

# Knowledge and Prevalence of Energy Drinks Consumption among King Khalid University Female Students

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Received: February 2020; Accepted: March 2020; Published: April 1, 2020.

Citation: Abrar Abdulaziz Sultan, Safar A. Al Saleem, Amani A.M. Osman, Ossama A. Mostafa. Knowledge and Prevalence of Energy Drinks Consumption among King Khalid University Female Students. World Family Medicine. 2020; 18(4): 4-17

DOI: 10.5742/MEWFM.2020.93793

## Abstract

**Background:** Consumption of energy drinks has become a global concern, and Saudi Arabia is not an exception. The Saudi Council of Ministers has decided to ban the advertisement of energy drinks after a recent rise in sudden cardiac deaths among healthy young Saudis.

**Aim of Study:** To assess prevalence of energy drinks consumption and knowledge about its ingredient safety and side effects among female college students at King Khalid University (KKU).

**Methods:** A cross sectional study design was followed. A self-administered questionnaire was constructed by the researchers and was validated and pretested. It consisted of socio-demographic characteristics, following unhealthy nutritional habits and knowledge about energy drinks, and their effects and impact.

**Results:** A total of 300 female college students participated in this study. Their mean age was  $20.9 \pm 1.6$  years. Prevalence of energy drinks consumption was 31.3%. The commonest drink used was Code Red (55.3%), Bison (40.4%), Red Bull (23.4%) and Power Horse (20.2%). The monthly intake of energy drinks ranged between 1 to 4 times among 61.7% of students. Overall, 64% of the students had poor knowledge about energy drinks, whereas only 0.7% had good knowledge.

**Conclusions:** Energy drinks consumption is commonly practiced among female university students. It is frequently associated with fast food intake. Knowledge of female university students is generally poor to fair.

**Key words:** Energy drinks, college students, females, knowledge and practice.

## Introduction

The term “Energy drinks” is used to describe a wide variety of beverages that contain “caffeine, taurine, guarana, sugar, vitamins, herbal supplements, and other ingredients” (1). These beverages are being marketed as energy-improving, and are being used to boost their consumers’ energy, which has made energy drinks a fast-growing market in a few years (2).

The prime marketing target for energy drinks is the youth, such as athletes and university students (2). The appeal to the consumers is that they are living busy lives, and need products that will help them to stay focused, alert, and productive while doing their tasks during the day (3).

Heckman et al. (2) noted the high demand of energy drinks among the population of students. It has been found that more than 33% of young people 18-24 years old were drinking energy drinks almost every day (4), while energy drink consumption among college students ranged from 39% to more than 57% (5). Malinauskas et al. (6) found that, during the last 30 days, 51% of college students drank one energy drink or more and 73% tried a cocktail of energy drinks mixed with alcohol.

Zucconia et al. (7) noted that consumption of energy drinks has become a global concern. In Europe, prevalence rate for consumption of energy drinks among adults was 30%, and 12% of adolescents were “High Chronic” users because they consumed almost seven liters of energy drinks over a 30-day period with four to five times during the week.

The Saudi Council of Ministers has decided to ban the advertisement of energy drinks due to a recent rise in sudden cardiac deaths among young healthy individuals. This ban also applies to the distribution of free energy drinks to consumers of all age groups and prohibits the sale of energy drinks in restaurants and canteens in government facilities, education and health facilities, halls of government and private sports clubs. A committed council resolution of factory owners and importers of energy drinks has warned against the harmful effects of energy drinks (8).

Morrone and Rathbun (9) reported that 17% of students in Ohio State University had diarrhea, which is a sign of using unsafe food or drink, and only 26.4% read the labels of products they buy and only 6.5% of students pay attention to the product labels (10).

Energy drinks have become a new surging public health concern. These products could lead to serious health issues that may either affect the person physically or mentally. Therefore, several papers are being published to explain energy drinks’ negative side effects on health (10).

College students usually undertake stressful lives due to many reasons, e.g., study load, being away from family and home, pressure of competition, lack of adequate

resources, and the influence of social environment, through peers, media, and exposure to violence (11).

Lack of proper education or experience about stress management, and poor skills to cope with stress may lead the students to use unhealthy or risky ways to relieve stress. Moreover, stress, sleep disturbances, anxiety, and depression are among the main factors that impact students’ academic performance. Therefore, it has been suggested that energy drink consumption is an emerging issue, which is related to stress management among college students (6).

While consumption of energy drinks by college students is common, and increasing (2), it is unclear how aware the students are about actual effects or potential risks of energy drinks.

Therefore, this study aimed to assess prevalence of energy drinks consumption among female students at King Khalid University (KKU) and to assess their knowledge about energy drinks ingredients, safety, and side effects.

## Subjects and Methods

A cross sectional study design was followed. A total of 300 female students at KKU during the academic year 2017-2018 were included. A multi-stage random sampling technique was used as follows:

- **Stage I:** All KKU health sciences colleges were selected (i.e., Medicine, Dentistry, Pharmacy, Nursing, Laboratory and Radiology).
- **Stage II:** Following a simple random sampling technique, 50 students were selected from each of the above-mentioned colleges.

Based on relevant review of literature, a self-administered questionnaire (in simple Arabic Language) was constructed by the researchers. It consisted of: Socio-demographic characteristics of participants; following unhealthy nutritional habits; and participants’ knowledge regarding energy drinks.

The content validity of the study questionnaire was assessed by three faculty members at the Department of Family and Community Medicine in KKU. The questionnaire’s reliability was assessed for internal consistency using Cronbach’s alpha coefficient, which was 0.769. Moreover, a pilot study was applied on 20 students to explore clarity of included statements and necessary time to fill out the questionnaire. As feedback, the questionnaire was clear and an average 12 minutes was needed for its completion. Collected data were not included in the main study.

Scores were assigned for knowledge items related to energy drinks. A correct answer was assigned a score of (1) and an incorrect answer was assigned a score of (0). All knowledge scores were summed up (maximum was 20 and minimum was 0).

