**Title:** Attitudes Towards Functional Foods Scale: Psychometric proprieties and adaptation for use among adolescents

**Título:** Escala de Atitudes face a Alimentos Funcionais: Propriedades psicométricas e adaptação para uso em adolescentes

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**Short Title:** Attitudes Towards Functional Foods Scale

**Conflicts of interest**

The authors declare that there are no conflicts of interest.

**Protection of humans and animals**

The authors declare that the procedures were followed according to the Helsinki Declaration of the World Medical Association.

**Data confidentiality**

The authors declare having followed the protocols in use at their working center regarding patients’ data publication.

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**Resumo**

**Introdução:** Os alimentos funcionais são aqueles que promovem a saúde e o bem-estar e/ ou reduzem o risco de determinadas doenças crónicas. Sabe-se que o conhecimento dos jovens sobre alimentos funcionais é baixo. Este estudo visa estudar as propriedades psicométricas da “Escala de Atitudes face a Alimentos Funcionais” (EAAF) numa amostra de adolescentes e, com base nesse estudo, proceder à sua adaptação para aplicação neste grupo populacional.

**Material e métodos:** Após um pré-teste, a escala foi aplicada a 340 alunos do 3.º ciclo do ensino básico na Ilha Terceira, Açores, com idades entre os 11 e os 19 anos (média = 14,0; desvio-padrão = 1,2). Foi analisada a consistência interna e a validade de constructo.

**Resultados:** O estudo das propriedades psicométricas levou à exclusão de um item. O alfa de Cronbach (α = 0,876) mostrou uma boa consistência interna da escala e a análise fatorial revelou que, tal como a versão original (adultos), a versão para adolescentes (EAAFa) apresenta uma estrutura unifatorial.

**Conclusão:** Este estudo mostra a adequação do uso da Escala de Atitudes face a Alimentos Funcionais para avaliar a perceção de alimentos funcionais em adolescentes, salientando-se a necessidade de utilização da versão adaptada (EAAFa).

**Palavras-chave:** Alimentos Funcionais; Escala; Perceção; Atitudes; Adolescentes.

**Abstract**

**Introduction:** Functional foods are those that promote health and well-being and/or decrease the risk of certain chronic diseases. It is known that youth's knowledge about functional foods is low. This study was aimed at studying the psychometric proprieties of the “Attitudes towards Functional Foods Scale” (AFFS) in a sample of adolescents and, on the basis of that analysis, adapting the scale for its use among this population group.

**Material and Methods:** After a pre-test, the scale was applied to 340 students attending the 3rd cycle of basic education on Terceira Island, Azores, whose ages range between 11 and 19 years (mean = 14.0, SD = 1.2). We analyzed the scale’s internal consistency and construct validity.

**Results:** The study of the psychometric proprieties led to the exclusion of one item. Cronbach's alpha (α = 0.876) showed good internal consistency of the scale, and factor analysis revealed that, like the original (adults) version, the scale presents a unifactorial structure.

**Conclusion:** This study has demonstrated the adequacy of the Attitudes Towards Functional Foods Scale to assess Portuguese adolescents’ perception regarding functional foods, highlighting the need of using its adapted version (AFFSa).

**Keywords:** Functional foods; Scale; Perception; Attitudes; Adolescents

# INTRODUCTION

Functional foods are those that have beneficial physiological effects on health beyond basic nutritional functions, by improving health and well-being and/or by reducing the risk of chronic diseases. Their functional compounds must remain in the food and demonstrate their effects in amounts consumed in a normal diet and should be consumed regularly as part of a healthy diet.1

According to the European Commission,2 functional foods include: natural food that has not been changed (*e.g.* fatty fish with a high portion of polyunsaturated fatty acids omega-3); food in which one or more components have been increased, decreased, added or removed (*e.g.* fruit juice with an increased portion of antioxidants; margarine with added phytosterols; yogurt with reduced fat content); food in which bioavailability of a component has been modified (*e.g.* rice that has been genetically modified to increase the bioavailability of iron); or a combination of these.

