



ORIGINAL ARTICLE

Analysis of the consumption of soft drinks, energy drinks, and sports drinks among adolescents in the Principality of Asturias (BREDA Project)



Judit Cachero-Rodríguez^{a,b}, María del Mar Fernández-Álvarez^{a,b,*},
Lucía Fernández-Arce^{a,b}, Carla Carrizo-Rodríguez^a, Cristina Fernández-Rodríguez^a,
Rubén Martín-Payo^{a,b}

^a Facultad de Medicina y Ciencias de la Salud, Universidad de Oviedo, Oviedo, Spain

^b Instituto de Investigación Sanitaria del Principado de Asturias (ISPA), Oviedo, Spain

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KEYWORDS

Sugar-sweetened
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Physical activity

Abstract

Introduction: The consumption of sugar-sweetened beverages has significantly increased among adolescents worldwide. Factors such as marketing strategies, misconceptions about their benefits, and low levels of physical activity exacerbate this issue. The aim of this study was to describe the prevalence and consumption patterns of soft drinks, energy drinks, and sports drinks among adolescents in the Principality of Asturias.

Methods: A cross-sectional descriptive study was conducted in secondary schools across Asturias, targeting students aged 13–18 years during the first trimester of 2025. A self-administered questionnaire was distributed to assess the consumption of sugar-sweetened beverages, along with the PAQ-A questionnaire to evaluate physical activity levels.

Results: A total of 1250 students participated. Consumption of soft drinks (57.7%), energy drinks (11.8%), and sports drinks (27.2%) was high. Regular consumption of energy drinks was more prevalent among students in upper secondary education ($P = .049$). Occasional ($P = .05$) and regular ($P = .012$) consumption of sports drinks was more frequent among lower secondary students. Soft drinks and energy drinks were primarily consumed during leisure time (50.4% and 10.9%, respectively), whereas sports drinks were mainly consumed during and after physical activity (31%). We found a significant association between physical activity and sports drink consumption ($P < .001$).

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* Corresponding author.

E-mail address: fernandezmar@uniovi.es (M.d.M. Fernández-Álvarez).

Conclusion: The consumption of sugar-sweetened beverages is widespread. Their use during leisure time and in association with physical activity underscores the need for health promotion strategies aimed at improving nutrition literacy among adolescent populations.

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PALABRAS CLAVE

Bebidas azucaradas;
Adolescentes;
Ejercicio físico

Análisis del consumo de bebidas refrescantes, energéticas y deportivas en adolescentes del Principado de Asturias (Proyecto BREDA)

Resumen

Introducción: El consumo de bebidas azucaradas ha aumentado significativamente entre adolescentes a nivel mundial. Factores como el marketing, creencias erróneas sobre sus beneficios y bajo nivel de actividad física agravan esta problemática. El objetivo de este estudio describir la prevalencia y hábitos de consumo de bebidas refrescantes, energéticas y deportivas en adolescentes del Principado de Asturias.

Métodos: Estudio descriptivo transversal realizado en centros escolares de Asturias con alumnado de edad entre 13 y 18 años, durante el primer trimestre del año 2025. Se distribuyó un cuestionario autocumplimentado sobre el consumo de bebidas azucaradas, y la realización de ejercicio con el cuestionario PAQ-A.

Resultados: Participaron un total de 1250 estudiantes. El consumo de bebidas refrescantes (57,7%), energéticas (11,8%) y deportivas (27,2%) fue elevado. El consumo habitual de bebidas energéticas fue superior en bachiller ($p=0.049$). El de bebidas deportivas ocasional ($p=0.05$) y habitual ($p=0.012$) fue mayor en la ESO. Las bebidas refrescantes y energéticas se consumieron especialmente en tiempo de ocio (50,4%; 10,9% respectivamente) mientras que las deportivas durante y después de la práctica de ejercicio (31%). Se encontró asociación entre la práctica de ejercicio y el consumo de bebidas deportivas ($p<0.001$).

Conclusión: El consumo de bebidas azucaradas está ampliamente extendido. Su consumo en momentos de ocio o asociado a la práctica deportiva hace necesario que desde la promoción de la salud se implementen estrategias que favorezcan la alfabetización nutricional en estos grupos de población.

