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FRONT MATTER

Title: Survey on Energy Drinks consumption and related lifestyle among students of two Italian high schools.

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Abstract

The European Food Safety Authority (EFSA) has identified some risk factors for the occurrence of side effects linked to energy drinks (EDs) consumption by young people. Tachycardia, sleeplessness, caffeine addiction may be caused by excessive consumption of EDs during parties, sport matches, ect. EDs consumption has been evaluated in a sample of students in Italy together with some aspects of their lifestyle. The survey was performed in two high schools from September 2014 to June 2015. 583 students between 14 to 18 years were recruited and a standard questionnaire (EFSA checklist) was used to collect information on responders characteristics, beverages consumption, EDs with alcohol, and EDs and sports. 350 out of 583 responders (60%) consumed EDs and 146 out of 583 responders (25%) reported an occasional alcohol consumption. Despite 82 out of 146 alcoholic drinkers (56%) were EDs-alcohol consumers, only 70 out of 583 adolescents (12%) reported habitual EDs consumption. Moreover, 38 out of 379 (10%) of all physically active adolescents reported frequent EDs consumption before sportive trainings. Study results highlight the need for primary prevention measures in communication campaigns and training delivered by school to limit potential health threats related to excess of EDs consumption.

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Introduction

During the last decades Energy Drinks (EDs) have become a popular beverage worldwide[1, 2] and represent one of the most rapidly growing segments of the beverage industry and soft drink market[3, 4]. EDs consumption has increased in 18–35 years old young adults, mostly among athletes and students. Some studies show that adolescents and young adults consume EDs to increase their alertness, physical and mental energy and to improve mood[1, 5 ,6]. In particular, 5% of young people consume EDs on a daily basis, while 30–70 % of adolescents drink these beverage less frequently. College and university students use energy drinks at least once a month to compensate for insufficient sleep, also mixing them with alcohol during parties. Other studies report that female students drink more energy beverages than male[7-11].

Energy drinks are composed of a combination of stimulants as caffeine, amino acids such as taurine, sugar derivatives, including glucuronalactone, amino acid derivatives such as carnitine, herbal extracts such as guarana, ginseng, B vitamins, ect[11, 12]. EDs may contain excessive amounts of caffeine, from 75 to 125 mg per can, and could cause cardiovascular effects, the alteration of endothelial function, the increase of anxiety, heart rate, systolic blood pressure, ventricular tachyarrhythmias and abnormalities of cardiac repolarization time as measured by the QT interval [13-21].

The consumption of energy drinks is widely spread among physically active people. These beverages may be considered a source of stamina and refreshment for young athletes performing matches or training sessions in the evening. Young people are targeted by energy drink sponsorships during sports events, promoting physically active people's belief of an increase in endurance and invincibility. Therefore, EDs are considered as functional beverages appropriate to drink during sports and designed to increase physical and mental performance[22-26].

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Many studies show that almost 25% of university students usually mix alcohol with EDs since both are meant to have depressive properties. This promotes the increase of risks because this mix reduces the perception of intoxication and induces the belief of not being totally drunk. Furthermore, kids who try EDs early will be more likely to become frequent consumers and mix them with alcohol[23, 27-29].

The issue of EDs consumption has been widely discussed in Europe. From 2001, The French Agency for Food, Environmental and Occupational Health & Safety[30] reported a negative opinion on the consumption of these drinks for their potential toxic effects caused by taurine and glucuronalactone. In 2012 the European Food Safety Authority (EFSA) highlighted all risks related to EDs consumption in association with alcohol and sport activities. A study commissioned by EFSA and Consortium NOMISMA-ARETÉ showed a large EDs consumption in adults, adolescents and children groups analyzing people lifestyle through a questionnaires-based survey involving more than 50.000 participants from 16 different EU Member States. The data proved an extensive EDs and alcohol consumption in adolescent groups[8].

Based on existing literature, the purpose of this study is to evaluate young people lifestyles related to EDs consumption and to assess if the assumption of energy beverages is a common habit among adolescents.

