

## Energy drink consumption in Italian university students: food habits and lifestyle

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### Abstract

**Objectives.** The aim of this study was to investigate the consumption of ED (Energy drink) among young people, both alone and in association with alcohol, as well as the food habits and lifestyle of ED consumers.

**Materials and Methods.** An anonymous closed-ended questionnaire, was administered to a sample of students. The questionnaire is composed of 30 questions with multiple answers. The students, who come from different regions in Italy, were enrolled at two Italian Universities: Rome and Cagliari. T-test and the analysis of variance (ANOVA) were performed and chi-square test was used to compare observed and expected frequencies.

**Results.** The sample was composed by 618 females and 389 males and revealed statistically significant differences related to the gender in terms of lifestyle and food habits. About 2/3 of the sample has consumed ED at least once. ED consumers in the total sample accounted for 655 students (65,0%). The 41,3% of the females and the 58,8% of males were ED consumers. Habitual consumers represent the 15,8% of the ED consumers, while occasional consumers the 84,2%. Habitual and occasional consumers show statistically significant differences both for the lifestyle and the food habits. The 72,1% of ED consumers drink ED in association with alcohol (ED-based cocktails).

**Conclusions.** Our results suggest that would be recommended to inform consumers about the side effects related to an excessive use of ED, particularly when combined with alcohol: indeed, this combination is known to have adverse effects on the cardiovascular system, on the nervous system, leading in particular to sleeping disorders. *Clin Ter* 2016; 167(6):175-181. doi: 10.7417/CT.2016.1968

**Key words:** alcohol, energy drink, food habits, lifestyle, student

### Introduction

The non-alcoholic energetic drinks (ED) market has grown remarkably since the beginning of the new millen-

nium. Over the last ten years, the consumption of such kind of drinks has risen markedly, and now accounts for 20% of the beverage market. According to Zenith International, a counselling company in the food and beverage sector, worldwide consumption of ED increased by 14% in 2011 alone, and from 3.2 millions litres in 2007 up to 4.8 million litres in 2011 (1).

The main consumers of ED are young people, who are influenced by aggressive and widespread advertising campaigns. According to the estimates of the multinational counselling company Mintel, 65% of consumers of ED are between 13 and 35 years of age (2). The target market of such products includes athletes, students and professionals who need to maintain high concentration levels; ED are also consumed by young people in clubs often being combined with illicit substances such as amphetamines and marijuana (3).

The numerous brands of ED share one common factor: they all contain caffeine. The caffeine content ranges from 50 mg to 505 mg per can, compared with 80 mg contained in a cup of coffee (4). Beside caffeine, ED also contain extracts of guarana, taurine, ginseng, inositol, carnitine, glucuronolactone, B group vitamins and carbohydrates (ribose, sucrose, fructose).

The substances contained in the preparation of ED, which are claimed to have positive effects on a person's health, allow and facilitate performances that require a high energy levels (5).

Moreover, according to advertisements, such substances enhance performances and increase concentration, reactions, wakefulness, attention, emotions and metabolism, and reduce physical and mental stress. A number of side effects related to the use of ED have been reported in the literature. The most common side effects are hypertension, tachycardia, tremor, agitation, insomnia, dizziness, nausea and sickness (6,5; 7-10). Many studies have shown that such side effects are typical of intoxication induced by caffeine, which is one of the main components of ED and may also be responsible for the decreased insulin sensitivity and increased blood pressure (11-13).

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The aim of this study was to investigate the consumption of ED among young people, both alone and in association with alcohol (ED-based cocktails), as well as the food habits and lifestyle of ED consumers.

## Materials and Methods

An anonymous closed-ended questionnaire, previously validated, was administered to a sample of students, not representative of a general population, attending both humanities and scientific courses at the Universities of Cagliari and Sapienza of Rome. The students were enrolled during lectures randomly chosen on various calendar days, as agreed with the lecturers of the courses, and were informed about Energy drinks and what the study was aimed to. The sample was recruited from September 2014 to October 2015.

In the questionnaire, students provided details regarding their gender, age, qualifications, place of birth and the area in which they lived, whether they were resident or non-resident students, the academic course they were enrolled on, and the university they were attending.

The questionnaire is composed of 30 questions with multiple answers. The first five questions concern food habits: breakfast habits, food variety, consumption of sweets at the end of the meal, fruit and vegetable daily consumption. The following three questions concern lifestyle: physical activity (defined as any kind of physical activity, not only that performed in the gym or while practising a sport) consisting in at least 150 minutes of moderate-intensity aerobic physical activity throughout the week as recommended by WHO (14) free time activities and smoke habits.

