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Energy drink consumption among medical high school students in Serbia

Gordana Švonja Parezanović, Bojana Perić Prkosovački*

Energy drinks have become very popular among adolescents. The aim of this study was to determine the frequency of energy drink consumption alone and in combination with alcohol among medical high school students according to gender and grade, as well as to evaluate their knowledge of its adverse effects. The cross-sectional survey was conducted using an anonymous questionnaire. A total of 258 medical high school students, 162 female and 96 male, were surveyed. The χ^2-test was used to test age and gender differences in energy drink consumption. Study results showed nearly half of the students to take energy drinks, 1.56% of them taking these beverages every day. A higher percentage of female students did not take these drinks (54%), while 32% of male students reported taking these drinks once a week. Also, 28% of consumers of these beverages reported taking alcohol mixed with energy drinks. In conclusion, a significant proportion of medical high school students used energy drinks. Further studies are needed to evaluate the impact of long-term energy drink consumption. It is also necessary to focus on the problem of mixing energy drinks with alcohol and to implement appropriate school based health promotion programs among medical high school students that will help them gain knowledge and skills for applying health promotion in their future medical profession.

Keywords: adolescents, consumption, energy drinks, survey, alcohol

INTRODUCTION

Energy drinks have become very popular among teenagers, athletes and people whose activities require fast recovery from effort activities, with an additional source of energy. Energy drinks include a group of many different beverages that contain, besides carbohydrates, caffeine in combination with other energy-enhancing ingredients. Energy blends mostly contain caffeine in combination with other ingredients such as taurine, ginseng, guarana, glucuronolactone, B vitamins, claiming to provide the consumers with extra energy (1, 2). Owing to these ingredients, these beverages enhance physical and mental endurance, improve mental focus, power of perception and level of alertness and vigilance, and aid rapid recovery from effort activities (3).

Carbohydrates are the basic currency for energy in the body, with glucose being the key carbohydrate that can readily be oxidized by skeletal muscle for energy production. Caffeine is a xanthine alkaloid that is a naturally occurring substance found in the leaves, seeds and/or fruits of at least 63 plant species worldwide. Caffeine is consumed most frequently in beverages such as coffee (71%), soft drinks (16%), and tea (12%) (4). This substance is also found in cocoa, chocolate, and in dietary supplements. Caffeine is found in nearly all commercially available energy drinks at a concentration of approximately 75 to 80 mg *per* 250 mL serving (5). Since caffeine is a stimulant, in excess, it may cause heart palpitations, nervousness, irritability and insomnia. Daily intake of caffeine varies from one individual to another, but for most people, 200 mg or less is not harmful for adult (about 3 mg/kg body weight (b.w.) for adult/children/adolescents) (6).

Ginseng is regarded as an immune stimulant that helps increase physical and mental endurance, and has anti-stress, anti-oxidant and anti-inflammatory properties (7). Moreover, ginsenosides have been found to inhibit free radical production and stimulate nitric oxide production, which can cause depressant action of ginsenosides on cardiomyo-

* Medical High School "7.april" Novi Sad, Serbia

Correspondence to:
Gordana Svonja Parezanovic, Medical High School "7.april" Novi Sad, Serbia, Novi Sad, Serbia, e-mail: gsvonja@yahoo.com

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cyte contraction (8). American ginseng increases insulin production and reduces blood glucose in patients with type 2 diabetes (9). Although ginseng is considered "safe", high doses (several grams) can cause bleeding, hypertension, dizziness, diarrhea and sleep disturbances (10). A combination with antidepressants is particularly dangerous. In energy drinks, there are much smaller quantities of ginseng, at most about 800 mg *per* liter (11), but overdoses of energy drinks can cause these side effects of ginseng.

Taurine modulates skeletal muscle contractile function and may attenuate exercise-induced DNA damage, showing the ability to improve exercise capacity and performance (12).

The consumption of these beverages is associated with serious adverse effects. Adverse effects include diabetes, cardiac abnormalities, and behavioral disorders. One study demonstrated correlation of energy drink consumption, increased alcohol and drug use among young people. The use of energy drinks also leads to increase in some physiological parameters. Research results show a significant increase in the mean arterial pressure and heart rate (12).