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Introduction

The consumption of sugar-sweetened beverages, including soft drinks, energy drinks, and sports drinks, has significantly increased worldwide. According to a study conducted in 185 countries by Lara-Castor et al,¹ the consumption of these beverages in the population aged 3–19 years increased by 23% between 1990 and 2018.

Neither Europe² nor Spain is immune to this trend.^{3,4} According to data from the European Food Safety Authority,⁵ 68% of European adolescents consume energy drinks, and their consumption is increasing. The study conducted by Cruz-Muñoz et al⁴ in a sample of students aged 13–18 years in Spain found that 92.9% of adolescents regularly consumed soft drinks, 61.7% energy drinks and 49.2% sports drinks.

With regard to their composition, soft drinks are characterized by a high added sugar content that may reach or even exceed 10% of the total energy intake recommended by the World Health Organization in a single serving.⁶ On the other hand, energy drinks are distinguished by containing a combination of caffeine, taurine, guarana, sugars and other

compounds with stimulant effects.³ Last of all, isotonic or sports drinks are chiefly composed of water, carbohydrates and electrolytes with the goal of contributing to maintaining hydration.⁷

In the specific case of sports drinks, we ought to highlight their widespread inappropriate use, as they were originally designed to replace electrolytes following intense and prolonged physical activity,⁷ but are currently consumed under circumstances in which such replacement is not needed and water alone would suffice for adequate hydration.⁸ Although there is evidence of a slight decrease in the consumption of isotonic drinks in Spain,⁹ one third of adolescents continue to consume them on a regular basis.⁴

The literature reflects the adverse health effects of regular sugar-sweetened beverage consumption, chief among which are weight gain, overweight and obesity,^{8,10–13} insulin resistance and the development of type 2 diabetes,^{10,11,14} dental problems,^{8,10,11,14} cardiovascular diseases^{8,11,13–15} and even mood disorders, such as depression.¹⁴ Specifically, in 2020, 9.8% of new type 2 diabetes cases and 3.1% of cardiovascular disease cases were attributed to sugar-sweetened beverage consumption.¹⁵

The factors described in the literature as contributing to consumption include marketing campaigns specifically targeted at youth, peer pressure, and the erroneous perception that these beverages improve athletic performance.^{16,17} In this regard, it is worth noting the study conducted by Pfender et al.,¹⁶ who reported a high consumption of these beverages in adolescents with a strong athletic identity motivated by erroneous beliefs about their benefits. According to the International Society of Sports Nutrition position statement, while caffeine has ergogenic effects on mental and physical performance, there is no evidence supporting the potential additive benefits of the other nutrients in these drinks.¹⁸

This trend can be considered even more worrisome when the intake of these beverages is combined with a low level of physical activity, which makes their consumption even more inappropriate. For instance, a low level of physical activity combined with high consumption of sugar-sweetened drinks in adolescence is associated with higher levels of psychological distress in adulthood.¹⁷ On the other hand, regular consumption of energy drinks is associated with physical dependence, so that consumption needs to increase in order to achieve the desired effects.³

The literature describes a variety of interventions aimed at reverting sugar-sweetened drink consumption trends.^{19,20} While these interventions are heterogeneous in design, they all share the feature of being adapted to the particular characteristics and needs of the target population. Thus, based on the current knowledge, it would be reasonable to investigate the determinants influencing the consumption of these drinks in the target population prior to designing an intervention. While such an analysis has already been performed in some regions in Spain,⁴ there are no data for the Principality of Asturias, which motivated the performance of the present study with the primary objective of describing the prevalence and patterns of consumption of soft, energy and sports drinks in the adolescent population of the Principality of Asturias, exploring its association with physical activity as a secondary objective.

Methods

Design

Cross-sectional descriptive study conducted in schools in the Principality of Asturias. The field work took place between January and March 2025.

Sample

The study universe consisted of all students aged 13–18 years enrolled in schools in the Principality of Asturias. This corresponds to students in secondary education (including both the compulsory [*ESO*] and noncompulsory [*bachillerato*] courses). During the academic year when the study took place, the size of the population of interest was of approximately 40 000 students.

To assess the regular consumption of sugar-sweetened drinks as the primary outcome, and, taking as reference the consumption of sports drinks since, based on the literature, it is the lowest among the three types of beverages,⁴

we calculated that a minimum random sample size of 381 students was necessary to estimate a population percentage, expected to be approximately 49%, with a 95% level of confidence and a margin of error of 5 percentage points.