Yet another six questions concern alcohol consumption (wine, beer, aperitifs).

The remaining part of the questionnaire investigates the consumption of sport drink (beverage containing electrolytes and sugar) and the use of ED, both as alone and combined with alcohol. The questions on ED are designed to investigate the student's awareness of ED, their opinion of ED, the reasons and the frequency of consumption and where the ED are usually purchased.

The ED consumers were divided into two groups: occasional consumers (less than once per week) and habitual consumers (up to 3-4 times per week).

The data collected were analysed in order to determine:

- any differences between habitual (up to 3-4 times per week) and occasional (less than once per week) ED consumers;
- the characteristics of ED consumers (habitual and occasional)
- the characteristics of consumers of cocktails that combine ED and alcohol (ED-based cocktails)
- gender-related differences in food consumptions and lifestyle.

After the normal distribution of the variables was verified, t-test and the analysis of variance (ANOVA) were performed to assess any differences between means of the groups; chi-square test was used to compare observed and expected frequencies. Differences were considered to be statistically significant at  $p < 0.05$ . Statistical analyses was

performed using SPSS 10.0 statistical software (SPSS Inc Wacker Drive, Chicago, IL, USA).

## Results

One thousand and seven students answered to all the questions and the analysis here presented is based on such sample. About fifty students did not complete the questionnaire and their answers have not been considered. The students, who come from different regions in Italy, were enrolled at two Italian universities as follows: 520 from the Sapienza University of Rome and 487 from the University of Cagliari. There were no statistically significant differences between students enrolled at the different universities. The sample was composed by 618 females and 389 males. The mean age of the sample was  $22.7 \pm 4.41$  years. Non-residents accounted for 60.6% of the female students and the 59.3% of the male students. The 47,3% of females and 74,3% of males attend Scientific courses instead the 52,7% of females and 25,5% of males attend Humanities courses. There was statistically significant frequency difference between males and females. Sample's lifestyle and food habits related to the gender are shown in Table 1. The proportion of interviewees who knew what ED are was 81.7%, with a statistically significant difference between genders (77.7% F e 86.6% M) ( $p < 0.05$ ).

### Results of ED consumers

About 2/3 of the total sample has consumed ED at least once (75.8%), with a statistically significant difference related to gender (57.4 % Females; 78.9 % Males) ( $p < 0.05$ ).

ED consumers in the total sample accounted for 655 students (65,0%). The 41,3% of the females (270 students) and the 58,8% of males (385 students) were ED consumers. There were statistically significant differences between genders. The 72,1% of ED consumers drink ED in association with alcohol (ED-based cocktails), with a statistically significant difference related to gender (37,2% Females; 62,8 % Males) ( $p < 0.05$ ).

ED consumers were divided in two groups. Habitual consumers were defined as students who drink ED up to 3-4 times per week, while occasional consumers were defined as students who drink ED less than once per week. Only five students declared a consumption of ED higher or equal to 5 times per week, but their answers were not considered in the analysis of the differences between consumers as clearly not significant. Habitual consumers represent the 15,8 % of the ED consumers, while occasional consumers the 84,2 %. Even in this case, there were no statistically significant differences between genders. Differences between the two groups of consumers are shown in Table 2. The 72,6% of habitual consumers and the 57,8% of occasional consumers attend Scientific courses instead the 27,4% of habitual consumers and 42,2% occasional consumers attend Humanities courses.

The 48,1% of the occasional consumers and 44,7% of the habitual consumers did physical activity at least 150 min per week. With regard to smoking habits, the 37,1%

Table 1. Sample's lifestyle and food habits related to the gender.

		Females (N 618)	Males (N 389)
		%	%
Physical activity	Recommended (at least 150 min per week) <sup>1</sup>	52,9*	36,7
Smoking (cigarettes per day)	> 15	49,6*	33,7
	5-15	25,2*	31,7
	< 5	25,2*	34,6
Free time	Walking	13,9	9,7
	Watching TV/Listening to music/Computer/Reading	27,5	39,8
	Practising sport	23,8	13,7
	Going out with friends	48,8	37,2
Food habits	Have a breakfast (daily) <sup>1</sup>	68,7*	57,4
	Have a varied diet (weekly) <sup>1</sup>	56,5	61,8
	Eat fruit (twice or more per day) <sup>1</sup>	38,5	37,2
	Eat vegetable (twice or more per day) <sup>1</sup>	24,6*	10,2
	Sweet consumption at the end of the meal (at least once a week) <sup>1</sup>	62,8	63,1
	Sport drink consumption (twice or more per week) <sup>1</sup>	48,8*	34,9
	Wine consumption (two or three times per week) <sup>1</sup>	24,6*	30,7
	Beer consumption (two or three times per week) <sup>1</sup>	21,6*	34,9
	Drink or alcoholic drink consumption (two or three times per week) <sup>1</sup>	17,7*	24,8

