ORIGINAL ARTICLE

Energy drink consumption: a survey in high school students and associated psychological effects

S. SCURI[1], F. PETRELLI[1], M. TESAURO[2], F. CARROZZO[1], L. KRACMAROVA[3], I. GRAPPASONNI[1]
[1] School of Medicinal and Health Products Sciences, University of Camerino, Italy; [2] Department of Biomedical Surgical and Dental Sciences, Environmental Hygiene Lab, University of Milan, Italy; [3] Regional Hospital of T. Bata in Zlin, Hospital Pharmacy, Czech Republic

Keywords

Energy drinks • Abuse • Caffeine • Alcohol • Young

Summary

Introduction. *Energy drinks represent an emerging health problem among young people. Energy drinks generally refer to a class of beverages containing sugars and various combinations of bioactive ingredients such as caffeine, taurine etc. Also the mix of energy drinks with alcohol is fairly frequent among young people and could be associated with dangerous effects.*
Methods. *In 2016-2017, a cross-sectional study was conducted in 1581 students attending eight high school in the Marche Region. Data were collected via an anonymous self-administered questionnaire.*
Results. *The 27.7% of students use energy drinks and the majority, corresponding with the 93.0%, are aware of the main ingredients contained in energy drinks. The main activities for which young people use these drinks are: sport, leisure, pleasure, study. Young people who admit to using alcohol mixed with energy drinks more than 4 times a month are an alarming fact.*
Conclusions. *This research confirms that energy drinks are used more by young males and especially by those who practice sports. Furthermore, the use these beverages to increase the concentration in the study and to be more brilliant in free time, is confirmed.*

Introduction

The first energy drink was introduced in Austria in 1987 and was launched in the United States (US) in 1997 [1]. Since then, the consumption of energy drinks has increased dramatically although they have become twice as expensive as traditional soft drinks. 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 the average consumption was 2 L/month in adolescents and 0.49 L/week in children [2, 3].
In the last decade the consumption of energy drinks has increased among athletes and the general public, above all in young individuals.
"Energy drinks" (EDs) generally refer to a class of beverages containing sugars and various combinations of bioactive ingredients such as caffeine, taurine, glucuronolactone, B-group vitamins, inositol, niacin, panthenol, extracts of guarana, green tea and ginger, purported to "energize" the body and the mind. Energy drinks have been found to improve attention and/or reaction times and indices of alertness in some studies; the combination of caffeine and glucose can ameliorate deficits in cognitive performance and subjective fatigue during extended periods of cognitive demand [4]. However, several ingredients may have unwanted health consequences in youngsters and should be used carefully. The health risks associated with energy drink consumption are primarily related to their caffeine content: a caffeine overdose can cause palpitations, hypertension, dieresis, central nervous system stimulation, nausea, vomiting, marked hypocalcemia, metabolic acidosis, convulsions and in rare cases, also death. Therefore, the European Union regulates the labeling of EDs by requiring that beverages characterized by "a high caffeine content", in a proportion in excess of 150 mg/l, show the following message clearly: "High caffeine content" [5]. In particular, in Italy the maximum concentration of caffeine is 32 mg/100 ml and must be specified on warning labels, such as "high caffeine content" and "not recommended for children, pregnant women or people sensitive to caffeine" [6]. Caffeine can also have a neuro-pharmacological effect, in fact it can increase the tendency to alcohol addiction. International studies have also indicated that mixing energy drinks with alcohol is fairly frequent among college students: this may be dangerous given the stimulant nature of energy drinks and depressant characteristics of the alcohol (the stimulant effect can mask how a person is intoxicated by alcohol); moreover, this mix is very dehydrating and will hinder the body's ability to metabolize alcohol, thus increasing intoxication [7, 8]. Another side effect of energy drink consumption is the increased risk of obesity due to their high sugar content [9]. The potential adverse health effects of the other ingredients of energy drinks (guarana, taurine, glucuronolactone, B vitamins) are not well known, so further studies are required [10]. Past observations have suggested that young adults can easily access energy drinks, but there is scarce evidence on the reason why they consume this kind of beverage and whether they are aware of their potential health hazards [9].

In accordance, this study examined the frequency of consumption of energy drinks in groups of high school students in the Marche Region (Italy) and investigated the factors for preferring these drinks and their eventual use with alcohol and during physical activity. It also analyzed and investigated the sensation of anxiety and depression in young people.