Materials and Methods

From September 2015 to June 2017 a survey was performed enrolling 583 adolescents aged from 14 to 18 years during school lessons in accordance with teachers and school principals. The two investigated schools are located in two different Tuscan cities: Lucca and Pisa (Italy) and have represented a convenience sample. This study used data that were obtained from student answers provided in EFSA questionnaire. We did not make any changes to the document. After the school

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councils we obtained a written study consent by parents, teachers and heads of schools. Participants and all involved people were informed of study aims before agreeing to participate. They were free to refuse or withdraw from the study.

Moreover, we submitted the issue at the Ethical Committee of our hospital and it did not prevent our "not clinical" experimental study already validated by the EFSA Institution.

The EFSA questionnaire[8] was submitted to all responders during the school years 2015-2016 and 2016-2017. The checklist was organized in four principal sections.

The first section was called "Responders Informations" and aimed at collecting personal characteristics of respondents, as age, gender, address, education and training.

The second section was divided in "Beverages Consumptions", aiming at understanding people habits and their relationship with all kind of beverages; and "EDs Consumptions", aimed at investigating EDs consumption levels and the reasons for drinking these beverages. This section collected information on consumption of generic beverages and EDs in different times: during sport, at home, during parties ect.

"EDs with Alcohol" was the third checklist section, which assessed consumption of EDs associated with alcohol both during parties and in other occasions. This section allowed to understand alcohol and EDs addiction in young people.

The last section, called "EDs and Sports", investigated EDs consumption among adolescents physically active and why sportive adolescents requested EDs use.

Statistical analysis was performed using the software XLSTAT (ver. 2016.03.30523). The Pearson χ^2 test was employed to asses differences in the distribution of frequency of replies and the Fisher exact test where the frequencies were small. A value of $p<0,05$ was considered significant.

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Results

Participants data and EDs consumption

Out of 583 participants, 360 attend high school in Lucca, while 223 people attend high school in Pisa. Overall, 51% (299/583) of the students are male and 49% (284/583) are female. No participant is affected by chronic disease or other physical and behavioral disorders.

During the day 91% (530/583) of respondents regularly drink water, but a little percentage of students from Lucca reports regular consumption of carbonated EDs or fruit juice during the day. Description of EDs consumption is shown in Table 1.

RESULTS	PERCENTAGE
Male	**297% (94/583)**
Female	**286% (89/583)**
Percentage of people not water consumers	**9% (52/583)**
Percentage of people who often consume EDs	**12% (70/583)**
Percentage of people who occasionally consume EDs	**48% (279/583)**
Percentage of people who never consume EDs	**40% (233/583)**
Percentage of people who have consumed EDs in the last 3 days	**14% (82/583)**
Percentage of people who have consumed EDs in the last year	**60% (350/583)**
Percentage of people who usually consume 3-5 EDs cans in a week	**16% (93/583)**
Percentage of people who usually consume over 3 EDs cans at the same time	**7% (41/583)**

Table 1: Percentages of Tuscan students who generally consume EDs.

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233 out of 583 responders (40%) never consume energy drinks because of their nasty flavor and nutritional parameters. 70 out of 583 (12%) often drink EDs beverages, while 280 out of 583 (48%) occasionally consume EDs either during parties or other fun opportunities during the night. Therefore, only 14% of the sample (82/583) results to have consumed these beverages during the last 3 days. Among all participants 70 out of 583 (12%) consume EDs several times a week, mostly young athletes performing matches or training sessions during the evening. More than 15% of respondents needs from 1 to 5 EDs cans a week to increase physical and mental performance. Moreover, 41 out of 583 people (7%) consume more than 3 EDs cans at the same time. Investigating on the reasons why people consume EDs, we gathered up information that EDs consumers need to compensate for insufficient sleep. Furthermore, people choose beverages with added sugar to get a better flavor. Our statistical results showed that ED consumption did not differ significantly ($p=0.52$) between female and male responders, and it is the same either they come from Pisa or Lucca ($p=0.70$).