\*p < 0.05 statistically significant frequency difference between males and females

<sup>1</sup> Between brackets it is reported the most frequent answer to the relevant question

Table 2. ED Consumers lifestyle and food habits.

		Habitual Consumer <sup>2</sup> (N 103)	Occasional Consumer <sup>3</sup> (N 547)
		%	%
Physical activity	Recommended (at least 150 min per week) <sup>1</sup>	48,1	44,7
Smoking (cigarettes per day)	> 15	37,1	41,2
	5-15	40,0	28,9
	< 5	22,9	29,9
Free time	Walking	14,9	8,7
	Watching TV/Listening to music/Computer/Reading	30,8	27,6
	Practising sport	13,2	14,7
	Going out with friends	41,1	49,0
Food habits	Have a breakfast (daily) <sup>1</sup>	51,2*	66,4
	Have a varied diet (weekly) <sup>1</sup>	51,1*	58,5
	Eat fruit (twice or more per day) <sup>1</sup>	37,3	36,2
	Eat vegetable (twice or more per day) <sup>1</sup>	25,4	36,5
	Sweet consumption at the end of the meal (at least once a week) <sup>1</sup>	53,4*	63,4
	Sport drink consumption (two or three time per week) <sup>1</sup>	34,6*	14,7
	Wine consumption (two or three times per week) <sup>1</sup>	35,4*	23,5
	Beer consumption (two or three times per week) <sup>1</sup>	44,0*	27,2
	Drink or alcoholic drink consumption (two or three times per week) <sup>1</sup>	38,0*	19,4

\*p < 0.05 statistically significant difference between the two groups

<sup>1</sup> Between brackets it is reported the most frequent answer to the relevant question

<sup>2</sup> With an ED consumption up to 3-4 times per week

<sup>3</sup> With an ED consumption less than once per week

of occasional consumers and 41,2% of habitual consumers smoked more than 15 cigarettes per day. The statistically significant differences between the groups of consumers about the food habits were the following: 51,2% of habitual consumers and the 66,4% of the occasional consumers had a breakfast daily, 51,1% of habitual consumer and 58,5% of the other group had varied diet weekly. The 53,4% of habitual consumer and 63,4% of the occasional consumed sweets at the end of the meal. The sport drinks were consumed by the occasional consumers for the 34,6% and by the habitual consumers for the 14,7% (Tab. 2).

With regard to alcohol consumption, statistically significant differences ( $p < 0.05$ ) emerged between habitual and occasional consumers: in particular, 35,4% of habitual consumers drank wine 2-3 times per week compared with 23,5% of occasional consumers; 44,8% of habitual consumers drank beer 2-3 times per week compared with 27,2% occasional consumers. Moreover, 38% of habitual consumers and 19,4% of occasional consumers drank aperitifs or alcoholic drinks 2-3 times per week (Tab. 2).

When asked "what do you think of ED?", 12,7% of the ED consumers answered "they are healthy", 10,5% "they are useless", 3,5% "they are dietetic" and 73,3% "they are energizing". Half of the consumers bought ED at the supermarket, 46% in leisure locations (clubs, pubs, etc.), the remainder at the gym ( $p < 0.05$ ).

As regards the circumstances associated with ED consumption, 28,6% of the consumers used ED when studying very hard, while 17,9% used ED on Saturday evenings to maintain high activity levels throughout the night (Fig. 1). The reasons leading to ED consumption were that ED have an energizing effect for 32,5% of the ED consumers, while

16,9% believed that ED enhance the concentration levels required to study ( $p < 0.05$ ) (Fig. 2).

Forty-eight percent of the ED consumers started drinking ED after seeing an advertisement, 41% following a friend's recommendation and 11% following a personal trainer's recommendation (Fig. 3).

Alcoholic cocktails based on a combination of ED and alcohol (ED-based cocktails) were consumed by 68,2% of the ED consumers  $\geq 1$  time per week, by 28,6%  $< 1$  time per week and by only 3,2%  $\geq 4$  times per week. There were no statistically significant differences between genders.

