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Benefits and Side Effects of Energy Drink Consumption among University Students

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ABSTRACT

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Recently, energy drinks are becoming a popular beverage among youths, especially students in tertiary education. It claims to provide many benefits for students such as increased energy and wakefulness. This study was carried out to determine the prevalence, types, benefits, and side effects of energy drink consumption among university students. This cross-sectional study was carried out in Universiti Teknologi MARA (UiTM) Puncak Alam Campus, Selangor from April 2019 to July 2020. Students who participated using convenience sampling (n=376) were asked to complete a set of self-administered questionnaires. Data were analysed using IBM-SPSS Statistics (Version 25) to determine the prevalence of energy drinks consumption. A Chi-square test was also used to determine the association between energy drink consumption and gender. Out of 380 respondents, 217 (57.1%) students consumed energy drinks of which 93 (42.9%) were males and 124 (57.1%) were females. For the types of energy drinks, male students significantly consumed more Red Bull and Gatorade compared to females at 68 (53.1%) and 39 (53.4%) respectively ($p<0.05$). Also, male students reported that energy drinks were effective in improving physical performance (n = 55, 51.4%), increased stamina in exercise or sports (n = 47, 52.8%), increased reaction rate (n = 30, 56.6%) and improved driving (24, 66.7%) ($p<0.05$). In contrast, females (n = 80, 52.3%) perceived that the drinks were able to improve energy ($p<0.05$). However, no statistically significant association was found between males and females for the side effects of energy drink consumption ($p>0.05$). In conclusion, a majority of university students in Selangor consumed energy drinks. Most male students also believed that it is beneficial with few side effects.

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1. INTRODUCTION

Energy drinks are known as non-alcoholic beverages that constituted a high amount of caffeine. Other than caffeine, energy drinks also contain different ingredients including taurine, guarana, glucuronolactone, B vitamins, and ginseng (Hardy, Kliemann, Evansen & Brand, 2017). Examples of energy drinks in the market are Red Bull, Monster, and Explosion. These energy drinks have been advertised with the ability to improve strength, endurance, wakefulness, and relieve the symptoms of a hangover (Kushwaha, Mandal, Koirala & Rauniar, 2019).

Caffeine is a methylxanthine that is well known as a central nervous system (CNS) stimulant involved in cognitive performances, increased alertness, and deferred fatigue (Rath, 2012). High caffeine consumption of more than 400 mg is associated with chronic daily headaches, nervousness, sleeplessness, increased urination, arrhythmia, and stomach upset (Alsunni & Badar, 2011). Another ingredient in energy drinks, guarana, is an extract of the seeds from the *Paullinia cupana* Mart var. Sorbilis plant which has a caffeine concentration of four times in coffee beans (Moustakas, Mezzio, Rodriguez, Constable, Mulligan & Voura, 2015). Taurine is one of the constituents of energy drinks that is often referred to as an amino acid that assists neurological growth and helps control the amount of water and mineral salts in the blood (Casuccio, Bonanno, Catalano, Cracchiolo, Giugno, Sciuto & Immordino, 2015).

The following studies have reported an alarming trend of energy drink consumption among all age groups, including children and adolescents. The population of the younger generation, specifically between 18 to 24 years old consuming energy drinks is at 36% (Kelly & Prichard, 2016). Caffeine intoxication can occur when the caffeine content of two to three cans of energy drinks is equivalent to more than 300 mg (Alrasheedi, 2016). However, there is little evidence on the benefits of energy drinks (Salih, Lumpur & Sentral, 2015), specifically among university students in Selangor. Thus, this study aimed to determine the prevalence, types, benefits, and side effects of energy drink consumption between male and female university students located in Selangor.

2. METHOD

2.1 Study Design, Location, and Sampling

In this study, a cross-sectional design was used. This study was conducted at Universiti Teknologi MARA (UiTM), Puncak Alam Campus, Selangor. There were eight faculties and approximately 17,153 students in UiTM Puncak Alam Campus during the study period. UiTM Puncak Alam Campus has been chosen as the study location due to the feasibility of the researcher to answer the research objective and to collect the data. The sample size was calculated using Raosoft (2004), where a sample size of 380 respondents was considered adequate (rule of thumb) with a 5 percent margin error and a 95 percent confidence level. Students who participated in this study were from the Faculty of Pharmacy, the Faculty of Health Sciences, the Faculty of Management and Business, the Faculty of Hotel and Tourism, the Faculty of Accounting, the Faculty of Education, and partly from the Faculty of Art and Design and the Faculty of Architecture. The inclusion criteria for this study are 18 years old and above, Malaysian, able to understand English, undergraduate students, and full-time students. Before data collection, potential respondents were asked whether they are allergic to any ingredients in energy drinks and if the answer is yes, they were excluded from the study. This study was approved by the UiTM Research Ethics Committee with reference number 600-IRMI (5/1/6). The respondents were approached with an ethical approval letter and

informed consent was given before data collection. Full confidentiality and anonymity were maintained throughout the study.

