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# Consumption patterns and side effects of energy drinks among university students in Palestine: cross-sectional study

## Abstract

This study describes the patterns of energy drinks consumption and associated factors among University students in Palestine. A cross-sectional study was conducted at An-Najah National University in Nablus, West Bank-Palestine. The study included 279 students of three colleges: Medicine, Physical Education and Engineering. Data were collected using a 25-item self-administered questionnaire. Energy-drink consumption was significantly higher among male students, as 80.5% of energy-drink users involved in this study was males. It was higher among those with higher monthly expenditure. The most common cause for using energy drinks among users was to stay awake at night (68.6%), while most of those who never tried energy drinks in their lives didn't do so because they thought energy drinks are unhealthy. About two thirds (64.4%) of the participants didn't know the main constituents of energy drinks and about half (53.6%) stated that they knew that there might be side effects associated with the use of energy drinks. More than half of the current users (56.8%) consumed less than 1 bottle/day. Energy-drink usage is common among university students in Palestine and higher among males and those with higher monthly expenditure. Campaigns should be encouraged in order to spread awareness about the contents and possible side effects of energy drinks.

**Keywords:** energy drinks, consumption, university, students, Palestine

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**Abbreviations:** BMI, body mass index; WHO, world health organization

## Introduction

Energy drinks are carbonated drinks that contain large amounts of caffeine and sugar with additional ingredients, such as B vitamins, amino acids (e.g. Taurine) and herbal stimulants such as Guarana.<sup>1-3</sup> The term "energy drinks" refers to beverages that contain caffeine in combination with other ingredients such as Taurine, guarana, and B vitamins, and are purported to provide its consumers with extra energy.<sup>4</sup> Regarding the history of the Energy Drinks; the Scottish Iron-Bru "Iron Brew" is considered to be the first energy drink produced in 1901, although not marketed as such. In the early 1960s, Japan started selling Lipovitan in small brown glass bottles. These bottles contained a concentrated amount of the drink which was equivalent to a full-sized can of the drink. Other drinks such as Gatorade were marketed to help improve performance in athletes.<sup>5</sup> Athletes believe that energy drinks can be used to enhance their performance during training and competition due to their potentially ergogenic ingredients.<sup>6</sup>

Energy drinks entered the North American beverage market with exotic names, catchy slogans and expensive marketing campaigns and now occupy a significant portion of the industry. The first energy drink to hit the shelves in North America was Jolt Cola in 1985. At the time, it was basically marketed as a cola with high-caffeine and high-sugar contents. Jolt Cola's original marketing strategy targeted students and busy professionals.<sup>7</sup> The Red Bull energy drink was introduced to Europe in 1987 and to the United States in 1997 was the forerunner of the modern energy drink and remains the most recognizable brand in the industry.<sup>8</sup> However, it has considerable competition in today's

marketplace; 500 new varieties of energy drink were introduced to the worldwide market in 2006.<sup>9</sup> The worldwide sales of the drinks rose from \$ 3.5 billion in 2006 to \$ 4.7 billion in 2007.<sup>10</sup>

Many companies continue to introduce new drinks, hoping to capture a share of a growing consumer base. Responding to the influx of new products with which they must compete, manufacturers push the boundaries, producing drinks with increasingly complex combinations of medicinal ingredients, with ever higher levels of caffeine, served in larger sizes.<sup>9</sup> A dose of caffeine 85-250mg may result in feelings of alertness, decreased fatigue, and eased flow of thought. Whereas, excessive caffeine uses 250-500mg resulted in restlessness, nervousness, insomnia, tremors, seizures and cardiovascular instability,<sup>11-15</sup> in addition, it leads to hypokalemia.<sup>16,17</sup> With the rising popularity of energy drinks and with more young people ingesting higher levels of caffeine, more serious health problems are now being reported. Today, energy drinks have become available everywhere, their manufacturers say that, in addition to providing a boost in energy, the drinks promote wellness through medicinal properties (they usually contain vitamins and/or ingredients like ginseng, guarana and Taurine). Whatever their intended use and purported benefits, consumers today consume energy drinks for a variety of reasons: to boost energy, keep awake at night, relief stress and other causes.<sup>10</sup>

Energy drinks are marketed with colorful descriptions and provocative names that make them sound fun and exciting. "Rockstar, Monster, Full Throttle, Throw Down and Sobe" are just a sampling of the inviting products that fill store shelves. Marketing slogans are developed to stimulate interest in a product and distinguish it from its competition: "Get spiked" "Party like a Rockstar" and "Feel the

freak” are slogans representing the marketing strategies of energy drink companies. The language and images of such advertising are not directed at mature adults. If anything, the marketing of energy drinks removes all ambiguity about whom these products are meant to appeal to: teens and young adults.<sup>18</sup> As a result, the consumption of energy drinks is likely to become even more common and socially acceptable.

