



Attitudes of Polish adolescents towards energy drinks. Part 1. Development, validation and reliability testing of a scale to identify attitudes towards energy drinks

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Abstract

Introduction. Attitudes towards food are one of the most important but often underestimated factors related to food consumption. In recent years, researchers have pointed to the growing popularity of energy drinks (EDs) among adolescents and emphasized health risks posed by energy drink (ED) consumption. A substantive and research gap has been found in the subject of identifying attitudes towards EDs.

Objective. The aim of the study was to develop and validate a scale to identify adolescents' attitudes towards EDs, and to examine this scale in terms of reliability.

Materials and method. The scale was validated, including content validation, response process validation and statistical validation. Experts in identifying attitudes towards food participated in the content validation procedure. Response process validation was conducted in a pre-test sample of adolescents aged 13–19 years, while statistical validation was performed based on results obtained in a pilot study. Reliability was tested using Cronbach's alpha.

Results. At the beginning, the scale consisted of 28 statements. Performing content validation resulted in the elimination of 2 items from the scale. The last step of the procedure, reliability testing, was connected with removing another 5 statements from the scale. A final version of the scale to identify adolescents' attitudes towards EDs consisted of 21 statements. Cronbach's alpha of the scale was 0.856, indicating high reliability of this scale.

Conclusions. The constructed scale is valid, reliable and therefore can be used as a research instrument in the identification of adolescents' attitudes towards EDs, and also in investigating associations between these attitudes and behaviours related to ED consumption.

Key words

attitudes, reliability, validation, scale, energy drinks, pilot study, pre-test sample

Abbreviations

BMI—body mass index; ED—energy drink; EDs—energy drinks; KMO—Kaiser-Meyer-Olkin; PC—principal component; PCA—principal component analysis; PCs—principal components; PC1—first principal component; PC2—second principal component; PC3—third principal component

INTRODUCTION

Energy drink consumption among adolescents. Red Bull was the first energy drink (ED) introduced to the European market in the second half of the 1980s as a drink reducing mental and physical fatigue [1]. In the early 2000s, the ED market began to develop intensively with nearly 500 new ED brands launched worldwide in 2006 [2]. Since then, the value of the global ED market has been growing steadily. Energy drinks (EDs) are very popular among adolescents [3–7], while scientific literature emphasizes health risks posed by ED consumption among this population group [8–11]. EDs contain significant amounts of caffeine which elicits psycho-activating effects and, as a result, their frequent consumption

may adversely affect health. Reports indicating harmful effects of EDs on children and adolescents appeared over a decade ago. In 2011, the American Academy of Pediatrics issued a negative opinion regarding ED consumption among these groups of consumers [12]. A year later, the European Food Safety Authority conducted a survey among a population of people aged 3–65 years from 16 European countries. The results showed that 68% of the surveyed adolescents consumed EDs [13]. In response to the health risks posed by ED consumption in adolescents, the prohibition of ED sale to minors was imposed in Mexico [14], Lithuania and Latvia [15]. Health consequences of excessive ED consumption include sleep disorders [16], cardiovascular system disorders [17], negative impact on mental health [18, 19], engagement in risky behaviours [20], dental enamel erosion [21] and also a risk of overweight development due to the high content of added sugars in EDs [22].

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Attitudes towards food and their association with eating behaviours. ED consumption and its relationship to various aspects of adolescent life have been extensively analyzed in recent years. Among such publications, there were also research papers which aimed to identify attitudes towards EDs as a factor that may constitute a premise underlying their consumption. Attitudes are defined as a tendency to evaluate a specific object [23, 24] and are also often understood as a combination of three components: cognitive—related to knowledge, opinions and beliefs about a given object, affective—expressing emotions felt towards that object, and behavioural—which can be perceived as a tendency to behave in a particular way towards the object [25, 26]. Identification of attitudes makes it possible to modify these attitudes, and in the longer term also to control or even change behaviours related to the attitude object. An analysis of literature data showed an association between attitudes towards a specified type of food and behaviours related to its consumption. An example in this case is the research carried out as part of the GEBaHealth Project on the associations between health- and taste-related attitudes, and nutritional behaviours of Polish girls and women aged 13–21. The authors showed that positive attitudes towards health were associated with healthy eating behaviours manifested through the consumption of vegetables and fruits. By way of contrast, negative attitudes towards natural food products, as well as positive attitudes towards sweets and positive attitudes towards using food as a reward, were associated with eating behaviours less beneficial for health [27]. In turn, Koo et al. demonstrated that Malaysian children with positive attitudes towards whole grains consumed whole grains more often than children with negative attitudes towards these products [28].

