Intake of Energy Drinks in Association With Alcoholic Beverages in a Cohort of Students of the School of Medicine of the University of Messina

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Background: Energy drinks (ED) are a widely used group of beverages known for their stimulant effects on central nervous system (CNS). The main components of ED are caffeine, taurine, carbohydrates, glucuronolactone, inositol, niacin, pantenol, and β-complex vitamins. The studies evaluating the effects of ED describe improvements in attention and/or reaction times and indices of alertness. It has been also shown that combination of caffeine and glucose, fundamental constituents of ED, can ameliorate deficits in cognitive performance and subjective fatigue during extended periods of cognitive demand. Moreover, the associated ingestion of alcohol and ED has recently been observed to be becoming more and more widespread.

Methods: With the aim to know the habits and uses of students, we administered a questionnaire containing questions regarding ED drinking alone or in association with alcoholic beverages. Five hundred students of the School of Medicine of the University of Messina were interviewed, and 450 filled the questionnaire.

Results: A total of 56.9% of students declared using ED. A great part of users (48.4%) associate frequently ED and alcohol. In particular, 35.8% of ED + alcohol users have used ED + alcohol more than 3 times in the last month. Distinguishing the users into 2 groups (users of ED + alcohol and users of both ED and ED + alcohol), we observed in the second group a major use of cocktail containing a mix of ED and alcoholic beverages. This difference between the 2 groups is less represented about the ingestion of ED + alcohol in the night.

Conclusions: Our data indicate that association of ED + alcohol is very popular among students. This behavior can be dangerous. In fact, the combination of ED + alcoholic drinks can reduce adverse symptoms of alcohol intoxication including the depressant effects. As consequence, users of ED + alcoholic beverages might not feel the signs of alcohol intoxication, thus increasing the probability of accidents and/or favoring the possibility of development of alcohol dependence.

Key Words: Energy Drinks, Alcohol, Caffeine, Taurine, Students, Cocktails.

ENERGY DRINKS (ED) are a widely used group of beverages known for their stimulant effects on central nervous system (CNS). The main components of ED are caffeine, taurine, carbohydrates, glucuronolactone, inositol, niacin, panthenol, and β-complex vitamins.

Studies evaluating the effects of ED described improvements in attention and/or reaction times and indices of alertness (Alford et al., 2001; Reyner and Horne, 2002; Smit and Rogers, 2002). Moreover, it has been shown that a combination of caffeine and glucose, principal constituents of ED, can ameliorate deficits in cognitive performance and subjective fatigue during extended periods of cognitive demand (Kennedy and Scholey, 2004). Studies with laboratory animals have shown that the previous or concomitant administration of taurine affects the pharmacologic and behavioral effects of ethanol (Aragon et al., 1992; Dahchour et al., 1996; Ferko and Bobyock, 1988; Kuriyama and Hashimoto, 1998), and that co-administration of caffeine can enhance the reinforcing effects of ethanol in a dose-dependent way (Kunin et al., 2000) and increase the locomotor stimulation induced by the administration of ethanol (Koo, 1999; Kuribara et al., 1992; Waldeck, 1974).

Moreover, the consumption of ED in association with alcohol could cause an uncontrolled falling asleep while driving that accounts for a significant number of road crashes, particularly on dull and monotonous roads (Horne and Reyner, 1995, 1999).

In the last years, the ingestion of alcohol with ED has become rapidly increased and more and more popular, especially among young people. In a recent study, Ferreira et al. (2006) observed that the ingestion of a single dose of ED reduces the intensity of some depressant symptoms of

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alcoholic intoxication such as headache, weakness, dry mouth, and motor coordination, but does not significantly reduce the deficits of alcohol ingestion (Ferreira et al., 2006). Some findings reported enhancement of the mood state, as well as physical and psychomotor performance (time of motor reaction, concentration, work memory, and subjective sensation of alertness and vigor), after the ingestion of ED (Porkka-Heiskanen et al., 1997; Radulovacki, 1995).

However, there is a poor knowledge on the use of ED, and a little scientific evidence on the interaction of their constituents with ethanol.

With the aim of increasing the knowledge of using ED alone or in association with alcoholic beverages, we carried out a survey using a questionnaire administered to a group of students of the School of Medicine of the University of Messina in Italy.