Functional foods – some of which are specifically directed to youth – have been developed with increasing frequency. For instance, foods that supply the needs of children and adolescents with nutritional deficiencies were among the top ten food trends in 2016.3 Accordingly, the functional foods market has an enormous potential. However, despite being extremely favorable to the consumers’ interests, this fact raises a challenging and complex set of issues for nutritionists, not only due to the various definitions of functional foods, but also because of the difficulty in clearly distinguishing between "healthy" and "functional" foods. In addition, it is known that consumers’ perception is heavily influenced by marketing, which is able to increase demand for this type of food, even without scientific evidence on its benefits.4, 5

Parents are a primary authority over the eating habits of their offspring,6 and youth learn about consumption by observing and imitating their parents' behaviors.7 It is also known that parents' knowledge about food and nutrition influences youth's eating behavior throughout life.8

Several studies have reported low levels of knowledge about functional foods among consumers9-11, even young ones.12, 13 Individuals with greater knowledge were found to have more positive attitudes towards such products.9

The intention to consume functional foods is also strongly influenced by other consumer-related factors: attitudes, lifestyle, socio-demographic characteristics (such as sex, age or level of education). In addition, it is influenced by factors related to the food itself: taste, quality, price, convenience, and its effect on health. 14-16

Other important factors that positively influence the intention to consume functional foods are the attractiveness of claims for health benefits17 and the perception of benefits arising from their consumption.18, 19 It is also worth noting that, according to Goetzke et al.,20 cognitive-emotional well-being is more related to the consumption of functional foods than to the consumption of other kinds of food, and a lower psychological and emotional well-being increases the likelihood that functional foods will be consumed.

According to Markovina et al.,12 the attitudes of young consumers regarding functional foods are mostly affected by health awareness, confidence, and price. Furthermore, the same study showed that the most relevant determinants for buying functional foods among young consumers are the taste and the quality/price ratio.

Considering all these issues, nutritionists play an important role in educating consumers, so that they increase their food literacy, including their knowledge of marketing strategies related to functional foods, and thus become more conscious and informed when they choose these products.

Despite the relevance of assessing attitudes towards functional foods among young consumers, to our knowledge, instruments for performing such assessment are not available in the Portuguese language yet. Therefore, the main aim of this study was to analyze the psychometric proprieties of “Attitudes towards Functional Foods Scale” (AFFS) in a sample of adolescents. Based on the results of this analysis we also adapted the scale for its use among this population group.

**MATERIAL AND METHODS***Instrument*

The AFFS is a tool for assessing the perception and attitudes towards functional foods. It was previously developed and validated for the adult Portuguese population. 21 This scale was based on the one developed by Urala and Lähteenmäki (2007),19 which aimed to assess attitudes towards functional foods among the Finnish population. The AFFS comprises 17 items, mostly selected and adapted from the Urala and Lähteenmäki’s scale. Such selection and adaptation were necessary not only for cultural reasons but also because the language needed to be simplified in order to enhance the understanding of the items, considering that previous studies11, 13, 22 reported low levels of knowledge about functional foods among the Portuguese population.

At the beginning of the scale, a brief definition of functional foods was provided ("foods that improve health and well-being and/or reduce the risk of certain diseases"), in order to ensure that the concept was as clear as possible for all the participants. The items consist of statements related to: benefits of consuming functional foods (items 1, 3, 4, 9 and 14), reasons why they should be consumed (items 2, 5, 7 and 11), confidence (items 6, 16 and 17), and safety (items 8, 10, 13 and 15).

Prior to the main study, a pre-test was carried out, in which the scale was applied to a convenience sample of 10 adolescents attending the 3rd cycle of basic education. This pre-test was intended to ensure that the participants understood the items and instructions. Based on its results, some items were reformulated, in order to facilitate their understanding. Despite these changes, we will continue to refer to this scale as AFFS, in order to make the text easier to read.

The initial version of AFFS included 17 items (whose order of presentation was randomized), answered in a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). An additional response option ("I don’t know / I don’t want to answer") was included. The value assigned to this option was 3 (the scale’s midpoint). Items 2, 4, 5, 6, 7, 8, 11, 14, 15 and 16 were quoted reversely. The total score, obtained by adding the scores of all items, ranges from 0 to 85. For each item and total score, higher values correspond to more positive perceptions and attitudes towards functional foods.