The inclusion criteria were: (a) signed informed consent provided by parents/legal guardians of students younger than 16 years or by the students themselves if aged 16 years or older, (b) absence of any physical or mental impairment that would interfere with the completion of the questionnaire.

Members of the research team contacted nine schools selected by convenience sampling, considering both public and charter (private ownership with public funding) schools and schools located in urban and rural settings. The informed consent form and an informational sheet were submitted to the selected schools to have them distributed through the teaching staff to the parents/legal guardians or the students, as applicable based on the age of the latter.

After the collection of the signed informed consent forms, the questionnaires required to fulfil the objectives of the study were distributed among the students.

The study was approved by the Research Ethics Committee of the Principality of Asturias (CEImPA file number 2024.531).

Data collection

The data required to fulfil the objectives of the study was collected through two anonymous questionnaires, provided in paper or digital (Microsoft Forms) format depending on the preference of the school.

The first questionnaire, used in previous studies,^{4,5} included items pertaining to sociodemographic and personal characteristics and variables related to the pattern of consumption of soft, energy and sports drinks. The items concerning the consumption of soft, energy and sports drinks concerned the frequency and time of consumption. The item assessing frequency asked “how frequently do you consume [type of drink] drinks?”. The answer choices were the same proposed by Cruz-Muñoz et al.⁴ and Zucconi et al.⁵: “never”, “once or twice a month”, “2–3 times a week”, “4–5 times a week”, “every day”. In the analysis, the data were categorized into a dichotomous consumption variable (consumption/no consumption) and a frequency variable with three categories: never, occasionally (once or twice a month) and regularly (more than twice a month). When it came to the time of consumption, there were four answer choices: “any time of day” (unrelated to any specific event), “during meals”, “during leisure time” or “while exercising”.

The instrument used to collect information on physical activity was the validated Spanish version of the Physical Activity Questionnaire for Adolescents (PAQ-A).²¹ The PAQ-A is a 7-day recall questionnaire. It comprises nine items that assess the level of physical activity scored on a 5-point Likert scale (1 indicates the lowest and 5 the highest). The final score is obtained by calculating the mean of the item scores, with higher total scores indicating a higher level of physical activity.

Finally, we added three ad hoc items concerning the consumption of sugar-sweetened drinks in relation to physical

Table 1 Sociodemographic and personal characteristics of the adolescents.

	Total (n = 1250)	ESO ^a (n = 797)	Bachillerato ^b (n = 453)
Mean age, (SD)	15.13 (1.384)	14.32 (0.988)	16.55 (0.636)
Female, % (n)	50.6 (632)	51.4 (409)	49.2 (223)
Weight status based on BMI, % (n)			
Underweight	20.5 (255)	25.9 (205)	11.1 (50)
Normal weight	72.8 (904)	67.9 (538)	81.3 (366)
Overweight	5.3 (66)	4.9 (39)	6.0 (27)
Obesity	1.4 (17)	1.3 (10)	1.6 (7)

Frequency and time of consumption of sugar-sweetened drinks.

Abbreviation: BMI, body mass index.

^a ESO: compulsory secondary education (first four years of secondary education).

^b Bachillerato: noncompulsory secondary education (last two years of secondary education).

activity. The first assessed beverage preferences (“What do you prefer to drink during physical activity?”) and had five possible answer choices: “nothing”, “water”, “soft drinks”, “energy drinks”, and “sports drinks”. The second concerned the frequency of consumption of sugar-sweetened drinks during physical activity (“When you exercise, how often do you drink [type of drink]?”). There were four answer choices: “never”, “rarely”, “sometimes” and “always”.

Statistical analysis

We conducted a descriptive analysis of the sociodemographic and consumption-related variables, with results expressed as absolute frequencies, percentages, mean and standard deviation or median and interquartile range, as applicable. Normality was assessed with the Kolmogorov-Smirnov test. To analyze differences between groups, we used the χ^2 test for qualitative variables and the Student *t* test for quantitative variables.

We defined statistical significance as a *P* value of 0.05 or less. All the analyses were performed with the statistical software IBM SPSS Statistics, version 27.0.