Energy drinks derive their properties chiefly from sugar and caffeine. Several studies suggest an association between sugar-sweetened beverage intake and weight.<sup>19,20</sup> One way for people to reduce their intake of added sugars and help manage their weight is to reduce the amount of sugar-sweetened beverages they drink.<sup>21</sup> Caffeine in energy drinks will provide the consumer the desirable effects of increased alertness, improved memory and enhanced mood. However, caffeine can have harmful physical consequences, including central nervous system, cardiovascular, gastrointestinal and renal dysfunction.<sup>22</sup> Energy drinks contain between 14 and 31 mg of caffeine per 100 ml.<sup>23</sup> Although their caffeine concentration (in milligrams per milliliter) may be similar to coffee, energy drinks are often packaged in significantly higher volumes, resulting in increased caffeine intake.<sup>24</sup> Many energy drinks would list the herbs as ingredients, but the caffeine in the herbs may not be listed as a separate ingredient. By law, caffeine does not have to be listed on labels unless it has been added to the product separately as a pure substance and so, consumers may be completely unaware of the amount of caffeine they are ingesting.<sup>25</sup>

Various energy drinks are marketed with claims of performance enhancing effects although the existence and extent of such effects is subject to debate. Red Bull, for example, advertises several benefits of consumption including improved performance, endurance, concentration and reaction speed and increased metabolism.<sup>26</sup> Consumers may falsely believe that “more is better” and ingest multiple servings of these products. Since there are no restrictions on the sale of energy drinks, adolescents and children (who may be inexperienced and less tolerant to the effects of caffeine) may be at an increased risk for caffeine intoxication.<sup>18</sup> Suspected deaths linked to energy drinks have been reported in Australia and Ireland, three people died in Sweden after drinking Red Bull: two had mixed Red Bull with alcohol and the third drank it after an exercise session. There is debate regarding whether the drinks caused these deaths, but as a result, some restaurants in Sweden have banned Red Bull in their establishments. The Swedish National Food Administration recommended that Red Bull not be mixed with alcohol or consumed after exercise. Norway sells Red Bull only in pharmacies because of its high level of caffeine. Due to health experts’ recommendations, France and Denmark have banned Red Bull altogether. In 2004, the European Union as a whole began requiring Red Bull and other energy drinks to carry a health warning about their “high caffeine content”.<sup>27</sup>

Although energy drinks have been sold worldwide for more than a decade, unfortunately only few studies have been published to test the effectiveness of these beverages on the physical or cognitive performance. There have been no reported or published studies about the exact situation of energy drink usage, patterns of consumption or side effects among young adults in Palestine. University students represent part of the society with high vulnerability to stress mainly derived from studying, exams and lifestyle (especially those who live away from their homes & families). And thus, have high tendency to consume energy-providing substances, adding that most of them don’t know about the adverse side effects of these drinks on their health.

They are totally taken by the deceiving stimulating effects of energy drinks, causing them to feel less intoxicated than they actually are.<sup>1,28</sup> This study aimed to:

- i. Determine the patterns of energy drinks consumption and their associations with socio-demographic characteristics (age, gender, faculty and economic status) and body mass index among a group of An-Najah National University students.
- ii. Find out the occurrence of adverse side effects among energy drink users.
- iii. Verify the relationship between energy-drink consumption and certain daily habits of drinkers, such as cigarette smoking, sports, breakfast and sleeping patterns.
- iv. Identify the main causes for using energy drinks and the occurrence of side effects amongst current energy drink users.

