

ORIGINAL ARTICLE

Consumption of soft, sports, and energy drinks in adolescents. The BEENIS study[☆]

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Abstract

Introduction: The wide range of non-alcoholic drinks are currently grouped as soft (carbonated), sports, and energy drinks, and all of them have a high sugar content, along with their known risk of obesity. Their consumption is increasing and in inadvisable circumstances also an elevated health risk. The real consumption of sports and energy drinks is not well known.

Objective: To determine the habits and consumption of soft, sports, and energy drinks in adolescents.

Material and methods: A descriptive, cross-sectional study was performed in which questionnaires were obtained from 4769 schoolchildren from 13–18 years-old from Sabadell, Barcelona, Spain.

Results: The prevalence of consuming soft drinks was observed in 92.9% of the adolescents, and was predominantly done during leisure time, during meals, or any time during the day. In sports it was 61.7%, mainly on practising the sport and in leisure time. In energy drinks, it was 49.2%, mainly in leisure time (they were mixed with alcohol in 49%) and on practising sport. The simultaneous consumption of the three types was 38%, and soft drinks were the most common.

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Discussion: A description is presented on the consumption of sports drinks, normally included as soft drinks, as well as the simultaneous consumption of the three types of drinks, and the time in which they are consumed. We have a diagnostic tool of consumption of these drinks by adolescents in our setting that will enable us to design and evaluate educational interventions in order to make the adolescent population and their families aware.

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PALABRAS CLAVE

Adolescentes;
Bebidas;
Conducta de salud;
Bebidas energéticas;
Bebidas carbonatadas;
Estudios transversales

Consumo de bebidas refrescantes, deportivas y energéticas en adolescentes. Estudio beenis

Resumen

Introducción: Actualmente, la gran oferta de bebidas no alcohólicas se agrupa en refrescantes, deportivas y energéticas, todas ellas con un alto contenido en azúcares y su conocido riesgo de obesidad. Cada vez es más frecuente su consumo y en circunstancias no recomendables, con un elevado riesgo sobre la salud. El consumo real de bebidas deportivas y de energéticas no es bien conocido.

Objetivo: Conocer los hábitos y el consumo de bebidas refrescantes, deportivas y energéticas en adolescentes

Material y métodos: Estudio transversal descriptivo. Se obtuvieron las encuestas de 4769 alumnos de 13 a 18 años de Sabadell, Barcelona.

Resultados: La prevalencia de consumo de bebidas refrescantes se observó en el 92.9% de los alumnos y se realizaba preferentemente en momentos de ocio, durante las comidas y en cualquier momento del día. En deportivas fue del 61,7%, preferentemente al realizar deporte y en momentos de ocio. En energéticas fue del 49,2%, principalmente en momentos de ocio (un 49% las mezclaba con alcohol) y al realizar deporte.

El consumo simultáneo de los tres tipos fue del 38% y las bebidas refrescantes siempre eran las más habituales.

Discusión: Se describe el consumo de bebidas deportivas, normalmente incluidas en las bebidas refrescantes, así como el consumo simultáneo de los 3 tipos de bebidas y de los momentos en que son consumidas. Disponemos de un diagnóstico del consumo de estas bebidas en los adolescentes de nuestro ámbito que nos permitirá diseñar y evaluar intervenciones educativas para concienciar a la población adolescente y sus familias.

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Introduction

Water is the main source of hydration. However, since antiquity, concerns regarding the safety of drinking water and the appeal of tasting different flavours contributed to the use of alternative beverages.

At present, the broad range of non-alcoholic drinks available in the market could be divided into three groups: soft drinks, sports drinks and energy drinks. Consumption of these beverages is ever increasing under circumstances that are not advisable, which has prompted concerns about their adverse events on health.

The origin of soft drinks dates to the late XVIII century in the pharmaceutical sector, with carbonated drinks being used for treatment of mild illnesses. It later became popular as a drink to have for pleasure. Their composition is characterised by a high sugar content. At present, a wide variety of soft and carbonated drinks is available in the market.