Collected data were verified by hand then coded before computerized data entry. The Statistical Package for Social Sciences (SPSS version 25) was used for data entry and analysis. Descriptive statistics (e.g. number, percentage, mean, and standard deviation) and analytic statistics using chi-square " $\chi^2$ ", Fisher exact and Student's t-tests were applied. The total knowledge score was tested for normality by Shapiro-Wilk test and was found to not be normally distributed. Therefore, the non-parametric Mann-Whitney test was applied to compare knowledge score between two groups (energy drink consumers and non-consumers). P-values <0.05 were considered as statistically significant.

## Results

Table 1 shows that participant students' age ranged between 18 and 26 years with a mean ( $\pm$ ) standard deviation (SD) of 20.9 $\pm$ 1.6 years. Exactly one-quarter of participant students were in third academic year, whereas only 7% were in the sixth academic year. Family size of 68.7% of students ranged between 6 and 10 persons. About one-fifth of them (19%) were first birth order, whereas 29.7% were more than the third. The majority of them (95.7%) had more than 95% academic achievement in the previous year. More than half of their fathers (51.1%) and 35.3% of their mothers were university graduated. The majority of them (90.7%) live with their families. The family income exceeded 10000 SR/month in 68.3% of the students as represented.

The prevalence of energy drink consumption among participants was 31.3% (Figure 1). The commonest used one was Code Red (55.3%), followed by Bison (40.4%), Red Bull (23.4%) and Power Horse (20.2%), as shown in Figure 2. The frequency of energy drinks consumption ranged between 1 and 4 times during the last month among 61.7% of students, whereas it exceeded 10 times per month among 13.8% of them (Figure 3).

Most participant students (84.7%) reported daily intake of tea and/or coffee, as shown in Figure 4. History of taking fast foods was reported by 81% of students, (Figure 5), with 65.8% of students taking fast foods more than once per week (Figure 6).

Table 2 shows that most students correctly knew that energy drinks contain caffeine (78.3%) and sugar (74%). However, only 25.7% knew that energy drinks contain vitamins and 19% knew that they contain taurine. Most students knew that energy drinks are harmful to teeth (82%) and about two-thirds knew that they are harmful to the digestive system (67.3%), heart (67.3%) and bones (66.3%). On the other hand, only 23.3% of them knew that energy drinks have no effect on the respiratory system. Insomnia and addiction were recognized by 83% and 62% of the students, respectively, as side effects of excessive consumption of energy drinks, whereas obesity was recognized by only 47.3% of them.

Overall, students' knowledge score percentage ranged between zero and 85%, with a mean of 50.27% and standard deviation of 16.84%, as illustrated in Figure 7.

Figure 8 shows that 64% of the students had poor knowledge whereas only 0.7% had good knowledge regarding energy drinks.

Table 3 shows that none of the studied socio-demographic characteristics of the students was significantly associated with energy drinks intake.

Table 4 shows that students who consume fast food were more likely to also consume energy drinks than those who did not consume fast food (34.2% versus 19.3%,  $p=0.03$ ). Among those who consumed fast food, the frequency of consumption was not significantly associated with energy drinks intake. Students who drink tea/coffee daily were more likely to also consume energy drinks compared to those who did not consume fast food (33.5% versus 19.6%). However, this difference was not statistically significant.

Table 5 shows that students who reported energy drinks consumption were significantly more knowledgeable regarding the contents of energy drinks than those who did not consume energy drinks (mean ranks were 170.44 and 141.40, respectively,  $p=0.006$ ). However, there was no significant difference between students who reported intake of energy drinks and those who did not report that regarding knowledge of impact of energy drinks on body systems and side effects of excessive consumption of energy drinks. Students who reported consumption of energy drinks had higher overall knowledge regarding energy drinks than those who did not consume them (mean ranks were 164.4 and 144.2, respectively). This difference was not statistically significant.

Table 1: Socio-demographic characteristics of the participants (n=300)

Characteristics	Frequency	Percentage
Age (years)		
• Range		18-26
• Mean±SD		20.9±1.6
Academic year		
• First	51	17.0
• Second	74	24.6
• Third	75	25.0
• Fourth	50	16.7
• Fifth	29	9.7
• Sixth	21	7.0
Family size		
• ≤5	54	18.0
• 6-10	206	68.7
• >10	40	13.3
Birth order		
• First	57	19.0
• Second	92	30.6
• Third	62	20.7
• >Third	89	29.7
Previous year academic achievement (%)		
• ≤95	13	4.3
• >95	287	95.7
Accommodation		
• Alone	21	7.0
• With family	272	90.7
• With relatives	4	1.3
• Shared	3	1.0
Paternal educational level		
• Illiterate	8	2.7
• Primary school	22	7.3
• Intermediate school	25	8.3
• Secondary school	91	30.3
• University	154	51.4
Maternal educational level		
• Illiterate	27	9.0
• Primary school	32	10.7
• Intermediate school	53	17.7
• Secondary school	82	27.3
• University	106	35.3
Family monthly income (in SR)		
• <5000	26	8.7
• 5000-10000	69	23.0
• >10000	205	68.3

**Table 2: Responses of the participants to knowledge questions about energy drinks**

	Correct answers	
	No.	%
<b>Energy drinks contain:</b>		
• Caffeine (✓)	235	78.3
• Taurine (✓)	57	19.0
• Sugar (✓)	222	74.0
• Fats (X)	80	26.7
• Vitamins (✓)	77	25.7
• Minerals (✓)	86	28.7
• Antibiotics (X)	123	41.0
• Hormones (X)	105	35.0
<b>Impact of energy drinks on body organs/systems</b>		
• Digestive system (harmful)	202	67.3
• Heart (harmful)	202	67.3
• Bones (harmful)	199	66.3
• Respiratory system (no effect)	70	23.3
• Teeth (harmful)	248	82.7
• Nervous system (harmful)	159	53.0
• Eye (harmful)	110	36.7
<b>Side effects of excessive consumption of energy drinks</b>		
• Addiction (✓)	186	62.0
• Allergy (X)	89	29.7
• Insomnia (✓)	249	83.0
• Polyuria (✓)	175	58.3
• Obesity (✓)	142	47.3

Table 3: Association between socio-demographic characteristics of the students and intake of energy drinks