*Sample and procedures*

All the seven basic education schools of Terceira island, Autonomous Region of the Azores, were invited to participate, and only two did not communicate authorization for the study. We selected a non-probabilistic sample of three classes per grade within the 3rd cycle of basic education of the participant schools.

The study was approved by the governing bodies of the five schools that agreed to participate, and written informed consent was provided by the parents of all the participants. The Informed Consent Form addressed to the parents included information on the nature of the study, on conditions of participation (namely data confidentiality), and on how to contact a member of the research team, if needed.

The questionnaires, of direct answer, were filled in a classroom setting by those students who accepted to participate and whose parents had consented to their participation. The distribution of consent forms and all data collection took place between March and June 2015. The project was carried out in accordance with all ethical requirements stated by the Helsinki Declaration and by applicable legislation.

**Statistical analysis**

After data collection, statistical treatment was performed with IBM SPSS Statistics, version 23.0 for Windows.

Mann-Whitney test was used to compare the responses to each item between sexes. Given the absence of significant differences, the entire analysis was performed for the entire sample (*i.e.*, not split by sex). The internal consistency of the scale was measured by using Cronbach's alpha coefficient. The scale was submitted to factor analysis by principal component extraction method (without rotation). The factor analysis models were validated using the Kaiser-Meyer-Olkin (KMO) sampling adequacy measure and Bartlett’s test. The scree plot method23 was used to determine the number of components to be retained. Pearson’s correlation coefficient (r) was calculated to measure the degree of association between pairs of variables. The null hypothesis was rejected when the level of critical significance for its rejection (p) was below 0.05.

**RESULTS**

A total of 432 adolescents were invited to participate in the study, 66 (15.3%) of which were not included due to lack of parental consent or to their own refusal. Twenty-six (7.1%) of the remaining 366 participants were also excluded, due to incompleteness of the questionnaire.

Thus, we analyzed data from 340 students. Of these, 57.4% (n = 195) were females and 42.6% (n = 145) were males. The participants’ ages ranged between 11 and 19 years (mean = 14.0, SD = 1.2). Most students were attending the 9th grade (40.0%), 30.6% the 8th grade and 29.4% the 7th grade.

**Reliability and factor analysis**

Table 1 shows the results of the reliability analysis. Since item 13 presented an item-total correlation below 0.2 we opted to exclude it, which reduced the scale to 16 items.24 This 16-item version, which also includes the reformulation of items based on the pre-test, was considered a new version of the scale “Attitudes towards Functional Foods Scale – version for adolescents” (AFFSa). The Cronbach's alpha (α = 0.876) reveals that the scale has a good internal consistency.

Table 2 presents the factor analysis results. Both the KMO and Bartlett’s test indicate a good adequacy of the model. Despite the fact that the factor analysis generated three components with eigenvalues higher than 1, the scree plot analysis25 suggested a unifactorial solution, with the latent factor explaining 36.0% of the total variance.

**DISCUSSION**

AFFSa showed to be an instrument of easy and quick application among the youth population, just like the original version (for adults).21 The total time of application of the questionnaire was about 5 minutes and during its application no questions were posed regarding the instructions or the items’ phrasing. It should be noted that the use of AFFSa should be preceded by a clarification on the concept of functional foods, since, as previously stated, knowledge about this subject among youth is low.13

The study of the psychometric properties of AFFSa led to the exclusion of one item from the version for adults.21 Despite this adaptation, both versions of the scale present a unifactorial structure,21 unlike the scale developed by Urala and Lähteenmäki19, for which the Finnish authors proposed a tetrafactorial structure.

AFFSa presented a good internal consistency, and exploratory factor analysis showed a good correlation between items. The extraction of factors from the scree plot showed that there was only one latent factor, which explains 36.0% of the total variance. This value is similar to the one found for the adults’ scale (30.4%)21. In the Urala and Lähteenmäki’s scale19, the four factors explained a somewhat higher variance (44.0%), but this proportion was highly distributed by the four factors (from 14.0% for the 1st factor to 9.0% for the 4th).

For future research, it would be important to carry out studies able to generate normative data, taking into account socio-demographic characteristics. Such data might add value to results obtained by the application of the AFFSa, thus improving and widening its potential use in the development of policies and strategies related to the consumption of functional foods among adolescents.