Results

Nine schools located in the Principality of Asturias participated in the study, of which 55.5% (*n* = 5) were public schools and 44.4% (*n* = 4) charter schools. The sample included 1250 students with a mean age of 15.13 years (*SD* = 1.384), 63.7% (*n* = 797) enrolled in compulsory secondary education (ESO). Table 1 summarizes the rest of the sociodemographic and personal characteristics of the sample.

There were no significant differences in the consumption of soft drinks based on the cycle of secondary education. However, regular consumption of energy drinks was significantly more prevalent in *bachillerato* students compared to ESO students (*P* = .049), while the consumption of sports drinks, both occasionally (*P* = .05) and regularly (*P* = .012) was more prevalent in ESO students (Table 2).

When it came to the times when the students consumed sugar-sweetened drinks, we found a significantly higher proportion of consumption during exercise in ESO students compared to *bachillerato* students (*P* = .002) (Table 3).

In the case of energy drinks, we found more prevalent consumption at any time of day and during leisure time in *bachillerato* students (*P* = .046 and *P* < .001, respectively) (Table 3).

Both groups consumed sports drinks more frequently in the context of physical activity. The consumption of sports drinks at any time of day was significantly more prevalent in ESO compared to *bachillerato* students (*P* = .029) (Table 3).

Physical activity and the consumption of sugar-sweetened drinks

The mean score in the PAQ-A²⁰ was 2.65 (*SD*, 0.731). We did not find significant differences in the mean score based on the consumption or absence of consumption of soft drinks (*P* = .230) or energy drinks (*P* = .879). However, the mean score was significantly higher in the subset of students that consumed sports drinks (*P* < .001; Cohen *d*, 0.71) (Table 4).

Beverage preferences during physical activity

When asked about what they preferred to drink during physical activity, 54.5% of the adolescents (*n* = 672) expressed a preference for water. Another 16.5% (*n* = 203) reported not drinking anything during physical activity. Sports drinks were the preferred choice in 15.8% (*n* = 195), while 8.5% (*n* = 105) chose soft drinks and only 4.6% (*n* = 57) preferred energy drinks.

During physical activity, sports drinks were the most frequently consumed type of drink, and energy drinks the least, with 87.6% of students reporting never consuming the latter (Table 5).

Discussion

The aim of our study was to characterize the consumption of soft drinks, energy drinks and sports drinks among adolescents residing in the Principality of Asturias and its association with physical activity. Its results reveal differential patterns of consumption based on the type of drink, the education cycle and the context of consumption, contributing relevant information to guide health promotion strategies in this population.

Table 2 Frequency of consumption of soft drinks, energy drinks, and sports drinks.

	Total (n = 1250)	ESO ^a (n = 797)	Bachillerato ^b (n = 453)	P
<i>Soft drinks, % (n)</i>				
Never	10.4 (130)	9.9 (79)	11.3 (51)	.443
Occasionally	31.9 (398)	33.2 (264)	29.6 (134)	.207
Regularly	57.7 (720)	56.9 (453)	59.1 (267)	.458
<i>Energy drinks, % (n)</i>				
Never	70.4 (877)	73.1 (581)	65.6 (296)	.06
Occasionally	17.8 (222)	16.5 (131)	20.2 (91)	.101
Regularly	11.8 (147)	10.4 (83)	14.2 (64)	.049
<i>Sports drinks, % (n)</i>				
Never	43.9 (547)	39.6 (315)	51.3 (232)	<.001
Occasionally	28.9 (361)	30.8 (245)	25.7 (116)	.05
Regularly	27.2 (339)	29.6 (235)	23.0 (104)	.012

^a ESO: compulsory secondary education (first four years of secondary education).

^b Bachillerato: noncompulsory secondary education (last two years of secondary education).

Table 3 Time that adolescents consumed soft drinks, energy drinks, and sports drinks (n = 1250).