Variables	Energy drinks		p-value	
	No (n=206)	Yes (n=94)		
Age (years)	Mean±SD	20.8±1.6	21.1±1.8	0.316 <sup>°</sup>
College	<ul style="list-style-type: none"> <li>• Nursing (n=50)</li> <li>• Laboratory (n=50)</li> <li>• Dentistry (n=50)</li> <li>• Medicine (n=50)</li> <li>• Pharmacy (n=50)</li> <li>• Radiology (n=50)</li> </ul>	33 (66.0%) 35 (70.0%) 34 (68.0%) 38 (76.0%) 36 (72.0%) 30 (60.0%)	17 (34.0%) 15 (30.0%) 16 (32.0%) 12 (24.0%) 14 (28.0%) 20 (40.0%)	0.628*
Academic year	<ul style="list-style-type: none"> <li>• First (n=51)</li> <li>• Second (n=74)</li> <li>• Third (n=75)</li> <li>• Fourth (n=50)</li> <li>• Fifth (n=29)</li> <li>• Sixth (n=21)</li> </ul>	34 (66.7%) 51 (68.9%) 53 (70.7%) 37 (74.0%) 22 (75.9%) 9 (42.9%)	14 (33.3%) 23 (31.1%) 22 (29.3%) 13 (26.0%) 7 (24.1%) 12 (57.1%)	0.151*
Family size	<ul style="list-style-type: none"> <li>• ≤5 (n=54)</li> <li>• 6-10 (n=206)</li> <li>• &gt;10 (n=40)</li> </ul>	34 (63.0%) 146 (70.9%) 26 (65.0%)	20 (37.0%) 60 (29.1%) 14 (35.0%)	0.465*
Birth order	<ul style="list-style-type: none"> <li>• First (n=57)</li> <li>• Second (n=92)</li> <li>• Third (n=62)</li> <li>• &gt;third (n=89)</li> </ul>	40 (70.2%) 62 (67.4%) 45 (72.6%) 59 (66.3%)	17 (29.8%) 30 (32.6%) 17 (27.4%) 30 (33.7%)	0.848*
Previous year academic achievement	<ul style="list-style-type: none"> <li>• ≤95% (n=13)</li> <li>• &gt;95% (n=287)</li> </ul>	10 (76.9%) 196 (68.3%)	3 (23.1%) 91 (31.7%)	0.376**
Paternal educational level	<ul style="list-style-type: none"> <li>• Illiterate (n=8)</li> <li>• Primary school (n=22)</li> <li>• Intermediate school (n=25)</li> <li>• Secondary school (n=91)</li> <li>• University (n=154)</li> </ul>	6 (75.0%) 15 (68.2%) 17 (68.0%) 66 (72.5%) 102 (66.2%)	2 (25.0%) 7 (31.8%) 8 (32.0%) 25 (27.5%) 52 (33.8%)	0.876*
Accommodation	<ul style="list-style-type: none"> <li>• Alone (n=21)</li> <li>• With family (n=272)</li> <li>• With relatives (n=4)</li> <li>• Shared (n=3)</li> </ul>	12 (57.1%) 190 (69.9%) 2 (50.0%) 2 (66.7%)	9 (42.9%) 82 (30.1%) 2 (50.0%) 1 (33.3%)	0.546*
Maternal educational level	<ul style="list-style-type: none"> <li>• Illiterate (n=27)</li> <li>• Primary school (n=32)</li> <li>• Intermediate school (n=53)</li> <li>• Secondary school (n=82)</li> <li>• University (n=106)</li> </ul>	19 (70.4%) 21 (65.6%) 36 (67.9%) 51 (62.2%) 79 (74.5%)	8 (29.6%) 11 (34.4%) 17 (32.1%) 31 (37.8%) 27 (25.5%)	0.481*
Family monthly income (in Saudi Riyals)	<ul style="list-style-type: none"> <li>• &lt;5000 (n=26)</li> <li>• 5000-10000 (n=69)</li> <li>• &gt;10000 (n=205)</li> </ul>	18 (69.2%) 43 (62.3%) 145 (70.7%)	8 (30.8%) 26 (37.7%) 60 (29.3%)	0.427*

\* Chi-square test

\*\* Fisher Exact test

° Student's t-test

**Table 4: Association between fast food, tea and coffee consumption and intake of energy drinks among the participants**

Variables	Energy drinks		P value§
	No (n=206)	Yes (n=94)	
<b>Fast food consumption</b>			
• No (n=57)	46 (80.7%)	11 (19.3%)	0.030
• Yes (n=243)	160 (65.8%)	83 (34.2%)	
<b>Frequency of fast food consumption (n=243)</b>			
• Once/month (n=9)	4 (44.4%)	5 (55.6%)	0.237
• Once/week (n=74)	46 (62.2%)	28 (37.8%)	
• >once/week (n=160)	110 (68.8%)	50 (31.2%)	
<b>Tea/coffee consumption</b>			
• No (n=46)	37 (80.4)	9 (19.6)	0.061
• Yes (n=254)	169 (66.5)	85 (33.5)	

§ Chi-square test

**Table 5: Association between knowledge about energy drinks and their intake among the participants**

Knowledge about energy drinks	Energy drinks		P value§
	No (n=206)	Yes (n=94)	
<b>Energy drinks' contents</b>			
• Median	37.5	50	0.006
• IQR	25-50	37.5-62.5	
• Mean rank	141.40	170.44	
<b>Impact of energy drinks on body organs/systems</b>			
• Median	57.1	57.1	0.576
• IQR	39.3-85.7	42.9-85.7	
• Mean rank	152.35	146.4	
<b>Side effects of excessive consumption of energy drinks</b>			
• Median	60	60	0.228
• IQR	40-80	40-80	
• Mean rank	146.5	159.2	
<b>Total knowledge about energy drinks</b>			
• Median	50	55	0.059
• IQR	40-60	45-65	
• Mean rank	144.2	164.4	

§ Mann-Whitney test

Figure 1: Prevalence of energy drink consumption among female university students

