



Attitudes of Polish adolescents towards energy drinks. Part 2. Are these attitudes associated with energy drink consumption?

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Abstract

Introduction and Objective. In recent years, researchers have pointed to the growing popularity of energy drinks (EDs) in adolescents. This is a worrying trend due to the fact that energy drink (ED) consumption in this age group poses health risks. Among factors that could predict ED consumption, are attitudes towards EDs. The aim of the study was to identify attitudes towards EDs, and to investigate associations between these attitudes and ED consumption behaviours. The study also aimed to assess whether attitudes and ED consumption behaviours were differentiated by variables, such as gender, stage of education, socio-economic status and academic achievement.

Materials and method. The study was conducted among adolescents aged 13–19 years living in the Pomeranian Province (northern Poland). An anonymous questionnaire with a scale to identify attitudes towards EDs was used in the study. Results were assessed as statistically significant at $p \leq 0.05$.

Results. According to the results, $\frac{2}{3}$ of the surveyed adolescents consumed EDs. Boys, high school students and students with poorer academic achievement consumed EDs more often than girls, middle school students and very good students. The adolescents preferred a single ED intake at the level of 250 mL. The distribution of the results in this regard was differentiated by gender and academic achievement. The prevailing percentage of the respondents had ambivalent attitudes towards EDs. It was found that negative attitudes towards EDs were expressed by a higher percentage of the girls and the very good students. Positive attitudes towards EDs were associated with frequent ED consumption and with a high level of single ED intake.

Conclusions. The results allow the conclusion that attitudes towards EDs identified in the studied sample can be considered an important factor related to ED consumption behavior.

Key words

attitudes, teenagers, health risks, energy drinks, eating behaviours

Abbreviations

B—boys, **ED**—energy drink, **EDs**—energy drinks, **G**—girls, **GS**—good students, **H**—high SES, **HS**—high school, **L**—low SES, **M**—medium SES, **MS**—middle school, **SES**—socio-economic status, **SS**—sufficient students, **VGS**—very good students

INTRODUCTION

In recent years, energy drinks (EDs) have become very popular among adolescents [1–6]. Consuming these products in an adolescent population is considered a non-beneficial eating behaviour due to the fact that EDs contain caffeine with psychoactivating properties. The health consequences of excessive energy drink (ED) consumption include improper quality and duration of sleep [7, 8], arterial hypertension [9], impaired functions of the cardiovascular system, including tachycardia and arrhythmia [10–12], states of increased anxiety and irritation, and deterioration of mental state that may be associated with increased risk of the development of depression [13–15]. The results of the study by Serdar et al. [16] showed the negative impact of caffeine and taurine on the neurodevelopment of children and adolescents consuming excessive amounts of EDs. In addition, EDs have a low pH

and, therefore, their consumption contributes to the erosion of dental enamel [17–19]. EDs are also implicated to be triggers of other behaviours that adversely affect the health of adolescents and their proper functioning in society, such as non-attendance of classes, smoking, consuming alcohol and taking drugs [20–23]. Moreover, frequent consumption of EDs increases the risk of developing excess body weight because of the high content of added sugars in EDs [24, 25]. It is noteworthy that the programme which aimed to combat childhood obesity in the United Kingdom included banning the sale of EDs to minors [26]. Another problem is consumption of alcoholic beverages mixed with EDs. It has been found that caffeine may increase the positive reinforcing effects of alcohol, leading to drinking higher amounts of alcoholic beverages [27]. Results of studies conducted in adolescents showed that consumption of alcoholic beverages mixed with EDs was associated with taking violent and risky behaviors [28, 29].

The dynamic development of the ED market and optimistic forecasts for its further development [30, 31] are prospective for producers and alarming for medical and nutrition specialists,

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who are aware of the health risks posed by ED consumption in young consumers, even though EDs are classified as functional beverages (mainly due to the psychoactivating and ergogenic properties of caffeine) [32, 33]. As ED consumption in adolescents could be risky to their health, numerous studies have searched for factors underlying ED consumption in this age group. It is worth mentioning that among such studies were research papers that aimed to identify attitudes towards EDs. However, as has been shown in the first part of the present paper [34], authors of the cited studies have failed to identify these attitudes. Therefore, a substantive and research gap has been found in the issue of attitudes towards EDs.

OBJECTIVE

The study aimed to identify adolescents' attitudes towards EDs, and to investigate associations between these attitudes and ED consumption behaviours. Attitudes towards EDs were identified based on a scale which was developed, validated and tested by the authors in terms of reliability [34]. The study also aimed to assess whether attitudes and ED consumption behaviours were differentiated by variables, such as gender, stage of education, socio-economic status and academic achievement.

MATERIALS AND METHOD

Identification of adolescents' attitudes towards EDs.