METHODS

An anonymous questionnaire was administered to 500 students (about the 25% of population of students of the Faculty of Medicine of Messina in the current academic year). In the questionnaire, each student reported sex, age, and use of ED alone or in combination with alcoholic beverages. Principal questions focused on the way of using ED (alone or with alcohol), the number of tins drunk daily and in the last month, the main reasons of utilization, and on the monthly and daily number of cocktails containing ED and the alcohol used.

The percentage of responders was 90% (450 subjects), divided in 41.3% of males and 58.7% of females (mean age 24.5 years; range 19 to 30). The ED users were considered students, declaring to drink almost 1 ED in the last month. Fifty students (not responders) did not give back the questionnaire and were excluded from the analysis.

RESULTS

The 56.9% of participants in the survey declares to use ED. Table 1 reports the way of use of the ED. The greatest part of ED users reports the intake of ED in combination with alcoholic beverages (22.7%), or both ED alone and ED + alcohol (25.8%). Only 8.4% of the participants declared to drink only ED alone. Table 2 reports the use of ED alone in comparison with the use of ED alone and ED + alcohol in the last month.

Data reported in Table 2 show that the consumption of ED is more widespread in the group, who use both ED alone and ED + alcohol with respect to the users of ED alone. Analog results were obtained regarding the daily ingestion of ED (Table 3). The 81.8% of ED users reports the motivations for use. The main motivations are reported in Table 4.

Table 1. Ways of Use of Energy Drink (ED) Beverages

Way of use	Number of ED users	% of ED users
ED	38	14.8
ED + alcohol	102	39.8
Both ED and ED + alcohol	116	45.3

Sample: 256 users.

Table 2. Energy Drink (ED) Tins Ingested in the Last Month by Users

Tins drunk in the last month	Users of ED alone (%)	Users of both ED alone and ED + alcohol (%)
1	38.3	17.2
2	10.7	6.9
3	10.7	20.7
>3	31.8	53.5
NR	8.5	1.7

NR, not reported.
Sample: 154 ED users.

Dividing the users into 2 groups (users of ED alone and users of both ED alone and ED + alcohol), we observed that students in the second group appear more motivated to justify the use ($p < 0.05$) (Table 5).

In the second part of the questionnaire, we investigated the use of ED in association with alcoholic beverages. In general terms, 218 students (48.4% of the total sample) declared to use ED + alcohol. Of these, 116 (53.2%) declared the use of both ED alone and ED + alcohol. The main alcoholic beverages ingested in association with ED by students were gin (40% v/v) or vodka (37.5% v/v).

Table 6 reports the number of cocktail containing ED and alcoholic beverages ingested in the last month. Differentiating the users into 2 groups (users of ED + alcohol and users of both ED and ED + alcohol), we observed in the second group a major use of cocktail containing a mix of ED and alcoholic beverages.

The last investigation regarded the ingestion of ED + alcoholic beverages in the night in the 2 groups of comparison (Table 7).

DISCUSSION

Energy drinks are beverages containing a mixture of different substances whose use is widespread among young people.

Consistent and wide ranging improvements in performance after ED ingestion were described and they have been interpreted as reflecting the effects of the combination of its ingredients (Alford et al., 2001). The principal constituents are caffeine, taurine, carbohydrates, glucuronolactone, inositol, niacin, pantenol, and β-complex vitamins.

Caffeine belongs to the xanthine chemical group and it seems to interfere with adenosine in the brain at multiple sites, including the reticular formation. Adenosine is a naturally occurring xanthine in the brain that is used as a neurotransmitter at some synapses. Based on this interaction, it has been suggested that caffeine may have a direct inhibitory effect on sleep system (Porkka-Heiskanen et al., 1997; Radulovacki, 1995). Other caffeine effects are mediated by the stimulation of the synthesis and turnover of catecholamines and include: increase in alertness, reduction of fine motor coordination, insomnia, headaches, nervousness, and dizziness (Battig and Welzl, 1993).

Table 3. Daily Ingestion of Energy Drink (ED) Tins

More than 1 tin in a day	Number of users of ED alone	Users of ED alone (%)	Number of users of both ED alone and ED + alcohol (%)	Users of both ED alone and ED + alcohol
Yes	8	21.1	42	36.2
No	30	78.9	74	63.8

Sample: 154 users.

Table 4. Main Motivations for Consumption of Energy Drinks (ED) Indicated by Users

Motivations for consumption of ED	Users (%)
I like it	67.5
It makes me feel better	22.1
It makes me to be wide awake until late	13.0
It helps me in the practice of sport	13.0
It helps me in the concentration during study or work	5.2

Table 5. Number of Motivations Indicated by Energy Drink (ED) Users

Number of motivations for consumption of ED	Users of ED alone (%)	Users of both ED alone and ED + alcohol (%)
1	64.8	61.9
2	21.6	23.2
>2	5.0	13.5
NR	8.6	1.4

NR, not reported.

