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A survey of energy drink consumption patterns among 4th and 5th year students of Faculty of Medicine, Medical University of Lodz

Badanie spożycia napojów energetyzujących wśród studentów IV i V roku Wydziału Lekarskiego Uniwersytetu Medycznego w Łodzi

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Abstract

Introduction. Energy drink consumption has continued to gain in popularity since the introduction of first Red Bull. The usage of energy drinks must be controlled because they don't remain indifferent to the body. There has been little research carried out in Poland on the risks associated with the increase in energy drink consumption, particularly among young people.

Material and methods. Anonymous questionnaire surveys were conducted among 131 students of 4th and 5th year Faculty of Medicine, Medical University of Lodz. The collected data was subjected to gender-related statistical analysis. Questions concerning the frequency of energy drinks, the reasons for the consumption, preferred brand and volume of purchased beverages, the effects of consumption on the individual marks, as well as the frequency and type of adverse events occurring after ingestion.

Results. The vast majority of the surveyed students (n = 89; 68%) reported energy drinks consumption. The majority (n = 55; 42%) consumed energy drinks occasionally. The study participants chose energy drinks in order to: improve mental performance while studying (47%; n = 62), increase energy in general (47%; n = 61), eliminate sleepiness for insufficient sleep (20%; n = 26) and drink with alcohol while partying (10%; n = 13). Most of the students, when asked about the well-known brand of energy drink mentioned as follows: Red Bull (93%), Tiger (92%), Burn (90%) or Black (75%). Most of the students (58%; n = 76) chose the drink of the beverage quantity of 0.3 L. Effects of the consumption were assessed by the most of respondents as effective in stimulation (54%; n = 71). After consuming an energy drink almost half of the students (48%; n = 63) observed side-effects.

Conclusions. The action should be taken to increase knowledge about the negative effects of excessive consumption of energy drinks among students.

Key words: students, energy drinks, gender, side-effects

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Introduction

Energy drinks have become popular in Japan during World War. In the 40s of the last century Taisho Pharmaceuticals Company started manufacturing extract of taurine designed primarily for seafarers to reduce their fatigue during the night watch. In 1960 Taisho started to produce a new product called Lipovitan D — first energy drink. In the 60s of the last century similar drink appeared in Thailand. This drink was discovered by Austrian businessman Dietrich Mateschitz, who used it as a treatment for jet lag syndrome. He developed Red Bull based on the Thai drink Krating Daeng. In Europe, energy drinks were pioneered by the Lisa Company and a product named "Power Horse" based on Lipovitan [1]. Energy drink consumption has continued to gain in popularity since the introduction of first Red Bull in Austria in 1987 and in the United States in 1997 [2]. Hundreds of different brands are now marketed.

The usage of energy drinks must be controlled because they don't remain indifferent to the body. The main purpose of these products is increasing or improving the mental and physical capacity of the organism (concentration, thinking, responsiveness, increasing exercise capacity). These drinks contain biologically active substances that stimulate the central nervous system (e.g. caffeine, taurine, guarana, inositol, glucuronolactone, L-carnitine, the B vitamins and plant extracts such as *ginkgo biloba* and *ginseng*) [2]. Energy drinks in Poland generally contain 32 mg of caffeine per serving 100 ml. The population as a whole has variable sensitivity to the stimulant effects of caffeine. It depends on the age, sex and physiological state [3]. Children, adolescents, pregnant women and people sensitive to caffeine or suffering from various diseases should be careful in drinking caffeinated products. Drinks of this type can cause many adverse symptoms. Caffeine in energy drinks can cause the excretion of water from the body to dilute high concentrations of sugar entering the blood stream, leading also to dehydration. High-caffeine consumption among pregnant women increases the risk of late miscarriages [4].