Methods

In 2016-2017, a cross-sectional study was conducted in students attending eight high schools in the Marche Region, and in particular in the district of Macerata, Ancona and Ascoli Piceno. This survey included 1581 students, after approval was obtained from the administrators of each faculty, and verbal consent was received from each participant. Data were collected via an anonymous self-administered questionnaire; it consisted of 30 questions on students sociodemographic characteristics, personal habits, total caffeinated fluid intake, knowledge of energy drinks and habits (possible consumption during physical exercise and in association with alcohol). Before arriving at the final form of questionnaire we tested it on 120 people to check if the questions were interpreted as intended and to assess the extent of response, we only assigned validity to our questionnaire after the validation process was completed. Another important step in the construction of the questionnaire was our focus on reliability: results have to be reproducible; in our case, reliability was assessed by comparison with similar data obtained from other researches in PubMed.

To evaluate the consumption of caffeine we were inspired by the CCQ (Caffeine Consumption Questionnaire) [11], slightly modified according to our requirements. The data about the association of energy drinks and alcohol were collected using BAES (Biphasic Alcohol Effects Scale) [12], a self-report, unipolar adjective rating scale that is designed to measure both stimulant and sedative effects of mixing alcohol with energy drinks. It consists of fourteen items that comprise two sub-scales (stimulant and sedative). Individuals were instructed to rate the extent to which drinking alcohol produced these feelings, from 0 (not at all) to 10 (extremely).

Results

Table I shows the characteristics of the sample, uncovering some unhealthy lifestyle choices in this group, such as the habit of smoking, the use/abuse of substances and the intake of hunger sedatives. Analyzing the data showed that the majority of these students (1130 subjects), corresponding with 93.0%, are aware of the main ingredients contained in energy drinks; the most commonly reported ingredients are caffeine, taurine and sugars. The part (7.0%) who is not aware often confuses energy drinks with sport or soft drinks. On the other hand, the majority of students (64.3%) are not aware of the possible side effects caused by abusing energy drinks. However, among the side effects associated with their consumption, they admit to having experienced insomnia, anxiety, tachycardia and gastrointestinal disturbances above all (Fig. 1).

Students who use energy drinks are 436 (27.7%) and we have seen that men were more likely than women to make use of these beverages; their assumption happens especially during the hours when sports are being practiced, followed by consumption during hours of study and leisure. Only 215 students from the participants said they do not use energy drinks because they "think it is unhealthy", while 770, the majority, answered they do not feel as if they need to use them, and don't question themselves about their risks.

The main activities during which young people use these drinks are: sport (97), free time (82), pleasure (72), study (60). During sport activities which see the largest percentage of energy drinks consumption among young people, the most popular brand was Red Bull (321) as it is most strongly associated with sport competitions.

If we ask the student sample to indicate on which occasion their choosing an energy drink is a first choice, we can say that they are strongly motivated by the need for energy (193), staying awake (145) and because they like the taste (139), finally to increase athletic performance (71).

Though to a much lesser extent, the data on energy drinks consumption as first choice (32) during study (to increase concentration) and at the wheel to drive for longer periods (32) should be noted. Analyzing the consumption of energy drinks as second and third choice shows that, no less than 131 participants, turn to energy drinks to increase athletic performance as a second choice (259 as third choice), 143 to increase concentration during study (240 as third choice), 61 to aid in hangover recovery (352 as third choice) and finally 64 to stimulate their metabolism (350 as third choice).

Even if mixing energy drinks with alcohol is not frequent, and the prevailing answers are "sometimes" and "rarely", the percentage of students who consume energy drinks with a frequency of 1 to 4 is relevant. The most worrying data shows that 44 students admit to drinking cocktails of alcohol and energy drinks more than 4 times per month (Fig. 2).

Consumers of these cocktails were then asked to estimate (using numbers) sensations they experienced as shown in the BAES table, and the results showed that the stimulating effects such as " elated", " energized", "excited", "stimulated", "talkative", "up" and "vigorous" prevailed, though with very little difference between them (Fig. 3).

Discussion

As in previous researches, this study has allowed to photograph the situation of the population of young people regarding the adoption of incorrect lifestyles that expose young people to risks to their health (smoking, alcohol, drugs…) [13-15]. Most of the students in our sample who responded to the questionnaire know the main ingredients of energy drinks, but are not aware of the possible side effects that their abuse may cause. This is very seri-

Fig. 1. Side effects reported by students.