Table 6. Ingestion of Cocktails Containing ED + Alcohol in the Last Month

Number of cocktails	Users of ED + alcohol (%)	Users of both ED alone and ED + alcohol (%)	All users of ED + alcohol and of both ED alone and ED + alcohol (%)
1	40.9	22.1	31.5%
2	12.9	16.6	14.7%
3	21.5	9.2	15.3%
>3	23.7	51.6	37.7%
NR	1.0	0.5	0.8%

ED, energy drinks; NR, not reported.
Sample: 218 users.

Table 7. Ingestion of Cocktails Containing ED + Alcohol in the Night

Number of cocktails	ED + alcohol users (%)	Users of both ED alone and ED + alcohol (%)
1	62.8	56.9
2	20.9	29.5
3	5.2	5.9
>3	5.1	5.9
NR	6.0	1.8

ED, energy drinks; NR, not reported.
Sample: 218 users.

The β-amino acid taurine is found in millimolar concentrations in mammalian tissues, but humans are dependent on dietary sources of taurine (Bouckenooghe et al., 2006).The healthy body is able to synthesize this amino acid from methionine and cysteine in liver and brain via 3 pathways known to require the active coenzyme form of vitamin B6. The highest concentration of taurine is found in the retina and in the neutrophils. It is also found in cardiac and skeletal muscle (Anon, 2001; Stapleton et al., 1998).

Taurine is involved in a wide array of physiological phenomena including inhibitory neurotransmission, long-term potentiation in the striatum/hippocampus, membrane stabilization, feedback inhibition of neutrophil/macrophage respiratory bursts, adipose tissue regulation, and calcium homeostasis (Birdsall, 1998). Studies conducted with laboratory animals showed pharmacological interactions between alcohol and taurine on locomotor activity and dopamine release and on the deleterious effects of ethanol on liver metabolism (Aragon et al., 1992; Dahchour et al., 1996; Kerai et al., 1998).

Glucose can also have an alerting effect; however this effect is usually of short duration (about 10 minutes) (Reyner and Horne, 2002). The ED users frequently report a reduction in sleepiness and an increase in the sensation of pleasure when these drinks are combined with alcoholic beverages, suggesting that they might reduce the depressant effects and/or increase the excitatory effects of alcohol (Ferreira et al., 2004). ED effects on alcohol intoxication may be due to the antagonistic effects of caffeine and taurine against depressant alcohol properties (Dahchour et al., 1996; Kunin et al., 2000).

The present work collects answers of a group of young students to questions about ED use. Analysis of data shows that a large part of the sample of students frequently use ED. Within the group of ED users, the greatest part of students declare to use ED in association with alcohol. The evaluation of monthly consumption of single tins of ED demonstrates that the sporadic use is more frequent in the group of students using ED alone, whilst consumption of more tins is reported by users of both ED alone or in association with alcohol. This major consumption of ED tins in the second group suggest that, in a large part of young students, the association with alcohol could stimulate the use of ED. These data are confirmed by the fact that more than one-third of users of both ED alone and association (about 9% of the students interviewed) ingests more than 1 ED a day.

The principal reason of utilization seems to be linked to a common sensation of pleasure. The largest trend to indicate more reasons for using in the group of users of both ED alone

and ED in association with alcoholic beverages, leads to hypothesize in this group a sort of need to justify the use.

The second part of the questionnaire investigated the use of ED in association with alcoholic beverages. The 48.4% of the total sample of students interviewed declared to use ED + alcohol. The 53.2% of these students use both ED alone and ED + alcohol. Interestingly, more than one-third of these students have ingested in the last month more than 3 cocktails composed of ED and alcohol.

Evaluation of monthly and daily number of single cocktails (ED + alcohol) drunk shows that users of both ED and ED + alcohol ingested more single cocktails than users of ED + alcohol. Hence, these ones tend to consume a greater quantity of ED and alcohol compared with the other groups examined.

In conclusion, our study confirms a large use, among young people, of ED either alone or in combination with alcoholic beverages. Furthermore, the use of ED may influences ingestion of large amount of alcohol. The implications linked to the possible risks of car accidents caused by alcohol intake and the risk of development of alcohol dependence indicate the need for a thorough evaluation of this new social phenomenon.

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