Energy drinks can be sold in all European Union (EU) countries, but some countries have introduced regulations, including setting rules for sales to children. In Italy and France, the launch of "energy drink" requires the permission of the Ministry of Health. Hungary introduced in 2012 a public health tax that includes energy drinks. In Sweden, sales of some types of energy drinks are restricted to pharmacies and sales to children are banned. In Norway, Denmark and Iceland energy drinks are also sold only in pharmacies. In Austria and Belgium beverages are treated as foodstuffs for particular nutritional uses, while in Germany and Poland considered ordinary drinks.

Energy drink sales are rarely regulated by age, unlike alcohol and tobacco. In 2011, the European Food Safety Authority (EFSA) commissioned a study to gather consumption data for energy drinks in 16 countries of the European Union. They found that 68% of adolescents (aged 10–18 years) and 18% of children (< 10 years) consumed energy drinks. Among adolescents, consumption varied from 48% in Greece to 82% in the Czech Republic. Among children, consumption varied from 6% in Hungary to 40% in the Czech Republic [5]. Nevertheless, there has been little research carried out in Poland on the risks associated with the increase in energy drink consumption, particularly among young people. The aim of the study was to evaluate the frequency of energy drink consumption in medical students, determinate of the motives for consumption and brands preferred. Particular attention was paid to the kind of side effects resulting from the consumption and to their incidence.

Material and methods

It's a student-conducted study within Students' Research Club at the Department of Cardiology, Medical University of Lodz. The research was conducted over the 2013 and 2014 years among students of the Faculty of Medicine in Medical University of Lodz. The respondents were students in their 4th and 5th year of medical degree. Anonymous questionnaire surveys were conducted among 131 students. The majority of the participants were women (88/131, 67%). All participants agreed to participate in the survey.

The study was conducted using a questionnaire authoring, available in an electronic form, consisting of 10 questions relating to the consumption of energy drinks among surveyed students (Annex 1). The questionnaire was constructed according to the applicable standards and rules concerning the collection of data through a survey. Questions concerning the frequency of energy drinks, the reasons for the consumption, preferred brand and volume of purchased beverages, the effects of consumption on the individual marks, as well as the frequency and type of adverse events occurring after ingestion were included.

The collected data was subjected to gender-related statistical analysis. The qualitative variables have been characterized by cardinality and percentage. In order to detect statistically significant correlation between the groups, depending on the size of the sample Yates' chi-squared test were used. The statistical analysis was carried out with use of Statistica 10.0 PL software (StatSoft, Cracow, Poland). The results were considered statistically significant when $p < 0.05$.

The study was positively reviewed by the Bioethical Committee of Medical University of Lodz, Consent no. RNN/55/14/KB.

Table 1. Habits of the students associated with the consumption of energy drinks

Characteristics		Total		Females		Males		χ^2 test
		n = 131	%	n = 88	%	n = 43	%	p value
Consumption of energy drinks	Yes	89	67.94	52	59.09	37	86.04	0.003
	No	42	32.06	36	40.91	6	13.96	0.003
Frequency of consumption of energy drinks	Occasionally	55	41.99	29	32.95	26	60.47	0.105
	Several times a month	28	21.37	20	22.73	8	18.60	0.754
	Few times a week	4	3.05	3	3.41	1	2.33	0.839
	Daily	2	1.53	0	0.00	2	4.65	0.201
Consumption during exams sessions	Yes	63	48.09	41	46.59	22	51.16	0.759
	No	26	19.85	11	12.50	15	34.88	0.065
Volume of beverage	0.3 L	76	58.02	47	53.41	29	67.44	0.180
	0.5 L	24	18.32	11	12.50	13	30.23	0.02
	1.0 L	13	9.93	2	2.27	11	25.58	≤ 0.001

The study was conducted in accordance with the principles contained in the Declaration of Helsinki.