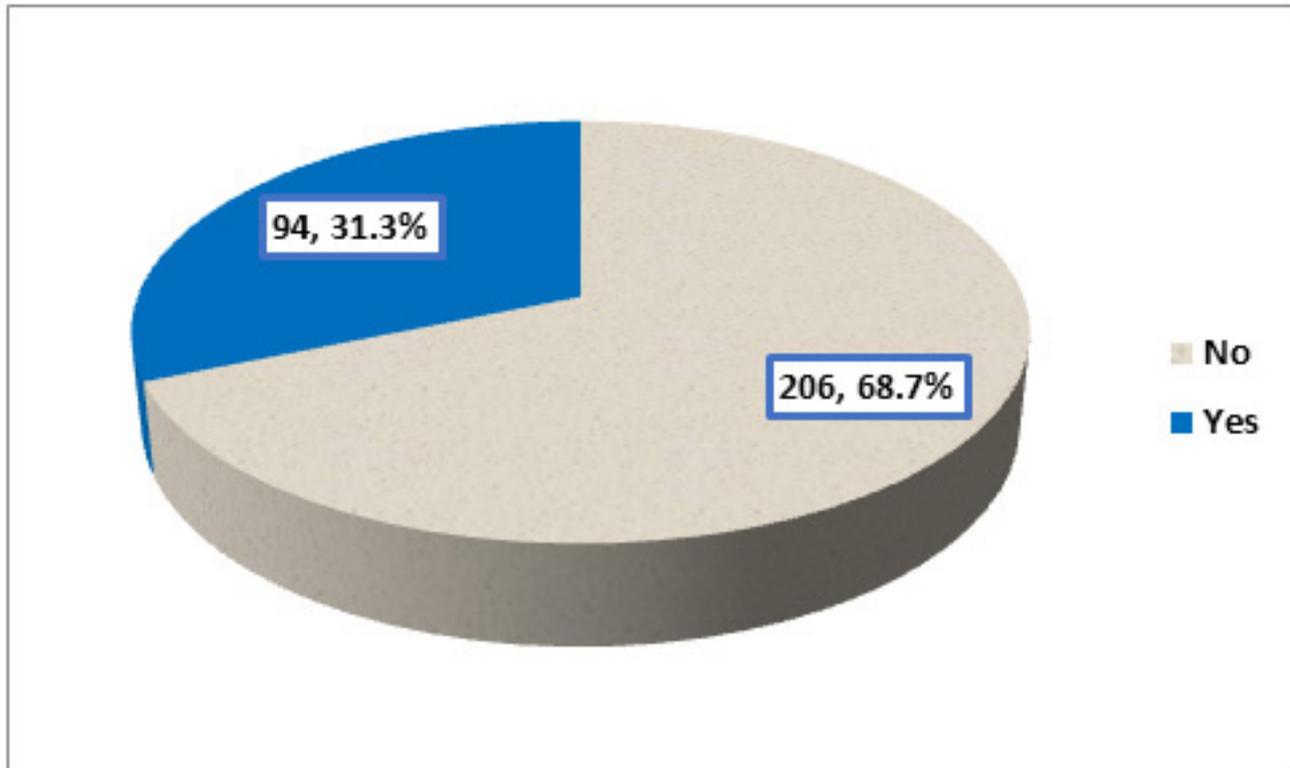
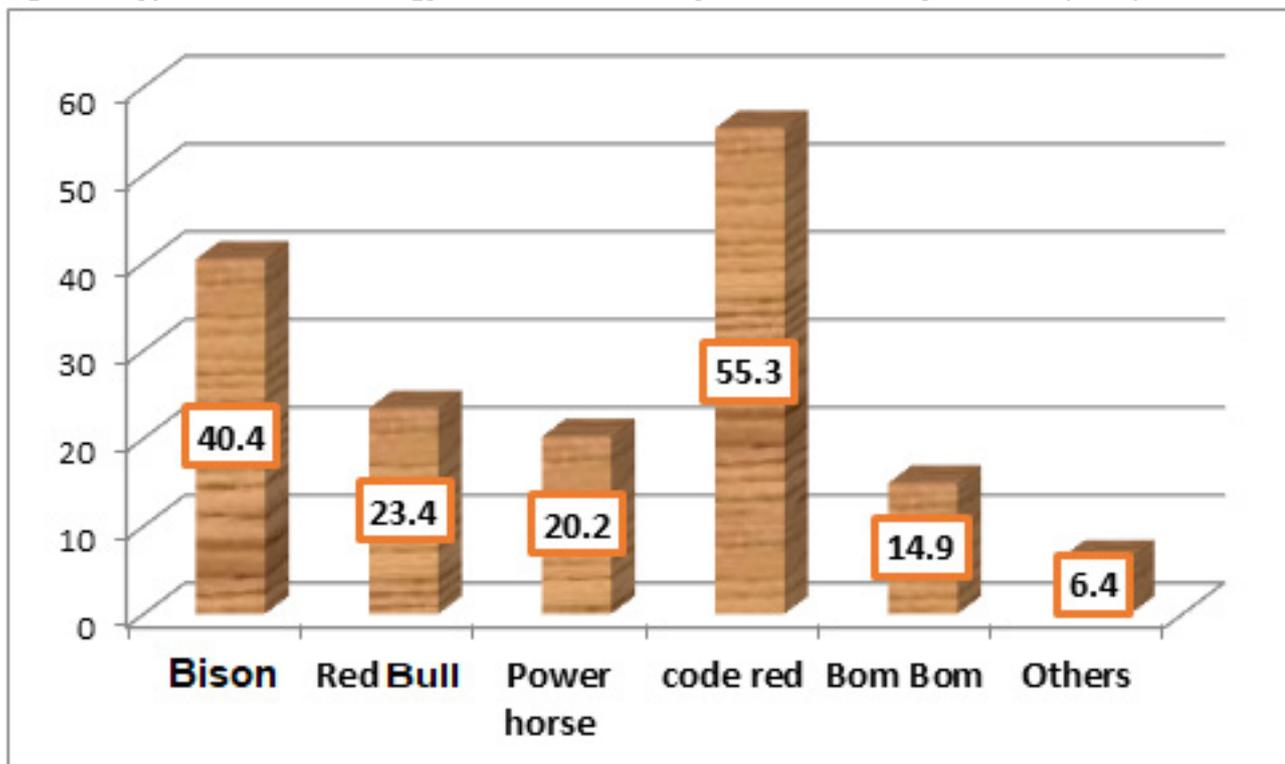