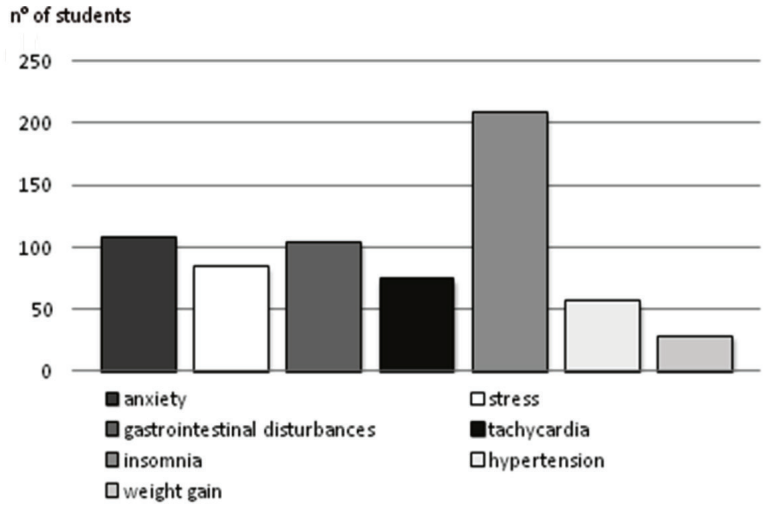
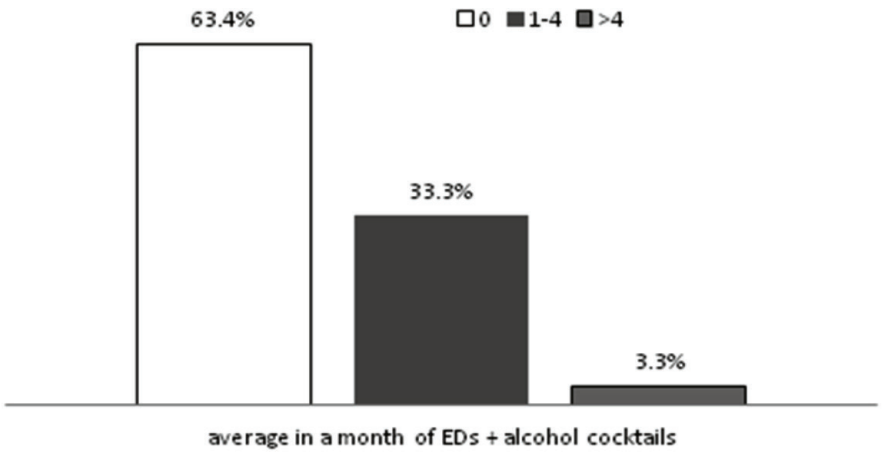


Fig. 2. The use (%) of energy drinks mixed with alcohol in a month.

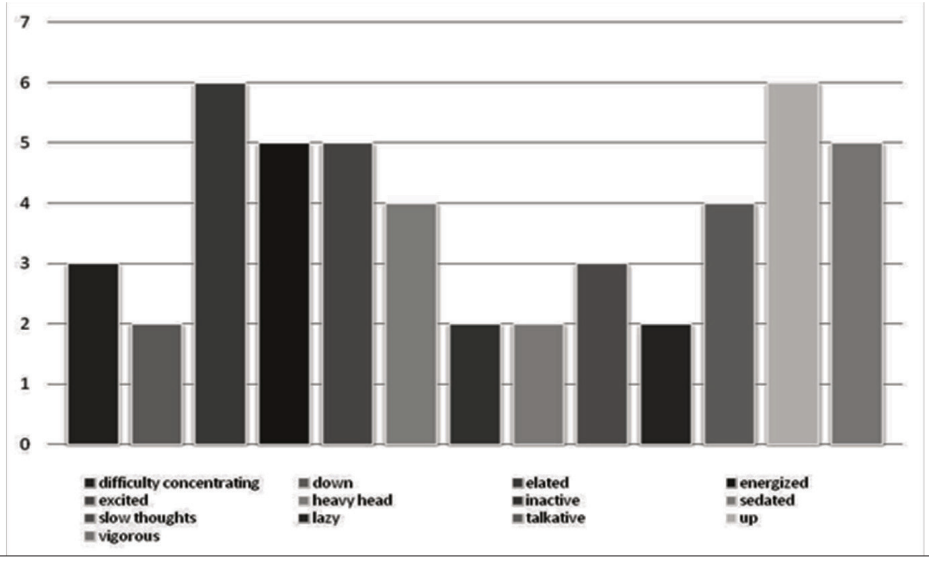


ous because it means that today's youth are not aware of what they can face, acting without awareness of possible consequences. Previous studies also showed that abusing energy drinks may lead young people to take other illegal substances, and this is even more severe [16-18]. Therefore, education is very important, first of all by the family and then by the school, in order to warn children and adolescents of the possible risks they may incur by simply drinking a can. Education on the health hazards of various nutritional elements and/or supplements can be included in school curricula.