An attitude is a hypothetical construct. As a result, it cannot be assessed by observation [23]. It is worth mentioning that there are explicit attitudes, i.e. those whose identification depends on the respondents' declarations, and implicit attitudes, i.e. attitudes that are triggered automatically and whose assessment is based on the use of such instruments as the implicit association test [29]. Supporters of identifying implicit attitudes often question the sense of investigating explicit attitudes. The most frequent objection is the low credibility of the results. Study participants tend to present themselves in a more favourable light, which is why they sometimes provide answers that are not true [30]. However, a meta-analysis of 61 studies on the associations between attitudes and behaviours demonstrated that explicit attitudes had a stronger impact on consumer and voting behaviours than implicit ones. Thus, identification of explicit attitudes towards food related to eating behaviours classified as consumer behaviours is supported by the results of the aforementioned meta-analysis [31, 32].

Although investigations into the role of attitudes in affecting behaviours have been conducted for several decades, a review of research papers showed that the issue of attitudes identification remains underexplored. Mistakes have been made in this field, ranging from designing empirical research to the analysis and interpretation of the obtained results. This, in turn, may indicate a problem already at the level of defining attitudes. The problem is that knowledge, beliefs, opinions and even behaviours related to a specific object, are often equated with attitudes towards that object. In fact, these terms are connected with attitudes; however, knowledge, beliefs and opinions are considered to be factors that may

affect attitudes, while behaviours are perceived as a factor that may be determined by attitudes. Therefore, mistakes made in defining attitudes lead to the adoption of an incorrect methodology [33].

According to the most frequently used method, explicit attitudes are identified based on results obtained by expressing a position in relation to a set of selected statements (items) with both positive and negative overtones, and the number of these two types of statements should be similar. Each statement should be addressed using a Likert scale, which reflects the degree of agreement with the statement. When using the 5-point Likert scale and responding to positive statements, the answer 'I strongly disagree' is given 1 point and the answer 'I strongly agree' is given 5 points. In turn, re-coding is deployed, i.e. scoring inversion, in the case of negative statements. The sum of the points received by each respondent allows identification of an attitude as a positive, a negative or an ambivalent/a neutral attitude. The results should be considered in relation to the theoretical range of points, i.e. the highest possible total number of points [23].

Literature review on attitudes towards EDs. By analyzing the titles and contents of publications on attitudes towards EDs, some research papers were identified which, in fact, did not deal with the issue of attitudes. An example is an article in which, instead of identifying medical students' attitudes towards EDs, behaviours related to ED consumption, such as the regularity and circumstances of ED consumption, as well as cigarette smoking, coffee consumption and alcohol consumption, depending on the regularity of ED consumption, were evaluated [34]. In another study, instead of assessing attitudes towards energy shots, nurses' opinions on the adverse effects of energy shot consumption and opinions on the content of vitamins and minerals in these products, were examined. The results were presented as the proportion of respondents answering these questions in a specific way [35]. Attempts were also made to study Olympic athletes' attitudes towards EDs, dietary supplements and doping, by formulating a direct question asking the respondents to indicate a positive, a negative or a neutral attitude towards these objects [36]. Similarly, in a study conducted in China, adolescents were asked about their own attitudes and attitudes of their parents towards EDs [37]. According to the literature, attitudes, as other psychological constructs, are hypothetical and unobservable; therefore, attitudes cannot be assessed based on answers to a direct question on respondents' attitudes towards a specific object [23, 38].

Another example is the research in which opinions and behaviours of Turkish students regarding consumption of EDs, sports drinks and ergogenic substances were assessed, although the title of the article suggested identification of attitudes [39]. A similar mistake concerns the study in which only adolescents' behaviours regarding ED consumption and the level of knowledge about EDs were determined, even though the study aimed to explore behaviours, knowledge and attitudes towards EDs [40]. In another article, attitudes were presented in the form of quotations about the opinions of adolescents on caffeinated drinks [41]. In turn, in a study conducted by Russian researchers, opinions on the harmful effects of EDs on health, and information about the frequency and purposes of ED consumption, including consumption of EDs of specific brands, were evaluated, instead of identifying attitudes towards EDs [42].

Analysis of the literature on attitudes towards EDs showed that authors have made another mistake by averaging the results. In one of the research papers showing such a mistake, instead of identifying an attitude of each of the respondents based on all the scale-building statements, and then presenting the distribution of results in a surveyed sample, the average number of points for each of the statements was calculated. In the next step of the study, the mean value of individual statements, which was interpreted as a final result used to identify attitudes towards EDs in Tri-City adolescents (northern Poland), was computed. Thus, one value was obtained for the surveyed sample, instead of analyzing the distribution of the results [43]. An attitude towards a certain object is characteristic of an individual and, as such, should represent the total result of each respondent. The group of respondents or the studied sample is characterized by a distribution of attitudes, and this distribution cannot be assessed based on the average values of points obtained by all survey participants responding to individual scale-building statements, namely based on one number. The research procedure used in the cited study can be compared to the assessment of nutritional status of a given population using the average body mass index (BMI) value. Even if the average BMI value for this population is within the normal range and can be interpreted as normal body weight, this result does not provide any information about the percentage of people who are underweight, normal weight, overweight or obese in this population. Similarly, the discussed paper failed to show the distribution of attitudes towards EDs. All of the results were averaged; hence, respondents' attitudes towards the research subject were not identified. Ultimately, the percentage of adolescents expressing positive, negative and ambivalent/neutral attitudes towards EDs was not determined.