Soft drinks are the non-alcoholic drinks whose consumption has been investigated most thoroughly: it increases the risk of obesity,¹ diabetes mellitus,² metabolic syndrome, caries, osteoporosis and cancer.³ Based on the National Survey of Dietary Intake of Spain, consumption of soft drinks has increased in recent years: in 2011 consumption increased by 1.9% compared to the previous year.⁴ In fact, consumption of these drinks has become a daily habit and a regular source of added sugars in the diet, so that added sugars may contribute up to 21% of the daily energy intake, when the World Health Organization (WHO) recommends that this percentage not to exceed 10%.⁵

Sports drinks (which are chiefly hypotonic or isotonic) were first developed in the United States in 1965 to prevent dehydration and improve performance in athletes. Their composition includes water, carbohydrates and mineral salts (sodium, potassium and calcium chloride, among others).⁶ Consumption of sports drinks by children and adolescents is not recommended by the American Academy of Pediatrics

and other scientific associations due to their deleterious effects on health, such as development of dental caries,^{7,8} overweight, obesity and an increased risk of hypertension in adulthood.^{9,10} The data on the consumption of sports drinks by adolescents are scarce.

Energy drinks are stimulant drinks. They emerged in Asia, where they have been marketed since 1960, and entered the European market in 1987. With the aim of counteracting fatigue and improving concentration, alertness, endurance and mood, they have non-nutritive components such as caffeine, guarana, taurine, ginseng, L-carnitine, creatine and glucuronolactone.¹⁰ Consumption of these drinks is not recommended under any circumstances due to the associated health hazards, and it could potentially become a public health problem.¹¹ Previously described adverse effects include tachycardia, hypertension, insomnia and behavioural changes, as well as exacerbation of underlying psychiatric disorders, arrhythmias and nausea, among others.¹² A study published in the *International Journal of Cardiology* in March 2016 underscored that consumption of energy drinks increased the risk of developing a variety of cardiovascular problems, even in healthy adults.¹³ Recently launched sports drinks feature caffeine concentrations that have been increased to the extreme to carve out a market share in this sector.¹⁴

There is evidence of an increased and heedless consumption of sports and energy drinks in the adolescent population.¹⁴ A study conducted in 2012 by the European Food Safety Authority (EFSA) that analysed the consumption of energy drinks in different European countries found that approximately 68% of the youth aged 10–18 years consumed energy drinks at least once a year and that 12% of those that consumed these drinks would consume more than 1 L of such products in a single session.^{11,15}

The Spanish public education system provides free education to all children and adolescents through the years of compulsory secondary education (*educación secundaria obligatoria* or ESO, ages 12–15 years) and the years of non-compulsory secondary education (*bachillerato*, ages 16–18 years). In the autonomous community of Catalonia, the Department of Health and the Department of Education has established a school-based health programme (Programa Salut i Escola, PSiE) that includes the appointment of nurses that facilitate coordination between schools and primary care centres.¹⁵

Professionals in the PSiE programme are aware of the importance of this problem, but they do not know the actual frequency of consumption of sports and energy drinks in our region or the circumstances in which they are consumed. This motivated the performance of a study to determine the current prevalence of the consumption of soft, sports and energy drinks by adolescents and associated information on how, when and why they are consumed.

Material and methods

We performed a cross-sectional study in the framework of the BEENIS project with the goal of analysing the consumption of soft, sports and energy drinks and related habits in the school-aged population of Sabadell, a town in the Barcelona metropolitan area. The population is distributed

into 76 schools and includes approximately 25 000 students aged 6–18 years.

Taking as reference the questionnaires used in the study carried out by the EFSA in 2012 to gather consumption data on specific consumer groups of energy drinks,¹⁷ we divided the population into 3 groups, administering a specific questionnaire to each: parents of students aged 6–9 years, students aged 10–12 years and students aged 13–18 years.

In this article, we present the results of the survey of students aged 13–18 years (years 2–4 of the ESO and years 1 and 2 of the *bachillerato*).

This population comprises approximately 9146 students distributed across 37 schools (15 public schools, 10 privately owned but publicly funded lay schools and 12 privately owned but publicly funded religious schools). We contacted the schools and requested their participation in the project.

The nurses of the PSiE¹⁶ distributed the self-report questionnaires, which were completed anonymously by students in the classroom in the presence of their form tutor.