An attitude is defined as a tendency to evaluate a specific object [35]. In the present study, EDs were considered an object of an attitude. The adolescents participating in the survey were expected to respond to a set of 21 statements on the scale to identify attitudes towards EDs, using a 5-point Likert response format containing answers from 'I strongly disagree' to 'I strongly agree', which were assigned a number of points reflecting the increasing intensity of the feature when analyzing the results. Statements containing negation were re-coded, i.e. the scores were reversed for individual responses, assigning 1 point for the answer 'I strongly agree' and 5 points for the answer 'I strongly disagree'. Among re-coded statements, were statements No. 6, 7, 10, 11, 13, 14, 15, 17, 20 and 21 (Tab. 1). The greater total number of points meant a more positive attitude of the respondent towards the attitude object. Using the tercile distribution, respondents were identified as having negative (lower tercile), ambivalent (middle tercile) or positive (upper tercile) attitudes. The theoretical range of points was 21–105; therefore, the total number of points in the range of 21–48 indicated a negative attitude of a respondent, whereas the number of points in the range of 49–77 indicated an ambivalent attitude. Achieving at least 78 points meant that a respondent had a positive attitude towards EDs (Tab. 2).

The analysis of results of studies conducted by other authors demonstrated neutral attitudes aside from negative and positive ones. However, when constructing the model of empirical research, the authors made the decision to identify ambivalent attitudes instead of neutral ones. Given the fact that the development of attitudes is strongly affected by emotions, whereas the existence of neutral emotions is often questioned by scientists, the conclusion was reached that identification of ambivalent rather than neutral attitudes

Table 1. Scale to identify adolescents' attitudes towards EDs

Scale-building statements
1. EDs improve well-being
2. EDs are tasty
3. EDs improve concentration and make learning easier
4. EDs stimulate
5. EDs improve physical condition
*6. Positive effects of EDs are not proven by scientists
*7. Parents should prohibit children and adolescents from drinking EDs
8. I can drink EDs
9. For me, there is nothing wrong in EDs
*10. EDs should be allowed only to adults
*11. EDs should not be sold to children and adolescents
12. EDs can provide a source of vitamins
*13. EDs contain too much sugar
*14. EDs can be addictive
*15. Drinking EDs poses health risks
16. Negative opinion on EDs is exaggerated
*17. EDs are redundant and unnecessary
18. Drinking EDs is safe
19. I would like to try EDs, even if I do not know how I would feel afterwards
*20. EDs are carcinogenic
*21. There are too many types of EDs available in stores
* statements with negative overtones

Table 2. Range of points used to identify attitudes towards EDs

Attitudes towards EDs	Point range
Negative	21–48
Ambivalent	49–77
Positive	78–105

is more reasonable. According to the literature, it is likely that an individual would express a partly positive and a partly negative attitude towards a certain object. Such a phenomenon is then referred to as the 'ambivalence of attitudes'. Persons manifesting ambivalent attitudes see both the drawbacks and advantages of the object of an attitude, while feeling simultaneously positive and negative emotions [36, 37]. Therefore, in the present paper, attitudes other than negative and positive were classified as ambivalent.

Assessment of ED consumption behaviours. Assessment of behaviors related to ED consumption was based on the answers to the question about the frequency of ED consumption (possible choice of one out of six answers, ranging from never to several times a day), and to the question about the level of single ED intake in ED consumers (adolescents declaring ED consumption). In the case of the second question, there was a possibility to choose one out of five answers ranging from < 250 mL to > 500 mL.

Study sample selection. The study was conducted in 2018 among 709 adolescents aged 13–19 years, who were students of middle schools and high schools located in the Pomeranian Province (northern Poland). Anonymous questionnaires were used in the study, in accordance with the guidelines

of the Declaration of Helsinki. Details of the selection of the study sample have been described in the first part of the present paper [34], apart from showing information on the method used to calculate sample size. It is worth mentioning that calculation of a minimum sample size before conducting the main study is one of the basic conditions for obtaining adequate credibility and accuracy of estimation—due to the fact that the accuracy of an interval estimation depends on a value of a standard deviation of a trait in a population, confidence coefficient and sample size. Thus, in the present study, a formula on a confidence interval for a given parameter of a general population was transformed. In order to calculate sample size, it was assumed that the interval built with the confidence coefficient was of such a length that its half, defined as a permissible error of estimation, did not exceed the determined *ex ante* of the number [38].

Variables considered during analysis of results. The survey results were interpreted in terms of their associations with such variables as gender, stage of education (middle and high school), socio-economic status (SES) and academic achievement. Choice of the variables was determined by the fact that these factors could be considered important, potentially differentiating the study sample with regard to nutritional issues.

Socio-economic status. Socio-economic status (SES) of the respondents was determined based on the method deployed by Długosz et al. [39]. Six discriminants were used for its assessment, which had a total of 23 categories. Numerical values were assigned to the individual categories of SES discriminants about which respondents were asked. More favourable SES of the adolescents was associated with higher numerical values of the discriminants, which are given below:

- father's education—three categories: elementary (1), secondary (2), higher (3);
- mother's education—three categories: elementary (1), secondary (2), higher (3);
- size of the place of residence—three categories: village (1), town with less than 50,000 inhabitants (2), and city with more than 50,000 inhabitants (3);
- self-declared economic situation of the family—four categories: bad (1), sufficient (2), good (3), very good (4);
- household situation—six categories: we live very poorly—we do not have enough resources even for the cheapest food and clothing (1), we live poorly—we do not have enough resources for housing fees (2), we live modestly—we have enough resources only for food and clothing (3), we live very thriftily (4), we live relatively thriftily (5), we live very well—we can afford everything without limitations (6);
- number of children in the family—four categories: 6–11 children (1), 4–5 children (2), 2–3 children (3), 1 child (4).