	Total (n = 1250)	ESO ^a (n = 797)	Bachillerato ^b (n = 453)	P
<i>Soft drinks, % (n)</i>				
Any time of day	10.1 (124)	10.5 (82)	9.3 (42)	.508
During meals	18.2 (224)	18.8 (147)	17.1 (77)	.448
While exercising	2.4 (30)	3.5 (27)	0.7 (3)	.002
During leisure time	50.4 (620)	49.9 (389)	51.3 (231)	.621
<i>Energy drinks, % (n)</i>				
Any time of day	3.6 (45)	2.2 (10)	4.4 (35)	.046
During meals	0.2 (3)	0.4 (3)	0.0 (0)	.191
While exercising	6.3 (79)	6.5 (52)	6.0 (27)	.693
During leisure time	14.4 (179)	11.7 (93)	19.0 (86)	<.001
<i>Sports drinks, % (n)</i>				
Any time of day	3.2 (40)	4.1 (32)	1.8 (8)	.029
During meals	3.1 (39)	3.7 (29)	2.2 (10)	.159
While exercising	31.0 (384)	32.8 (259)	27.8 (125)	.065
During leisure time	10.9 (135)	12.2 (96)	8.7 (39)	.057

^a ESO: compulsory secondary education (first four years of secondary education).

^b bachillerato: noncompulsory secondary education (last two years of secondary education).

Table 4 Association between the consumption of soft drinks, energy drinks, and sports drinks, and physical exercise (n = 1250).

	PAQ-A ²⁰ Mean (SD)	Cohen d	P
<i>Soft drinks</i>			
Did not consume (n = 130)	2.72 (0.781)	0.73	.230
Did consume (n = 1118)	2.64 (0.725)		
<i>Energy drinks</i>			
Did not consume (n = 877)	2.64 (0.723)	0.73	.879
Did consume (n = 369)	2.65 (0.744)		
<i>Sports drinks</i>			
Did not consume (n = 547)	2.44 (0.699)	0.71	<.001
Did consume (n = 700)	2.81 (0.713)		

At the national level, the findings of our study were consistent with the data available for the adolescent population of Spain. In our study, the consumption of soft drinks, both

regular and occasional, was most prevalent among adolescents. This was consistent with the findings of Cruz-Muñoz et al,⁴ who reported regular consumption in 73% and occa-

Table 5 Frequency of consumption of sugar-sweetened drinks during physical activity (n = 1238).

	Never	Rarely	Sometimes	Always
Soft drinks, % (n)	71.8 (887)	22.4 (277)	4.7 (58)	1.1 (14)
Energy drinks, % (n)	87.6 (1085)	8.8 (109)	2.5 (31)	1.1 (13)
Sports drinks, % (n)	59.9 (742)	27.8 (344)	9.9 (122)	2.4 (30)

sional consumption in 19.6%. The most frequent context of consumption was leisure time, which was also consistent with previous studies.^{4,22} In light of the findings of previous studies, their consumption is a matter of concern, as numerous studies have established an association between regular consumption of sugar-sweetened drinks and an increased risk of overweight and obesity, as well as other chronic diseases.^{8,11–13,23,24} Among the causes described in the literature in regard to the high consumption of these beverages, the lack of awareness of its effects seems particularly important,²⁵ an aspect that should unquestionably be taken into account in the development of health promotion strategies aimed at reducing their consumption.

With respect to energy drinks, the prevalence of consumption observed in our sample was slightly lower compared to previous studies conducted in Spain.^{4,5} However, in agreement with the previous literature, we found that consumption increased with age, with a slightly higher prevalence during the second cycle of secondary education (*bachillerato*).^{5,26} Recent studies have concluded that the consumption of energy drinks is integrated in social dynamics characteristic of adolescence, such as gatherings with friends or relatives.^{26–29} These conclusions were consistent with the findings of our study, in which leisure time was the most frequently reported time of consumption.

Finally, in relation to sports drinks, we found a prevalence of regular and occasional consumption similar to the prevalence reported in previous studies,^{4,30} with frequencies between those of soft drinks and energy drinks. While sports drinks were developed to be consumed during physical activity, as our findings show, their consumption beyond this context has become widespread among adolescents. Thus, their consumption, which at times does not meet a real physiological requirement, can be unnecessary from a nutritional standpoint.³¹ Their consumption is also associated with erroneous beliefs regarding their purported benefits. In this regard, the study of Maloney et al³² identified the common misperception among adolescents that these drinks may be needed to avoid dehydration.

The analysis of the association between the consumption of these drinks and physical exercise only revealed a direct and significant association of PAQ-A scores²¹ with the consumption of sports drinks. This was also consistent with the previous literature. The study conducted by Cartagena et al³³ found an association between the consumption of sports drinks and higher scores in the PAQ-A.²¹ Similarly, Cordrey et al³⁰ found that more physically active participants were more likely to consume sports drinks on a regular basis.

