakistan reported their sources of information to be television (65.7%) and friends (48.5%) (Usman et al., 2015), while in Turkey, 14.0% reported acquiring information from visual media sources and 10.0% from written sources (Kayapinar & Özdemir, 2016). It was determined that adolescents in Saudi Arabia obtained information about EDs most frequently from advertisements (Musaiger & Zagzoog, 2013). Thus, in the literature, as sources of information about EDs, students specify visual and written media sources, ED labels, and their circles of friends. The use of visual and written media to inform people about EDs is of great importance for preventive public health policies. In addition, attractive and instructive informative texts on EDs will contribute to this issue further.

In our study, 32.7% of the students knew about the contents of EDs (ED users: 35.5% and non-ED users: 28.8%), with 71.3% of them reporting that EDs contained caffeine (ED users: 77.4% and non-ED users: 62.6%) and 32.2% stated that they contained vitamins (ED users: 38.0% and non-ED users: 23.9%). In the study conducted by Usman et al., 46.8% of the participants stated that they knew the contents of EDs and 84.5% of them stated that they contained caffeine (Usman et al., 2015). In a study conducted with university students, 47.0% of the students stated that caffeine, and 9.0% of them stated that vitamins were in Energy Drinks contents (Kayapinar & Özdemir, 2016). It seems that there are important deficiencies in the knowledge of students about ED contents, both in the literature and in our study. The fact that the caffeine contents of EDs are better known than the vitamin contents may be because caffeine is in the foreground, emphasized as the major ingredient of EDs. The fact that ED contents were better known by ED users in our study may be because ED users were informed about this subject thanks to package labeling.

The negative effects of EDs on health arise due to the substances that these beverages contain, especially excessive quantities of caffeine. The American Pediatric Association recommends the consumption of less than 100 mg of caffeine per day in children (Centers for Disease Control and Prevention, 2021). The near-daily introduction of new EDs makes it difficult to determine the amount of caffeine contained in such beverages. However, it is known that the caffeine content of EDs is in the general range of 50 – 505 mg (Boolani et al., 2020). Excessive caffeine intake increases the risk of convulsions, hypertension, nausea and vomiting, and metabolic acidosis (World Health Organization, 2021). The high sugar content of EDs has also been identified as a risk factor for obesity and the acidic pH as a risk factor for dental caries (De Sanctis et al., 2017; Pinto et al., 2013). It has been reported that caffeine and taurine have effects on cardiac

contraction, increase aerobic capacity with an increase in heart rate, and increase the risk of heart attack and other diseases with excessive use (Grasser et al., 2016).

In a study involving adolescents, it was determined that 32.9% of ED users and 67.1% of those who did not use EDs considered these beverages to be bad for one's health (Frayon et al., 2019). In a study conducted with university students, 44.0% of students stated that EDs were harmful to one's health (Kayapinar & Özdemir, 2016). In our study, it was determined that 70.5% of the students (69.7% of those using EDs and 71.8% of those not using EDs) thought that EDs were harmful to health. The opinion that EDs are harmful to the health was present at a higher percentage in our study compared to other studies, and we think that this is because the universe of our study comprised of medical students.

In a study conducted among university students in Turkey, 62% of the students stated that EDs were dangerous for the heart, 26% stated that EDs were harmful to the kidneys, 18% stated that EDs could cause obesity, and 16% stated that EDs may cause dental disorders (Kayapinar & Özdemir, 2016). In our study, 63.7% of the students reported that the emergency room increased blood pressure, 80.1% cause heart palpitations, 48.4% kidney disease, 42.6% weight gain, and 46.6% dental disorders. Thus, in both our study and the study of Kayapinar and Özdemir, it was revealed that the negative effects of EDs on health are not sufficiently known.

In our study, 56.4% of the students using EDs stated that the use of EDs could cause headaches, 56.8% vomiting, and 55.6% dizziness. Of those who did not use EDs, 50.3% stated that the use of EDs could cause headaches, 56.8% vomiting, and 55.6% dizziness. In a Canadian study, 22.5% of participants aged 12 – 24 years using EDs stated that they had experienced a concussion episode (increased alertness and energy followed by sudden drop in energy), 18.3% a headache, and 5.1% nausea and/or vomiting (Hammond et al., 2018). As a finding of our study, it is important that students did not know about the symptoms they could experience as a result of using EDs. This lack of knowledge may cause serious stress if students encounter such symptoms after consuming EDs. It is important to inform students about this issue.

In our study, 35.9% of the students using EDs stated that ED consumption increased mental performance, 45.3% stated that it increased sports performance, and 9.4% stated that it increased memory; in contrast, 23.9% of the students who did not use EDs stated that ED consumption increased mental performance, 45.4% stated that it increased sports performance, and 19.6% stated that it increased memory. The fact that ED users have such opinions on the positive effects of ED consumption may cause an increase in their use of these products. In a study conducted with tennis players, it was determined that the use of EDs increased sports performance (Gallo-Salazar et al., 2015). The study conducted by Bichler et al. (2006) determined that caffeine and taurine did not affect short-term memory. Cavka et al. (2015) found that ED consumption increased psychomotor performance (reaction time, concentration, attention, and memory). The study conducted by Wilhelm et al. (2013), however, determined that ED consumption did not affect cognitive functionality measures such as attention, learning ability, and vocabulary.