The project was reviewed and approved by the Research Ethics Committee of the IDIAP Jordi Gol (file P15/113), and we requested consent from all parents and from students aged more than 13 years.

Data collection questionnaire

We asked the EFSA for the validated Spanish version of their questionnaire for adolescents (13–18 years), and we created an adaptation that has not validated which only included the items concerning the frequency of energy drink consumption, amounts consumed and habits associated to this consumption. We added questions about soft and sports drinks and sociodemographic characteristics (Appendix A). The final questionnaire included 45 close-ended questions (with yes/no or multiple-choice answer formats). When it came to the associated habits, we asked students in which settings, for what reasons and when they consumed these drinks, and whether they consumed these drinks along with alcohol.

We carried out a pilot study in a secondary education school in a nearby town to verify adequate comprehension of the questionnaire and explore logistic aspects related to its administration, and then corrected the identified problems. The data collected in this pilot are not included in the analysis presented here.

Statistical analysis

We obtained the most important information about consumption of these drinks by asking whether the students had consumed each of these types of drink in any month of the past year. The answer choices were *never*, *once or twice a month*, *once a week*, *2–3 days a week*, *4–5 days a week* and *every day*.

In the analysis, we regrouped these answer choices into 3 categories (*never*, *occasionally* [once or twice a month] and *habitually* [more than twice a month]) and again into 2 categories (*does not consume* [never] and *does consume* [once or twice a month]).

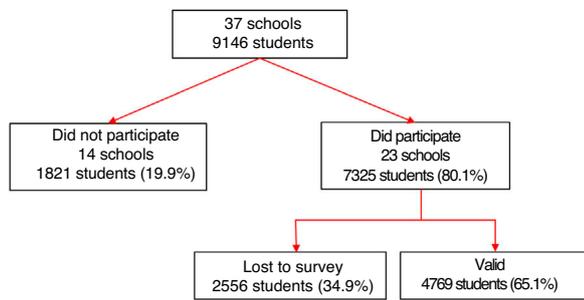


Fig. 1 Flow chart of student participation.

We have summarised qualitative data as absolute and relative frequencies and continuous data as mean and standard deviation.

We compared proportions and analysed linear trends by means of the chi square test. We compared means using the Student *t*-test for independent samples or analysis of variance.

Statistical significance was defined as a *p*-value of 0.005 or smaller in any of the tests.

The statistical analysis was performed with the software SPSS for Windows version 23.0

Results

Twenty-three schools (62.2%) accepted to participate: 90.2% of public schools, 84.6% of private-publicly funded lay schools and 25.0% of private-publicly funded religious schools. The total number of students enrolled in these schools was 7325, from who we received 4769 completed questionnaires (65.1%) (Fig. 1).

On average, ESO students were aged 13–15 years and bachillerato students 16–17 years (Table 1). Of the total participants, 52.7% were female, 46.7% slept fewer than 7 h a day, 11.1% spent more than 3 h a day watching television, 51.8% spent more than 3 h a day of other type of screen time (computer, tablet, mobile phone), 17.2% smoked occasionally, 5.7% had failed more than 2 subjects the previous year, and the mothers of 81.4% were Spanish.

Consumption of drinks

When it came to soft drinks, 929 (19.6%) reported occasional consumption and 3473 (73.3%) habitual consumption. In ESO students, habitual consumption was reported by approximately 75%, and occasional consumption by 18.5%, but habitual consumption declined through the bachillerato to reach 68.1% while occasional consumption increased to 23.5% (Fig. 2).

As for sports drinks, 1333 of participants (28.2%) reported occasional consumption and 1582 (33.5%) habitual consumption. Occasional consumption was maintained through all school years, while habitual consumption declined.

Last of all, concerning sports drinks, 1691 (35.7%) reported occasional consumption and 638 (13.5%), habitual consumption. Occasional and habitual consumption increased slightly through the ESO years but declined in the bachillerato.