Those most at risk are young people who frequent night dance parties or raves, and consume energy drinks in combination with alcohol. Alcohol as a depressant and diuretic, along with a diuretic quality of caffeine, can cause severe dehydration, which may lead to other disorders in the body. The dehydrating effect of caffeine further hinders the body's ability to metabolize ethanol, increases alcohol toxicity, as well as adrenaline release (13). Brazilian researchers conducted a study on the effects of mixing alcohol and Red Bull, and found energy drinks to reduce perception of alcohol effects on motor coordination, but they did not invalidate it. Consumption of alcohol mixed with energy drinks such as Red Bull has become increasingly popular among young people because it reduces the feeling of sleepiness and increases the feeling of satisfaction. In the previous research on the effects of energy drinks, it was revealed that respondents felt happier, having more physical energy, as well as having a feeling of euphoria and release from restraints. This shows that energy drinks can reduce the depressant effects of alcohol, resulting in greater levels of alcohol intake among these people (14, 15). Researchers found no significant difference between subjective perception and objective measures of their abilities. In individuals who drank alcohol and Red Bull, compared with those having taken alcohol alone, the perception of headache, weakness, dry mouth and poor motor coordination was significantly decreased, but it did not reduce the effect of alcohol on actual measurements of motor coordination and visual reaction time. In other words, due to the effects of energy drinks, the person is drunk but does not feel as drunk as he/she really is (3). Accordingly, it can be concluded that mixing alcohol and energy drinks is more harmful than helpful.

The above studies pointed to the risk of using these beverages, and it is therefore necessary to perform continuous monitoring of the frequency of energy drink consumption, especially among adolescents.

The aim of this study was to determine the frequency of energy drink use and the frequency of mixing energy drinks with alcohol among medical high school students, according to gender and grade, as well as to assess the level of their knowledge about the risks of using these beverages.

SUBJECTS AND METHODS

The survey was conducted using an anonymous questionnaire. A total of 258 medical high school students, 162 female and 96 male, were surveyed. The questionnaire included gender, grade and questions concerning types and quantities of drinks the respondents used.

The sample was defined from all four grades of the April 7 Medical High School in Novi Sad, with two classes in each grade. Parents provided the informed consent for those aged <18 years with their assent, while those aged ≥18 provided consent themselves. The number of respondents by gender and grade is shown in Table 1. The classes for the survey were selected randomly, i.e. all classes had an equal chance of being selected for the sample.

TABLE 1. Sample characteristics

Survey participants	N	%	Male		Female	
Grade			n	%	n	%
1st	62	23.64	23	8.91	39	15.12
2nd	65	25.19	25	9.69	40	15.51
3rd	63	24.42	20	7.75	43	16.67
4th	68	26.36	28	10.85	40	15.51
Total	258	100	96	37.21	162	62.79

The methods of descriptive statistics were used on data processing and analysis. The differences obtained were assessed using the χ^2-test. Graphs were made in Microsoft Excel program. In all analyses, differences were interpreted as statistically significant if the p-value was less than 0.05, and statistically significant if the p-value was less than 0.01.

RESULTS

Study results showed that about half of the students consumed energy drinks (n=128), of which 1.56% used to take energy drinks daily and 11.24% weekly. Energy drink con-

sumption was most common among fourth grade students; the increasing consumption of these beverages is presented in Figure 1.

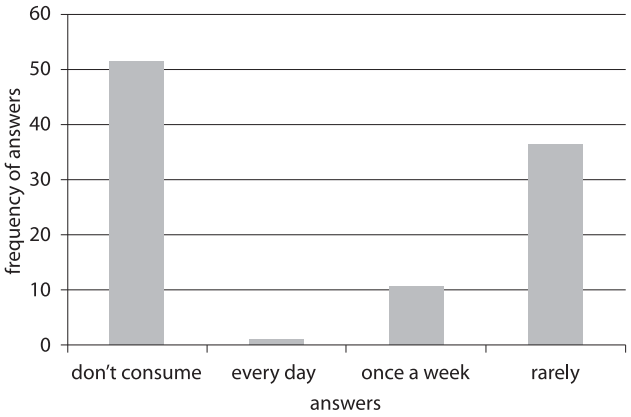

FIGURE 1. Distribution of energy drink consumption

Data on the consumption of energy drinks according to gender showed that a higher percentage of female students (54%) did not take these drinks, while 32% of male students reported drinking them once a week (Figure 2). Differences in energy drink consumption between male and female students were determined by use of χ^2-test, which yielded a statistically significant gender difference (p=0.00012; χ^2=20.626).