## Methods

### Study design and settings

A cross-sectional study was conducted at AN-Najah National University, Nablus and Palestine in the period between 8-2-2011 and 7-3-2011. A written approval for this study was obtained from the university IRB. In addition, a letter of approval to conduct this study was written by the dean of the faculty of medicine, which made it easier to acquire verbal approvals from deans of the other two faculties. A brief summary about the study and its objectives was provided at the top of the questionnaire’s first page along with a consent statement allowing the participant to freely choose whether to participate in the study or not. The questionnaires were anonymous.

An-Najah National University is considered to be one of the largest and highest ranked universities among all Palestinian universities. The number of students attending this university was 20,537 students in 2010 (according to “An-Najah National University Self Evaluation report” published in January, 2011), with a female presentation of 55%.<sup>29</sup> The attendants are distributed mainly on 18 different faculties: Science, Arts, Shari’a, Economics and Administrative Sciences, Engineering, Educational Sciences, Fine Arts, Agriculture, Pharmacy, Law, Veterinary Medicine, Information Technology, Medicine, Nursing, Optometry, Physical Education, Media and Faculty of Graduate Studies.

### Population and sample

This study was conducted in 3 faculties, including the Faculty of Medicine, Faculty of Engineering and Faculty of Physical Education. Selection of faculties was based on the likelihood of energy drink use by the students. Students of these faculties are assumed to be more likely to use energy drinks in order to stay awake for studying due to high levels of academic stress; in order to work on projects for long periods of time; and to boost their performance in exercising and training, respectively. As the main purpose of the study is to determine the patterns of drinking and occurrence of side effects among energy-drink consumers, students of these faculties are predicted to be better informants than any others. A total of 300 students were randomly selected from the targeted faculties.

### Instrument

Initially a focus group discussion of 8 students who were enrolled in a lecture was interviewed. Those students were asked open-ended

questions regarding situations they use energy drinks in, frequency patterns and side effects from using energy drinks. Based on the focus group responses, and with the help of previous studies on energy drinks, a self-administered questionnaire consisted of 25 closed-ended questions was developed. The first section assessed personal and demographic information (age, gender, etc). The second section was concerned with daily behavior of participants including playing sports, smoking, feeding and sleeping habits. The third section evaluated energy drink consumption patterns among participants, causes of drinking and any adverse side effect that might have possibly been encountered

## Measures

**Age:** Calculated by using the date of birth of each participant in relation to the date of filling the questionnaire.

**The body mass index (BMI):** Calculated by using the weight and height of participants, which were self-reported and then it was categorized based on the (WHO) international BMI classification of adult's.<sup>30</sup>

**Monthly expenditure:** The monthly household income was categorized by dividing them into quartiles using SPSS software as there was no reliable source determining household income categories in Palestine apart from a survey done in early 1996, according to the Palestinian Central Bureau of Statistics which could not be applicable to the current situation in Palestine.

**Smoking:** Categorized according to the recommendations of the World Health Organization (WHO) in which a heavy smoker is defined as that with a daily cigarettes consumption of more than 20 pieces per day.<sup>31</sup>

**Sleeping:** Sleeping hours were divided into 3 categories, with the normal average sleeping hours considered to be between 7 and 8 hours per day, according to a study in 2005.<sup>32</sup>

The last section of the questionnaire consisted of 5 questions, with the first question categorizing the participants into 3 groups based on their use of energy drinks. Students who denied ever trying energy drinks were asked about the reasons for never using them, while those who ever used energy drinks were asked to determine the reasons for using them. Both (reasons for using and not using energy drinks) were determined based on the focus group held at the early beginning of this study and were further developed with the aid of a previous study on energy drink consumption done by the Department of Public Health at Hacettepe University Faculty of Medicine, Ankara, Turkey.<sup>33</sup>

In addition, two questions were designed to be answered only by those who still used energy drinks, the first question assessing the amount of energy drinks consumed and the second one assessing the occurrence of any side effects that might have possibly been due to their use of energy drinks. The question regarding the side effects was developed based on different studies regarding side effects thought to be associated with energy drinks or any of its ingredients.