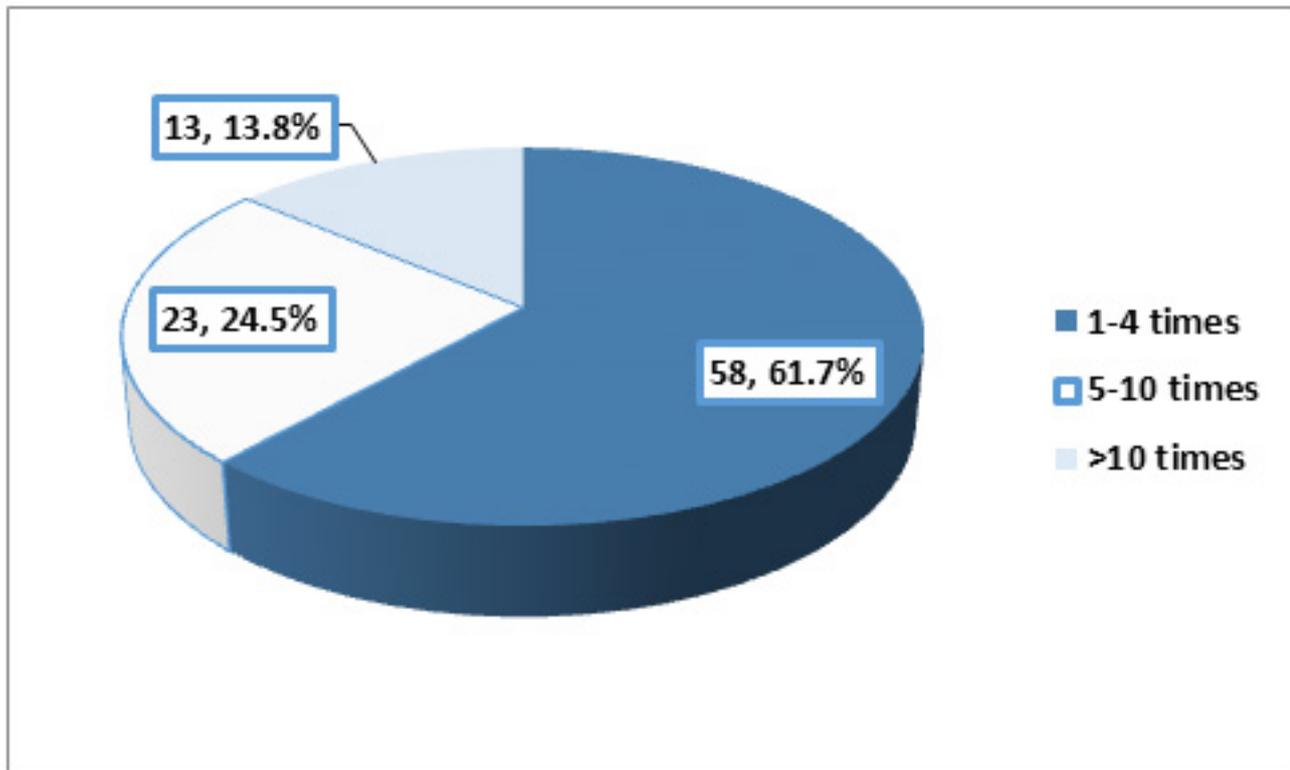
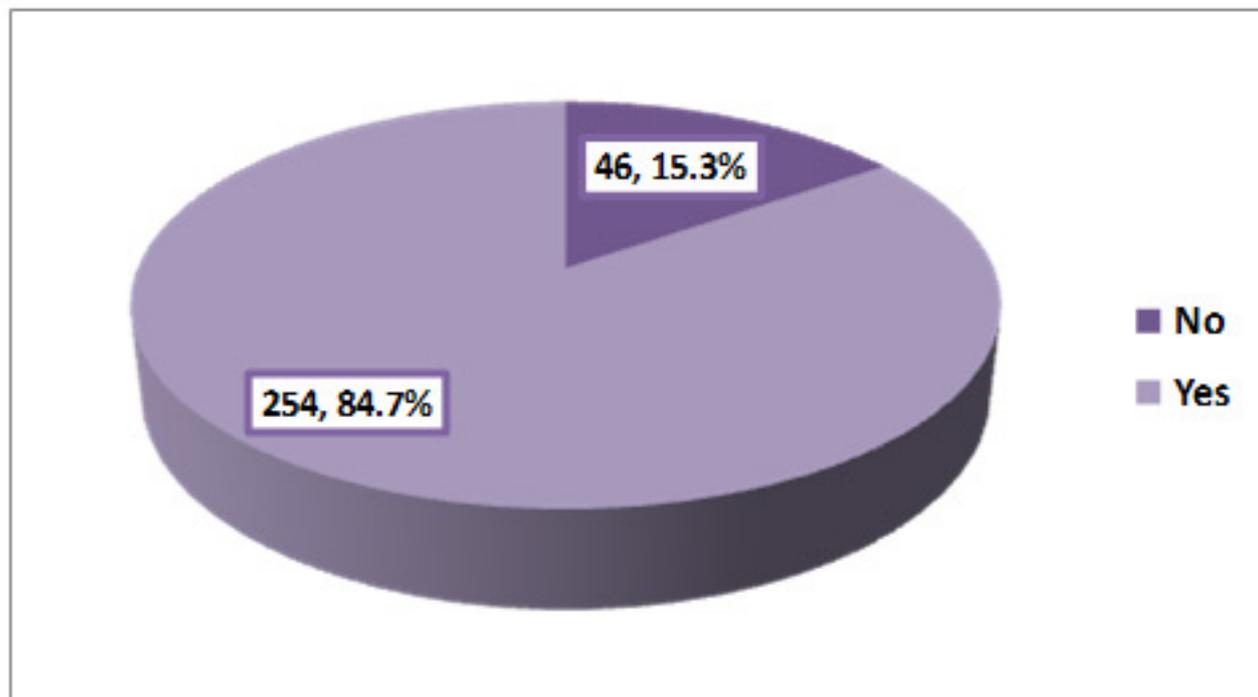
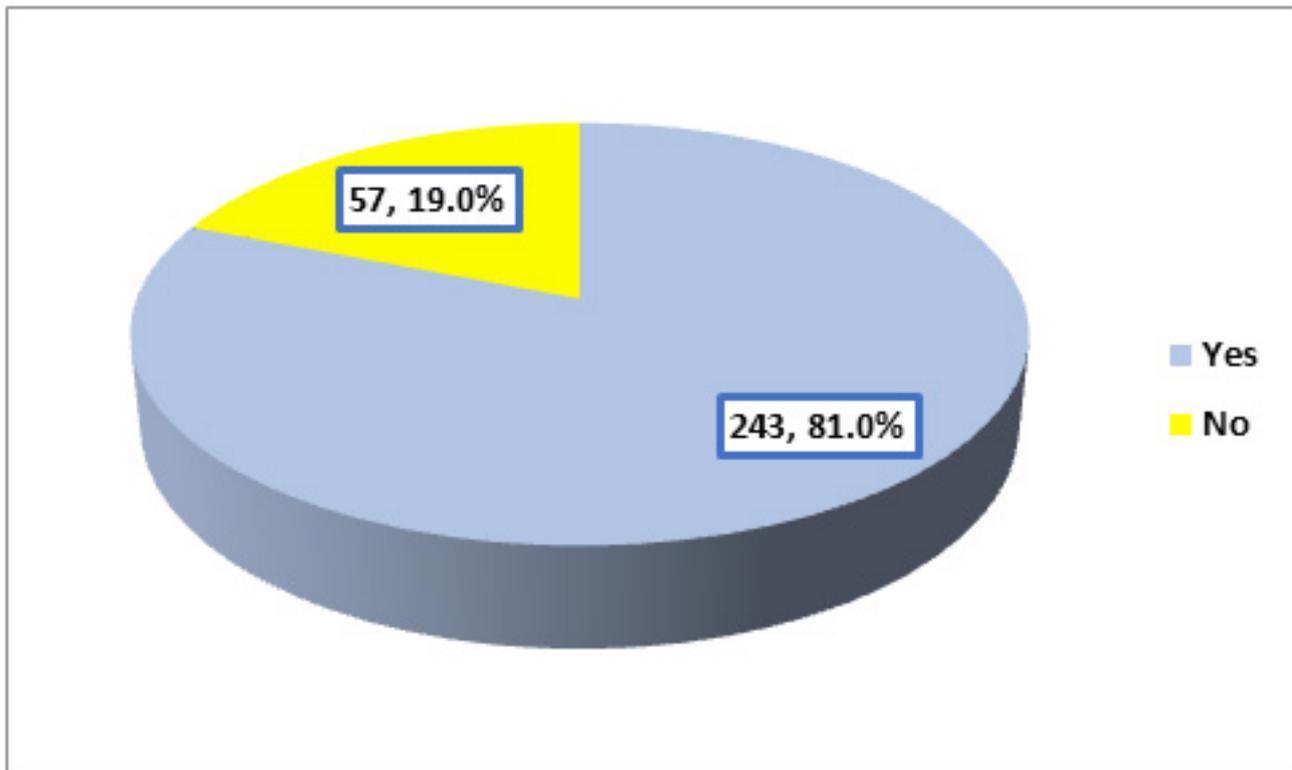