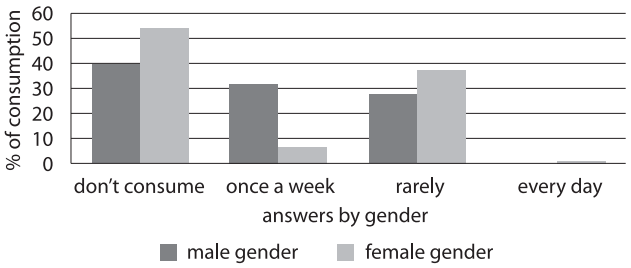

FIGURE 2. Frequency of energy drink consumption according to gender

Differences in the frequency of energy drink consumption according to grade revealed it to be highest in fourth year students, with the highest percentage of students taking this kind of beverage on a daily basis.

In the selected target population of adolescents that did not drink energy drinks, a decrease in frequency from first to fourth grade is illustrated by a diagram (Figure 3).

In addition to the frequency of energy drink use, our aim was to find out whether students were familiar with the side effects of these drinks. Therefore, the questionnaire also contained the question: Are you familiar with the risks of energy drink use?, to which 81.8% of the respondents gave

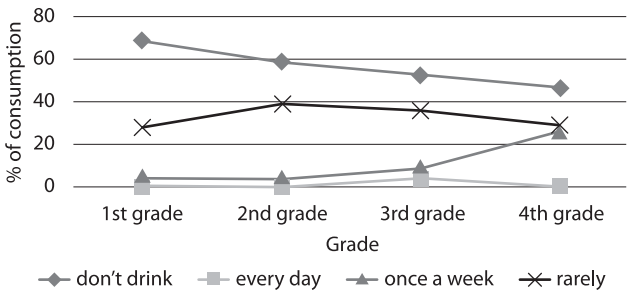

FIGURE 3. Distribution of frequency of energy drink consumption according to grades

affirmative answer, whereas 37% of males responded they did not know whether there were any side effects. Among those selected as a target population taking energy drinks daily or weekly, 59.4% responded they were not familiar with the risks of using these drinks.

The majority of the sample reported having consumed alcohol in the previous 30 days (69.3%). When asked whether they used to mix alcohol and energy drinks, 28% (n=36) of the consumers of these beverages responded they did mix alcohol and energy drinks, whereas 72% did not do it. Answers according to age are shown in Figure 4.

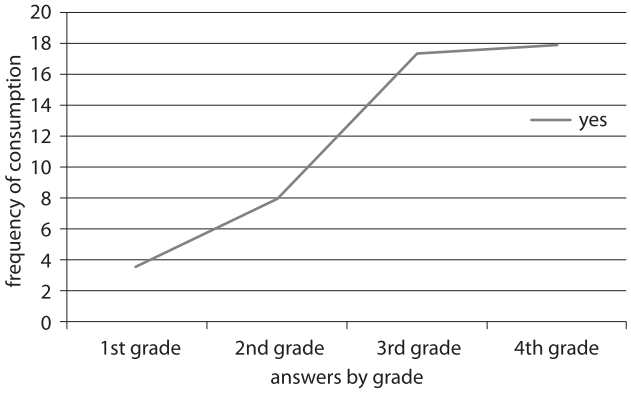

FIGURE 4. Distribution of mixing alcohol and energy drinks according to grades

The χ^2-test showed that drinking alcohol and energy drinks together was more prevalent among the third and fourth grade students, with no statistical difference in responses to this question (χ^2=0.007; p=0.9333). A statistically significant difference was found between the first and fourth grade students selected as a target population (χ^2=9.069; p=0.0025).

DISCUSSION

Our findings showed about half of the students to take energy drinks, which is consistent with the results of similar studies conducted in Poland, Saudi Arabia and Greece (16-18). In 2011, the European Food Safety Authority (EFSA)