## Data collection

The study included 279 students, who agreed to participate and fill the questionnaire, 8 refused to participate, stating that (they had no time to fill the questionnaire), another 13 did not turn the questionnaire back. The questionnaires were collected from students at the faculties

of medicine, engineering and physical education. Within each faculty, classes were randomly chosen among a list of those containing students of that faculty and of different academic years. The faculty of medicine had the exception that students of every academic year attend separate classes, so the numbers of participants from each academic year was chosen based on the proportion of each specific year to the total number of students of that faculty. Participants were randomly chosen among students attending those classes who in turn filled the questionnaires anonymously. Data collection from the Faculty of Physical Education and the Faculty of Engineering was accomplished with the assistance of lecturers from both faculties under the guidance of the principal investigator

## Data analysis

All data were entered, tabulated and analyzed using version 17 of SPSS software. Data were presented as frequencies and cross tabulations. Chi-square test was used to compare differences by socio-demographic characteristics. A significance level of  $p < 0.05$  was used.

## Results

### Socio-demographic characteristics

Table 1 demonstrates social and demographic characteristics of participants. More than half (59.1%) of participants were males and 40.9% were females. The ages of participants ranged from 18 to 28 years, with a mean of 20.8 years and standard deviation of 2.15 years (median 20.74 years). Of the 279 participants, 99 were students from the faculty of Physical education, 91 from the faculty of Medicine, and 89 were from the faculty of Engineering. Regarding the Body Mass Index (BMI), the highest proportion of both males and females were in the normal range, only 14.3% of females were overweight compared to 30.9% of males. Most of the participants ( $n=265$ ) were single, 12 were engaged and only 2 were married. The highest proportion shared residency with their families (81%), compared to 15.8% who lived together with other students and only 3.2% were living alone. The monthly income of the students' families ranged from 1000 to 20000 NIS with a mean of 4345 NIS and standard deviation of 2611 NIS. The students' monthly expenditure ranged from 100 to 2200 NIS, with a mean of 683 NIS and standard deviation of 395 NIS.

### Daily habits

Some aspects of daily habits of participants that might have an effect on energy drinks consumption were approached during this study. Table 2 presents the distribution of some of those daily habits. According to the participant's reports, only 39 of them were smoking, 31 of which smoke less than one pack/day and only 8 were smoking more than one pack/day. There was a significant difference between males and females regarding smoking ( $p < 0.001$ ), the majority (95%) of smokers were males. More than half of the participants (51.6%) stated that they did sports irregularly, 29% did sports regularly and 19.4% didn't do sports at all. Of the total participants, about one third (37.6%) confirmed having breakfast on a regular basis, half (51%) had it irregularly and 11.1% didn't have breakfast at all. Regarding sleeping pattern, more than half (54.8%) of the participants had irregular sleeping patterns and 45.2% had a regular sleeping pattern, with the highest proportion (60.2%) of participants sleeping between 7 and 8 hours a day. It was noticed that the males were more likely to have irregular sleeping patterns than females.

**Table 1** socio-demographic characteristics of study sample

Characteristics	Males		Females		P	Total	
	No.	%*	No.	%*		No.	%
Gender (of total)	165	59.1	114	40.9		100	279
<b>Age Groups (Years)</b>							
≤20	45	28.8	51	45.5	0.018†	96	35.8
21-24	110	70.5	60	53.6		170	63.4
≥25	1	0.6	1	0.9		2	0.7
<b>Body Mass Index (BMI)</b>							
<18.5	6	3.6	8	7.1	0.004†	14	5.1
18.5-24.9	108	65.5	88	78.6		196	70.8
25-29.9	51	30.9	16	14.3		67	24.2
≥30	0	0	0	0		0	0
<b>Faculty</b>							
Faculty of Medicine	47	28.5	44	38.6	0.208	91	32.6
Faculty of Physical Education	62	37.6	37	32.5		99	35.5
Faculty of Engineering	56	33.9	33	28.9		89	31.9
<b>Average Cumulative Grade</b>							
Excellent	14	8.5	8	7	0.023†	22	7.9
Very good	52	31.7	56	49.1		108	38.8
Good	94	57.3	46	40.4		140	50.4
Acceptable	4	2.4	4	3.5		8	2.9
<b>Marital Status</b>							
Single	161	97.6	104	91.2	0.039†	265	95
Married	0	0	2	1.8		2	0.7
Engaged	4	2.4	8	7		12	4.3
<b>Residency</b>							
With family	134	81.2	92	80.7	0.125	226	81
Student's house	23	13.9	21	18.4		44	15.8
Alone	8	4.8	1	0.9		9	3.2
<b>Monthly Income (NIS)</b>							
<2600	36	24.8	18	23.7	0.744	54	24.4
2600-4000	30	20.7	15	19.7		45	20.4
4000-5000	22	15.2	16	21.1		38	17.2
<b>Monthly Expenditure</b>							
<400	24	15.5	23	25	0.185	47	19
400-600	42	27.1	27	29.3		69	27.9
600-1000	45	29	24	26.1		69	27.9
>1000	44	28.4	18	19.6		62	25.1

\*Percentage of characteristic within males/females.