When the ED consumers were asked what led to the consumption of cocktails containing ED, 6,5% of the students answered "because I end up drinking less alcohol", 63,4% "because I like it", 14,6% "because I can maintain high activity levels throughout the night", 12,2% "because I feel euphoric" and 3,3% "because I can concentrate better" (some of the interviewees gave more than one answer to this question). The alcoholic drinks most often combined with ED were vodka (81,0%) and gin (41,8%).

## Discussion

In recent years there has been a remarkable increase in the consumption of ED worldwide, particularly among young people. We planned this study in order to analyse the consumption of ED, both on their own and combined with alcohol, in a population of Italian university students. The results of our study show that ED are known by the majority of students, who consume such drinks on their own or combined with alcohol. The sample we analysed

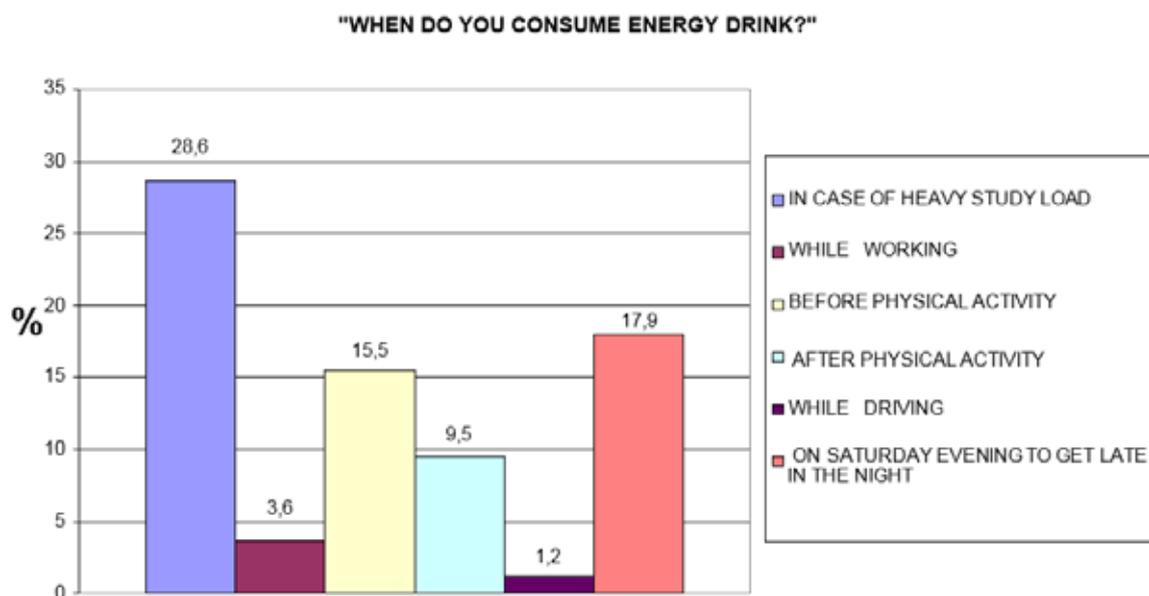


Fig. 1. The circumstances associated with ED consumption.