Results

In the study the vast majority of the surveyed students (68%) reported energy drinks consumption. However more than 40% consumed energy drinks occasionally (Table 1). Almost half of the total number of students used this type of drinks frequently during exam sessions (Table 1). Consumption several times a month was declared by less than 1/4 of students. Fixed consumption, i.e. a few times a week or daily, was admitted by 5% (n = 6) of studied participants.

Statistical analysis showed that the frequency of overall consumption is not significantly varied by sex. Most of the students (Table 1) chose the drink with a capacity of 0.3 L.

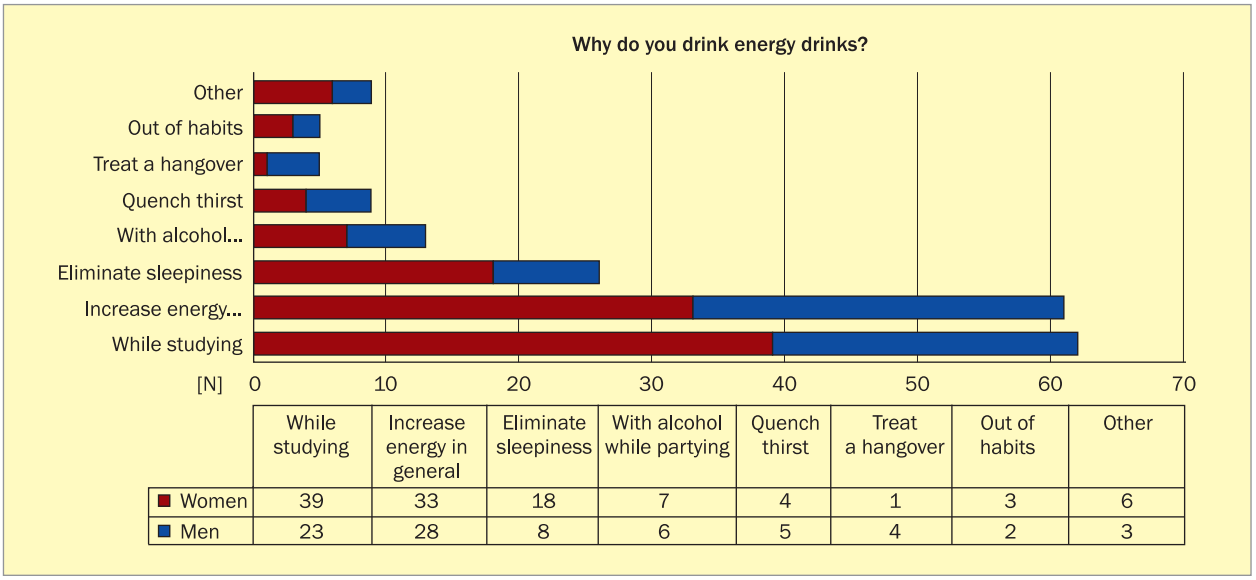
Men more often than women chose a volume of 0.5 L (30% men vs. 13% women, p = 0.02) and 1 L of beverage (26% men vs. 2% women, p ≤ 0.001).

The study participants consume energy drinks generally in order to improve mental performance while studying (47%) and increase energy in general (47%). They chose them rarely to eliminate sleepiness for insufficient sleep (20%) and drink with alcohol while partying (10%). Energy drinks were also consumed while driving a car for long periods of time, out of habit and to quench thirst or to treat a hangover (Fig. 1). These responses differed according to sex only in favour to increase energy in general (65% men vs. 38% of women, p = 0.02). Most of the students, when asked about the well-known brand of energy drink mentioned as follows: Red Bull (93%), Tiger (92%), Burn (90%), Black (75%) and others which are presented on Figure 2. Responses were statistically different only in choosing Be Power, which was more often marked by men (63% vs. 42%, p = 0.04) and *R20+* (56% men vs. 18% women, p < 0.01). Effects of the consumption were assessed by the most of respondents as effective in stimulation (54%, n = 71).