commissioned a study to collect data on energy drink consumption in 16 European Union countries. They found that 68% of adolescents (aged 10-18 years) were taking energy drinks (16). Among adolescents, consumption varied from 48% in Greece to 82% in the Czech Republic. A study in the USA showed that approximately 30% of secondary school students used energy drinks (19), while another study showed 51% of the US college students to take energy drink *per* month (18). One study revealed 54% of the respondents to report mixing energy drinks with alcohol (20), which is higher than our finding (28%) that is similar to a study in Polish adolescents (24%) (17). The results of this study revealed that energy drink consumption was significantly higher among males as compared with females. This finding agrees with the results of many other studies (21-25). Sales of energy drinks have soared in recent years. In the USA, sales increased by 60% between 2008 and 2012 (18). Increasing consumption of energy drinks has caused an increase in adverse health effects. A report from the Substance Abuse and Mental Health Services Administration revealed the number of emergency department visits involving energy drinks to have doubled between 2007 and 2011, from 10,068 visits to 20,783 (25). A major concern is the number of young adults who mix energy drinks with alcohol. Different professions and fields of science concerning young people express their strong concerns about the increase of high-risk behavior among young people in Serbia (26, 27). Most health disorders in adolescents are neither difficult nor dangerous (if viewed in relation to other ages), but if ignored, can become aggravating for regular growth and development. In addition, attention must be paid to the health of young people because the health of future generations depends on it (28).

The social community encourages, with their expectations, risky behavior among young people. On the one hand, there is the availability of potentially dangerous things that can lead to risky behavior (alcohol, energy drinks and drugs). On the other hand, there is the negative impact of mass media that advertise certain products, thus imposing, directly or indirectly, attitudes and values dangerous for young people. In some countries, there is a legal capability to deal effectively with these phenomena, while in others they deal less effectively with hazards young people may be exposed to, in spite of the existing legislation. However, in some countries, there is a serious and widespread failure in the protection of young people.

CONCLUSION

The results demonstrate that the use of energy drinks is significantly frequent among medical high school students. Research has shown that no matter how many medical high students are aware of the hazards of energy drinks (81.8% of young people are aware of their side effects), still about half of medical high students consume these drinks, and some of them mix them with alcohol (28%), thus risking their own health. Unlike females, a higher percentage of males said they were not aware of the risks of energy drink consumption, and the results show that they are more likely to consume energy drinks. The most common use of these drinks was recorded among fourth grade students, while the highest percentage of medical high students taking them daily was found in third year. Frequent consumption of these beverages can be classified as a health risk behavior, especially in combination with alcohol, which implies the need for continuous monitoring. As energy drink sales are not regulated by age in Serbia, unlike alcohol and tobacco, there is a potential for a significant public health problem in the future. More screening tests should be conducted on the consumption of energy drinks among adolescents. Toxicity surveillance should be improved, and regulations of energy drink market should be based on appropriate research. It is also necessary to focus on the problem of mixing energy drinks with alcohol and to implement appropriate school based health promotion programs among medical high school students that will help them gain knowledge and skills for applying health promotion in their future medical profession.

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SAŽETAK

Potrošnja energetskih pića među učenicima srednje medicinske škole u Srbiji

G. Švonja Parezanović, B. Perić Prkosovački

Energetska pića postala su vrlo popularna među adolescentima. Cilj ovoga istraživanja bio je utvrditi učestalost uzimanja energetskih pića samih ili u kombinaciji s alkoholom među učenicima srednje medicinske škole prema spolu i razredu te procijeniti njihovo poznavanje štetnih učinaka ove navike. Ovo poprečno istraživanje provedeno je pomoću anonimne ankete, a obuhvatilo je 258 polaznika srednje medicinske škole, odnosno 162 učenica i 96 učenika. Razlike u potrošnji energetskih pića prema dobi i spolu ispitane su pomoću χ^2-testa. Rezultati istraživanja su pokazali da gotovo polovica učenika pije energetska pića, a 1,56% njih radi to svakodnevno. Visok postotak učenica (54%) ne uzima ova pića, dok je 32% učenika navelo da pije ova pića jedanput na tjedan. Isto tako, 28% onih koji piju energetska pića navelo je da uzima alkohol pomiješan s energetskim pićima. U zaključku, značajan dio učenika srednje medicinske škole pije energetska pića. Potrebna su daljnja istraživanja kako bi se procijenio učinak dugotrajnog uzimanja energetskih pića. Također je potrebno usredotočiti se na problem miješanja energetskih i alkoholnih pića te provesti odgovarajuće školske programe za promicanje zdravlja među učenicima srednjih medicinskih škola i tako im pomoći steći potrebna znanja i vještine u promicanju zdravlja u njihovom budućem medicinskom zvanju.

Ključne riječi: adolescenti, potrošnja, energetska pića, pregledno istraživanje, alkohol