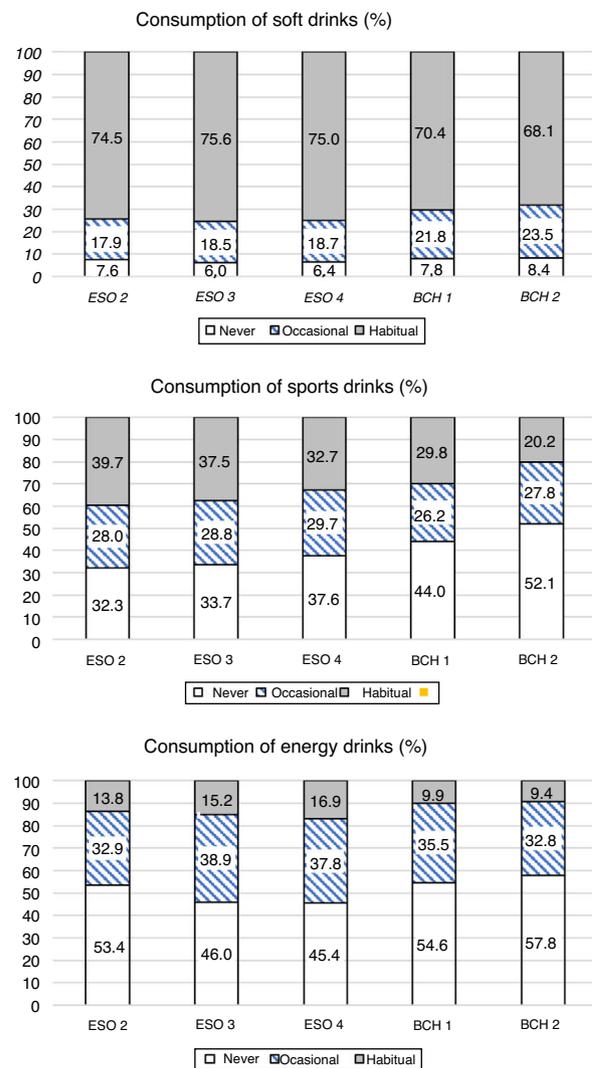


Fig. 2 Description of the consumption of the different types of drinks by school year.

Consumption classified as habitual (more than twice a month), occasional (up to twice a month) and never.

BCH, bachillerato (non-compulsory secondary education); ESO, compulsory secondary education.

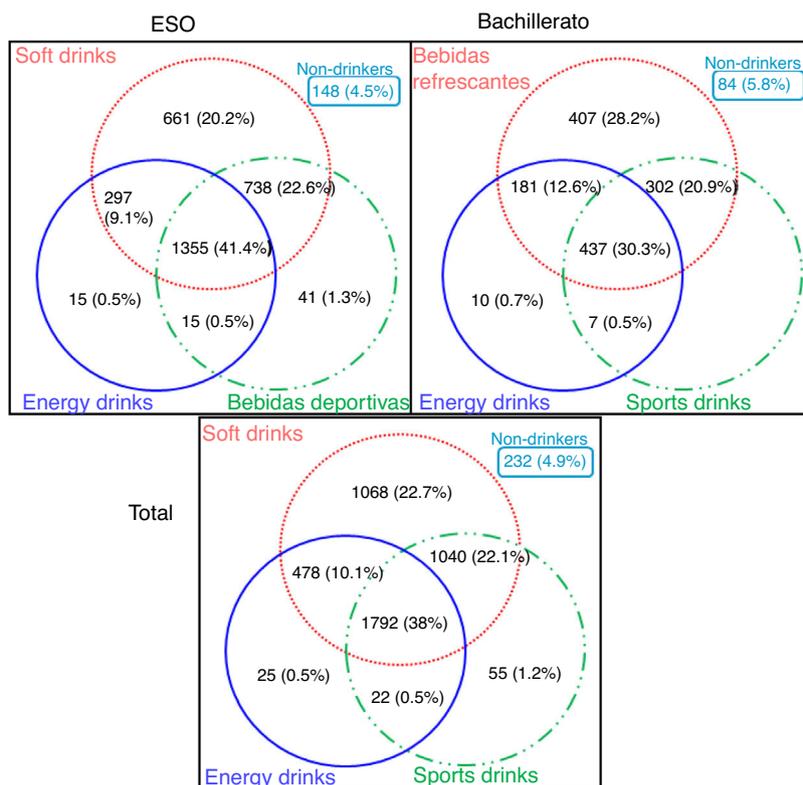
Overall, 38% of participants reported consumption of all 3 types of drinks, a finding that was more frequent in ESO students (41.4% versus 30.3%); soft drinks were the most frequently consumed drinks in every group in the sample (Fig. 3).