**CONCLUSION**

AFFSa showed adequate properties for the assessment of adolescents’ perception and attitudes towards functional foods. This instrument can be used, for example, to assess the results of both food marketing strategies and food education programs aimed at demystifying misbeliefs related to functional foods, thus promoting food literacy and more informed food choices.

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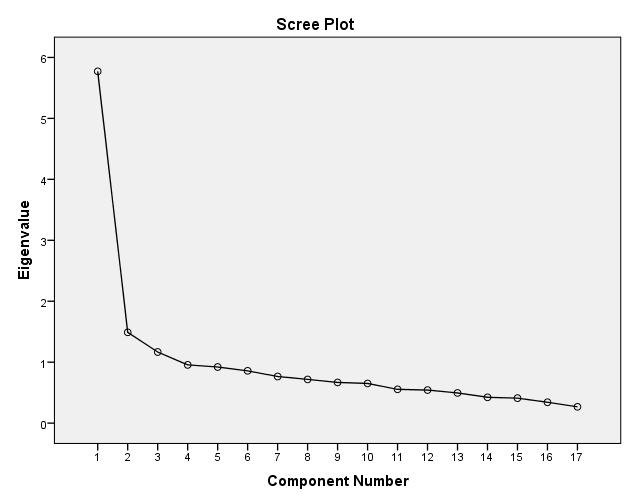
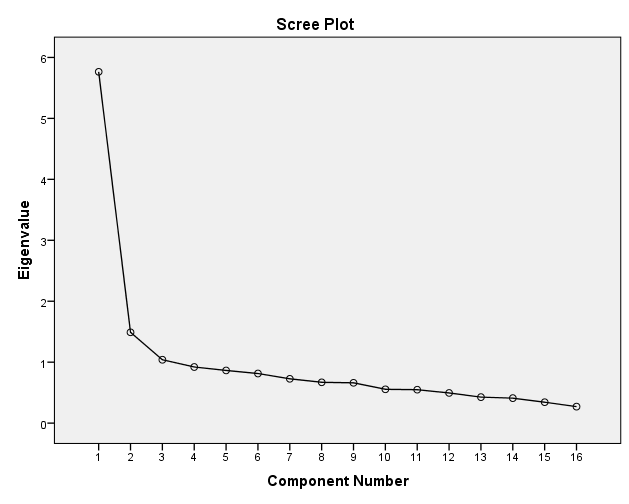
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**Figures and tables**

Table 1 – Reliability analysis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All items**  **(AFFS)** | | **Without item 13**  **(AFFSa)** | |
| **Statements** | **Corrected item-total correlation** | **α Cronbach if item is deleted** | **Corrected item-total correlation** | **α Cronbach if item is deleted** |
| **1.** Functional foods does not replace a healthy diet, but should be eaten as part of a varied diet. | 0.444 | 0.861 | 0.452 | 0.872 |
| **2.** Functional foods are useless for a healthy person. | 0.603 | 0.854 | 0.612 | 0.865 |
| 3. Functional foods can repair the damage caused by an unhealthy diet. | 0.420 | 0.862 | 0.420 | 0.873 |
| **4.** Functional foods have a pleasant taste. | 0.499 | 0.859 | 0.503 | 0.870 |
| 5. Functional foods are unnecessary. | 0.646 | 0.852 | 0.657 | 0.863 |
| **6.** The notices that refer benefits of functional foods are false. | 0.548 | 0.857 | 0.549 | 0.868 |
| **7.** Functional foods are only for the elderly, sick and kids. | 0.611 | 0.854 | 0.617 | 0.865 |
| **8.** Functional foods can have undesirable effects. | 0.592 | 0.855 | 0.592 | 0.866 |
| **9.** Functional foods are able to improve my well-being. | 0.570 | 0.856 | 0.577 | 0.867 |
| **10.** It’s safe to use functional foods. | 0.582 | 0.856 | 0.592 | 0.866 |
| **11.** Functional foods are a fad that will pass. | 0.601 | 0.854 | 0.606 | 0.865 |
| **12.** The safety of functional foods is well studied. | 0.439 | 0.861 | 0.428 | 0.873 |
| **13.** The excess functional foods are harmful. | 0.088 | 0.876 |  |  |
| **14.** Functional foods are more expensive. | 0.430 | 0.862 | 0.436 | 0.873 |
| **15.** The only functional foods are the ones whose labels claim health benefits. | 0.429 | 0.862 | 0.423 | 0.873 |
| **16.** I believe in the effect of functional foods a health professional (physician, nutritionist, etc.) you recommend the product. | 0.484 | 0.860 | 0.483 | 0.872 |
| **17.** Functional foods cause the health benefits mentioned in advertising. | 0.379 | 0.864 | 0.372 | 0.875 |
| **Cronbach alfa coefficient** | 0.866 | | 0.876 | |