OBJECTIVE

A critical analysis of the literature showed that there is a substantive and research gap in the issue of identification of attitudes towards EDs. Taking into account the fact that EDs are very popular among adolescents, and the fact that frequent consumption of EDs may pose health risks, it seems reasonable to identify attitudes towards EDs in this age group. Identifying attitudes towards EDs would allow the investigation of associations between these attitudes and variables, such as gender and socio-economic factors, and associations between attitudes and behaviours related to ED consumption. Since these attitudes have not been identified in any age group, and especially in the group of adolescents who are most exposed to the adverse effects of these beverages, the current study aimed to develop and validate a scale to identify adolescents' attitudes towards EDs, and to examine this scale in terms of reliability.

MATERIALS AND METHOD

Sample selection for a main study. The main study was conducted in 2018 among 709 adolescents aged 13–19 years, who were students of middle schools and high schools. The choice of adolescents aged 13–19 years as a study sample was due to the fact that, according to the scientific papers, it is an age group characterized by a high consumption of EDs,

and at the same time, the age group insufficiently studied for attitudes towards EDs and their associations with ED consumption.

The schools participating in the survey were randomly selected from among middle schools and high schools located in Pomeranian Province of northern Poland. Stratified random sampling was used. The study area was divided into two strata: the first—middle schools and high schools located in the cities of the Pomeranian Province with more than 20,000 inhabitants, the second—middle schools and high schools located in rural areas of the same province. One middle school and one high school were selected in the first and second strata. As a result, students of schools located in urban and rural areas, including students of two middle schools and two high schools, participated in the research. The sample of the main study was not a representative sample for the population of middle school and high school adolescents in Poland.

Before starting the survey, permission was obtained from the principals of the above-mentioned educational institutions. The principals decided which classes could be surveyed. Moreover, in the case of underage students, only those students whose parents or legal guardians consented in this regard by signing the appropriate form participated in the study. The survey was conducted using anonymous questionnaires, in accordance with the guidelines of the Declaration of Helsinki.

Sample selection for a pre-test and for a pilot study. Data allowing for scale validation was collected in 2018, before conducting the main study. Performing the validation procedure was connected with the necessity to collect data in two different samples of adolescents—the pre-test sample and the pilot sample. The pre-test sample participated in response process validation, while the pilot sample was involved in the study conducted to perform statistical validation. The adolescents belonging to these samples attended the same secondary schools and high schools as the main study participants, but they were students of different classes. The adolescents participating in the pre-test and those participating in the pilot study were excluded from the main study to eliminate the potential impact of knowing the scale-building statements on responding in the main study.

The pre-test sample consisted of 33 respondents, of whom 20 were girls (60.61%). Data on variables other than gender were not assessed due to the fact that there was no need to evaluate their impact on the results of validation. According to information presented by Yusoff, the minimum number of participants of response process validation is 10; however, the majority of the studies analyzed by him involved at least 30 respondents [44]. Therefore, the current study met the criteria on the minimum sample size of this step of validation procedure.

The number of participants of the pilot study was determined, taking into account the fact that the minimum number of respondents in such a type of study is 5 for each scale-building statement [45]. As after performing content validation and response process validation the scale to identify attitudes towards EDs consisted of 26 statements, the pilot study should have included at least 130 respondents. The pilot sample consisted of 140 students. Thus, the condition of the minimum sample size was met. By evaluating data

on gender, it was found that girls accounted for 54.29% of the pilot sample.

Development of the scale to identify attitudes towards EDs.

Before developing the scale to identify attitudes towards EDs, the literature on ED consumption in adolescent population was analyzed. Based on the information gained from this analysis, a 28-item scale was developed. This scale contained the same number of the statements with positive and negative overtones. The positive and the negative statements were not placed in a sequential manner in order to prevent adolescents from being influenced by their thoughts. While developing the scale, some of the statements building the scale to measure Tri-City adolescents' attitudes towards EDs were modified (Items No. 1, 5, 6, 7, 18, 20, 21, 22 and 23 in Table 1 showing the scale after performing content validation and response process validation) and after that, these statements were used as part of our scale [43]. The author of the cited study deployed the scale for identifying attitudes towards functional food developed by Urala and Lähteenmäki [46]. The scale-building statements remained the same, but the attitude object was replaced with EDs. Although the researcher did not validate the scale and failed to correctly identify attitudes towards EDs, construction of the scale used in his study could be compared to the construction of the current scale. The scale used to identify Tri-City adolescents' attitudes towards EDs contained the same number of positive and negative statements; however, in comparison to the scale developed for the current study, the total number of statements was lower (16 statements). It is difficult to assess whether a scale containing more items is better than a scale with a lower number of items, but it seems that using a higher number of statements allows for the inclusion of more information on attitude object.