After consuming an energy drink almost half of the students (48%, n = 63) observed side-effects. The most common symptom was heart palpitations (31%). Over 20% of the students noticed significant stimulation and tremors/ trembling hands. Headaches were reported by 9% of the respondents. Disorders of the gastrointestinal tract and breathing problems were reported by almost 5% of the students (Fig. 3).

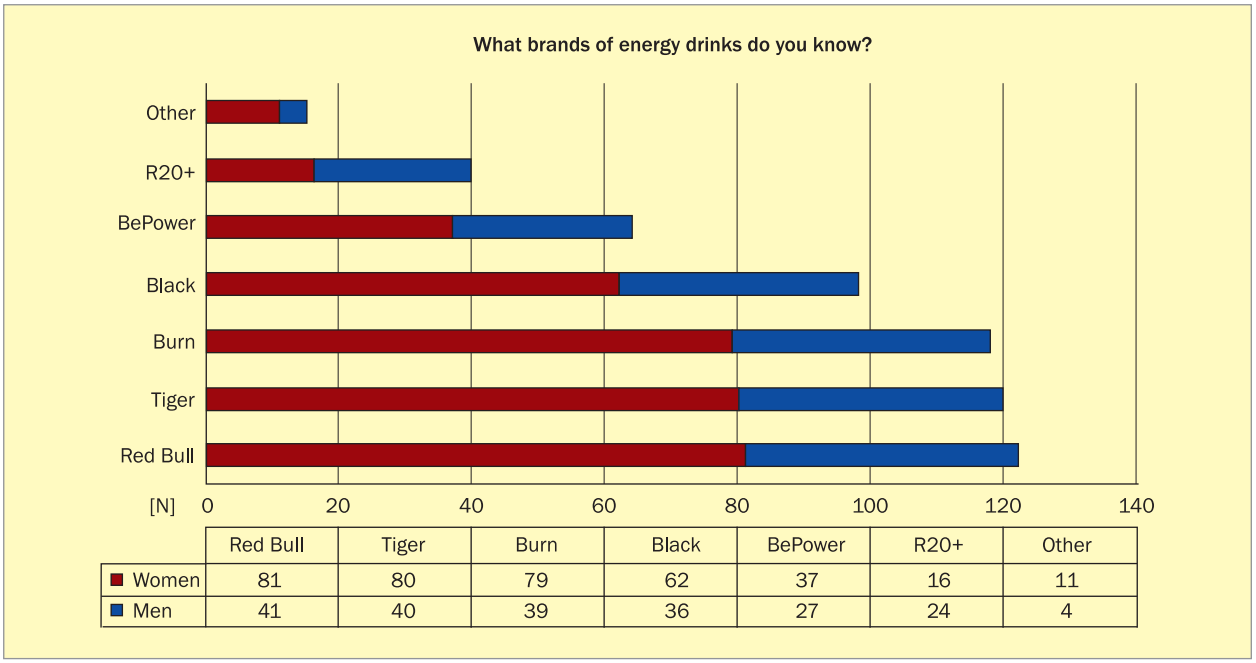
Discussion

This study shows that majority of medical students in Lodz reported energy drinks consumption. However, the most common is the occasional consumption. The results of this study are confirmed by data from national and international literature. However, in comparison with the study conducted in the University of Life Sciences in Lublin [6], the Medical Faculty of the Medical University of Lodz have a lower percentage of 'daily drinkers' (2% in Lodz vs 9% in Lublin). The knowledge that medical students gain during their education is reflected in their daily lives. Greater number of medical students used this type of drinks during the exams sessions (48% in Lodz vs 15% in Lublin). Medical students have more learning than the average student in other fields and examination session is a period of increased mental work and many sleepless nights. For most of the students in Lublin favourite brand of energy drink was Tiger. Most of the students in Lodz listed Red Bull. Both student groups chose energy drinks but motivation is different depending on the university. In Lublin, the participants chose stimulant drinks to feel better and to quench thirst or to treat a hangover.



