Behaviors scale towards sustainable nutrition: development and validity-reliability analysis

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Abstract

Purpose – The evaluation of sustainable eating behaviors of individuals who constitute the society is important in the interpretation of both health-related and environmental effects. Therefore, this study aims to develop a valid and reliable scale to assess the sustainable food consumption behaviors of adults living in Turkey.

Design/methodology/approach – The validity of the scale was evaluated by using the factor analysis, correlation analysis and comparison of the lower and upper 27% groups with the *t*-test technique. Cronbach's alpha (CA), split-half, parallel and strict criteria were used to determine the internal consistency of the scale, and the Pearson correlation analysis was conducted for the test and retest. The explanatory factor analysis and confirmatory factor analysis were applied to test construct validity.

Findings – The total variance rate explained by all the factors was 77.03%. CA value of the scale was 0.92, and the test–retest reliability coefficient was 0.96. The difference between the lower and upper 27% group means was significant at the $p < 0.05$ level. The factor structure of the scale was confirmed by the results of the confirmatory factor analysis.

Originality/value – There are scales in the international literature that have been validated to evaluate various aspects of behaviors related to sustainable food consumption (Tobler *et al.*, 2011; Verain *et al.*, 2015). However, to the best of the authors' knowledge, there are no validity and reliability studies of a scale developed in Turkey on sustainable food consumption of adults.

Keywords Sustainability, Nutrition, Scale development, Sustainable food consumption, Sustainable diet

Paper type Research paper

Introduction

Agriculture and food production systems have direct effects on the environment (Lynch *et al.*, 2018). Problems such as global climate change, loss of biodiversity and transformation of agricultural lands pose serious food security and safety risks (World Health Organization, 2018). Climate change also causes an increase in the prices of existing foods; thus,

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inequalities arise in access to food at the societal level, with the number of people who are able to follow a sufficient and balanced diet gradually decreasing (Costello and Osborne, 2005). In this context, in addition to a healthy, sufficient and reliable diet, sustainable food production and consumption are required to maintain the health of individuals and the planet (Rossati, 2017). According to the proposed definition of Food and Agriculture Organization (FAO), sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically viable and affordable and nutritionally adequate, safe and healthy, and they use natural and human resources in the best way [Food and Agriculture Organization (FAO), 2012]. Sustainable food consumption not only aims to achieve a transition to eating habits that have less detrimental impacts on the environment but also means a reduction in overconsumption and food waste and loss [Food and Agriculture Organization (FAO), 2012]. In 2008, the United Nations called on governments to reduce the amount of food waste by at least 50% by 2025 (Songur and Cakiroglu, 2016). Furthermore, a sustainable diet policy statement published by the British Dietetic Association (BDA) has highlighted that the profession should lead the debate on how dietary behaviours can affect both health and the environment [British Dietetic Association (BDA), 2017]. Many dietitians and nutritionists in the UK advocate for sustainability in a variety of sectors, such as working with local food partnerships, a movement led by the "The Sustainable Food Places Network". This BDA policy is accompanied by a practical "toolkit" to support them to advise on sustainable eating in their everyday practice. One Blue Dot® is a live toolkit created following the BDA Sustainable Diets Policy document published in November 2017 [British Dietetic Association (BDA), 2018].

To meet the needs of future generations and reduce the environmental effects of diets, it is necessary to adopt sustainable food consumption practices and make a transition into new diet models. In this context, social behaviors studies are important, especially in terms of ensuring that individuals recognize their behaviors that are inadequate to support sustainability and improve such behaviors. This study was conducted to evaluate the behaviors of individuals by addressing the basic issues of sustainable nutrition. Therefore, it is necessary to determine the level of knowledge of individuals who constitute the society concerning the principles of sustainable nutrition. There are scales in the international literature that have been validated to evaluate various aspects of attitudes related to sustainable food consumption (Tobler *et al.*, 2011; Verain *et al.*, 2015). The questions in the scales are based on choices made in general dietary behaviour, food purchasing, preparation and disposal in line with sustainable living principles (Fischer *et al.*, 2017). However, most previous scales have focused on measuring the level of consumer awareness, ignoring the behavioral aspect (Balderjahn *et al.*, 2013; Sudbury-Riley and Kohlbacher, 2016). There is an ongoing debate that although consumers are conscious about a particular issue and have a positive attitude towards a particular product or service, they may not actually make it a habit (Quoquab *et al.*, 2019). Therefore, this study attempts to focus on the behavioral aspect of sustainable nutrition. However, to the best of our knowledge, there are no validity and reliability studies of a scale developed in Turkey on sustainable food consumption of adults. In light of this information, the aim of the current study was to develop the behaviors scale towards sustainable nutrition and conduct the validity–reliability studies of this measurement tool.