In our study, 436 out of 1.581 students use energy drinks. It is worrying that the students who consume energy drinks, though aware of the side-effects associated with their use such as insomnia, anxiety, tachycardia and gastrointestinal disturbances, continue to use these drinks in association with sport activities, free time, fun and study. Even more worrying is the data showing energy drink as the first choice of drink during study to increase concentration and at the wheel in order to increase concentration and feel less tired [19]. Finally, an analysis of the consumption of energy drinks as second and third choice drink show an increase in students who turn to EDs to increase athletic performance, their concentration in study, combat hangover symptoms and lastly to stimulate their metabolism [9, 20, 21].

Our study shows that young people see energy drinks as containing stimulating, helpful substances which aid them in activities such as driving, study and sports. This notion represents an unhealthy lifestyle that is dangerous to oneself and others, caused in part by the superficiality of some young people, but mostly by the image that producers of energy drinks publicize through mass media by associating successful competitive performances with their consumption.

Fig. 3. Feelings associated (BAES: 0-10) with the use of energy drinks mixed with alcohol.



Among our participants, the consumption of energy drinks mixed with alcohol was not high, in fact the answers which were chosen most frequently were "sometimes" and "rarely" with an average of 1 or 2 cocktails being consumed in a month.
However, it is worrying and dangerous to see that in a sample of young people of high school age, 36.3% admitted to consuming energy drinks mixed with alcohol with a frequency going from once a month to more than 4 times a month.
This data increases in relevance when confronted with the results of a study on 500 students of the University of Messina which found that 56.9% of students were using energy drinks and of that percentage, 48.6% is used to drinking EDs mixed with alcohol [22]. In our study, consumers of these cocktails were then asked to estimate (using numbers) their sensations as shown in the BAES table, and results showed that stimulating effects such as "elated", " energized", "excited", "stimulated", "talkative", "up" and "vigorous" prevailed, though with very little difference between them.
The problem deriving from perceiving these sensations is the habit of consuming these mixtures, as it can lead to a risk of alcohol dependency [23]. The energy drink market has grown exponentially over the past decade. Energy drinks marketing strategies include sporting events and athlete sponsorships, alcohol-alternative promotion, and product placement in the media (including Facebook and video games) oriented to children, adolescents, and young adults. Newer alcoholic energy drinks, the cans of which resemble their nonalcoholic counterparts, target risk-taking youth. Contrasting with brand design is the voluntary fine-print warning label on some products, which state that they may not be safe for children, those who are sensitive to caffeine, or for pregnant or nursing women [6, 24]. The use of EDs by young people does not only create problems associated with caffeine, but also sugars. The literature shows that in EDs, sugars are present in amounts able to cause insomnia, nervousness, headache, tachycardia and seizures [25-27].
The absence of precise rules in many countries has resulted in the aggressive marketing of energy drinks over the world, targeted primarily at adolescents and young adults (men in particular) [28].
Producers have taken advantage of shortcomings in international and community legislation which, allow drinks in Europe to contain quantities of caffeine over 150 mg/100 ml by simply adding a warning label which is often not read, and in the US, producers are not obliged to label the amount of caffeine on the product.

Conclusions

The amount of data available allows us to illustrate a picture of the use of EDs in the younger population.
Our study confirms energy drinks are used mostly by young males and people taking part in sports. The tendency to use these drinks to help increase concentration during study and be on the ball in their free time was also confirmed.
The promotion of these drinks feeds the market of illusions, consolidating the opinion that any problem can be overcome with a drink, alcohol or a pill.
This illusion could determine a serious problem of public health also between the italian young people [29, 30].

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Authors' contributions

SS: conceived and coordinate the study, evaluated the results and wrote the manuscript. FP: coordinated and

contributed to the manuscript writing. MT: contributed to critically revised the manuscript. LK: contributed to critically revised the manuscript. FC: contributed to the recruitment of the participants, the acquisition of epidemiological data. IG: contributed to the supervision of the study and evaluated the results.

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■ Correspondence: Fabio Petrelli, School of Medicinal and Health Products Sciences, University of Camerino, Italy. Tel. +39 0737402417 - E-mail: fabio.petrelli@unicam.it