EDs and alcohol consumption

A little percentage of our sample (41/583, 7%) reports a large EDs consumption during parties while 146 out of 583 responders (25%) drink alcoholic beverages (spirits, beer and wine) in these occasions. Among all alcohol consumers, 56% (82/146) mix alcohol and EDs at the same time or in the same glass: 23 out of 82 (28%) drink mix of alcohol and EDs from 1 to 3 times a month; 56 out of 82 (68%) consume these mix beverages from 4 to 8 times a month and 3 out of 82 (4%) drinks mix beverages from 9 to 12 times a month (Figure 1). The habit of mixing EDs with alcohol has no significant differences between males and females ($p=0.25$) and between Lucca and Pisa ($p=0.64$).

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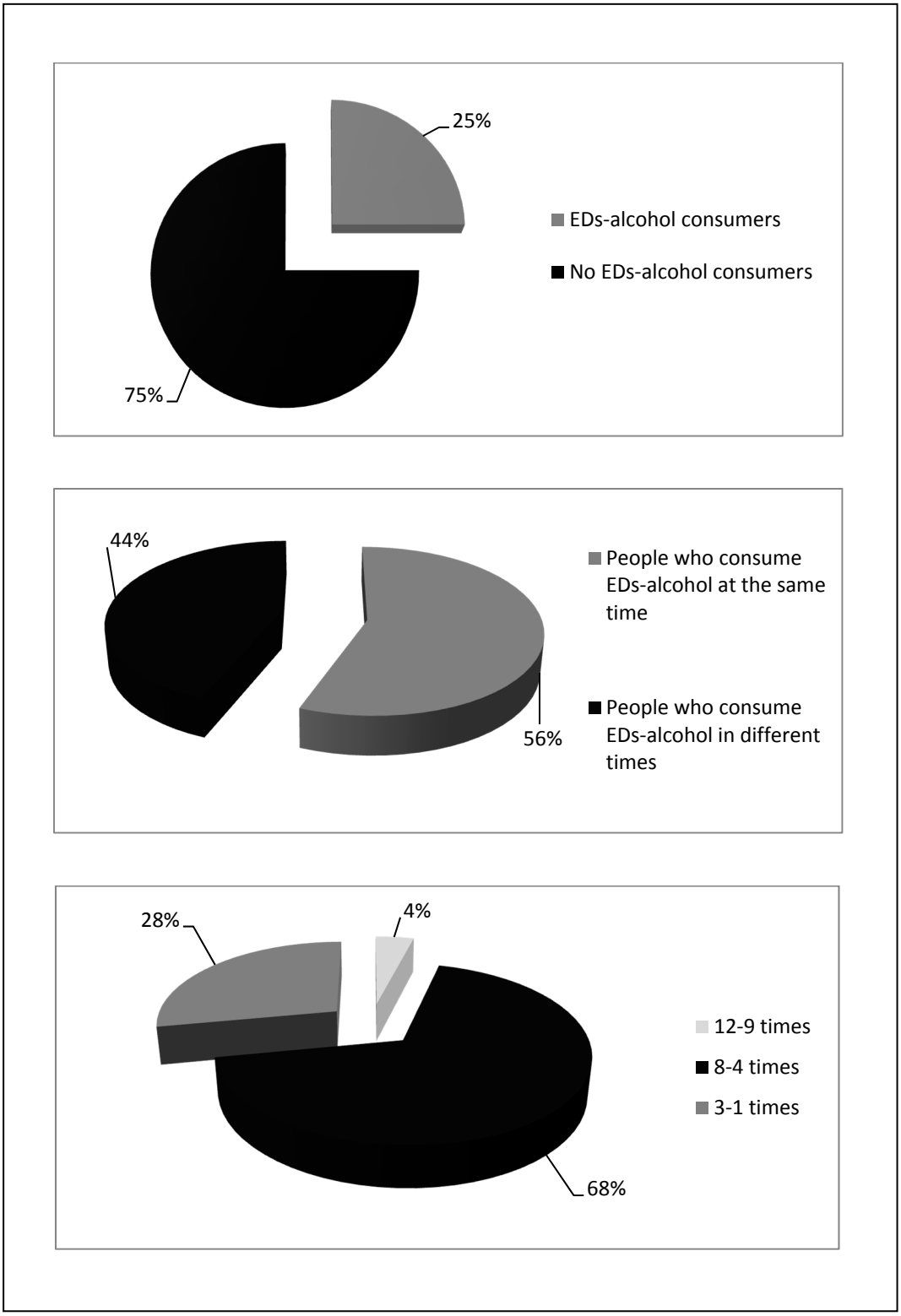

Figure 1: Percentages of young people who consume EDs with alcoholic beverages.