Habits associated with the consumption of beverages

- When asked about where they consumed energy drinks, students reported that they mainly drank them at parties (70.3%), when doing sports (48.0%), at clubs (44.4%), at home (39.5%) and in bars (35.2%) (Table 2).
- When we compared groups, we found that students of bachillerato consumed them more often in bars and above all at clubs, whereas ESO students consumed them more often at home and in the context of physical activity.

Table 1 Characteristics of surveyed adolescents.

	ESO (n = 3308)	Bachillerato (n = 1461)	Total (n = 4769)
Age	14.0 (1.0)	16.5 (0.8)	14.8 (1.5)
Minimum-maximum	13–15	16–18	13–18
Female sex	1503 (49.9%)	799 (59.1%)	2302 (52.7%)
Native Spanish mother	2610 (80.6%)	1191 (83.3%)	3801 (81.4%)
Sleep duration (< 7 h)	1257 (38.1%)	964 (66.0%)	2221 (46.7%)
[0,1–4]			
[0,1–4] TV watching			
Occasional	1564 (47.8%)	849 (59.0%)	2413 (51.2%)
1–3 h/day	1279 (39.1%)	499 (34.7%)	1778 (37.7%)
> 3 h/day	429 (13.1%)	92 (6.4%)	521 (11.1%)
[0,1–4]			
[0,1–4] Other screen time			
Occasional	522 (16.0%)	212 (14.8%)	734 (15.7%)
1–3 h	1071 (32.9%)	455 (31.7%)	1526 (32.5%)
> 3 h	1663 (51.1%)	767 (53.5%)	2430 (51.8%)
Smoker	472 (14.4%)	340 (23.5%)	812 (17.2%)
School failure	236 (7.3%)	27 (1.9%)	263 (5.7%)

**Fig. 3** Pattern of mixed consumption of soft, sports and energy drinks.

BCH: bachillerato (16–18 years); ESO, compulsory secondary education (13–15 years); Total, 13–18 years.

- When asked about the reasons that motivated consumption of energy drinks, students reported that they agreed or strongly agreed that the main reasons they consumed them were enjoying taste (87.8%), as a means to stay awake (55.6%), needing more energy (44.8%), to improve performance (36.0%), to improve concentration (21.4%), as a remedy for hangover (17.8%) or because it was trendy (10.8%).
- We found that a greater percentage of ESO students consumed them to manage a hangover, to improve performance and because they were trendy.

Table 2 Settings of consumption of energy drinks and reasons for consumption.

	ESO	Bachillerato	Total	P
[0,1-5] <i>Where are they consumed?</i>				
Home	601 (41.9%)	183 (33.3%)	784 (39.5%)	< .001
Parties	1013 (70%)	397 (71.1%)	1410 (70.3%)	.602
Bar	473 (33.6%)	213 (39.3%)	686 (35.2%)	.018
Club	550 (38.7%)	330 (58.8%)	880 (44.4%)	< .001
Physical activity	735 (51.8%)	209 (38.1%)	944 (48.0%)	< .001
[0,1-5] <i>Why are they consumed?</i>				
To get energy	685 (45.3%)	251 (43.6%)	936 (44.8%)	.478
To stay awake	828 (54.8%)	334 (57.9%)	1.162 (55.6%)	.199
To enjoy the taste	1.359 (88.4%)	499 (86.3%)	1.858 (87.8%)	.204
To improve concentration	324 (21.6%)	118 (20.7%)	442 (21.3%)	.648
To manage a hangover	306 (20.5%)	63 (11.0%)	369 (17.9%)	< .001
To improve performance	563 (37.7%)	180 (31.6%)	743 (36.0%)	.010
It's trendy	200 (13.3%)	23 (4.0%)	223 (10.8%)	< .001

Table 3 Situations and times when adolescents consume energy drinks.