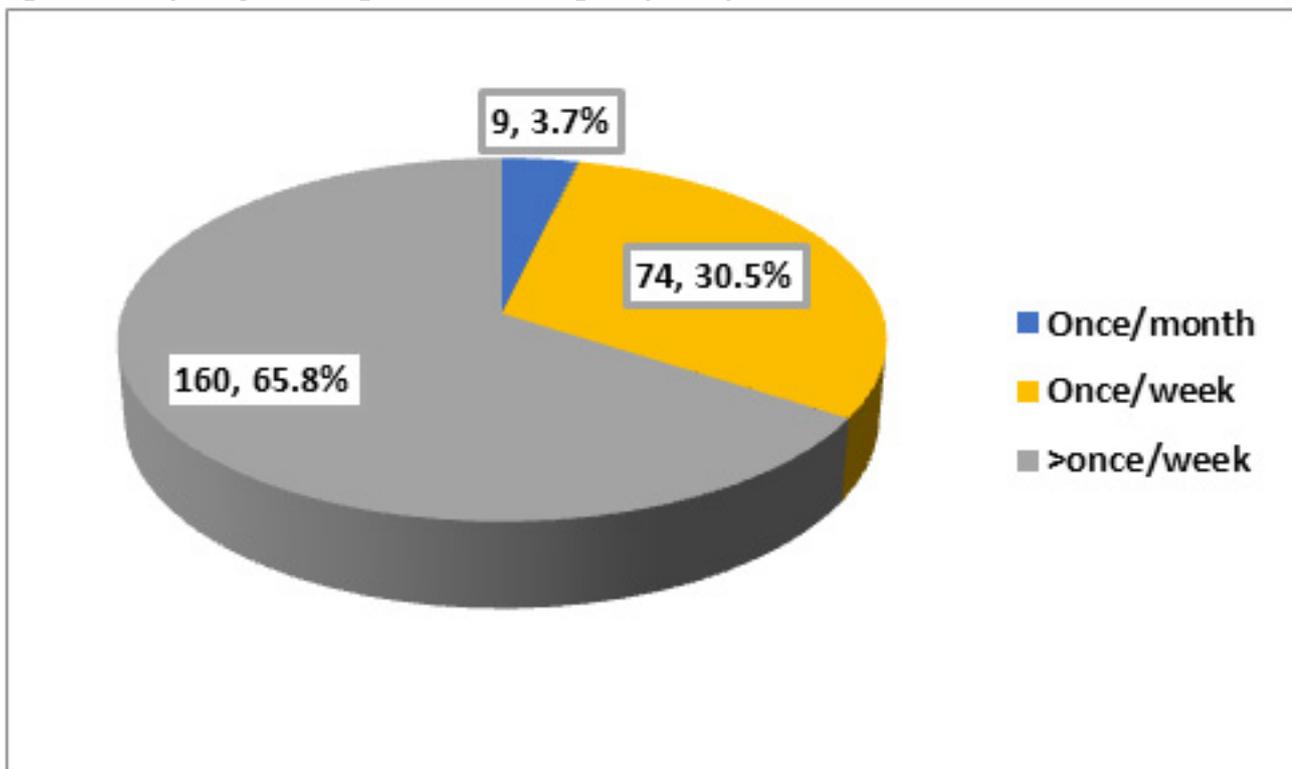
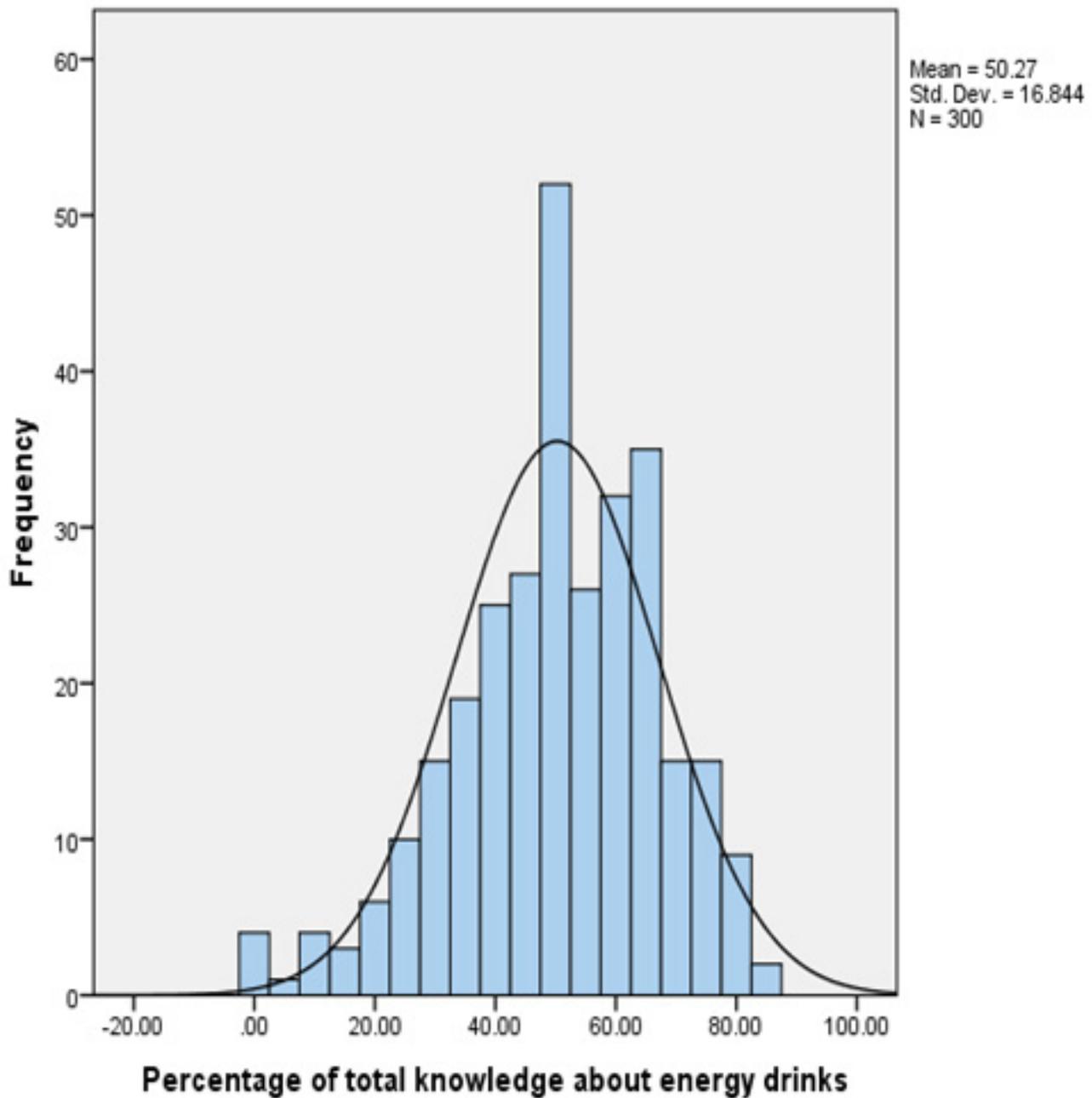