2.2 Research Instrument

The study's questionnaire was adapted from a previous study by Badar (2019). It consisted of two sections: 1) Section 1 was on Socio-Demographic Data, and 2) Section 2 included questions about Energy Drink Consumption; prevalence, types of energy drinks used (five items), benefits (nine items), and side effects (five items) of energy drink consumption. Respondents were required to answer "yes" or "no" for questions in Section 2. The Cronbach's alpha from the previous author was good (α=0.86) (Badar, 2019) which corroborated the value for Cronbach's alpha in this research at 0.83.The adapted instrument was subjected to peer review by four research experts with a health sciences background. This ensures that the tool was consistent, and the items used met the study's objective. The panel found that the instrument was appropriate for measuring the study material.

2.3 Statistical Analysis

All data were analysed using the IBM SPSS Statistics (Version 25). The demographic data were analysed with descriptive statistics consisting of frequency, percentage, mean and standard deviation. A Chi-square test was used to analyse the study objectives as well as to compare the proportion of the categorical variables between males and females. The accepted significance was set at $p<0.05$.

3. DATA ANALYSIS AND RESULTS

All respondents (n=380) agreed to participate in this study and completely answered the questionnaire. 70% percent (266) of the respondents were female whilst the other 30 percent (114) were male. The average age of the respondents was 21.8 (±1.16) years, where a majority were between 20 and 22 years old. Meanwhile, for year of study, most respondents were in second-year (n=146, 38.4%), followed by third-year (n=131, 34.5%), first-year 62 (16.3%) and fourth-year (n=41, 10.8%). Their Cumulative Grade Point Average (CGPA) showed that on average, the CGPA of the respondents was 3.31 (±0.29), where a majority of respondents were at second upper class (n=235, 61.8%) and first-class (n=115, 30.3%) levels.

3.1 Prevalence of Energy Drink Consumption among Students

The prevalence of energy drink consumption was at 217 (57.1%), and it was higher among females (n = 124, 57.1%) compared to males (n = 93, 42.9%). There was a significant association between energy drinks consumption and gender (χ^2 (1) = 380.0, p-value = 0.001) (refer Table 1).

Table 1. Prevalence of Energy Drinks Consumption

Do you use energy drinks?	Male, n (%)	Female, n (%)	Total (380), n (%)	Test Statistics	p-value
Yes	93 (42.9)	124 (57.1)	217 (57.1)	380.00	0.001
No	22 (13.5)	141 (86.5)	163 (42.9)		

3.2 Types of Energy Drinks Preferred

Among the five types of energy drinks, Red Bull was prevalent among males (n = 68, 53.1%) as compared to females (n = 60, 46.9%), and there was a significant association between Red

Bull consumption among males and females with χ^2 (1) = 13.436, p = 0.001. Gatorade consumption was common among males (n = 39, 53.4%) compared to females (n = 34, 46.6%). Hence, there was a statistically significant association between Gatorade consumption among males and females as, χ^2 (1) = 5.016, p = 0.025. Meanwhile, there was no statistically significant association between gender groups for consumption of M7 energy, Monster and Livita (p > 0.05). Table 2 shows the types of energy drinks preferred by users.

Table 2. Types of Energy Drinks Preferred

Types of energy drinks	Male (n=93) n (%)	Female (n=124) n (%)	Total (217) n (%)	Test Statistics	p-value
Red Bull				13.436	0.001*
Yes	68 (53.1)	60 (46.9)	128 (59.0)		
No	25 (28.1)	64 (71.9)	89 (41.0)		
M7 energy				0.044	0.833
Yes	16 (44.4)	20 (55.6)	36 (16.6)		
No	77 (42.5)	104 (57.5)	181 (83.4)		
Gatorade				5.016	0.025*
Yes	39 (53.4)	34 (46.6)	73 (33.6)		
No	54 (37.5)	90 (62.5)	144 (66.4)		
Monster				0.108	0.743
Yes	20 (40.8)	29 (59.2)	49 (22.6)		
No	73 (43.5)	95 (56.5)	168 (77.4)		
Livita				0.768	0.381
Yes	35 (39.3)	54 (60.7)	89 (41.0)		
No	58 (45.3)	70 (54.7)	128 (59.0)		