	While studying	Increase energy in general	Eliminate sleepiness	With alcohol while partying	Quench thirst	Treat a hangover	Out of habits	Other
Women	39	33	18	7	4	1	3	6
Men	23	28	8	6	5	4	2	3

Figure 1. Determination of the motives to the consumption



	Red Bull	Tiger	Burn	Black	BePower	R20+	Other
Women	81	80	79	62	37	16	11
Men	41	40	39	36	27	24	4

Figure 2. Most frequently chosen brands of energy drinks

In Lodz, energy drinks were consumed with alcohol while partying, while driving a car for long periods of time, out of habit and also to quench thirst or to treat a hangover.

The most common side-effects in the students were heart palpitations, significant stimulation, aggression and disorders of the gastrointestinal tract. The students in Lublin had also insomnia after consuming energy drinks. The students in Lodz noticed tremors, trembling hands and headaches. Anxiety, nervousness and distracted attention were watched in 8% of the students in Lublin and 1% of respondents felt weakness and fatigue after drinking an energy drink. Breathing problems were reported in almost 5% of medical students. In studies performed by Malinauskas et al. [7], weekly jolt and crash episodes were experienced by 29% of users, 22% reported headaches and 19% heart palpitations from consuming energy drinks.

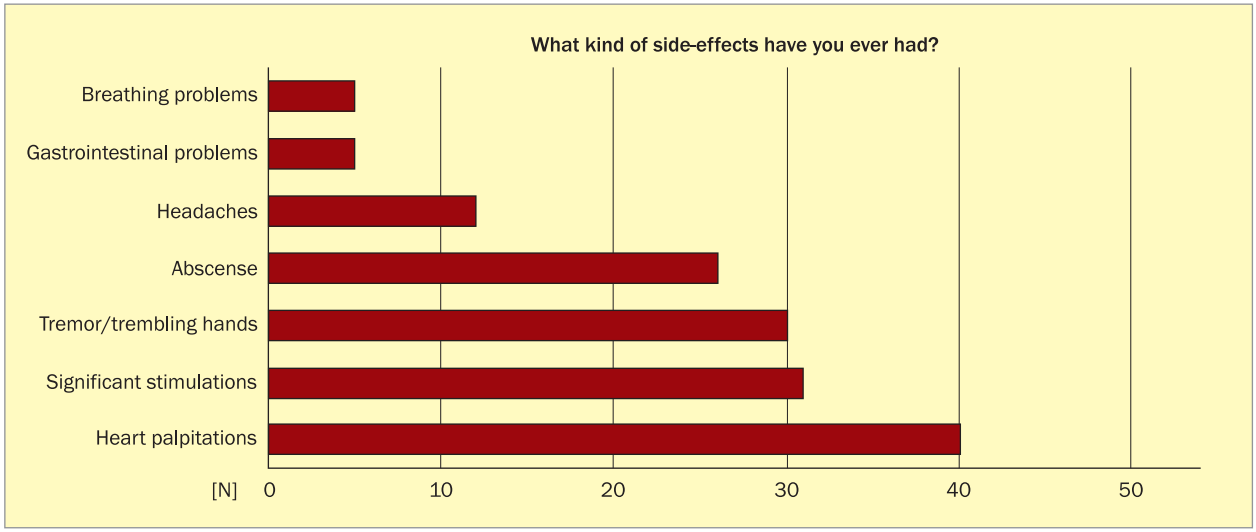


Figure 3. Negative symptoms observed by students after consuming energy drinks

High caffeine consumption is associated with chronic daily headaches [8]. Central nervous system, cardiovascular, gastrointestinal, and renal dysfunction have been associated with chronic caffeine ingestion [9].

Even as little as 50 mg of caffeine can induce tachycardia and agitation. In overdose caffeine toxicity can mimic amphetamine poisoning and lead to seizures, psychosis, cardiac arrhythmias and, potentially but rarely, death [10–13].