† A significant different by chi-square test.

**Table 2** Distribution of some aspects of daily habits of study sample

Characteristics	Male		Female		P	Total	
	No.	%*	No.	%*		No.	%
Energy drink use (of total)	165	59.1	114	40.9		279	100
<b>Cigarette Smoking</b>							
No	128	77.6	112	98.2	0.000†	240	86
£ 20 cigarettes per day	29	17.6	2	1.8		31	11.1
>20 cigarettes per day	8	4.8	0	0		8	2.9
<b>Doing Sports</b>							
Regularly	57	34.5	24	21.1	0.05	81	29
Irregularly	79	47.9	65	57		144	51.6
Never	29	17.6	25	21.9		54	19.4
<b>Having Breakfast</b>							
Regularly	63	38.2	42	36.8	0.664	105	37.6
Irregularly	86	52.1	57	50		143	51.3
Never	16	9.7	15	13.2		31	11.1
<b>Sleeping Pattern</b>							
Regular	65	39.4	61	53.5	0.02†	126	45.2
Irregular	100	60.6	53	46.5		153	54.8
<b>Average Sleeping Hours</b>							
£6	41	24.8	37	32.5	0.331	78	28
7-8	105	63.6	63	55.3		168	60.2
≥9	19	11.5	14	12.3		33	11.8

\*Percentage of characteristic within males/females

† A significant different by chi-square test.

### Main reasons for using (or not using) energy drinks

Out of 279 participants 118 reported ever using energy drinks, while 161 denied ever using them. When asked about the reasons for never using them, 78.9% of non users reported that they thought that energy drinks are “unhealthy”, 70.2% stated that they did not have curiosity to try energy drinks and 61.5% said they did not need extra energy. Only 18% of non-users didn’t use energy drinks because they are expensive. On the other hand, the most common cause for using energy drinks among users was to stay awake at night (68.6%), followed by enjoying the taste and the need to concentrate during studying, exams and project which were chosen by 59.3% and 58.5% respectively. The least chosen reason was to imitate friends in 7.6% of users (Table 3).

**Table 3** Distribution of some aspects of daily habits of study sample

Characteristics	No.	%
<b>Use of Energy Drinks</b>		
Ever	118	57.7
Never	161	42.3
<b>Reason for not Trying Energy Drinks</b>		
Expensive	29	18
No curiosity to try them	113	70.2
Don't know their ingredients	93	57.8
Think they might be addictive	92	57.1
High caloric content	75	46.6
Think they are unhealthy	127	78.9
Don't need extra energy	99	61.5
<b>Reason for Using Energy Drinks</b>		
Stay awake at night	81	68.6
Energy boost for sports	52	44.1
Eliminate depression	20	16.9
Enjoy the taste	70	59.3
Imitate friends	9	7.6
Concentrate during studying, exams, projects, etc	69	58.5
Relieve stress	21	17.8
Relieve headache	12	10.2
Curiosity to know its taste	54	45.8

\* Percentage of characteristic within males/females.

† A significant different by chi-square test

### Awareness of contents and possible side-effects of energy drinks

Of the 279 participants, 64.4% didn’t know the main constituents of energy drinks and 53.6% stated they knew that there might be side effects associated with the use of energy drinks.

### Current energy-drink users

More than half of current users (56.8%) consumed less than 1 bottle/day (Table 4). Regarding side effects, 40.9% of current energy-drink users denied having any side effect associated with their energy drink use, the most common side effect faced by users was palpitations, encountered by 29.5%, while headache was the least to be encountered, in 9.1% of current users. The most common cause for using energy drinks among current users was enjoying the taste (84.1%), followed by the need to concentrate during studying, exams and projects (59.1%), while the least causes were to imitate friends and to relieve headache in 4.5% and 13.6% of current users, respectively.