The weighted SES index was determined, which was calculated as the sum of the numerical values assigned to the SES discriminant categories. The discriminants were weighted, which allowed obtaining the equal share of each of the six SES discriminants. The tercile distribution allowed distinguishing respondents with low SES (lower tercile), medium SES (middle tercile) and high SES (upper tercile). The following distributions were obtained:

- low SES—below 15;
- medium SES—from 15 to 16;
- high SES—above 16.

Academic achievement. In the Polish education system, at the end of the semester, students receive grades expressed in the form of numbers from one to six. Thus, the grade point average obtained by each of the students in all subjects allowed for dividing the students in terms of their academic achievement. The classification was based on the following assumptions:

- sufficient students were adolescents whose grade point average did not exceed 3.50;
- good students were adolescents whose grade point average ranged from 3.51 to 4.50;
- very good students were adolescents whose grade point average was above 4.51.

Statistical analysis. Statistical analysis of the study results was conducted using Statistica 13.1 PL software (StatSoft). The results were presented as the percentage of the study sample, considering the four types of variables mentioned above. Distribution of the results was checked with Pearson's χ^2 independence test. The differences were classified as statistically significant at $p \leq 0.05$.

RESULTS

Characteristics of the study sample. The survey was conducted among 709 adolescents. The study sample was characterized in terms of differences in variables, such as gender, stage of education, SES and academic achievement. Girls accounted for 50.63% of the surveyed adolescents. When analyzing the distribution of the sample in terms of stage of education, it was noted that the high school students represented a slight majority of the sample (51.34%). The mean age of the adolescents was 16.58 ± 1.94 years, with the mean age of the girls being 16.34 ± 1.98 years, and the mean age of the boys at 16.40 ± 2.00 years. Assessment of the distribution of the study sample in terms of SES showed that almost the same percentage of the respondents concerned the adolescents with low (34.84%) and medium (34.28%) SES. Considering the division of the students in terms of academic achievement, it was found that the sample was predominated by the good students (44%), while the very good students represented 20.74% of the study sample (Tab. 3).

Table 3. Characteristics of the study sample in terms of analyzed variables

Variable	Types	N	%
Gender	Girls	359	50.63
	Boys	350	49.37
Stage of education	Middle school	345	48.66
	High school	364	51.34
SES	Low	247	34.84
	Medium	243	34.28
	High	219	30.88
Academic achievement	Sufficient students	250	35.26
	Good students	312	44.00
	Very good students	147	20.74
Age	Total sample	16.58 ± 1.94 years	
	Girls	16.34 ± 1.98 years	
	Boys	16.40 ± 2.00 years	

ED consumption behaviours—frequency of consumption and single intake of EDs. The frequency of ED consumption and the single ED intake were analyzed as part of the assessment of behaviours related to ED consumption. The obtained results allowed stating that 1/3 of adolescents had never consumed EDs and almost an identical percentage of the respondents consumed EDs with a frequency of 1–3 times a month. Consumption of these beverages with a frequency of several times a day was declared by 5.36% of the adolescents, and with a frequency of once a day—by 5.08% of the adolescents. Therefore, daily consumption of EDs was observed in every tenth surveyed student (Tab. 4).

Most of the respondents belonging to the group of ED consumers (43.62%) declared a single intake of EDs at the level of 250 mL, which corresponds to a volume of a can being the standard package for this type of beverage. Every fourteenth ED consumer drank more than 500 mL of EDs at one time (Tab. 5).

Considering the distribution of the results related to the frequency of ED consumption depending on gender of the respondents, it was noted that a statistically significantly higher percentage of the boys drank EDs more often than the girls. Furthermore, 28.92% of the boys did not drink EDs, while among the girls, this percentage was approximately 10% higher (39.57%). Consumption of EDs with a frequency of several times a day was observed in 4.34% of the girls and 5.95% of the boys (Tab. 4). It was also found that the boys declared a significantly higher level of single ED intake. The largest ED volume indicated in the questionnaire (> 500 mL) was consumed at one time by three times more boys than the girls. In almost 20% of the girls, the level of single ED intake was less than 250 mL, while the respective percentage noted among the boys was 11.32% (Tab. 5).

ED consumption was also analyzed considering the respondents' stage of education. Statistically significantly higher percentage of the high school students consumed EDs

compared to the middle school students. Not consuming these beverages was seen in 37.01% of the younger students and in 31.08% of the high school students. The highest frequency of ED consumption indicated in the questionnaire was declared by 3.41% of the middle school students and more than twice as many older students (Tab. 4). Therefore, the above results suggest that the frequency of ED consumption increased with the age of the surveyed adolescents, which could be due to the fact that factors related to ED consumption changed with age. However, it was not possible to demonstrate that the level of single ED intake was determined by stage of education (Tab. 5). Although the results achieved in this respect were not statistically significantly different, it was noticed that almost twice as high percentage of the middle school students than of the high school students consumed EDs in an amount exceeding 500 mL (10.28% vs 5.45%).