A controlled trial of escalating doses of caffeine in dogs surprisingly found that serum caffeine actually decreased the propensity for atrial fibrillation [14]. Study by Rashid et al. [15] demonstrated an increase in cardiac arrhythmias with high doses of caffeine administered. Another case report described a 58-year-old man with atrial fibrillation and a dilated cardiomyopathy induced by excess caffeine consumption. He had been consuming one bottle (1000 ml) per week of a highly caffeinated (caffeine content 4.04 mg/mL) beverage for 6 months [16]. Another case report described healthy 28-year-old man with a cardiac arrest after a day of motocross racing. He had consumed 7–8 cans of a caffeinated "energy drink" between 8 am and his collapse 7 hours later [17]. Avci et al. [18] reported another case where a 28-year-old man consumed three 250 mL energy drink cans, 5 h before a basketball match. After playing for 30 min, he lost consciousness, suffered from cardiac arrest, and died 3 days later. This case series describes the possible association between the consumption of highly caffeinated drinks and the development of cardiac arrhythmias, specifically atrial fibrillation, in a population. Energy drinks are often directed at teenagers and young adults. Cardiac arrhythmias in young related to high caffeine consumption have not been well described in the literature. One study report two cases of atrial fibrillation in healthy adolescent boys after the consumption of energy drinks [19]. A meta-analysis by Dr Sachin Shah [20] showed that energy drinks may increase systolic blood pressure and prolong QT interval. Prolonged QT can cause a cardiac arrhythmia, loss of consciousness or sudden death.

Consumption of energy drinks among adolescents is associated with other potentially negative health and behavioural outcomes such as sensation seeking, use of tobacco and other harmful substances. It is also associated with a greater risk for depression and injuries that require medical treatment [21, 22].

Study by Oteri et al. [23] indicated combination of energy drinks and alcohol is very popular among students. A consequence is increasing the probability of accidents or possibility of development of alcohol dependence [23].

In multivariable analyses [24], students who reported consuming energy drinks had significantly higher prevalence of alcohol-related consequences, including being taken advantage of sexually, taking advantage of another sexually and riding with an intoxicated driver.

Another study shows energy drink users tend to have greater involvement in drug use and higher levels of sensation-seeking, relative to non-users of energy drinks. Prospectively, energy drink use has a unique relationship with nonmedical use of prescription stimulants and analgesics [25].

More research is needed regarding the health risks associated with energy drink use in young adults, including their possible role in the development of substance use problems.

Limitations

The main limitation of the study is the method of data collection, i.e. the anonymous survey itself. The authors cannot be certain whether all respondents have answered consistently and if the answers reflect their actual status. The differences between results across similar studies conducted in Poland perhaps reflect the differences in methodology. Moreover, it is a small sample study and hence the reported results may not easily extrapolate on larger cohort. The results of study and other similar studies cannot be directly compared because of, e.g., the different type of data acquired and analyses performed with them. The authors cannot assess all the symptoms after consuming an energy drink described in the literature, which is a limitation resulting from the methodology of the survey.

Conclusions

In the studied population, the vast majority of the surveyed medical students reported energy drink consumption. The majority consumed energy drinks occasionally but there were also those who declared fixed consumption. After consuming an energy drink students observed a lot of side-effects. The usage of energy drinks, due to the high content of stimulants, should be controlled. Because of the widespread use of energy drinks, actions should be taken to increase knowledge about the composition, safe dose of the administered substances and the potential health risks associated with excessive consumption of energy drinks among students.

Voice of thanks

I should first of all like to thank Małgorzata Lelonek for her excellent work and close cooperation. I would like to thank for her availability and interesting contributions, for attentive words, new insights and new emphases.

I want to thank all who have helped to bring this article into being.

Conflict of interest(s)

The authors declare no conflict of interest.