While creating the statements, knowledge on positive and negative aspects of ED consumption was used. EDs are marketed as beverages reducing tiredness, boosting energy, and improving physical and mental performance [47–50]. A literature review revealed that in recent years, ED consumption among adolescents has been mostly associated with a specific taste of EDs [4, 13, 40, 51, 52], a high level of physical activity or playing sport [53–55], and with the need for an energy boost [40, 52]. Therefore, in the current study, among the statements that could be considered positive, were those related to ED properties, such as the stimulating effects of EDs, improving well-being, improving concentration and learning, enhancing physical activity, as well as providing a source of vitamins, and allowing children and adolescents to feel like adults. These statements were mostly connected with a cognitive component of attitude, i.e. knowledge, opinions and beliefs about EDs. Among the other positive statements, were items saying that EDs are tasty and that these beverages are trendy. Such statements could be considered items associated with an emotional component of an attitude towards EDs. However, the statements with positive overtones which could be classified as belonging to a behavioral component of an attitude towards EDs, i.e. a component of an attitude expressing a tendency to behave in a particular way towards EDs, were also used. The positive statements connected with the behavioural component included the statement saying that adolescents can drink EDs. This statement could be interpreted by adolescents as a statement demonstrating that there were no contraindications for drinking EDs. The

second statement with a positive overtone, belonging to the behavioural component of an attitude towards EDs, was the statement expressing willingness to try EDs in spite of not knowing the effects of such behaviour.

Taking into account the statements on the negative aspects of ED consumption, items connected with nutritional value of EDs (the high content of sugar and providing too much energy) and those related to the health risks of ED consumption, such as the risk of ED overdose and addictive properties of EDs, were used. It is worth mentioning that an addiction to caffeine is called *caffeinism* [56, 57] and that it may develop in the case of excessive consumption of products containing high amounts of caffeine, including EDs [58]. Also used in the current study was the statement that EDs are carcinogenic. Such an impact of ED consumption on health has not yet been found; however, the relationship between consumption of some food products (some substances present in food) and the risk of cancer development is quite well known [59, 60]. It was assumed that adolescents, similarly to adults, may tend to perceive food, the consumption of which poses potential health risks, as food that can lead to cancer development. Thus, this statement was used to allow for expressing negative emotions towards EDs. Among the other negative statements, were those showing that EDs should not be sold to children and adolescents, and that parents should prohibit children and adolescents from drinking EDs. It is quite difficult to assess to which component of attitudes belonged the statements mentioned in this paragraph. On the one hand, these statements might reflect adolescents' knowledge, opinions and beliefs about EDs. On the other hand, these statements could also express emotions felt towards the attitude object. In addition, it can be speculated that the emotional and cognitive components of attitudes towards EDs were strongly correlated with each other. For instance, having knowledge about the health risks of ED consumption could result in expressing negative emotions towards these beverages. According to the empirical model used by Svenningsson et al. in their study on students' attitudes towards technology, there was a relationship between the emotional and cognitive components of these attitudes. The authors suggested that it could be a two-way relationship. The cognitive component could influence the emotional component of attitudes towards technology, but on the other hand, the emotional component could influence the cognitive component of these attitudes [61].

Validation and reliability testing of the scale to identify attitudes towards EDs.

The scale was validated and examined in terms of reliability. It needs to be emphasized that reliability is not a part of validation, and that the research instrument should be tested in terms of reliability after performing validation procedure. Validation enables achieving an instrument which actually measures what it is designed to measure; for example, specific constructs such as attitudes, while reliability is about consistency when measurements are repeated. Thus, on the one hand, validation differs from reliability and must be tested separately. On the other hand, validation and reliability complement each other due to the fact that reliability of an instrument must be high for valid interpretations to be made using this instrument. However, reliability does not matter if a research instrument is invalid [62]. Considering this information, the scale developed for the current study was validated using content validation,

response process validation and statistical validation, and was also examined in terms of reliability based on calculating Cronbach's alpha. Validation and reliability testing were performed, including the following steps:

- 1) *Content validation*—the degree to which elements of an instrument are relevant to, and representative of, the targeted construct for the particular assessment purpose. Involving expert judges, who evaluate statements building a scale, is recommended in this step of validation [63].
- 2) *Response process validation*, which is also known as face validation, is a relationship between the intended construct and the thought processes of subjects participating in a study. This step of validation is usually conducted in a small sample of respondents representing a final study sample [64].
- 3) *Statistical validation*. This step of validation was performed based on the results obtained in the pilot study. In this study, the adolescents were expected to respond to the scale-building statements using the 5-point Likert response format containing answers from 'I strongly disagree' to 'I strongly agree', which were assigned the 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' (Statements No. 6, 7, 9, 13, 14, 16, 17, 18, 19, 21, 24, 25 and 26 in Table 1).