A factor that did not differentiate either the frequency of ED consumption and the level of single ED intake turned out to be SES (Tab. 4, Tab. 5). Despite the fact that there were no statistically significant differences in the collected results, an analysis of the frequency of ED consumption demonstrated that the adolescents with high SES more often declared not consuming EDs, compared to those with low and medium SES. A similar percentage of the students with low (4.42%), medium (5.15%) and high (5.86%) SES consumed EDs with a frequency of several times a day (Tab. 4).

An association between academic achievement and frequency of ED consumption was also assessed. As shown by the data presented in Table 4, statistically significant differences were identified in this respect. Compared to the sufficient students, the percentage of the very good students who did not drink EDs was twice as high (23.44% vs 46.36%). On the other hand, the percentage of the adolescents consuming EDs with a frequency of once a day was more than three times higher among the sufficient students than among the very good students. Therefore, it can be concluded

Table 4. Frequency of ED consumption (%); n = 709

Frequency of ED consumption	Study sample	Gender		Stage of education			SES			Academic achievement		
		B	G	MS	HS	L	M	H	SS	GS	VGS	
Never	33.71	28.92	39.57	37.01	31.08	31.86	32.62	37.73	23.44	37.15	46.36	
1–3 times a month	32.30	31.62	33.33	37.80	26.49	30.53	33.05	32.97	30.07	32.50	36.42	
Once a week	10.44	11.89	8.40	7.61	12.97	8.85	12.88	9.16	10.55	11.46	7.28	
Several times a week	13.11	15.40	10.57	11.28	14.86	16.38	12.44	10.62	18.36	13.31	2.65	
Once a day	5.08	6.22	3.79	2.89	7.30	7.96	3.86	3.66	9.77	2.48	2.65	
Several times a day	5.36	5.95	4.34	3.41	7.30	4.42	5.15	5.86	7.81	3.10	4.64	
p-value	–	$p \leq 0.05$		$p \leq 0.05$			$p \geq 0.05$			$p \leq 0.05$		

Abbreviations: G—girls; B—boys; MS—middle school; HS—high school; SES—socio-economic status; L—low SES; M—medium SES; H—high SES; SS—sufficient students; GS—good students; VGS—very good students

Table 5. Level of single ED intake in ED consumers (%); n = 470

Level of single ED intake	ED consumers	Gender		Stage of education			SES			Academic achievement		
		B	G	MS	HS	L	M	H	SS	GS	VGS	
< 250 mL	15.10	11.32	19.47	16.05	14.40	13.38	15.82	16.37	9.64	18.54	19.28	
250 mL	43.62	43.77	43.36	43.62	42.80	43.95	42.41	43.86	42.13	43.90	46.99	
330 mL	22.13	20.38	24.78	17.70	26.07	25.48	22.15	20.47	22.85	22.93	21.69	
500 mL	12.13	14.34	8.85	12.35	11.28	14.01	12.66	8.19	15.23	11.22	3.61	
> 500 mL	7.02	10.19	3.54	10.28	5.45	3.18	6.96	11.11	10.15	3.41	8.43	
p-value	–	$p \leq 0.05$		$p \geq 0.05$			$p \geq 0.05$			$p \leq 0.05$		

Table 6. Attitudes towards EDs (%); n = 709

Attitudes towards EDs	Study sample	Gender		Stage of education		SES			Academic achievement		
		B	G	MS	HS	L	M	H	SS	GS	VGS
Negative	20.03	13.71	26.14	21.90	17.81	18.03	19.67	21.96	14.22	20.39	27.66
Ambivalent	71.93	77.71	67.33	69.45	75.62	73.36	74.48	69.63	73.58	73.79	68.79
Positive	8.04	8.58	6.53	8.65	6.57	8.61	5.85	8.41	12.20	5.82	3.55
p-value	–	$p \leq 0.05$		$p \geq 0.05$		$p \geq 0.05$			$p \leq 0.05$		

that better academic achievement was conducive to lower ED consumption. By analyzing the association between the level of single ED intake and academic achievement (Tab. 5), it was found that the lowest level of single ED intake indicated in the questionnaire (< 250 mL) was declared by twice as many very good students than the sufficient students.

Identification of attitudes towards EDs. Evaluation of the results presented in Table 6 showed that every fifth adolescent had a negative attitude towards EDs, while 8.04% of the surveyed students had a positive attitude towards these beverages. It is interesting that the majority of the respondents, i.e. almost 3/4 of the adolescents, expressed an ambivalent attitude towards EDs. Manifesting such a type of attitudes towards EDs indicates that these drinks can be considered as products that evoked conflicting emotions, both positive and negative, in the adolescent study participants.

Attitudes towards EDs were statistically significantly differentiated by gender of the adolescents. It was noticed that twice more girls than the boys had a negative attitude towards EDs, and that the percentage of the girls with an ambivalent attitude towards EDs was about 10% lower than among the boys.

When analyzing the results in relation to academic achievement, it was found that better results in learning were conducive to manifesting a negative attitude towards EDs. Among the sufficient students, 14.22% expressed a negative, 73.58%—an ambivalent and 12.20%—a positive attitude towards EDs. In turn, among the very good students, almost twice as high percentage of the respondents had a negative attitude, and three times lower percentage—a positive attitude towards EDs.