Materials and methods

This study was designed as non-experimental quantitative research. The study was prepared according to the ethical standards of the Declaration of Helsinki and approved by

the ethics committee of the local university (No: E-20021704–604.01.02–9444). In the study, the survey model (field survey) was used to collect data from the sample. As the sampling method, random sampling, one of the selective sampling techniques, was used. A standard e-survey was created by using Google Forms. To develop the scale, a review of the literature was undertaken and 35 behaviors were determined. Five-point Likert-type options from "never" to "always" were created for participants to mark the option that best described their behavior.

Study population and sample

The population of the study consisted of individuals aged 18–65 years living in Turkey. According to the Turkish Statistical Institute 2020 Population Statistics, the population of Istanbul is 15,462,452. The sample consisted of 457 individuals who voluntarily participated in the study. The required number of individuals to be selected from a particular population for the sample was determined as 384 with a sampling error of 0.05 for $p = 0.50$ and $q = 0.50$, according to table developed by Yazicioglu and Erdogan (2004). Therefore, the sample size of the study was considered to be sufficient. The random sampling method was used in the research. The scale was administered to the participants between March 1, 2021 and April 30, 2021. The sample of the study consisted of 457 participants who accepted the informed consent form via the online platform. Random sampling method was used as the sampling method. In addition to the scale questions, questions about gender, age, marital status, education level and income were asked to the individuals. Individuals under the age of 18, participants who had to follow a special diet (celiac, lactose intolerance, vegetarian, etc.) that might affect their food choice were not included. In addition, the social and academic studies of individuals in the field of sustainability were questioned. According to the information obtained from the survey answers, people working on sustainability, academicians working in this field and nutritionists were not included in our study.

Scale development stages

The validity–reliability studies of the scale were carried out in stages that were determined by considering the suggestions of Hambleton and Patsula (1999) and Hambleton *et al.* (2005) in relation to scale development steps (Figure 1).

The content validity ratio (CVR) of the items was calculated using the following equation:

$$\mathrm{CVR} = (\mathrm{N_E}/\mathrm{N}/2) - 1$$

where $\mathrm{N_E}$ is the number of experts considering that an item was "essential" and N refers to the total number of experts providing opinions.

In the first evaluation, 6 of the 35 items of the scale were reconsidered, as their CVR was low, and according to expert opinions, 6 items were removed, reducing the scale to 29 items. According to the results of the analysis, the lowest CVR value was found to be 0.80. The content validity index (CVI) of the scale was calculated as 0.986. According to the CVR equation, CVR would be 0 if half the experts provided their opinion as "relevant" about an item in the scale, >0 if more than half the experts provided their opinion as "relevant", and <0 if less than half the experts provided their opinion as "relevant". If CVR is 0 or negative (less than 0), the item with such a value is considered not to have content validity. In the current study, CVR was >0 was for each item, and therefore the content validity of all the items was ensured; thus, no item was removed from the scale (Comrey, 1988).

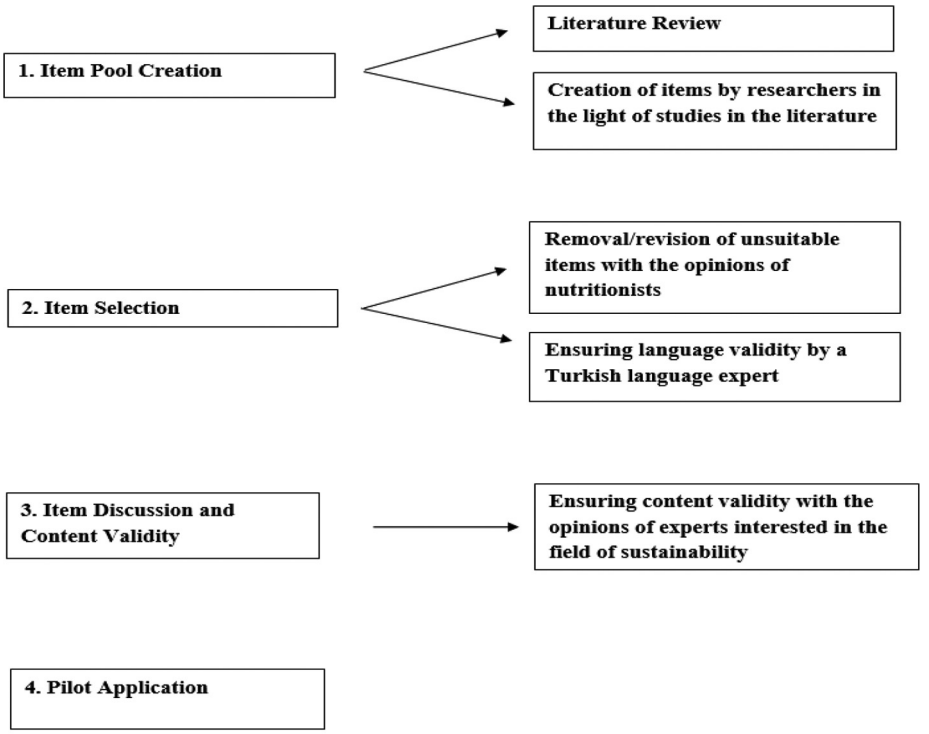

Figure 1.
Stages of development of the behaviors scale towards sustainable nutrition