Limitations and Directions/Suggestions for Future Research

While previous studies have investigated the short-term effects of EDs, studies investigating the long-term effects of these beverages are limited. The long-term effects of ED consumption during adolescence or at younger ages can have serious negative consequences for adolescent development. Although different results have been obtained in studies investigating the effects of EDs on sports performance, mental performance, and memory in the literature, the number of such studies is insufficient. Long-term, multi-subject studies are needed to determine the effects of ED.

In conclusion, this study determined that a significant portion of the students had experience with ED consumption, with male students using EDs more frequently than female students. There was a significantly prevalent opinion among the students that EDs increase sports and mental performance. It is also noteworthy that the consumption of EDs increased with levels of parental education. The most common reason for consuming EDs among our participants was for trial purposes. It has been revealed that students have a serious lack of knowledge about EDs. It is necessary to take measures to improve the attitudes and behaviors of students regarding EDs. There are still few studies on EDs, and investigating the effects of a product that adolescents and young adults consume so frequently will shed light on possible preventive health policies. The negative effects of ED consumption on health should be made clear in audio and visual media, especially on ED labels and in health institutions and schools.

Ethics Committee Approval: For this study, permission was obtained from Kahramanmaraş Sütçü İmam University Clinical Studies Ethics Committee with the letter dated January 22, 2020, and numbered 04, and the Helsinki Declaration criteria were taken into consideration.

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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References

Al, O. M., & Elshatarat, R. A. (2017). Influence of knowledge and beliefs on consumption of performance enhancing agents in north-western Saudi Arabia. *Annals of Saudi Medicine*, 37(4), 317 – 325. [CrossRef]

Bichler, A., Swenson, A., & Harris, M. A. (2006). A combination of caffeine and taurine has no effect on short term memory but induces changes in heart rate and mean arterial blood pressure. *Amino Acids*, 31(4), 471 – 476. [CrossRef]

Boolani, A., Fuller, D. T., Mondal, S., Wilkinson, T., Darie, C. C., & Gumprecht, E. (2020). Caffeine-containing, adaptogenic-rich drink modulates the effects of caffeine on mental performance and cognitive parameters: A double-blinded, placebo-controlled, randomized trial. *Nutrients*, 12(7), 1922. [CrossRef]

Borlu, A., Oral, B., & Gunay, O. (2019). Consumption of energy drinks among Turkish University students and its health hazards. *Pakistan Journal of Medical Sciences*, 35(2), 537 – 542. [CrossRef]

Buxton, C., & Hagan, J. E. (2012). A survey of energy drinks consumption practices among student-athletes in Ghana: Lessons for developing health education intervention programmes. *Journal of the International Society of Sports Nutrition*, 9(1), 9. [CrossRef]

Cavka, A., Stupin, M., Panduric, A., Plazibat, A., Cosic, A., Rasic, L., Debeljak, Z., Martinovic, G., & Drenjancevic, I. (2015). Adrenergic system activation mediates changes in cardiovascular and psychomotoric reactions in young individuals after red bull (©) Energy Drink Consumption. *International Journal of Endocrinology*, 2015, 751530. [CrossRef]

Centers for Disease Control and Prevention (2021). The buzz on energy drinks. Retrieved from <https://www.cdc.gov/healthyschools/nutrition/energy.htm>

De Sanctis, V., Soliman, N., Soliman, A. T., Elsedfy, H., Di Maio, S., El Kholly, M., & Fiscina, B. (2017). Caffeinated energy drink consumption among adolescents and potential health consequences associated with their use: A significant public health hazard. *Acta Bio-Medica: Atenei Parmensis*, 88(2), 222 – 231. [CrossRef]

Degirmenci, N., Fossum, I. N., Strand, T. A., Vaktksjold, A., & Holten-Andersen, M. N. (2018). Consumption of energy drinks among adolescents in Norway: A cross-sectional study. *BMC Public Health*, 18(1), 1391. [CrossRef]

Frayon, S., Wattelez, G., Cherrier, S., Cavaloc, Y., Lerrant, Y., & Galy, O. (2019). Energy drink consumption in a pluri-ethnic population of adolescents in the Pacific. *PLoS One*, 14(3), e0214420. [CrossRef]

Gallimberti, L., Buja, A., Chindamo, S., Vinelli, A., Lazzarin, G., Terraneo, A., Scafato, E., & Baldo, V. (2013). Energy drink consumption in children and early adolescents. *European Journal of Pediatrics*, 172(10), 1335 – 1340. [CrossRef]

Gallo-Salazar, C., Areces, F., Abián-Vicén, J., Lara, B., Salinero, J. J., Gonzalez-Millán, C., Portillo, J., Muñoz, V., Juarez, D., & Del Coso, J. (2015). Enhancing physical performance in elite junior tennis players with a caffeinated energy drink. *International Journal of Sports Physiology and Performance*, 10(3), 305 – 310. [CrossRef]

Ghosh, B. G. (2015). Sports & energy drinks: Keep them separated. *Nutraceuticals World*, 18(8), 50 – 51.