It is possible that the very label of *sports drinks* is what generates the false belief that these drinks offer benefits in this area. In addition, the influence of marketing strategies,

specifically targeting active individuals, may drive their consumption and promote the perception that these drinks are an adequate complement to athletic activity.^{16,34}

However, it is important to remember that the intensity of physical activity in adolescents does not always require electrolyte or sugar replacement,⁷ in which case water would be the recommended drink to maintain adequate hydration. The unnecessary consumption of beverages with added sugar can contribute to an excessive energy intake and a poorer overall quality of the diet.³⁵

Several international studies and institutions continue to recommend the development of public health strategies aimed at raising awareness about these beverages and discouraging their consumption in the adolescent population,^{20,36} in addition to the implementation of educational interventions to inform the population of the effects of consuming sugar-sweetened drinks²⁴ or implementing taxes on these products.^{36–38} This approach is supported by the findings of our study, which demonstrate high and regular consumption of soft drinks by more than half of adolescents, which suggests that the consumption of sugar-sweetened drinks has been normalized in this age group.

In this regard, we ought to underscore the importance of involving children in the development of this kind of strategies, as recommended by the authors of the Kids in Action study.³⁹ This study demonstrated the positive effects in terms of reducing the consumption of energy and sports drinks of involving children and adolescents in the participatory design of strategies to promote healthy lifestyle habits. This type of interventions, combined with policies such as those mentioned above, can be key in reducing access to sugar-sweetened drinks and the normalization of their consumption among adolescents, promoting the choice of healthier options, such as water. This is supported by the fact that water was the drink preferred by more than half of adolescents during physical activity, with a very low proportion choosing to consume energy drinks, which is indicative of a favorable attitude toward healthier choices in informed individuals.

Identifying the determinants that contribute to the excessive consumption of sugar-sweetened drinks is essential to the development of effective intervention strategies. A systematic review and meta-analysis conducted by Calabro et al⁴⁰ identified socio-cognitive determinants driving their consumption. Their findings support the implementation of educational interventions to strengthen self-efficacy and promote healthy choices, in addition to public health policies regulating the distribution and marketing of sugar-sweetened beverages. Integrating this knowledge in clinical practice can contribute to the promotion of healthier lifestyle habits and the reduction of the risks associated with the consumption of these products.

One of the main strengths of this study is the large sample of adolescents aged 13–18 years, which provides a representative view of the consumption of sugar-sweetened beverages at this key stage of development. Furthermore, the results were consistent with the previous literature and the recommendations of international organizations, which is indicative of the relevance and consistency of the findings. Despite these strengths, certain limitations should be noted: the cross-sectional design of the study precluded the establishment of causal relationships between the analyzed variables. In addition, the use of self-reported weight and height values may have introduced bias in the calculation of body mass index, so these results should be interpreted with caution.

Conclusions

Based on the findings of our study, the consumption of soft drinks, energy drinks, and sports drinks is widespread among adolescents residing in the Principality of Asturias, with differential patterns in relation to the type of drink, the cycle of education and the context of consumption. While the consumption of soft drinks was most prevalent and predominated during leisure time, the consumption of sports drinks was associated with a higher level of physical activity, and the consumption of energy drinks increased with age.

From a health promotion standpoint, it is necessary to implement strategies to promote nutrition literacy among adolescents so that they can understand the long-term effects of the consumption of sugar-sweetened drinks and make informed decisions.

Ethics statement

The study was approved by the Research Ethics Committee of the Principality of Asturias (CEImPA 2024.531).

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CRedit authorship contribution statement

Judit Cachero-Rodríguez: Investigation, Supervision, Writing - original draft, Writing - review & editing. **María del Mar Fernández-Álvarez:** Conceptualization, Methodology, Writing - review & editing. **Lucía Fernández-Arce:** Writing - original draft, Writing - review & editing. **Carla Carrizo-Rodríguez:** Investigation, Writing - original draft, Writing - review & editing. **Cristina Fernández-Rodríguez:** Investigation, Writing - original draft, Writing - review & editing. **Rubén Martín-Payo:** Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing.

Declaration of competing interest

The authors declare having no conflicts of interest.

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