As in the case of the frequency of consumption and the level of single ED intake, SES did not differentiate attitudes towards EDs in the examined sample. The distribution of results concerning attitudes towards EDs in connection with stage of education was similar.

Associations between attitudes towards EDs and ED consumption behaviours. The association between attitudes towards EDs and the frequency of ED consumption was found to be statistically significant. Among the adolescents with a positive attitude towards EDs, there were no respondents who did not consume EDs, while one in seven adolescents consumed these beverages several times a day. In turn, every fourth respondent with an ambivalent attitude towards EDs did not drink this type of beverage at all, while 5.64% of the students with an ambivalent attitude drank EDs with a frequency of several times a day. An analysis of this association in the group of students with a negative attitude towards EDs showed that 3/4 of these adolescents did not consume EDs. Moreover, none of the respondents with a negative attitude towards EDs declared consuming EDs with a frequency of several times a day (Tab. 7).

Table 7. Attitudes towards EDs vs frequency of ED consumption (%); n = 709; $p \leq 0.05$

Attitudes towards EDs	Frequency of ED consumption					
	Never	1–3 times a month	Once a week	Several times a week	Once a day	Several times a day
Negative	73.76	17.73	4.96	2.13	1.42	0.00
Ambivalent	26.46	36.58	11.67	14.20	5.45	5.64
Positive	0.00	22.22	16.67	33.33	12.96	14.82

Attitudes towards EDs were statistically significantly associated not only with the frequency of ED consumption, but also with the level of single ED intake. Among the ED consumers manifesting a positive attitude towards EDs, 12.96% consumed more than 500 mL of these beverages at a time, while every eleventh adolescent drank less than 250 mL. An opposite association was found for the students with a negative attitude towards EDs—about 1/3 of these adolescents drank less than 250 mL of EDs at a time. In addition, no students consuming the highest ED volume indicated in the questionnaire (> 500 mL) were identified in this group (Tab. 8).

Table 8. Attitudes towards EDs vs level of single ED intake (%); n = 470; $p \leq 0.05$

Attitudes towards ED in ED consumers	Level of single ED intake in ED consumers				
	< 250 mL	250 mL	330 mL	500 mL	> 500 mL
Negative	35.90	41.03	12.82	10.25	0.00
Ambivalent	13.12	44.09	24.15	11.02	7.62
Positive	9.26	40.74	20.37	16.67	12.96

DISCUSSION

ED consumption behaviours. In the present study, ED consumption was recorded among 66.29% of all of the respondents; therefore, this behaviour can be perceived in terms of a phenomenon that was common in the studied sample. The results regarding the frequency of ED consumption in the adolescents participating in the study were similar to the findings reported by other Polish authors. For instance, Cisińska demonstrated that 36.7% of the surveyed middle school students did not consume EDs, while 10.1% of the adolescents participating in the study drank this type of beverage every day [40]. In turn, Nowak and Jasionowski found that 33% of the respondents aged 12–20 years living in the Kujawy and Pomerania regions (north-central Poland) did not consume EDs, while daily ED consumption was declared by a five times lower percentage of adolescents compared to the results obtained in the present

study (2.1% vs 10.44%) [41]. Similarly, Błaszczuk-Bębenek et al. showed that 38.6% of high school students from south-east Poland did not drink EDs at all, while 61.4% of them belonged to the group of adolescents consuming EDs [42]. Kwiatkowska et al. reported ED consumption in 57% of the surveyed adolescents living in Lublin province (eastern Poland), which means that, compared to the results of the present study, 10% more adolescents did not consume EDs [43]. In contrast to the results presented in this study and in the cited publications, Piórecka et al. recorded a very low percentage of ED consumers in their survey conducted in the City of Kraków, and in the Commune and City of Niepołomice (southern Poland). The results of their survey showed that 98.1% of children and adolescents from rural areas, and 96.2% of children and adolescents from urban areas did not consume EDs at all [44]. These great discrepancies between the findings reported by Piórecka et al. and the results of other studies on ED consumption might be due to the fact that Piórecka et al. surveyed respondents representing a wider age range, namely children and adolescents aged 7–15 years. Including children, who probably did not drink EDs at all or drank EDs seldom, could lower the results on the frequency of ED consumption in the entire study sample.

A comparative analysis of the present study results with those obtained in other countries demonstrated that the percentage of adolescent consumers of EDs in these countries was lower than in the present study. When analyzing ED consumption in European adolescents, it was noted that Martins et al. reported ED consumption by less than 1/3 (27%) of Portuguese adolescents [45]. The results of the study by Cruz-Muñoz et al. indicated that half (49.2%) of the surveyed Spanish adolescents consumed EDs [46]; however, Tóth et al. recorded ED consumption among 80.3% of Hungarian adolescents aged 10–15 years, with everyday consumption of these beverages among 6.4% of the respondents [47]. The results of studies conducted in countries outside the European continent also differ from those shown in the present study. When analyzing ED consumption in American adolescents, Miller et al. showed that 41% of them consumed EDs in the three months preceding the survey [48]. In turn, ED consumption was declared by 56% of the surveyed Australian adolescents aged 12–18 years [49]. Discrepancies between the obtained results may be due to deploying a different research methodology. The authors of the cited studies took into account different time ranges; some of them asked the respondents about ED consumption in the month preceding the survey, whereas others in the last few months, and even in the last year, while in the present study no time frames were adopted.