	ESO	Bachillerato	Total	P
[0.1-5] <i>Soft drinks</i>				
During the day	398 (12.3%)	108 (7.5%)	506 (10.8%)	< .001
With meals	1317 (40.8%)	456 (31.8%)	1773 (38.0%)	< .001
Sports session	155 (4.8%)	63 (4.4%)	218 (4.7%)	.544
Leisure time	1307 (40.6%)	724 (50.5%)	2031 (43.6%)	< .001
[0.1-5] <i>Energy drinks</i>				
During the day	197 (6.2%)	44 (3.1%)	241 (5.2%)	< .001
With meals	44 (1.4%)	6 (0.4%)	50 (1.1%)	.004
Sports session	519 (16.3%)	148 (10.5%)	667 (14.6%)	< .001
Leisure time	629 (19.7%)	311 (22.1%)	940 (20.5%)	.067
[0.1-5] <i>Sports drinks</i>				
During the day	133 (4.2%)	33 (2.4%)	166 (3.6%)	.002
With meals	82 (2.6%)	27 (1.9%)	109 (2.4%)	.180
Sports session	1578 (49.8%)	560 (40.0%)	2138 (46.8%)	< .001
Leisure time	283 (8.9%)	102 (7.3%)	385 (8.4%)	.066

- We asked participants about the times when they consumed each of the 3 types of drinks. When it came to soft drinks, 43.6% of students reported consuming them in their free time, 38.0% with meals, 10.8% any time of day and 4.7% in the context of physical activity (Table 3). When it came to energy drinks, 20.5% consumed them during their free time, 14.6% in the context of physical activity, 5.2% any time of day and 1.1% with meals. As for sports drinks, 46.8% consumed them in the context of physical activity, 8.4% in their free time, 3.6% any time of day and 2.4% with meals.
- When we compared ESO and bachillerato students, we found that the proportion of ESO students that consumed soft drinks any time of day and with meals was higher, but the proportion that consumed soft drinks in their free time was lower. When it came to energy drinks, the proportion of ESO students that had them at any time of day, during meals and in the context of physical activity was higher

compared to bachillerato students. Also, higher percentages of ESO students consumed sports drinks at any time of day and in the context of physical activity.

We observed an increasing linear trend in the simultaneous consumption of energy drinks and alcohol with increasing school year (from 28.8% to 61.3%), with a decline in the practice of mixing drinks (from 27.4% to 5.4%) and an increase in the consumption of premixed drinks (from 59.5% to 74.8%) and separate consumption of energy drinks and alcohol (from 63.7% to 82.9%) (Table 4).

Discussion

In this study, we established the pattern of consumption of soft, sports and energy drinks in the local youth applying the criteria used in the survey carried out by the EFSA in

Table 4 Simultaneous consumption of energy drinks and alcohol and related variables.

	ESO 2 (n = 584)	ESO 3 (n = 525)	ESO 4 (n = 383)	BCH 1 (n = 316)	BCH 2 (n = 181)	Total (n = 1989)	P
Simultaneous consumption of energy drinks and alcohol	168 (28.8%)	237 (45.1%)	195 (50.9%)	182 (57.6%)	111 (61.3%)	893 (44.9%)	< .001
Mixed at time of consumption	46 (27.4%)	48 (20.3%)	35 (17.9%)	23 (12.6%)	6 (5.4%)	158 (17.7%)	< .001
Premixed and ready to consume	100 (59.5%)	138 (58.2%)	119 (61.0%)	121 (66.5%)	83 (74.8%)	561 (62.8%)	.002
Consumed at different times	107 (63.7%)	171 (72.2%)	140 (71.8%)	145 (79.7%)	92 (82.9%)	655 (73.3%)	< .001

2012.¹⁰ We also found specific information about the consumption of sports drinks, which is usually bundled with the consumption of soft drinks. We have also analysed the combined consumption of the 3 types of drinks and the times when they were consumed.

Soft drinks were the type of drink consumed most frequently by adolescents. Seventy-three percent of the sample reported habitual consumption and 19.6% occasional consumption. These results were similar to the 63.1% found in the ENALIA survey in 2014.¹⁸ Adolescents usually consumed these drinks in their free time and during meals.