**Table 4** Distribution of some aspects of daily habits of study sample

Characteristics	No.	%
<b>Frequency of Energy-Drink Usage</b>		
> 2 bottles per day	2	4.5
2 bottles per day	5	11.4
1 bottle per day	12	27.3
< 1 bottle per day	25	56.8
<b>Side Effects</b>		
Insomnia	10	22.7
Sleepiness	8	18.2
Diuresis	11	25
Increase in weight	6	13.6
Headache	4	9.1
Stress	8	18.2
Palpitations	13	29.5
Nothing at all	18	40.9
<b>Reasons for Using Energy Drinks</b>		
Stay awake at night	24	54.5
Energy boost for sports	23	52.3
Eliminate depression	10	22.7
Enjoy the taste	37	84.1
Imitate friends	2	4.5
Concentrate during studying, exams, projects. etc	26	59.1
Relieve stress	10	22.7
Relieve headache	6	13.6
Curiosity to know its taste	21	47.7

\* Percentage of characteristic within males/females.

† A significant different by chi-square test.

**Ever vs. never users**

Table 5 shows the effect of socio-demographic characteristics on energy drink usage among participants. There was a significant difference in energy-drink consumption between males and females ( $p < 0.001$ ), as 80.5% of those who ever tried energy drinks were males. There was a relationship between monthly expenditure of participants and the use of energy drinks ( $p < 0.05$ ). Of the 62 participants who estimated their monthly expenditure by more than 1000 NIS, 58.1% have ever used energy drinks ( $n = 36$ ), while only 27.7% ( $n = 13$ ) of those who spent less than 400 NIS have. There was no significant difference in energy drink use in relation to the BMI, faculty, or average cumulative grade.

**Table 5** Distribution of some aspects of daily habits of study sample

Characteristics	Never		Ever		P	Total	
	No.	%*	No.	%		No.	%
Energy drink use (of total)	161	57.7	118	42.3		279	100
<b>Gender</b>							
Male	70	43.5	95	80.5	0.000†	165	59.1
Female	91	56.5	23	19.5		114	40.9
<b>Age Groups (Years)</b>							
£ 20	59	37.8	37	33	0.328	96	35.8
21-24	95	60.9	75	67		170	63.4
³ 25	2	1.3	0	0		2	0.7
<b>Body Mass Index (BMI)</b>							
< 18.5	7	4.4	7	5.9	0.793	14	5.1
18.5-24.9	112	70.4	84	71.2		196	70.8
25-29.9	40	25.2	27	22.9		67	24.2
³ 30	0	0	0	0		0	0
<b>Faculty</b>							
Faculty of Medicine	47	29.2	44	37.3	0.123	91	32.6
Faculty of Physical Education	65	40.4	34	28.8		99	35.5
Faculty of Engineering	49	30.4	40	33.9		89	31.9
<b>Average Cumulative Grade</b>							
Excellent	14	8.7	8	6.8	0.782	22	7.9
Very good	65	40.4	43	36.8		108	38.8
Good	77	47.8	63	53.8		140	50.4
Acceptable	5	3.1	3	2.6		8	2.9
<b>Marital Status</b>							
Single	153	95	112	94.9	0.415	265	95
Married	2	1.2	0	0		2	0.7
Engaged	6	3.7	6	5.1		12	4.3
<b>Residency</b>							
With family	132	82	94	79.7	0.321	226	81
Student's house	26	16.1	18	15.3		44	15.8
Alone	3	1.9	6	5.1		9	3.2

Table continued...

Characteristics	Never		Ever		P	Total	
	No.	%*	No.	%		No.	%
<b>Monthly Income (NIS)</b>							
<2600	34	27.6	20	20.4	0.178	54	24.4
2600-4000	29	23.6	16	16.3		45	20.4
4000-5000	20	16.3	18	18.4		38	17.2
>5000	40	32.5	44	44.9		84	38
<b>Monthly expenditure (NIS)</b>							
<400	34	24.8	13	11.8	0.013†	47	19
400-600	41	29.9	28	25.5		69	27.9
600-1000	36	26.3	33	30		69	27.9
>1000	26	19	36	32.7		62	25.1

\* Percentage of characteristic within males/females.

† A significant different by chi-square test.