Notes: Validity-reliability stages of the scale: Item Pool Creation; Selection of Items; Discussion on Items and Content Validity; Pilot Application. The scale development stages suggested by Hambleton and Patsula (1999) and Hambleton, Meranda and Spielberger (2005) were taken into consideration in the creation of these stages
Source: Authors own creation

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) version 25.0 and IBM_SPSS AMOS version 25.0 were used for statistical analysis. The level of significance was taken as $\alpha = 0.05$. According to the results of the pilot study, Cronbach's alpha (CA)status was examined when items were deleted using the CA, split-half, parallel and strict reliability criteria. After deleting the items that were suitable to be removed from the scale, the scale was finalized and started to be implemented. For the incoming data, first, CVR and CVI were examined for the content validity analysis. As another step, the corrected item-total correlations were evaluated for item validity, and the CA values were also calculated by deleting each item. To determine item discrimination, the differences between the 27% lower and upper group scores were analyzed by using the independent-samples *t*-test. For the analysis of the internal consistency of the scale, the CA, split-half, parallel and strict criteria were evaluated. Then, the Pearson correlation analysis was performed for the test and retest. After these analyses for reliability, the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were applied for construct validity.

Results

In the study group, 31.1% of the participants were men and 68.9% were women. The mean age of the individuals was 34.41 ± 10.10 years. Concerning the educational level of the participants, a majority (65.2%) were university graduates. The descriptive data of the participants are given in Table 1.

The most commonly applied methods to test the reliability of a scale are the CA, split-half, parallel and strict criteria. If the value obtained as a result of the CA test is over 70%, this indicates that the scale is reliable (Table 2) (Brown, 2006).

The reliability of the overall scale was also examined by using the item-total correlation analysis and the item discrimination values of the 27% lower (n = 123) and upper (n = 123) groups. The t-test values for the item-total correlation of each item and the differences between the 27% lower-upper group scores are presented in Table 3.

	n (%)*
Gender	
Male	142 (31.1)
Female	315 (68.9)
Age	
18–25 years	92 (20.1)
26–36 years	196 (42.9)
37–47 years	113 (24.7)
47 years and over	56 (12.3)
Marital status	
Married	218 (47.7)
Single	239 (52.3)
Educational level	
Primary school	2 (0.4)
Middle school	3 (0.7)
High school	29 (6.3)
University	298 (65.2)
Post-graduate	125 (27.4)
Monthly income status	
No income	49 (10.7)
Insufficient income	118 (25.8)
Sufficient income	290 (63.5)

Note: *Categorical variables are expressed as percentages
Source: Authors' own creation

Table 1. Percentage distribution of the descriptive characteristics among the participants (n = 457)

Criteria*	Value
Cronbach alpha	0.92
Split-half	0.92–0.94
Parallel	0.92
Strict	0.92

Note: *Cronbach's alpha, split-half, parallel and strict tests were used to evaluate the internal consistency reliability
Source: Authors' own creation

Table 2. Results of the reliability analysis of the scale

Item No	Corrected item-total correlations	*p*	Lower 27%–Upper 27% difference significance test (*t*-test)	*p*
I1	0.62*	0.00	5.25**	0.00
I2	0.67*	0.00	6.89**	0.01
I3	0.63*	0.01	6.44**	0.00
I4	0.68*	0.00	5.81**	0.02
I5	0.62*	0.01	6.84**	0.00
I6	0.62*	0.00	5.44**	0.02
I7	0.57*	0.00	6.10**	0.00
I8	0.61*	0.01	7.23**	0.00
I9	0.78*	0.00	8.22**	0.00
I10	0.61*	0.00	7.40**	0.00
I11	0.56*	0.02	6.48**	0.01
I12	0.55*	0.02	6.55**	0.01
I13	0.69*	0.01	5.21**	0.02
I14	0.62*	0.01	5.81**	0.02
I15	0.77*	0.00	7.82**	0.00
I16	0.67*	0.00	5.46**	0.02
I17	0.65*	0.01	8.25**	0.00
I18	0.64*	0.00	6.30**	0.01
I19	0.69*	0.00	7.11**	0.00
I20	0.63*	0.02	6.90**	0.00
I21	0.65*	0.02	5.83	0.02
I22	0.62*	0.02	6.88**	0.01
I23	0.52*	0.03	7.66**	0.00
I24	0.79*	0.00	6.48**	0.00
I25	0.61*	0.02	5.33**	0.02
I26	0.64*	0.01	5.29**	0.02
I27	0.76*	0.00	6.30**	0.00
I28	0.71*	0.00	6.80**	0.00
I29	0.78*	0.00	7.57**	0.00