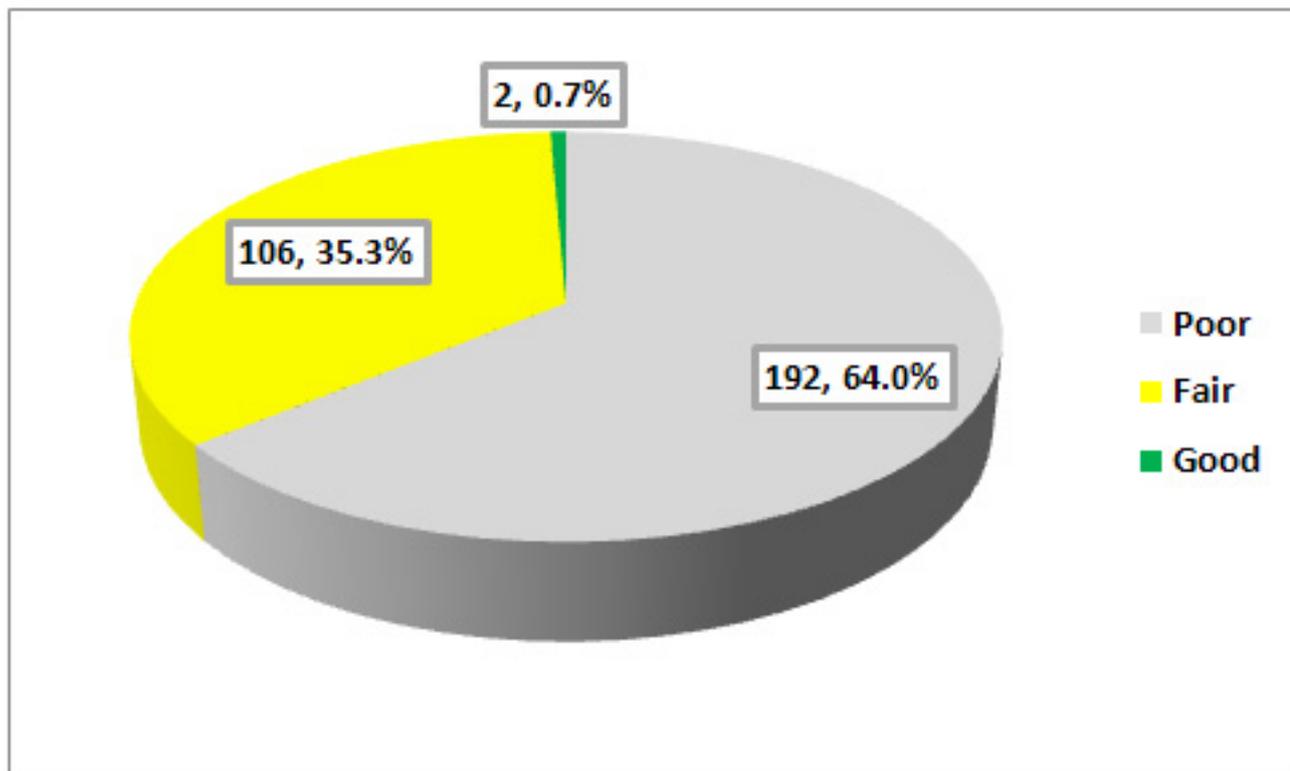
Figure 2: Types of different energy drinks consumed by female university students (n=94)