In order to conduct statistical analyses, Statistica 13.1 PL software (StatSoft) was used. The results were classified as statistically significant at $p \leq 0.05$. Statistical validation was performed based on principal component analysis (PCA), which is a multivariate statistical method analyzing several variables to reduce a large dimension of data to a relatively smaller number of components called principal components (PCs) [65]. The following steps were included in this procedure:

- a) Preparing results on descriptive statistics (mean values and standard deviations of each of the statements).
- b) Performing varimax rotation, which is an orthogonal rotation method used to investigate the principal component (PC) structure. Varimax rotation aims to estimate uncorrelated factors with a simpler loading matrix, which is considered to be easier to interpret [65].
- c) Testing reliability of the scale using Cronbach's alpha (based on the results of the pilot study). Cronbach's alpha is the most frequently used reliability measure of multi-item research instruments, such as scales developed to identify attitudes [66, 67].
- d) Testing reliability of the scale using data obtained in the main study.

RESULTS

The first step of the validation procedure was content validation, i.e. validation performed based on interviews with a panel of 4 experts in the field of identification of attitudes towards food products. After conducting content validation, 2 statements were removed from the scale: 'drinking EDs with alcohol is a perfect way to have fun' (a positive statement) and 'drinking EDs mixed with alcohol is risky' (a negative

statement). In fact, eliminating these items from the scale was a reasonable step because they could be used to identify attitudes towards alcohol mixed with EDs rather than to identify attitudes towards EDs. Some of the statements were also modified according to the suggestions of the experts. The research instrument validated in this way contained 26 statements, 13 positive and 13 negative.

The next step of validation of the scale was response process validation aimed at evaluating whether words and sentences used to create the statements of the scale to identify attitudes towards EDs could be easily understood by the respondents. The adolescents were asked to highlight words or phrases, the meanings of which were not clear to them. The obtained results showed that the scale did not contain any statements that were misunderstood by the respondents. Therefore, this step of validation was not connected with providing any changes in the scale-building statements.

According to the descriptive statistics results, the lowest mean value (2.214 ± 1.311) was observed in terms of statement No. 1—'EDs can be addictive' and the highest one (3.578 ± 1.346) in terms of the statement No. 10—'I can drink EDs' (Tab. 1). It can be concluded that the adolescents participating

Table 1. Descriptive statistics results of data obtained in the pilot study

Scale-building statements	Mean values	Standard deviations
1. EDs improve well-being	2.661	1.172
2. EDs are tasty	3.471	1.323
3. EDs improve concentration and make learning easier	2.586	1.201
4. EDs stimulate	3.347	1.276
5. EDs improve physical condition	2.280	1.119
6. Positive effects of EDs are not proven by scientists	2.239	1.032
7. Persons with a low level of physical activity should not drink EDs	2.842	1.303
8. Drinking EDs is trendy	2.404	1.151
9. Parents should prohibit children and adolescents from drinking EDs	3.082	1.235
10. I can drink EDs	3.578	1.346
11. For me, there is nothing wrong in EDs	3.363	1.258
12. Drinking EDs allows children and adolescents to feel like adults	2.330	1.192
13. EDs should be allowed only to adults	3.438	1.244
14. EDs should not be sold to children and adolescents	3.421	1.188
15. EDs can provide a source of vitamins	2.619	1.253
16. EDs are high-calorie drinks	2.628	1.205
17. EDs contain too much sugar	2.652	1.470
18. EDs can be addictive	2.214	1.311
19. Drinking EDs poses health risks	2.396	1.214
20. Negative opinion on EDs is exaggerated	2.909	1.161
21. EDs are redundant and unnecessary	3.165	1.427
22. Drinking EDs is safe	2.669	1.090
23. I would like to try EDs, even if I do not know how I would feel afterwards	2.561	1.250
24. EDs can be overdosed	2.471	1.378
25. EDs are carcinogenic	2.991	1.106
26. There are too many types of EDs available in stores	2.677	1.324

in the pilot study rated the highest the statement expressing that they could consume EDs, while the statement connected with addictive properties of EDs was rated the lowest.