(A) (B)

Figure 1 –*Scree plots* graphic: A – all itens (AFFS); B – without item13 (AFFSa).

Table 2 – Principal component analysis.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **All items**  **(AFFS)** | | | **Without item 13**  **(AFFSa)** | | |
| ***Kaiser-Meyer-Olkin*** | | 0.894 | | | 0.896 | | |
| ***Bartlett (p)*** | | < 0.001 | | | < 0.001 | | |
| **Component** | | **C1** | **C2** | **C3** | **C1** | **C2** | **C3** | |
| **Eigenvalue** | | 5.772 | 1.490 | 1.167 | 5.764 | 1.490 | 1.040 | |
| **Variance (%)** | | 33.953 | 8.763 | 6.865 | 36.027 | 9.310 | 6.500 | |
| **Statements** | |  |  |  |  |  |  | |
| **Correlation with the principal component** | **1.** Functional foods does not replace a healthy die, but should be eaten as part of a varied diet. | 0.522 | 0.403 | -0.178 | 0.523 | 0.401 | -0.204 | |
| **2.** Functional foods are useless for a healthy person. | 0.693 | 0.075 | -0.247 | 0.693 | 0.072 | -0.304 | |
| 3. Functional foods can repair the damage caused by an unhealthy diet. | 0.491 | 0.386 | -0.011 | 0.491 | 0.387 | -0.079 | |
| **4.** Functional foods have a pleasant taste. | 0.579 | -0.256 | 0.012 | 0.579 | -0.256 | 0.035 | |
| 5. Functional foods are unnecessary. | 0.733 | -0.110 | -0.297 | 0.735 | -0.114 | -0.410 | |
| **6.** The notices that refer benefits of functional foods are false. | 0.626 | -0.244 | -0.031 | 0.625 | -0.244 | -0.110 | |
| **7.** Functional foods are only for the elderly sick and kids. | 0.698 | -0.160 | -0.215 | 0.698 | -0.162 | -0.320 | |
| **8.** Functional foods can have undesirable effects. | 0.667 | -0.386 | 0.054 | 0.666 | -0.385 | 0.074 | |
| **9.** Functional foods are able to improve my well-being. | 0.651 | 0.472 | -0.064 | 0.652 | 0.470 | 0.001 | |
| **10.** It’s safe to use functional foods. | 0.665 | 0.403 | 0.015 | 0.666 | 0.402 | 0.201 | |
| **11.** Functional foods are a fad that will pass. | 0.682 | -0.220 | 0.077 | 0.682 | -0.220 | 0.211 | |
| **12.** The safety of functional foods is well studied. | 0.499 | 0.240 | 0.467 | 0.497 | 0.246 | 0.559 | |
| **13.** The excess functional foods are harmful. | 0.096 | -0.025 | 0.751 |  |  |  | |
| **14.** Functional foods are more expensive. | 0.507 | -0.368 | 0.055 | 0.508 | -0.369 | 0.279 | |
| **15.** The only functional foods are the ones whose labels claim health benefits. | 0.482 | -0.303 | 0.262 | 0.481 | -0.300 | 0.315 | |
| **16.** I believe in the effect of functional foods a health professional (physician, nutritionist, etc.) you recommend the product. | 0.557 | -0.121 | 0.028 | 0.557 | -0.120 | -0.082 | |
| **17.** Functional foods cause the health benefits mentioned in advertising. | 0.439 | 0.356 | 0.268 | 0.437 | 0.359 | 0.173 | |