Streszczenie

Wstęp. Napoje energetyzujące zyskują na popularności od debiutu napoju Red Bull w 1997 roku. Stosowanie energetyków, ze względu na wysoką zawartość substancji pobudzających, musi być kontrolowane, ponieważ mogą powodować wiele niekorzystnych objawów. Mimo że produkty te są skierowane do młodych dorosłych konsumentów, to niewiele było dotychczas badań dotyczących wzorców konsumpcji napoju energetycznego, na przykład wśród studentów.

Materiał i metody. Anonimowe badanie ankietowe przeprowadzono wśród chętnych 131 studentów IV i V roku Wydziału Lekarskiego Uniwersytetu Medycznego w Łodzi. Pytania dotyczyły częstotliwości spożywania napojów energetyzujących, motywu ich stosowania, preferowanych marek i pojemności kupowanych napojów, indywidualnej oceny efektu działania, a także częstości i rodzaju działań niepożądanych występujących po spożyciu tych napojów. Zgromadzone dane liczbowe poddano analizie statystycznej według płci.

Wyniki. Zdecydowana większość ankietowanych studentów (n = 89; 68%) przyznała, że korzysta z napojów energetyzujących, choć 42% (n = 55) sięga po nie bardzo rzadko/sporadycznie. Uczestnicy badania wybierali napoje pobudzające w celu: zwiększenia sprawności umysłowej w czasie nauki (47%, n = 62), ogólnie na pobudzenie (47%, n = 61), przy niedoborze snu (20%, n = 26) oraz w połączeniu z alkoholem na spotkaniu towarzyskim (10%, n = 13). Większość studentów zapytana o znaną im markę napojów energetyzujących zaznaczała Red Bull (93%), Tiger (92%) i Burn (90%). Przeważający odsetek studentów (58%, n = 76) sięgał po napoje energetyzujące o pojemności 0,3 l. Pod względem efektów działania większość badanych oceniła energetyki jako skuteczne (54%, n = 71). Po spożyciu napoju energetyzującego niemalże połowa studentów (48%, n = 63) zaobserwowała u siebie działanie niepożądane.

Wnioski. Ze względu na powszechne zastosowanie napojów energetycznych należałoby podjąć działania edukacyjne zwiększające wiedzę studentów o składzie, dopuszczalnej dawce przyjmowanych substancji i potencjalnym zagrożeniu dla zdrowia w przypadku ich nadmiernej konsumpcji.

Słowa kluczowe: studenci, napoje energetyzujące, płeć, działania niepożądane

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Annex 1
Anonymous questionnaire about the consumption of energy drinks

A survey of energy drink consumption patterns among 4th and 5th year students of faculty of medicine Medical University of Lodz

The aim of the study is to evaluate the frequency of energy drink consumption in students of the 4th and 5th year of the medical faculties, to determine the motives for consumption and brands preferred. Particular attention is paid to the incidence of adverse reactions and the kind of side effects associated with the consumption. In the survey you will be asked either to write your answer down or mark the best option. Please fill out the survey precisely and carefully. The survey is anonymous.

1. Sex
- □ Woman
- □ Man

2. What brands of energy drinks do you know?
You can give multiple answers.
- □ Burn
- □ Red Bull
- □ Tiger Energy Drink
- □ R20+
- □ Be-power
- □ Black
- □ Other

3. Do you drink any energy drinks?
- □ Yes
- □ No

4. How often do you drink energy drinks?
- □ Occasionally
- □ Several times a month
- □ Few times a week
- □ Daily

5. What volume of beverage do you choose?
You can give multiple answers.
- □ 0.3 L
- □ 0.5 L
- □ 1.0 L

6. Why do you drink energy drinks? You can give multiple answers.
- □ Out of habits
- □ Quench thirst
- □ Increase energy in general
- □ Eliminate sleepiness
- □ While studying
- □ With alcohol while partying
- □ Treat a hangover
- □ Other