After obtaining the results on content validation and response process validation, statistical validation was performed using PCA. Firstly, Kaiser-Meyer Olkin (KMO) test was conducted to search for appropriateness of the data for PCA. The KMO value should be between 0.80–1.0 [68]. The result of KMO test was 0.807, which allowed assessment of the sample size as adequate for further analysis. Secondly, Bartlett's test of sphericity was conducted to ensure that the correlation matrix was not random [69]. The results of this test confirmed that the correlation matrix was appropriate to perform PCA ($\chi^2 = 1367.774$; $p < 0.000001$).

The next step of the statistical validation procedure concerned extraction of the optimal number of PCs. According to the commonly-used Kaiser criterion, components with eigenvalues above 1.0 should be retained as PCs for further analysis [68]. The results (Tab. 2) showed that 3 components met this condition. The extracted PCs explained 48.13% of variance. It has been suggested that a high proportion of total variance means a powerful PC structure; however, proportions between 40%–60% are accepted to be high enough in studies conducted in social sciences, such as studies on attitudes [70]. In addition, by analyzing a scree plot, it was found that a curve began to flatten after the third component, which confirmed that 3 PCs should be retained for varimax rotation (Fig. 1).

Table 2. PCs and their eigenvalues

PCs	Eigenvalues	% of explained variance	Cumulative eigenvalues	Cumulative % of explained variance
1	6.461	24.85	6.461	24.85
2	4.502	17.31	10.964	42.16
3	1.554	5.97	12.519	48.13

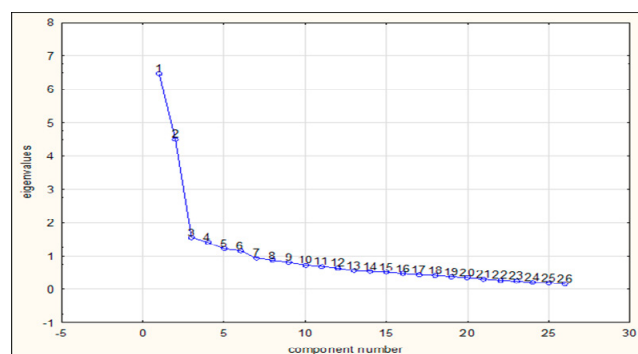


Figure 1. Scree plot allowing searching for the optimal number of PCs

In order to establish PC structure, varimax rotation was carried out. Following information presented in the paper written by Boateng et al., statements with component loading values of 0.40 and higher, which were derived from varimax rotation, were considered stable [71]. The obtained results showed that none of the statements had component loading value lower than 0.40, and that there were no statements with cross-loadings, which means that there was no need to eliminate any statements from the scale (Tab. 3).

Interpretation of the loading values of the PCs showed that the first principal component (PC1) consisted of 12 statements (Items No. 1, 2, 3, 4, 5, 6, 10, 11, 15, 20, 22 and 23), which were

connected with positive aspects of ED consumption (i.e taste, stimulating effects of EDs, impact of EDs on concentration and learning, providing a source of vitamins) and willingness to drink EDs. These were mostly the statements with positive overtones, apart from the statement No. 6 concerning lack of scientific proof of positive effects of EDs. The second principal component (PC2) also included 12 statements (Items No. 7, 9, 13, 14, 16, 17, 18, 19, 21, 24, 25 and 26), but compared to the PC1, these were only the negative statements, and concerned health risks posed by ED consumption and also the prohibition of these products to minors. As the scale consisted of 26 statements, the third principal component (PC3) included 2 statements (Items No. 8 and 12). These statements might reflect perceiving EDs as trendy products, and as products that allow children and adolescents to feel like adults (Tab. 3).

The results of varimax rotation showed that in order to perform the next steps of statistical validation, the scale to identify attitudes towards EDs should have been divided into 3 subscales (PC1, PC2, PC3). However, the first subscale consisted mainly of the positive statements and the second subscale—only of the negative statements. As mentioned in the Introduction, the scale to identify attitudes should include

Table 3. Loading values of PCs after varimax rotation

Scale-building statements	PC1	PC2	PC3
1. EDs improve well-being	0.675		
2. EDs are tasty	0.552		
3. EDs improve concentration and make learning easier	0.599		
4. EDs stimulate	0.635		
5. EDs improve physical condition	0.608		
6. Positive effects of EDs are not proven by scientists	0.519		
7. Persons with a low level of physical activity should not drink EDs		0.583	
8. Drinking EDs is trendy			0.614
9. Parents should prohibit children and adolescents from drinking EDs		0.736	
10. I can drink EDs	0.744		
11. For me, there is nothing wrong in EDs	0.815		
12. Drinking EDs allows children and adolescents to feel like adults			0.578
13. EDs should be allowed only to adults		0.693	
14. EDs should not be sold to children and adolescents		0.700	
15. EDs can provide a source of vitamins	0.546		
16. EDs are high-calorie drinks		0.460	
17. EDs contain too much sugar		0.478	
18. EDs can be addictive		0.701	
19. Drinking EDs poses health risks		0.733	
20. Negative opinion on EDs is exaggerated	0.668		
21. EDs are redundant and unnecessary	0.653		
22. Drinking EDs is safe	0.674		
23. I would like to try EDs, even if I do not know how I would feel afterwards	0.709		
24. EDs can be overdosed		0.562	
25. EDs are carcinogenic		0.562	
26. There are too many types of EDs available in stores		0.602	