Habitual consumption of sports drinks was reported by 33.5% of adolescents, and occasional consumption by 28.2%, with consumption decreasing in a linear fashion with increasing age. These percentages are very high considering that consumption of sports drinks is only recommended in the context of intense physical activity. The ENALIA survey found habitual consumption in 7.1% of youth aged 10–17 years and occasional consumption in 25.5%. Nationwide data for Spain show that sports drinks amounted to 14% of all beverages consumed in 2014,¹⁹ that their consumption increased 2.3% in 2017 and that consumption increased most significantly in households with children.²⁰ Two national surveys carried out in 2010 and 2015 in the United States also found a 1.6% increase in consumption.²¹ All these data indicate an increasing trend in consumption. As expected, sports drinks are most frequently consumed in the context of physical activity, but participants also reported consumption for leisure. Our findings suggest that there is a widespread belief that these are just like any other sugary drink that can be had during meals.

The prevalence of the consumption of energy drinks observed in the overall sample of students was lower compared to the Spanish sample in the study by the EFSA (49.2% versus 62.0%),¹⁵ but we cannot interpret these differences because we do not know the characteristics of the Spanish sample analysed in that study. The prevalence in our study is more similar to the prevalence of 40.4% found in 2014 in the ESTUDES survey on substance use in students aged 14–18 years, who were asked whether they had consumed drinks in the past month.²² Habitual consumption of these drinks increased lightly through the ESO (from 13.8% to 16.9%) and decreased through the bachillerato (to 9.4%), but occasional consumption remained stable at around 35%. The ESTUDES survey found an increase through the ESO years (from 46.8% to 51.3%) with the trend stabilizing in the bachillerato (at approximately 51%). The increasing trend observed in the ESO coincides with the increased susceptibility to peer pressure and the urge to experience new sensations in early adolescence.²³ Thus, we consider that it may be necessary to implement early health prevention, educational interventions in children aged 10–12 years.

These drinks were consumed most frequently during leisure times (20.5%), most often in the party settings (70.2%), with was consistent with the EFSA survey (65.0%). Consumption in the context of physical activity was reported by at least 40% of participants. In contrast, consumption at home under normal circumstances was lower compared to the EFSA survey (39.5% versus 56.0%). The main reason for consumption of these beverages is taste (38.9%), while fewer participants reported motives related to their stim-

ulant effects (5%-10%). This may be an advantage for the purpose of future interventions, as the taste argument can be counteracted more easily by the adverse effects.

The combined use of energy drinks and alcohol increased significantly with age (from 28.8% to 61.3%). The observed prevalence was similar to the 43.0% reported for the Spanish sample of the EFSA report, which also described a significant increase with age (from 32% to 59%).¹⁵ Due to the risk of alcohol poisoning involved in the combined use of these drinks, educational interventions should be redoubled from age 12 years.

Although our study had a large sample that was quite probably representative of the population of secondary education students aged 13–17 years, there were some limitations that deserve consideration:

Participation of privately-owned schools with public funding, especially religious ones, was lower compared to public schools. This bias in the representation by school ownership was also present in another study we carried out in the same setting (JOITIC).²⁴

In this instance, the overall response rate (65.1%) was lower compared to the rate in the JOITIC study (77.3%). A likely explanation is that the questionnaires were given out at the end of the academic year, when, on one hand, students were preparing for university entrance examinations, and on the other, other municipal surveys were also being conducted in some classes of the ESO cycle. It is important that future surveys be planned for early in the academic year to have some room for manoeuvre.

We did not include the students enrolled in vocational courses, who are predominantly male, as opposed to the bachillerato, where students are predominantly female, which could have been a source of sex bias. In light of this, we think it would be relevant to complete this study by surveying vocational schools.

The original questionnaire used by the EFSA was validated, but ours was not. However, the questions concerning the frequency of consumption were the same questions used in the original Spanish version of the validated questionnaire, except for the adaptation of the brand names of the drinks. We believe that the qualitative approach initiated by the study of the EFSA is adequate for the purpose of making simple assessments in the population and to evaluate the impact of any interventions.

In conclusion, the results of our study allowed us to establish the pattern of consumption of these drinks in our region, which in turn will facilitate the development of educational interventions to raise awareness in adolescents and their families of the health problems associated with these drinks, and the assessment of the effectiveness of these interventions.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.anpede.2020.01.010>.

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