An analysis of the level of single ED intake in ED consumers demonstrated that the respondents preferred ED consumption in the amount of 250 mL, which corresponds to the content of a can constituting the standard ED packaging. Similar results were obtained by Kozirok who noted that the level of single ED intake most often chosen by adolescents from the Tri-City (Gdansk, Gdynia and Sopot) and its vicinity (northern Poland) was 250 mL [50]. Michota-Katulaska et al. also found a 250-mL portion to be declared as the level of single ED intake by as many as 77% of the surveyed students of one of the Warsaw universities (central Poland) [51]. It can therefore be concluded that cans were the most popular type of ED unit packaging. The obtained results seem to correspond to the volume of ED packages prevailing on the market.

Consumption of EDs, due to the high content of caffeine with a psychoactivating effect, can be considered not only in terms of nutritional behaviours, but also in terms of risky behaviours, defined as behaviours undertaken by children and adolescents, inconsistent with social norms, and endangering health on the physical and mental level. [52]. Such a perception of ED consumption is supported by the fact that frequent ED consumption is associated with high caffeine intake, which may adversely affect health and even lead to the development of addiction to this substance, described in the literature as caffeinism [53]. Therefore, the sale of EDs to minors has been banned in several countries, such as Mexico [54], Lithuania and Latvia [55]. Moreover, EDs have even been classified as legal highs [56, 57].

Among the boys participating in the survey, in comparison to the girls, the level of single ED intake and the frequency of ED consumption were higher. Therefore, the results of the present study, as well as the results obtained by other researchers, suggest that boys are more likely to consume EDs than girls [1, 4, 5, 8, 13, 25, 40, 58, 59, 60]. Such a situation could be due to differences between boys and girls in terms of perception and propensity to engage in risky behaviours. Boys may perceive ED consumption primarily through the prism of benefits related to the functional properties of EDs. In turn, girls probably perceive ED consumption from the perspective of potential health risks. The differences in the propensity to engage in risky behaviours by male and female adolescents were confirmed by the results of the analysis conducted by Reiners et al. among British adolescents aged 13–20 years. The cited study showed that boys significantly more often than girls assessed risky behaviours as less risky, took risk more often, were less sensitive to the message about the adverse outcomes of risky behaviours, and represented a lower level of social anxiety [61]. Gardner and Steinberg also noticed that gender differentiated the perception of risk in terms of benefits and threats. Based on the study involving a video game consisting in making a decision about driving a car in traffic, these authors found that boys and men perceived benefits resulting from the risk to a significantly greater extent than girls and women [62].

The results of the present survey indicated that the frequency of ED consumption was higher among the high school students than among the middle school students. Therefore, it can be speculated that the frequency of ED consumption in the studied sample increased with age. Other authors also noted that older adolescents consumed EDs more often. This held true for studies conducted in Poland [43, 63] and in other countries [13, 21, 45, 48, 64]. Generally, almost all of the studies on ED consumption included in the discussion of the results of this study pointed to a trend in which the frequency of ED consumption increased with age of the respondents. A higher frequency of ED consumption by older adolescents could be due to the fact that the factors influencing ED consumption changed with age. In the present study, the high school students, probably more aware of the effects of caffeine on the body, could consume EDs for a different purpose than the middle school students. However, the study did not demonstrate that the level of single ED intake was determined by stage of education.

The results of the present study showed that SES did not differentiate the frequency of ED consumption. Perhaps ED consumption in the studied sample was so common, not only due to the low price of these drinks (even below PLN 2 ≈ EUR

0.50), that SES did not differentiate the frequency of consumption of these beverages. Holubcikova et al. obtained opposite results, demonstrating that frequent ED consumption in Slovak adolescents was statistically significantly associated with low SES, assessed as low family affluence [21]. Similar conclusions were reached by Degirmenci et al. in their survey conducted among Norwegian adolescents aged 12–19 years [59], and by Oh et al. who analyzed the frequency of ED consumption among Korean adolescents [65]. The likely reason for the discrepancies between the results of the present study and the findings from the above-cited studies could be using different methods to assess SES. It can be assumed that SES not only reflects the standard of living, but also indicates the lifestyle and perception of certain behaviours as more or less ennobling.

According to the obtained results, academic achievement was a factor that significantly differentiated the frequency of ED consumption and the level of single ED intake. The results indicated that lower frequency of ED consumption was accompanied by better academic achievement. Similar results were obtained by Champlin et al. in a group of American students [66], and by Martins et al. who surveyed Portuguese adolescents aged 11–17 years [45]. Authors of other studies on this issue also found a negative impact of frequent ED consumption on academic achievement, both among adolescents [58, 67–69] and among university students [70, 71]. Based on the results on the association between ED consumption and academic achievement, it can be assumed that better academic achievement is associated with higher nutritional awareness of adolescents, including their knowledge about EDs as products posing potential health risks. Having knowledge in this area could lead to consuming EDs less frequently. Therefore, in the present study, the adolescents with poor academic achievement, who were probably unaware of the health risks of ED consumption, were more likely to consume EDs; however, other explanations should also be considered. Smith and Richards suggested that higher consumption of EDs in British adolescents was connected with an increased likelihood of poor academic achievement due to being part of an unhealthy diet or being associated with skipping breakfast [69]. It should be noted that, in contrast to the results of the present study and the results of the aforementioned studies, Park et al. showed in their research on Korean adolescents aged 12–18 years, that very frequent ED consumption was associated with better academic achievement. The authors of the study speculated that due to the tendency of Korean students to increase study hours at the cost of sleeping hours, adolescents with high academic achievement could habitually use EDs for the wakening effects of caffeine [13]. Interestingly, however, another study conducted in a sample of Korean adolescents did not confirm the results obtained by Park et al.—Kim et al. found that frequent consumption of EDs was associated with achieving lower grades by students [72].