**Figure 3: Frequency of energy drinks intake (per month) among the participants (n=94)****Figure 4: Daily intake of tea and/or coffee among the participants**

**Figure 5: History of taking fast food among the participants****Figure 6: Frequency of taking fast food among the participants**

**Figure 7: Percentage of energy drinks knowledge score among the participants**

**Figure 8: Overall level of knowledge regarding energy drinks among the participants**

## Discussion

Prevalence of energy drink consumption by female KKU university students of medical sciences was 31.3%. This figure is very close to what has been reported recently in a study carried out among female university students in Taibah University, Saudi Arabia (30.1%) (12). In another Saudi study carried out in Al-Dammam University, 26.2% of female medical students were energy drinks consumers (13). However, in Umm Al-Qura University, a lower prevalence (12.3%) has been reported among female medical students (14).

Higher rates of energy drink consumption were reported among secondary school and non-medical university students in Jeddah 2013 (45%) (15), Makkah 2016 (46.7%) (16), Riyadh 2016 (71.6) (8), Wadi Al-Dawaser, Riyadh province (76.5%) (17) and Hail (46%) (10). In addition, a meta-analysis study estimated the rate of energy drinks consumption as 46.9% among the population of the Gulf Cooperation Council countries (18).

In Turkey (19), prevalence of energy drinks consumption was 32.6%, while in Pakistan, it was 37.1% among female medical students (20). In Taiwan (21), 24.8% of the university students reported consuming energy drinks in the past 30 days. In Puerto Rico, the prevalence was 21% among university students (22). In Canada, despite the rate of energy drinks consumption being relatively low (9.1%), the majority of consumers reported mixing it with other stimulants (23). In USA, higher rates were also reported among non-medical university students as 51% and 48.3% of them consume energy drinks (6, 24).

In Poland and UAE, exceptionally high rates were reported among medicine students (61.8% and 92%, respectively) (25, 26).

The variations in rates of consumption of energy drinks between different studies may be due to cultural differences. The relatively low prevalence of energy drinks consumption in recent years in KSA could be attributed to the recent application of 100% taxes on energy drinks purchase which was implemented in 2017 (27).

The frequency of energy drinks consumption during last month ranged between 1 and 4 times among most of the students in the present study. The commonest used energy drinks in the current study were Code Red (55.3%), followed by Bison (40.4%), Red Bull (23.4%) and Power Horse (20.2%).

Similarly, in Madinah (12) and Riyadh,(8) the most frequent usage of energy drinks was one can per week. In UAE (25), Red Bull was the most commonly used.

Findings of the present study showed that students who consumed fast foods were more likely to consume energy drinks. This link between consumption of fast foods and energy drinks has been documented by other studies (28-30). French et al. (31) noted that consumption of fast foods is positively correlated with energy drink consumption, and negatively correlated with fruit, vegetable, and milk intake. Moreover, several studies documented a relationship between consumption of fast food and depressed mood, and lethargy in young people (29, 32, 33). Thus, combining energy drink and fast food consumption may possibly adversely affect young people's mood and behavior.

Energy drinks consumption was also associated with intake of tobacco, tea, coffee and other stimulants (34). However, in the present study, consumption of tea and/or coffee was not associated with energy drinks consumption.

In the current study, the overall percentage of knowledge score about energy drink by female students at the health sciences colleges of KKU ranged between zero and 85% with a mean of 50.3%, while 64% of students had poor knowledge, and only 0.7% had good knowledge. Students who consumed energy drinks were more knowledgeable regarding energy drinks' ingredients than non-consumers. However, there was no statistically significant difference between both groups regarding impact of energy drinks on body organs/systems and side effects of excessive consumption of energy drinks.

Most participants in this study could correctly recognize caffeine and sugar as ingredients of energy drinks, while almost half of participant students were not aware about the adverse impact of energy drinks on the central nervous system.

A similar finding was found among university students in Riyadh (8). In a study carried out in Taiwan (21), almost half of the students were unaware of the energy drinks' ingredients. In Al-Madinah Al-Munawarah, 69.6% of female secondary school students did not know the active ingredients of energy drinks (35). Park et al. added that consumption of energy drinks is associated with multiple mental and nervous system health problems (28).

### Study Limitations

To the best of our knowledge, this is the first study in KSA investigating the association between consumption of energy drinks and fast foods. However, this study had two important limitations. The first is its cross-sectional research design, which is good only for hypothesis generation. The second is the inclusion of only female university students. Therefore, we were not able to compare our results with those of males.

In conclusion, consumption of energy drinks is a common practice among female students at medical sciences colleges. Almost one-third of female university students consume energy drinks. It is associated with fast food consumption. Overall knowledge about energy drinks is poor-to-fair among almost all female students. Less than 1% of students have a good level of knowledge. Students who consume energy drinks are more knowledgeable regarding the active ingredients of the energy drinks.

Therefore, it is recommended that curriculum of health sciences colleges should provide information on the potential health hazards related to excessive intake of caffeine-containing beverages. Health education intervention programs are needed to increase the awareness of students about the composition of energy drinks and their effects on health. Active ingredients of energy drinks should clearly appear on cans and consumers

should be encouraged to be aware of them and of their adverse effects on their health. Family physicians should play role in health education regarding energy drinks, to the patients.

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