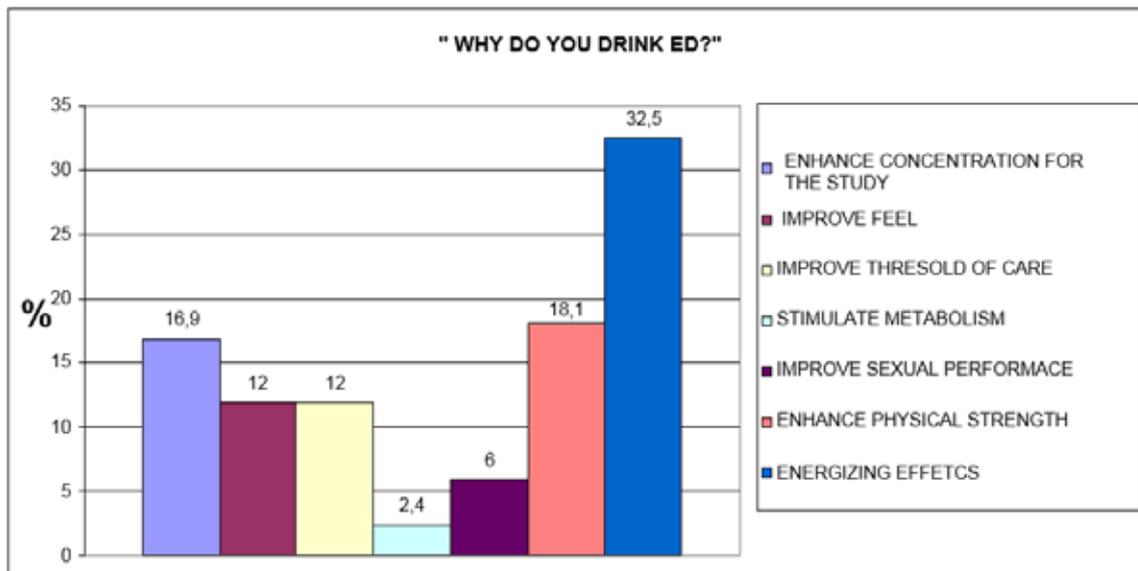


Fig. 2. The reasons leading to ED consumption.

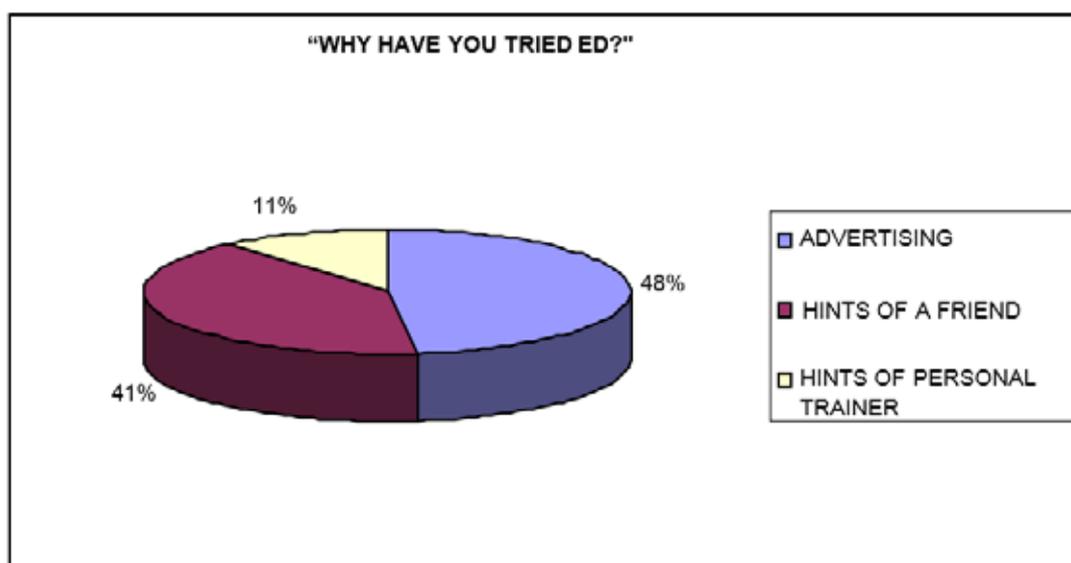


Fig. 3. The incentives to ED consumption.

is composed of 1007 students who were enrolled in two different Italian universities and were attending both humanities and scientific courses. The sample, in which there is a prevalence of female students, revealed statistically significant differences related to the gender in terms of lifestyle and food habits. Females in our study were also found to conduct a healthier lifestyle, with more than half following a recommended physical activity. The present study shows that female subjects adopt more correct food behaviour. Indeed, a higher proportion of female subjects than male subjects have breakfast everyday and consume 2 or more portions of vegetables per day, as recommended by the New Modern Mediterranean diet Pyramid (15). As

far as alcohol consumption is concerned, males consume more beer, wine, aperitifs and cocktails than females. These findings are in keeping with the latest ISTAT report on alcohol consumption, which revealed that more than the 80% of young males in Italy regularly consume alcoholic drinks. (16). Data related to ED consumption reveal that more than half of the sample has tried an ED at least once, while about half of the students drink ED less than once per week. These data are in keeping with those previously reported by other authors (17,18) in a study conducted on 1253 young students, reported that 27.6% used ED on a monthly basis. (17) An Italian study, carried out on 500 students (17), showed that one third of the students consumed ED less than once per

week, while students who consumed them habitually accounted for 14.8% of the sample, which is in line with the findings of the present study. In the EFSA (19) report on ED consumption, conducted on an Italian adult population, 28% of the interviewees had consumed an ED at least once in the previous year, while 5% of the consumers were defined as chronic because they consumed ED 4-5 times per week. The reasons for the consumption of ED that emerge from this study are in keeping with those that emerged in both the EFSA report and another Italian study; the main reason given is that such drinks are energizing (19,20).