**Effect of daily habits on energy-drink consumption**

Among the daily habits assessed, the only one found to have a significant effect on energy-drink usage was cigarette smoking ( $p < 0.05$ ), as 61.5% of all smokers included in this study ( $n = 24$ ) have tried using energy drinks and 60.8% of non-smokers never used energy drinks in their lives. There was no significant difference in the use of energy drinks in relation to doing sports, having breakfast, sleeping pattern or average hours of sleeping (Table 6).

**Table 6** Distribution of some aspects of daily habits of study sample

Characteristics	Never		Ever		P	Total	
	No.	%*	No.	%*		No.	%
Energy drink use (of total)	165	59.1	114	40.9		279	100
<b>Cigarette Smoking</b>							
No	146	90.7	94	79.7	0.022†	240	86
£ 20 cigarettes per day	13	8.1	18	15.3		31	11.1
>20 cigarettes per day	2	1.2	6	5.1		8	2.9
<b>Doing Sports</b>							
Regularly	47	29.2	34	28.8	0.938	81	29
Irregularly	84	52.2	60	50.8		144	51.6
Never	30	18.6	24	20.3		54	19.4
<b>Having Breakfast</b>							
Regularly	61	37.9	44	37.3	0.992	105	37.6
Irregularly	82	50.9	61	51.7		143	51.3
Never	18	11.2	13	11		31	11.1

Table continued...

Characteristics	Never		Ever		P	Total	
	No.	%*	No.	%*		No.	%
<b>Sleeping Pattern</b>							
Regular	78	48.4	48	40.7	0.224	126	45.2
Irregular	83	51.6	70	59.3		153	54.8
<b>Average Sleeping Hours</b>							
£6	42	26.1	36	30.5	0.156	78	28
7-8	104	64.6	64	54.2		168	60.2
³9	15	9.3	18	15.3		33	11.8

\* Percentage of characteristic within males/females.

† A significant different by chi-square test.

## Discussion

The main aim of this study was to find out the patterns of consumption among energy-drink users in a group of university students and the occurrence of side effects among current users. In general, 80.5% of those who ever used energy drinks were males and 19.5% were females. The significance of this difference could be more remarkable if compared to other studies in which energy-drink consumption did not vary significantly based on gender, on the contrary, 53% of energy drink users, in a study done at East California University, 2007, were females.<sup>22</sup> This difference might be due to cultural considerations in our community, which allow males to be more independent and gives them more freedom in controlling different aspect of their own lives. This point could be more clarified when viewing the most common reasons for using energy drinks among participants, on the top of which was to “stay awake at night” (68.6%). Staying awake at night on its own could have many reasons including partying and hanging out with friends at night (as to concentrate during studying and exams was a completely different reason to be chosen), this, in turn, is considered to be a more acceptable behavior for males in our community.

Other socio-demographic characteristics didn't have a significant influence on energy-drink usage among participants. The highest proportion of those who ever used energy drinks were students in the Faculty of Medicine (37.3%), followed by Faculty of engineering students (33.9%) and the least ones to use energy drinks were students of the Faculty of Physical Education (28.8%). This slight difference might support the idea that energy drinks are used more to help students get through situations involving mental stress (such as exams, projects, etc), more than situations involving physical stress (such as playing sports). The difference found in relation to age, marital status and residency, who are all university students and are expected to share common features, such as the same age category (most are younger than 24years), marital status (the vast majority are single) and living either with their families or with other students (which is considered to be a natural distribution of this sample), this, in turn, make these differences statistically insignificant.

In relation to daily habits, smoking seemed to have a significant

relationship with the use of energy drinks, as more than half (61.5%) of all smokers included in this study have tried using energy drinks and 60.8% of non-smokers never used energy drinks in their lives. A study done at the Department of Psychology, university of Memphis, 1994, showed that smokers were much more likely to drink caffeinated coffee and a dose-response relationship between caffeine from coffee and smoking intake was observed.<sup>34</sup>

The most common reasons for using energy drinks among participants were to stay awake at night (68.6%), to enjoy the taste (59.3%) and to concentrate during studying, exams and projects (58.5%). The same reasons applied for “current” energy-drink users, with enjoying the taste being the most common reason (84.1%), followed by “to concentrate during studying, exams and projects”, “to stay awake at night” and “to get energy boost for sports”. The least common reason for using them was “to imitate friends”. These results are somehow consistent with other studies.<sup>22,33</sup> The main difference was that mixing energy drinks with alcohol was among the main reasons for using them among participants in both mentioned studies. This does not apply to our study results. This reason was not even listed among the possible ones for using energy drinks, as it might be generally considered as socially and religiously unacceptable, even though, the participants were offered to add any other reasons not amongst those listed in the questionnaire, but none of them did.