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EDs consumption during sports

Among all responders 379 out of 583 (65%) usually practice sport activities during the week. Among physically active people, 171 out of 379 (45%) never consume EDs before sportive sessions; 171 out of 379 (45%) often need EDs before sportive trainings; 38 out of 379 (10%) regularly consumes EDs before sportive activities. A large percentage of responders highlight the importance of EDs consumption to increase endurance, physical and mental performance during matches or sport trainings. Among the 379 physically active adolescents consuming EDs, 303 (80%) drink only 1 can per each sportive session, 42 (11%) need at least 2 EDs cans for a single sportive session and 34 (9%) drink more than 2 EDs cans during a single sportive match (Figure 2). No difference in frequency of practicing sports was observed between male and female ($p=0.64$). Furthermore, little association among people practicing sports and those consuming EDs was also observed ($p=0.76$). Such evidence was the same whether the population come from Lucca or Pisa ($p=0.97$) and whether they were females or males ($p=0.17$). Among all 379 sportive students a higher EDs consumption before sportive trainings was observed in female people ($p=0.033$).

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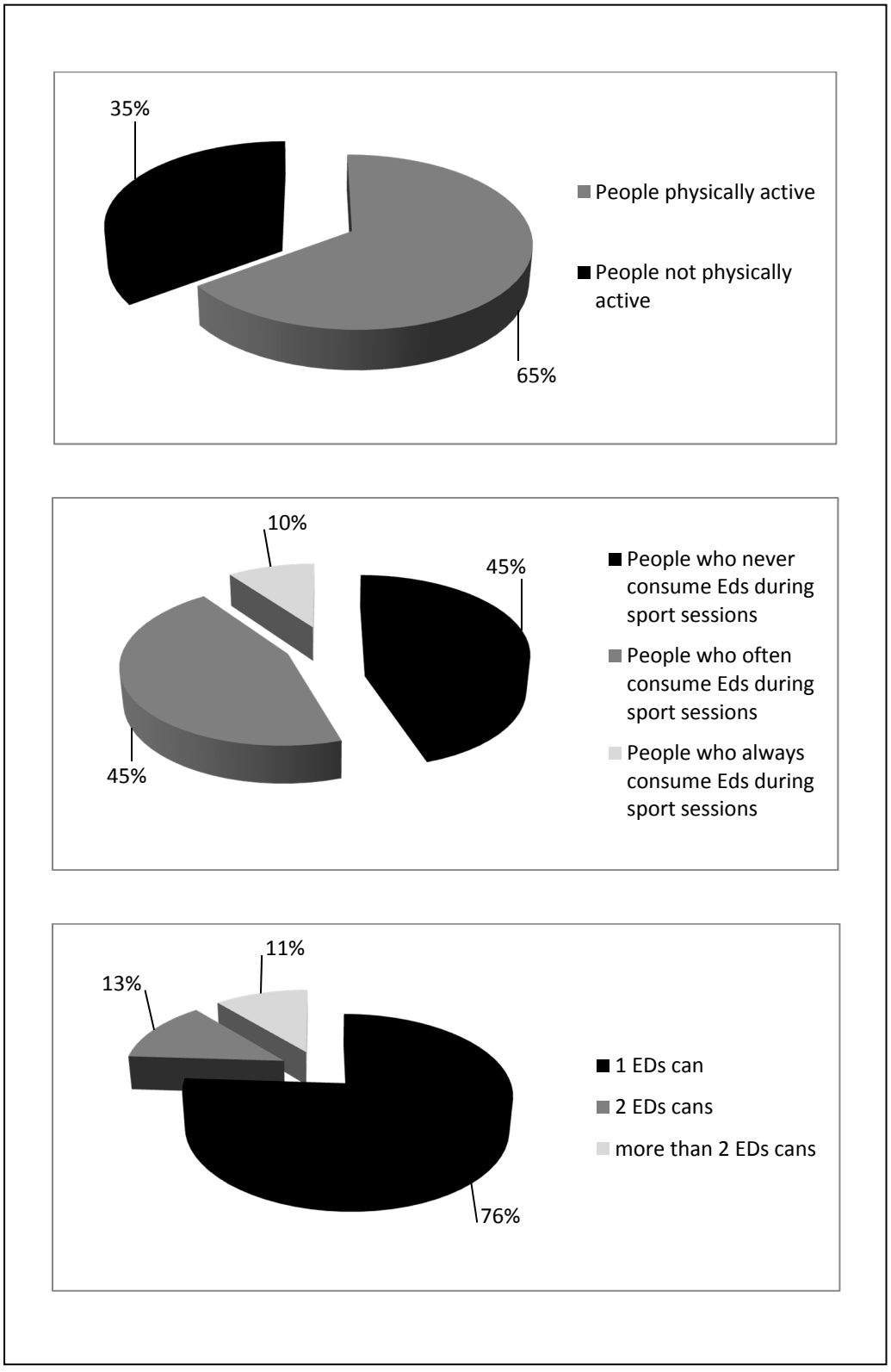