a similar number of positive and negative statements. Apart from that, the third subscale contained only 2 items and such a small number of statements is definitely insufficient to identify attitudes. Therefore, it would be impossible to use these subscales as independent research instruments in the identification of attitudes towards some of the aspects of ED consumption. In connection with the above, we decided to test scale reliability based on the whole scale, without dividing it into subscales.

Cronbach's alpha coefficient was used to assess the reliability of the scale. In addition to the calculation of overall Cronbach's alpha statistics, the impact of Cronbach's alpha coefficient of individual statements on scale consistency was determined by assessing the potential improvement in the overall Cronbach's alpha value after removing a given item from the scale (Tab. 4).

Statistical computations allowed the rejection of 5 statements building the scale to identify attitudes towards EDs. Their removal was connected with Cronbach's alpha increase to at least 0.75. Although according to the literature, the value of this coefficient reaching 0.70 can be considered an acceptable level of reliability, 5 statements were removed from the scale to make sure the achieved results would indicate possibly the highest scale reliability [67, 72]. For

this reason, 3 negative statements: 'persons with a low level of physical activity should not drink EDs', 'EDs are high-calorie drinks' and 'EDs can be overdosed', as well as 2 positive statements: 'drinking EDs is trendy' and 'drinking EDs allows children and adolescents to feel like adults', were eliminated from the scale (Tab. 4). Ultimately, the scale to identify attitudes towards EDs contained 21 statements—11 positive and 10 negative (Tab. 5). After removal of these statements, Cronbach's alpha of the scale increased from the initial value of 0.741 to 0.856. Apart from calculating Cronbach's alpha of the scale based on the results of the pilot study, Cronbach's alpha of the scale using results of the main study was also calculated. The results showed that its value reached 0.866. Therefore, it can be concluded that reliability of the scale to identify attitudes towards EDs in the main study was high.

DISCUSSION

As part of the present study, a research instrument was developed in the form of a scale to identify adolescents' attitudes towards EDs. The scale was validated and examined in terms of reliability to confirm that it was valid, reliable

Table 4. Assessment of reliability of the scale to identify attitudes towards EDs

Scale-building statements	Mean value of the scale after statement removal	Standard deviation of the scale after statement removal	Correlation between the removed statement and sum of the remaining statements	Cronbach's alpha of the scale after statement removal
1. EDs improve well-being	70.347	11.252	0.452	0.727
2. EDs are tasty	69.537	11.205	0.425	0.728
3. EDs improve concentration and make learning easier	70.421	11.300	0.397	0.731
4. EDs stimulate	69.661	11.545	0.170	0.745
5. EDs improve physical condition	70.727	11.368	0.371	0.733
6. Positive effects of EDs are not proven by scientists	70.768	11.483	0.294	0.737
*7. Persons with a low level of physical activity should not drink EDs	70.165	11.508	0.192	0.754
*8. Drinking EDs is trendy	70.603	11.909	-0.117	0.761
9. Parents should prohibit children and adolescents from drinking EDs	69.925	11.316	0.370	0.732
10. I can drink EDs	69.429	11.356	0.299	0.737
11. For me, there is nothing wrong in EDs	69.644	11.317	0.360	0.733
*12. Drinking EDs allows children and adolescents to feel like adults	70.677	12.011	-0.200	0.766
13. EDs should be allowed only to adults	69.570	11.149	0.507	0.723
14. EDs should not be sold to children and adolescents	69.586	11.307	0.396	0.731
15. EDs can provide a source of vitamins	70.388	11.310	0.368	0.732
*16. EDs are high-calorie drinks	70.380	11.799	-0.026	0.756
17. EDs contain too much sugar	70.355	11.518	0.150	0.748
18. EDs can be addictive	70.793	11.415	0.264	0.739
19. Drinking EDs poses health risks	70.611	11.352	0.347	0.734
20. Negative opinion on EDs is exaggerated	70.099	11.408	0.318	0.736
21. EDs are redundant and unnecessary	69.842	11.324	0.401	0.731
22. Drinking EDs is safe	70.338	11.353	0.397	0.731
23. I would like to try EDs, even if I do not know how I would feel afterwards	70.446	11.264	0.407	0.730
*24. EDs can be overdosed	70.537	11.603	0.105	0.750
25. EDs are carcinogenic	70.016	11.473	0.278	0.738
26. There are too many types of EDs available in stores	70.330	11.333	0.324	0.735

* statements removed from the scale

Table 5. Final version of the 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

and therefore allowed for achieving the intended goal—identifying adolescents' attitudes towards EDs. To the best of the authors' knowledge, the present study is the first which aimed to develop and validate a scale to identify attitudes towards EDs, and to examine this scale in terms of reliability.