The most common reason for not using energy drinks among participants was that they thought energy drinks were “unhealthy” (79.9%), followed by not having curiosity to try energy drinks (70.2%) and 61.5% said they did not need extra energy. This is probably due to the awareness of the possible health risks associated with energy-drink use among university students, as 53.6% of all participants stated they knew there might be side effects associated with the use of energy drinks. Regarding the knowledge of the main constituents of energy drinks, 64.4% of all participants didn't know the main ingredients of energy drinks. This might be justified by the lack of awareness of students to the constituents of drinks they consume, but at the same time it should be noted that many of these drinks do not display the exact amounts of their ingredients and some of them don't even mention some of the main ingredients (such as caffeine).

Of current users of energy drinks, 40.9% denied having any side effect associated with their energy drink use, this might be due to the relatively low intake of energy drinks, as more than half of them (56.8%) consume on an average less than one bottle per day. The most common side effect was palpitations, encountered by 29.5% of current users, followed by insomnia in 22.7% of users. These findings are consistent with results from a study done at a state university in the Central Atlantic region of the United States, 2007, in which 51% reported consuming at least one energy drink during the last month. Of these energy drink users, 22% reported headaches and 19% reported heart palpitations from drinking energy drinks.<sup>22</sup> Chronic daily headaches are associated with high caffeine consumption, particularly among young women (age < 40years).<sup>35</sup>

It is important to note that the most hazardous use of energy drinks in terms of the health of young adults seems to be use of energy drinks in mixtures with alcohol. Suspected deaths linked to energy drinks have been reported in Australia and Ireland. Three people died in Sweden after drinking Red Bull: two had mixed Red Bull with alcohol and the third drank it after an exercise session. There is debate regarding whether the drinks caused these deaths, but as a result, some restaurants in Sweden have banned Red Bull in their establishments.



The Swedish National Food Administration recommended that Red Bull not be mixed with alcohol or consumed after exercise.<sup>27</sup> This issue of mixing energy drinks with alcohol was not assessed in this study, due to social and cultural considerations, but it should be part of any future studies with relevance to this topic.

A self-reported questionnaire was used in the collection of data in this study, which might have led to underreporting of some data by participants, such as the weight, which would have probably been more accurate if measured, but the lack of adequate time made it difficult to be done that way. This could possibly have an influence on the results of the study. The sample was taken from three faculties of An-Najah National University (Faculty of Medicine, Faculty of Engineering and Faculty of Physical Education) for reasons mentioned earlier (see Methodology). The size of the sample was pre-determined to be 300, owing to the strict timeframe and limited resources available for this study. This could limit the generalization of the results on other university students.

## Conclusion

Energy-drink usage is common among Palestinian university students and higher among males and those with higher monthly expenditure. A high proportion of students are ignorant to the main constituents and side effect of energy drinks. Most side effects thought to be associated with energy-drink use are seen in only a small proportion of energy-drink users approached in this study. Campaigns should be encouraged in order to spread awareness about the contents and possible side effects of energy drinks. Such campaigns should focus to a greater extent on adolescents and young adults, males and people of high economic classes. Further experimental research should be done in order to identify the exact amounts of caffeine present in energy drinks and to study the prevalence of energy-drink consumption, not only among university students, but among all.

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Energy-drink usage is common among Palestinian university students and higher among males and those with higher monthly expenditure. A high proportion of students are ignorant to the main constituents and side effect of energy drinks. Most side effects thought to be associated with energy-drink use are seen in only a small proportion of energy-drink users approached in this study. Campaigns should be encouraged in order to spread awareness about the contents and possible side effects of energy drinks. Such campaigns should focus to a greater extent on adolescents and young adults, males and people of high economic classes. Further experimental research should be done in order to identify the exact amounts of caffeine present in energy drinks and to study the prevalence of energy-drink consumption, not only among university students, but among all.

## Authorship

HAS and NQ participated in the conception, design, analysis and interpretation of data. Both authors approved the final version submitted for publication.

## Conflict of interest

The author declares no conflict of interest.

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