Attitudes towards EDs, and associations between these attitudes and ED consumption behaviours. The research results obtained using the scale, which was developed, validated and examined by the authors in terms of reliability, indicated that the majority of respondents had an ambivalent attitude towards EDs, which suggests that the object of an attitude triggered both positive and negative emotions. On the one hand, due to adverse effects of EDs on health, EDs

could evoke negative emotions, but on the other hand, EDs could also trigger positive feelings, e.g. owing to their specific, interesting taste or to their beneficial effects on the body, such as reducing fatigue and improving cognitive functions. Therefore, EDs can be considered somewhat controversial as products triggering contradictory emotions in the surveyed adolescents.

It is noteworthy that ambivalent attitudes are weak and highly susceptible to persuasion [73]. Due to the fact that ambivalent attitudes towards EDs are the result of a conflict between positive and negative evaluations of ED consumption, this conflict can be exploited in nutrition education while emphasizing the risks posed by ED consumption. Properly planned educational activities could contribute to developing a negative attitude among adolescents with an ambivalent attitude towards EDs. Conversely, a change in an attitude towards EDs could promote a change in ED consumption behaviours. Identification of ambivalent attitudes towards EDs can therefore be considered in terms of favourable results because these attitudes may be more susceptible to modifications than positive ones.

When looking for an explanation of the differences in the distribution of results concerning attitudes towards gender-related ED consumption, one can refer to the differences in the perception of risky behaviours by the boys and by the girls. The reason for the development of a positive attitude towards EDs in the boys could be the perception of ED consumption only through the prism of potential benefits, connected, for example, with the functional properties and specific taste of EDs.

A factor creating a cognitive component of an attitude is knowledge about an object of this attitude. The level of knowledge about EDs or general knowledge about proper nutrition were not examined in this study. However, the results of studies conducted by other authors showed that girls had greater knowledge in this area. According to the research by Kozirok, Polish adolescent girls from the Tri-City and its vicinity (northern Poland) significantly more often than their male peers indicated the possibility of potentially adverse effects of ED consumption, including a risk of caffeine addiction, and significantly more often knew the correct answer to the question about the caffeine content in the ED unit package [74]. The results of the HELENA study conducted by Sichert-Hellert et al. among adolescents from nine European countries [75], and the results presented by Iranian researchers [76], showed that girls had greater knowledge of proper nutrition than boys. Kowalska et al., based on results obtained in a sample of Polish students of upper secondary schools, also found that girls had more knowledge about nutrition than boys [77]. Therefore, it can be speculated that the girls participating in the present study also had a broader nutrition knowledge, including a more extensive knowledge about EDs as food products that should be avoided in adolescence. Knowledge in this area could therefore play an important role in developing negative attitudes towards the subject of the study.

In the present study, stage of education, as well as SES, did not statistically significantly differentiate the distribution of results concerning attitudes towards EDs. On the other hand, in the case of learning outcomes, it was noticed that in the group of students with a better academic achievement, there was a higher percentage of respondents manifesting a negative attitude towards EDs. This could be due to the

greater knowledge of the good and the very good students about proper nutrition and food products to avoid in the diet, such as EDs. Due to their greater awareness of the impact of nutrition on health, the students with better academic achievement could have the highly developed cognitive component of an attitude towards EDs.

It has been initially assumed that a negative attitude towards EDs would imply a low frequency of ED consumption and a low level of single ED intake, and that a positive attitude towards EDs would result in frequent consumption of these beverages and a high level of their single intake. Thus, it was assumed that the frequency of consumption and the level of single ED intake would increase along with the change of attitudes from negative to positive ones. At the same time, it was taken into account that behaviours related to the examined object do not always have to reflect attitudes towards this object, because eating behaviours are determined by many different factors. Therefore, attitudes towards a particular type of food are not always the only or dominant factor that determines behaviours related to its consumption. Nevertheless, the association between attitudes towards EDs and the frequency of ED consumption, and the association between attitudes towards EDs and the level of single ED intake, were statistically significant in the studied sample.

The present study results revealed that the surveyed respondents with a positive attitude towards EDs consumed EDs more often and in higher amounts. By analogy, it was found that the frequency of ED consumption and the level of single ED intake in adolescents with a negative attitude towards EDs, were significantly lower compared to those with a positive or an ambivalent attitude. Therefore, it can be concluded that in the studied sample, manifestation of a positive attitude towards EDs was accompanied not only by frequent ED consumption, but also by higher levels of single ED intake.