Figure 2: Percentages of young people who consume EDs during sportive activities.

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Discussion

During the recent years some institutions as European Universities, Superior Health Council of Belgium, ANSES, the European Food Safety Authority, the European Center for monitoring Alcohol Marketing, among others, have carried out a wide range of research surveys to evaluate the risk related to EDs consumption by European young people[31-33].

EFSA checklist was submitted to adolescents to study young people lifestyles and to know all possible hazards related to EDs, drunk with or without alcoholic beverages, in different times of the day[8].

Our research, that involved a limited student sample in two Italian high schools, shows overall EDs consumption by 60% of the sample. Despite 82 out of 146 alcoholic drinkers (56%) resulted also EDs-alcohol consumers, only 70 out of 583 of adolescents (12%) have been shown to be habitual EDs consumers. Therefore chronic assumption of energy beverage is not a common habit among Italian young people yet.

Epidemiological data obtained from the Food and Drug Administration show deaths cases related to caffeinated and energy drinks consumption. Since 2004 a total of 34 deaths have now been linked to energy drinks worldwide. France and United States of America are the most involved nations[34].

No death cases are recorded in Italy and this is due to different eating habits and regulations compared to other nations. More than 130 American EDs contain a caffeine concentration higher than the recommended amount in Italian beverages. European laws on food information to consumers, applied to food business operators at all stages of the food chain, as for example the EU Regulation 1169/2011[35] , have introduced some requirements such as the nutrition facts label, required on pre-packaged products, to protect public health. Therefore, the Italian Antitrust Authority has prompted the EDs companies to avoid dangerous behaviors such as the concomitant

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assumption of EDs and alcohol by young people. On the other hand, the easy availability of energy beverages represents a barrier to implement the limits established by national authorities.

Conclusions

Our preliminary research add some evidence in suggesting the need for primary prevention activities in order to ensure people's awareness about all risks related to EDs consumption, mostly associated with alcohol and during physical activities. This kind of prevention needs further specific programs and regulatory interventions to promote public health.

Some lifestyles and eating habits may be changed thanks to education plans carried out by a school health team (teachers, physicians, nutritionists, social networks), remarking issues as the alcohol abuse and EDs consumption, often underestimated by Italian public institutions and schools.

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Authors contributions

Angelo Baggiani and Pier Luigi Lopalco conceived and led the study. Michele Totaro, Michela Avella, Alberto Tulipani, Paola Valentini and Anna Laura Costa contributed to the data collection, database searches, and they wrote the paper. Serena Giorgi performed statistical analysis. All authors approved the final manuscript.

Conflicts of interest

The authors declare that they have no competing interests.

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