*p<0.05 was statistically significant

3.3 Benefits of Energy Drinks

Table 3 shows the benefits of energy drinks experienced by users, a comparison between males and females. The result for "improve physical performances" was higher among males (n = 55, 51.4%) compared to females (n = 52, 48.6%). There was a statistically significant association between "improve physical performances" among male students and female students with χ^2 (1) = 6.293, p = 0.012. Besides, 47 (52.8%) male students perceived the benefits of energy drinks were to increase stamina in exercise or sports activity compared to female students 42 (47.2%), and there was a statistically significant association between "increase stamina in exercise/ sport" among males and females, χ^2 (1) = 6.102, p = 0.014. Male students reported that one of the benefits of energy drinks was an increase in reaction rate (n = 30, 56.6%) compared to female students (n = 23, 43.4%) and the results were statistically significant between "increase in reaction rate" and gender, as (χ^2 (1) = 5.411, p = 0.021). The results also found that there was a statistically significant difference between "improve driving" and gender group, where (χ^2 (1) = 9.991, p = 0.002). Male students claimed energy drinks can improve their performance in driving (n = 24, 66.7%) compared to female students (n = 12, 33.3%) (refer Table 3).

On the other hand, the study found "increased energy" to be higher among female students (n = 80, 52.3%) than male students (n = 73, 47.7%). The results also revealed a statistically significant association between increased energy and gender where χ^2 (1) = 4.994, p = 0.025. Meanwhile, there was no statistically significant association between male and female for "improved mental performance", "ability to stay awake longer", "ability to study better" and "improved emotional status" (p>0.05). Table 3 shows the benefits of energy drinks experienced by users.

Table 3. Benefits of Energy Drinks

Benefits	Male (n=93) n (%)	Female (n=124) n (%)	Total (217) n (%)	Test Statistics	p-value
Improved mental performances				0.045	0.831
Yes	29 (43.9)	37 (56.1)	66 (30.4)		
No	64 (42.4)	87 (57.6)	151 (69.6)		
Improved physical performances				6.293	0.012*
Yes	55 (51.4)	52 (48.6)	107 (49.3)		
No	38 (34.5)	72 (65.5)	110 (50.7)		
Increased stamina in sport				6.102	0.014*
Yes	47 (52.8)	42 (47.2)	89 (41.0)		
No	46 (35.9)	82 (64.1)	128 (59.0)		
Increased energy				4.994	0.025*
Yes	73 (47.7)	80 (52.3)	153 (70.5)		
No	20 (31.3)	44 (68.7)	64 (29.5)		
Ability to stay awake longer				1.900	0.168
Yes	47 (48.0)	51 (52.0)	98 (45.2)		
No	46 (38.7)	73 (61.3)	119 (54.8)		
Ability to study better				0.994	0.319
Yes	20 (37.0)	34 (63.0)	54 (24.9)		
No	73 (44.8)	90 (55.2)	163 (75.1)		
Increased in reaction rate				5.411	0.020*
Yes	30 (56.6)	23 (43.4)	53 (24.4)		
No	63 (38.4)	101 (61.6)	164 (75.6)		
Improved emotional status				3.678	0.055
Yes	14 (30.4)	32 (69.6)	46 (21.2)		
No	79 (46.2)	92 (53.8)	171 (78.8)		
Improve driving				9.991	0.002*
Yes	24 (66.7)	12 (33.3)	36 (16.6)		
No	69 (38.1)	112 (61.9)	181 (83.4)		

3.4 Side Effects of Energy Drinks

Table 4 demonstrates the side effects of energy drinks experienced by users. Some of the respondents experienced an increase in urination (n = 72, 33.2%), followed by sleeplessness (n = 58, 26.7%) and stomach upset (n = 46, 21.2%) after consuming the energy drinks. The results also show that there were no statistically significant associations for the side effects of energy drinks listed in Table 4 between males and females ($p>0.05$).