EDs should not be consumed by children and adolescents who are often unaware of the potentially adverse effects of EDs on the body. Thus, producers should take social responsibility for promoting EDs and develop an advertising message in such a way as to raise the awareness of children and adolescents about the harmfulness of EDs. In turn, growing consumer awareness in this regard could contribute to the development of negative attitudes towards EDs and to reduced ED consumption. To recapitulate, the development of the ED market should be the subject to regulations taking into account the idea of sustainable development supported by corporate social responsibility. It can be presumed that the dynamic development of this market will be one of the reasons behind an increased incidence of diseases related to ED consumption, a tendency that will mainly concern adolescents. It should also be emphasized that the profits related to development of the ED market will strengthen mainly the business, while the financial and social consequences of ED consumption will be borne by all of society. Therefore, it is justified to take steps to include business in the responsibility for the consequences of its activities, in the same way as it was organized in the case of the alcoholic beverage market.

Strengths and limitations of the study, and directions for future research. Identifying attitudes towards EDs is certainly one of the strengths of the presented study. To the best of the authors' knowledge, this is the only study in which attitudes towards EDs were identified in accordance with

the methodology adopted in social research using the scale which was developed, validated and examined by us in terms of reliability. The obtained results were used to analyze the association between attitudes towards EDs and the frequency of ED consumption, and the association between attitudes towards EDs and the level of single ED intake.

An attitude towards a specific object is often perceived as a predictor of behaviours related to this object. Therefore, an attitude towards EDs may be considered a factor predicting ED consumption. Taking into account this assumption, the results obtained in the present study may provide a source of information in developing nutrition education programmes aimed at reducing ED consumption among adolescents.

The 5-point Likert scale was used in the study. In the middle of this scale, there was the statement 'neither agree nor disagree'. In the authors' opinion, selecting such an answer by respondents indicated ambivalent attitude to a given statement and, more specifically, the inability to take a position due to the simultaneous positive and negative perception of EDs. Choosing this answer may also be considered as a lack of position in relation to a given scale-building statement. Perhaps the use of a 4-point Likert scale containing only negative and positive answers would reduce the percentage of those in the middle. On the other hand, respondents should be able to choose an answer that would reflect their ambivalent attitude or indecision about a particular statement. Moreover, identification of ambivalent attitudes towards EDs may be considered not only as a result of the choice of middle answers, but above all, as a result of the choice of the similar number of both the negative and the positive answers.

The strengths of the study lie in the fact that the results were assessed in terms of their connection with four variables, including gender and stage of education, as well as SES and academic achievement. In the opinion of the authors, SES is a very good measure of socio-economic conditions, providing a complete picture of the socio-economic situation of respondents. Therefore, its application may be treated as a better solution than interpretation of differences in results based on their associations with individual variables, such as parents' education level, place of residence or family's financial situation.

Although the survey was conducted in a fairly large group of adolescents, the selection of the study sample should be considered a limitation of the study. Because the study sample was not a representative sample of middle school and high school students in Poland, the conclusions concerned only study participants. It was impossible to generalize conclusions to the general population. Therefore, it seems worthwhile to identify attitudes and behaviours towards EDs in a representative sample of adolescents.

The study was conducted in 2018. When considering the Polish population, one of the factors that may affect ED consumption among adolescents is the introduction of a sugar tax at the beginning of 2021, which also applies to EDs [78]. An increase in the ED price may be related to a decrease in ED consumption, especially in adolescents, for whom the price of the product is probably quite important due to the limited financial resources available. Therefore, it would be useful to analyze ED consumption behaviours, and associations between these behaviors and attitudes towards EDs after implementation of the sugar tax.

CONCLUSIONS

Consumption of EDs was a common phenomenon in the studied sample. The stage of education, gender and academic achievement differentiated behaviours of the studied adolescents in terms of the frequency of ED consumption. The boys, the older students and the adolescents poorly performing at school consumed EDs statistically significantly more often than the girls, the middle school students, the good students, as well as the very good students. There were no differences in the frequency of ED consumption associated with SES of the respondents.

Gender and academic achievement were the factors that differentiated the level of single ED intake in the study participants. The girls, and the students with good and very good academic achievement more often than the boys and the sufficient students declared the lowest level of single ED intake among the ones indicated in the questionnaire. The stage of education and SES were not associated with the amount of EDs the respondents consumed at one time.

Most of the adolescents participating in the survey manifested an ambivalent attitude towards EDs. This finding can be considered a favourable outcome as ambivalent attitudes are more susceptible to modifications than positive ones due to the conflict between positive and negative emotions felt towards EDs. In the studied sample, gender and academic achievement statistically significantly differentiated attitudes towards EDs. Compared to the boys and the adolescents with poorer academic achievement, a higher percentage of the girls and the very good students expressed a negative attitude towards EDs.

In the study sample, attitudes towards EDs were associated with the frequency of ED consumption and with the level of single ED intake. It was found that a positive attitude towards EDs was accompanied by frequent ED consumption. Moreover, a positive attitude towards EDs was associated with higher levels of single ED intake. These results may be used in the nutrition education of adolescents.

Conflict of interest

The authors declare no conflict of interest.

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