According to the findings of the present study, habitual consumers are enrolled mainly in scientific courses at university. The statistical analysis conducted on lifestyle and food behaviour highlighted statistically significant differences between habitual and occasional consumers.

The occasional consumers adopt a better lifestyle and food behaviour than the habitual consumers in term of following a weekly-varied diet, having daily breakfast, consuming less sweets at the end of the meal, eating more fruits and vegetables, drinking fewer alcoholic and sports drinks, doing physical activity recommended throughout the week and smoking less cigarettes per day. Unfortunately, no comparative reference data are available in the literature.

By contrast, the majority of the ED consumers drinks ED-based cocktails, with more than half consuming drinks ED-based cocktails at least once per week. Several studies conducted both in Europe and overseas have highlighted the habit among young people to consume ED combined with alcoholic drinks (18, 21-24). According to the EFSA report on ED consumption, the European age group that consumes most ED, including those combined with alcohol, are "young adults" ranging from 18 to 29 years of age; this finding also includes Italian consumers (19). The results of our study show that the alcoholic drinks most often combined with ED are vodka and gin because of their taste. Several studies have reported that the habit of consuming ED with alcohol has a negative effect on behaviour related to alcohol intake. Indeed, some ingredients contained in ED affect the alcohol metabolism in such a way as to allow a faster absorption and a higher intake of alcohol without the reduced understanding normally induced by alcohol intoxication. (25) This combined effect may thus hide the effects of intoxication and leading to a higher alcohol intake, which is also encouraged by the marked palatability of the cocktails (17, 26-28). Taurine, which is another component of ED, not only modifies muscular stimulation but may, if associated with alcohol, modulate the effects of ethanol exerted on the central nervous system (29). Although few studies have investigated the interaction of other ED components with alcohol, the side effects of ED are known not to be attributable exclusively to caffeine or taurine.

Our results suggest that subjects who combine the consumption of ED with the alcoholic drinks, such as wine, beer or aperitifs, may be exposed to the possible side effects related to an excessive use of ED, particularly when combined with alcohol (21, 28).

The main reasons underlying the consumption of ED in our sample are "because I like it", "because it makes me feel euphoric" and "because I can concentrate better". Indeed, the results of our study show that ED are often consumed when

in the company of friends or in situations associated with intense stress, such as hard study. As regards the reasons that initially lead to the consumption of ED, the leading role is played by advertisements, followed by friend's recommendations. The majority of the interviewees believed that ED are energizing drinks.

The main limitation of the present study is related to the composition of the sample, which is made up prevalently of females and is thus biased by a gender imbalance. This was not obviously an intentional decision made in the planning phases of the study. The higher number of female students in the overall sample is simply due to the fact that more young women enrol at university than young men.

## Conclusions

In recent years the ED market has grown markedly, supported by widespread and aggressive advertisement campaigns designed to encourage the public to buy ED on the basis of their supposed benefits.

It would be advisable to inform consumers about the side effects related to an excessive use of ED, particularly when combined with alcohol: indeed, this combination is known to have adverse effects on the cardiovascular system, on the nervous system, leading in particular to sleeping disorders, which in turn impact on the capacity to maintain a high attention level and/or to react, thereby causing accidents such as car crashes (21, 28).

Another non-negligible risk, which is particularly likely to affect young people, is the consumption of ED during physical activity. Caffeine, which is the main component of ED, promotes diuresis which, when combined with liquid loss due to sweating caused by exercise, may induce dehydration and result in tremor and heart disease (30).

The high content of sugars in ED represents a risk factor not only because it causes public health risk problems such as obesity among young people, but also because of its high cariogenic and erosive potential. Indeed, many commercialized ED are characterized by a low pH and a high non-reducing sugar content, which is highly erosive for teeth (31).

To sum up, we believe that the label should contain, besides the statement "high caffeine content", more information such as that regarding the high sugar content so help make consumers more aware of the potential effects of ED on their health.

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## Author Contributions

Valeria del Balzo and Valeria Vitiello have designed the study

Valeria Vitiello, Laura Diolordi and Massimiliano Pirrone have administered the questionnaire

Lorenzo Maria Donini and Valeria Vitiello have analyzed data

Valeria del Balzo, Valeria Vitiello and Laura Diolordi have contributed to the writing of the manuscript.

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