Grasser, E. K., Miles-Chan, J. L., Charrière, N., Loonam, C. R., Dulloo, A. G., & Montani, J. P. (2016). Energy drinks and their impact on the cardiovascular system: Potential mechanisms. *Advances in Nutrition*, 7(5), 950 – 960. [CrossRef]

Hammond, D., Reid, J. L., & Zukowski, S. (2018). Adverse effects of caffeinated energy drinks among youth and young adults in Canada: A Web-based survey. *CMAJ Open*, 6(1), E19 – E25. [CrossRef]

Hidiroglu, S., Tanriover, O., Unaldi, S., Sulun, S., & Karavus, M. (2013). A survey of energy-drink consumption among medical students. *JPMA. Journal of the Pakistan Medical Association*, 63(7), 842 – 845.

Holubcikova, J., Kolarcik, P., Madarasova Geckova, A., Reijneveld, S. A., & van Dijk, J. P. (2017). Regular energy drink consumption is associated with the risk of health and behavioural problems in adolescents. *European Journal of Pediatrics*, 176(5), 599 – 605. [CrossRef]

Kayapinar, F. C., & Özdemir, I. (2016). Öğrencilerin Enerji İçeceği Tüketim Bilincinin ve Alışkanlıklarının Araştırılmasında Bir Meslek Yüksekokulu Örneği. *Ankara Sa*, 15(1), 1 – 12. [CrossRef]

Kopacz, A., Wawrzyniak, A., Hamulka, J., & Górnicka, M. (2013). Evaluation of energy drink intake in selected student groups. *Roczniki Panstwowego Zakladu Higieny*, 64(1), 49 – 53.

Kuş, C., Gümüştakım, R. Ş., & Eryılmaz, M. E. (2019). Kahramanmaraş Sütçü İmam Üniversitesi Tıp Fakültesi Öğrencilerinin Tütün ve Tütün Ürünleri Kullanma Durumu ve İlişkili Faktörler. *Addicta: The Turkish Journal on Addictions*, 6(4), 182 – 193.

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- Marczinski, C. A. (2011). Alcohol mixed with energy drinks: Consumption patterns and motivations for use in U.S. college students. *International Journal of Environmental Research and Public Health*, 8(8), 3232 – 3245. [\[CrossRef\]](#)
- Mattson, M. E. (2013). Update on emergency department visits involving energy drinks: A continuing public health concern. In The CBHSQ Report (pp. 1 – 7). US: Substance Abuse and Mental Health Services Administration.
- Musaiger, A., & Zagzoog, N. (2013). Knowledge, attitudes and practices toward energy drinks among adolescents in Saudi Arabia. *Global Journal of Health Science*, 6(2), 42 – 46. [\[CrossRef\]](#)
- Pinto, S. C., Bandeca, M. C., Silva, C. N., Cavassim, R., Borges, A. H., & Sampaio, J. E. (2013). Erosive potential of energy drinks on the dentine surface. *BMC Research Notes*, 6, 67. [\[CrossRef\]](#)
- Seifert, S. M., Schaechter, J. L., Hershorin, E. R., & Lipshultz, S. E. (2011). Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics*, 127(3), 511 – 528. [\[CrossRef\]](#)
- Tarım, & Bakanlık, K. (2021). Türk Gıda Kodeksi enerji İçecekleri Tebliği. Retrieved from <https://www.resmigazete.gov.tr/eskiler/2017/06/20170930-23.htm>
- Usman, A., Bhombal, S. T., Jawaid, A., & Zaki, S. (2015). Energy drinks consumption practices among medical students of a private sector University of Karachi, Pakistan. *JPMA. Journal of the Pakistan Medical Association*, 65(9), 1005 – 1007.
- Wilhelm, P., van Diepen, M. A. C., Nieuwenhuis, L., & Boulogne, T. L. (2013). Geen effect van energiedrank op de cognitieve prestaties van jongeren. *Tijdschrift voor psychiatrie*, 55(1), 57 – 62.
- World Health Organization (2021). WHO basic analytical toxicology. Retrieved from https://www.who.int/ipcs/publications/training_poisons/analytical_toxicology.pdf
- Zucconi, S., Volpato, C., Adinolfi, F., Gandini, E., Gentile, E., Loi, A., & Fioriti, L. (2013). Gathering consumption data on specific consumer groups of energy drinks. *EFSA Supporting Publications*, 10(3), 394E. [\[CrossRef\]](#)