Table 4. Side Effects of Energy Drinks

Side effects	Male (n=93) n (%)	Female (n=124) n (%)	Total (217) n (%)	Test Statistics	p-value
Abnormal heart rate				0.095	0.757
Yes	7 (46.7)	8 (53.3)	15 (6.9)		
No	86 (42.6)	116 (57.4)	202 (93.1)		
Sleeplessness				0.071	0.790
Yes	24 (41.4)	34 (58.6)	58 (26.7)		
No	69 (43.4)	90 (56.6)	159 (73.3)		
Dehydration				0.422	0.516
Yes	8 (36.4)	14 (63.6)	22 (10.1)		
No	85 (43.6)	110 (56.4)	195 (89.9)		
Increased urination				0.838	0.360
Yes	34 (47.2)	38 (52.8)	72 (33.2)		
No	59 (40.7)	86 (59.3)	145 (66.8)		
Stomach upset				0.057	0.811
Yes	19 (41.3)	27 (57.8)	46 (21.2)		
No	74 (43.3)	97 (56.7)	171 (78.8)		

4. DISCUSSION AND CONCLUSION

The study shows that the prevalence of energy drink consumption among university students in this study was high at 57.1 percent. The finding is supported by previous studies reporting that energy drinks were most popular among young adults and athletic students because they need more energy to promote alertness (Balaji, 2014; Buxton & Hagan, 2012). Furthermore, female students (57.1%) had a greater prevalence of consuming energy drinks compared to males (42.9%). This could be because most of the respondents in this study were females (about 70.0%) and only 30.0% were males. This demographic finding is similar to a previous study conducted in Malaysia by Salih et al. (2015), who found that a majority of female students in Universiti Kuala Lumpur consumed more energy drinks in their daily life, prevalently more than the male students. As a majority of the university students were females, it could be concluded that currently, female students are dominant in tertiary education.

Energy drinks are accessible because they are available in most convenience stores as well as vending machines. Energy drink consumption was generally high among females while Red Bull and Gatorade were the most preferred types of energy drinks chosen by males in this study. A previous study conducted in Management and Sciences University, Malaysia found that Red Bull was the most preferred energy drink selected by the students (Balaji, 2014). A few factors that may influence the choice and types of energy drinks are flavour, price, peers, and packaging. A previous study reported that males consumed more energy drinks compared to females because of energy drink advertisements, as most of them targeted young adult males, claiming that taking energy drinks will enable them to appear more masculine (Buxton & Hagan, 2012). A further qualitative study may be needed to better understand the reason behind these findings.

The benefits of energy drink consumption reported by male students were improvements in physical performance, reaction speed during exercise or sports, and driving. On the other hand, female students claimed these beverages were able to improve their energy levels. A previous study conducted in Turkey found that both females and males felt energetic and stronger after consuming energy drinks as it can increase their attention level (Kalkan et al., 2018). Another study stated that the most common reason for consuming energy drinks is for an extra boost in energy to provide cognitive and mood enhancement (Ishak et al., 2012). As energy drinks may have psychoactive effects due to the high caffeine content in the range of 50 mg to as high as 505 mg per can or bottle, they are indeed able to enhance mood and reduce fatigue (Masengo et al., 2020). However, some of the caffeine contained in energy drinks may be toxic and harmful to human organs and may interact with certain medicines (Borlu et al., 2019). Energy drinks are typically containing high levels of caffeine and excessive consumption may result in palpitation, cardiac arrhythmias, caffeine intoxication (Brian et al., 2012). Therefore, the authorities must take into serious consideration the usage and patterns of energy drink consumption, especially for students with health issues such as obesity, metabolic syndromes, and heart problems.

In terms of the side effects of energy drinks, this study found that respondents experienced an increase in urination, sleeplessness, and stomach upset with the proportion of 33 percent, 27 percent, and 21 percent respectively. However, there was no association found for the side effects of energy drink consumption between males and females. Similarly, a previous local study conducted among students in Management and Science University reported that students frequently had difficulties in sleeping, irritability, and stomach pain after consuming energy drinks (Balaji, 2014). However, there is no reliable evidence of serious adverse effects

from energy drinks due to caffeine, as energy drinks contain other constituents such as taurine, guarana extracts, and ginseng (McCrory et al., 2017). It can be suggested that special attention and awareness should be given to our university students, with emphasis on the long term side-effects so as to help them in controlling the excessive intake of energy drinks.

In conclusion, this study revealed that more than half of the respondents consumed energy drinks and a majority were females. Most of the male students reported experiencing more benefits in terms of improvements in physical performance, reaction speed, sports, and driving as opposed to side effects. Meanwhile, female students reported that their energy improved after consuming such beverages. There was no association between the side effects of energy drinks among gender groups. This research has limitations due to the methodology of study which lead to sampling selection and recall bias. Besides, the researchers were unable to determine their knowledge level of energy drinks. Future research is needed to determine the knowledge level specifically on the benefits and side effects of energy drinks among university students.

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