The developed scale consisted of 28 statements. After performing content validation with the experts in attitude subject, the number of scale-building statements was reduced to 26, including one statement with a negative overtone and one statement with a positive overtone. These statements concerned EDs, but were connected with specific behaviour related to ED consumption—drinking alcohol mixed with EDs—and according to the opinions of the researchers who were experienced in conducting studies on attitudes towards food products, using such statements would be appropriate in identifying attitudes towards alcohol mixed with EDs. The literature review showed that other researchers also involved panels of experts at the beginning of validation procedure of new scales. Augustine et al. consulted 5 expert judges to perform content validation of a scale developed to identify adolescents' knowledge on micronutrients. Based on the opinions of a panel of experts, the authors accepted, modified or rejected statements building the scale [73]. Similar procedure of content validation was performed by Byrne et al. while developing a scale to measure students' attitudes towards learning professional skills [74], and by Akan while validating a scale allowing assessment of the level of COVID-19 psychological impact on adults during or after the pandemic [75].

The next step of validation, which was response process validation, showed that the adolescents had no difficulties in understanding the meanings of the statements of the

scale to identify attitudes towards EDs. This procedure was not connected with the necessity to provide any changes in the statements building the scale, but without performing response process validation, it could not be certain whether the statements were clear to the adolescents. In the case of misunderstanding the meanings of some of the statements, the adolescents could give inappropriate responses. Of course, even after performing response process validation, there was still a risk of misunderstanding the statements by some of the adolescents participating in the pilot and main studies; however, response process validation reduced this risk. Therefore, this step of validation should not be skipped during validation procedure of new research instruments.

According to the results on PC structure, the scale to identify attitudes towards EDs should have been divided into 3 independent subscales allowing the identification of attitudes towards specific aspects of ED consumption. Unfortunately, the analysis of the nature of the statements demonstrated that the first subscale would consist mainly of the positive statements and the second subscale—only of the negative statements. Using such subscales to identify attitudes towards EDs would not be reasonable due to the fact that the scale to identify attitudes should contain positive and negative statements, and the number of these statements should be similar. By comparing structures of different scales developed to identify attitudes towards food products, it was found that some of these scales consisted of a few subscales. An example in this case could be a Polish version of a scale to assess attitudes towards chocolate (Attitudes to Chocolate Questionnaire), consisting of 3 subscales: a sense of guilt, emotional eating and desire for chocolate [76]. Another scale to identify attitudes—Health and Taste Attitude Scale—was divided into 6 subscales measuring attitudes towards different aspects of food and nutrition. It is worth mentioning that in contrast to the subscales extracted in the current study, each of these 6 subscales contained the same number of negative and positive statements [77].

The last step of the procedure of scale development, validation and reliability testing, was calculating Cronbach's alpha, which resulted in eliminating 5 statements from the scale (2 positive statements and 3 negative). The research instrument developed and validated in this way can be considered balanced in terms of the nature of statements. Cronbach's alpha value, after removing these 5 items, indicated high reliability of the scale to identify attitudes towards EDs. It should be noted that Cronbach's alpha value of the scale, which was calculated using the results obtained in the main study, also indicated high reliability of this scale. Thus, it may be concluded that the scale to identify attitudes towards EDs was valid and characterized by good internal consistency.

Unfortunately, as mentioned previously, it was not possible to discuss the results of the present study with the findings from the other studies, because the authors of the research papers signaling identification of attitudes towards EDs, in fact, failed to achieve the intended goal. None of those studies was aimed at developing and validating a scale to identify attitudes towards EDs, and to test its reliability. Thus, there were no data to compare the procedure of scale development, validation and reliability testing used in our study to the procedures performed by the other researchers assessing specific aspects of ED consumption in adolescents.

CONCLUSIONS

The scale, which was developed, validated and examined in this study in terms of reliability, has good psychometric properties. Therefore, it can be used to conduct studies on identification of attitudes towards EDs in adolescent populations. Understanding attitudes towards EDs may be beneficial in creating nutrition education programmes aimed at decreasing ED consumption in adolescents. The use of such an instrument also has the potential to advance research in the health and social sciences.

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