7. Do you drink energy drinks more often during exam session?
- □ Yes
- □ No

8. How would you rate effects of energy drinks?
- □ Very effective
- □ Effective
- □ Ineffective

9. Have you ever had any side-effects after consuming energy drinks?
- □ Yes
- □ No

10. What kind of side-effects have you ever had?
You can give multiple answers.
- □ Headaches
- □ Heart palpitations
- □ Tremor/trembling hands
- □ Significant stimulations
- □ Breathing problems
- □ Gastrointestinal problems

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Żyjemy w ciekawych czasach. W czasach nie tylko dobrobytu, ale przede wszystkim tempa i stresu. Napoje energetyzujące są przez wielu postrzegane jako substancje, które w krótkim czasie mogą zapewnić odpowiednią koncentrację i pomóc w doraźnym rozwiązywaniu problemów. Równocześnie wiemy, że to krótkowzroczne załatwienie problemu nie jest rozwiązaniem na przyszłość. W komentowanej przeze mnie pracy zaprezentowano wyniki ankiety dotyczącej konsumpcji napojów energetyzujących przeprowadzonej wśród studentów medycyny. Okazuje się, że wśród ankietowanych prawie 70% potwierdziło korzystanie z takich napojów. Musimy patrzeć na to zjawisko z niepokojem, gdyż dotyczy młodych osób w pełni świadomych, że takie postępowanie jest niekorzystne dla zdrowia. Co jest przyczyną nieprawidłowych zachowań? Według wyników ankiety przekonanie, że jest to sposób na poprawienie sprawności umysłowej w czasie nauki. Być może, charakter studiów medycznych, które wiążą się z dużym obciążeniem nauką, jest pewnym wytłumaczeniem. Jednak ankietowani to studenci 4. i 5. tego roku studiów — osoby dysponujące dużą wiedzą medyczną, które powinny promować zachowania prozdrowotne.

Czy świadomość nieprawidłowych postaw nie powinna ograniczać niepokojącego zjawiska, jakim jest stosowanie napojów energetyzujących? Co zatem się dzieje ze studentami innych kierunków studiów? Możemy jedynie przypuszczać, że w przypadku osób studiujących inne kierunki odsetek stosowania napojów energetyzujących jest podobny lub nawet wyższy.

Problemu spożywania napojów energetyzujących przez studentów nie można ograniczyć jedynie do kwestii poprawy koncentracji w okresie intensywnego przygotowywania się do egzaminów. To spożycie może się wiązać z równoczesnym stosowaniem alkoholu. W literaturze medycznej funkcjonuje nawet pojęcie „alkohol w połączeniu z napojem energetyzującym" (AmED, *alcohol mixed with energy drink*). W komentowanej pracy odsetek osób, które potwierdziły taką formę spożycia, wynosi około 10%. Wśród nieco młodszej populacji studentów college'u opisywano, że problem dotyczy 27–40% młodych ludzi. Zjawisko to jest traktowane bardzo poważnie — jako kluczowy czynnik mający znaczenie dla uzależnienia od alkoholu w przyszłości. Ma również niebagatelne skutki metaboliczne. Często prowadzi do nadwagi i otyłości. Osoby spożywające napoje energetyzujące wykazują także inne zachowania niekorzystne dla zdrowia, na przykład nikotynizm, siedzący tryb życia, stosowanie środków odurzających. Częściej z napojów energetyzujących korzystają ci, którzy nie odżywiają się regularnie, na przykład nie jedzą śniadań, mieszkają w internatach/domach studenta, lubią gry komputerowe. Okazuje się, że temat ten jest coraz częściej poruszany w piśmiennictwie medycznym. Liczba publikacji pod hasłem *energy drink consumption in students* w bazie medycznej PubMED przekracza 120. Dane opublikowane w komentowanym artykule to, niestety, jedne z najwyższych.

Piśmiennictwo

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