Table 3.
Results of analyses on item-total correlation and 27% upper–lower group score differences

Notes: *t*-test values for item-total correlation are given. *significant correlation at the 0.05 level; **significant difference at the 0.05 level
Source: Authors' own creation

The item-total correlations of the scale varied between 0.528 and 0.799, and all the correlations were significant at the 0.05 level (Table 3). This shows that each item had a positive and moderate relationship with the overall scale and supports the thesis that the items were consistent with the scale. In addition, the calculated *t*-test values varied between 5.218 and 8.254, and all the *t-values* were significant at 0.05 level. Significant *t-values* indicate that all the items of the scale had discrimination power (Kirkwood and Sterne, 2003).

The factor load values of the items in the measurement tool being 0.45 or above is a good criterion for item selection and use; however, in practice, this limited value can be reduced to 0.30 in the presence of a small number of items. In the current study, the factor loads of the items varied between 0.534 and 0.803 (Table 4).

To measure the invariance of the scale over time, a test–retest application was applied at two-week intervals to 205 people randomly selected from the same sample. As a result of the correlation analysis between the total scores of the two tests, a highly positive and significant correlation was found at the level of $r = 0.960$ and $p < 0.001$. In this context, it was determined that the results of the scale did not change depending on time, and the scale had test–retest reliability.

Factor 1: Food preference (Independent of my health/eating habits)	Explained variance*: 24.3	CA*: 0.92
	Factor load	CA if item deleted
1 – I prefer foods that generate less greenhouse gases during their production	0.68	0.91
2 – I eat more plant-based foods and less animal-based foods due to their environmental effects	0.71	0.91
3 – I prefer foods that are produced in an environmentally friendly way	0.78	0.91
4 – I consume processed foods less since they are harmful to the environment	0.74	0.91
5 – I prefer to cook at home since it has a lower environmental impact	0.61	0.90
6 – As a protein source, I prefer to consume nuts and/or legumes since they have a low environmental impact	0.69	0.91
Factor 2: Food waste reduction	Explained variance: 20.8	CA: 0.91
	Factor load	CA if item deleted
7 – I reuse leftover food in different meals	0.75	0.91
8 – I don't throw away stale bread; I make something out of it	0.78	0.91
9 – I reduce my food waste to protect the environment	0.66	0.91
10 – I reduce my food waste knowing that food loss causes world hunger	0.64	0.91
11 – I try not to waste food knowing that waste increases food prices	0.80	0.90
12 – I separate my food and packaging waste to reduce my ecological footprint.	0.83	0.90
13 – I try to consume only as much as I need, thinking of future generations	0.81	0.90
14 – I do not throw away softened vegetables and fruit; I use them in meals	0.69	0.91
15 – I store unused food in the freezer for later use	0.70	0.91
Factor 3: Seasonal and local food consumption	Explained variance: 17.4	CA: 0.91
	Factor load	CA if item deleted
16 – I pay attention to consuming foods that grow in season to reduce greenhouse gas	0.80	0.91
17 – I prefer fish caught in season to preserve ecological diversity	0.76	0.91
18 – I prefer to consume traditional/local foods	0.61	0.90
19 – I try to eat organic foods to protect the environment	0.53	0.90
20 – I prefer not to consume foods transported from other countries to help prevent global warming	0.78	0.90
21 – I buy food from small-scale local shops and/or the market	0.74	0.90
22 – I prefer to buy local and economical foods instead of imported and expensive foods	0.71	0.90
23 – I prefer to eat foods that are suitable for my cultural habits	0.63	0.90
Factor 4: Food purchase	Explained variance: 14.3	CA: 0.91
	Factor load	CA if item deleted
24 – When purchasing food, I check the local and ecological markings on the labels	0.59	0.91
25 – I make a shopping list to avoid buying more than I need	0.71	0.90
26 – I pay attention to the expiry date of food products to reduce waste	0.65	0.90
27 – I shop knowing that my food choices affect global climate	0.58	0.90
28 – I carry my own water container to reduce plastic waste	0.78	0.90
29 – I use my own shopping bag to reduce plastic waste	0.71	0.90

Notes: *The EFA was applied for construct validity. CA, Cronbach's alpha
Source: Authors' own creation

Table 4.
Results of the exploratory factor analysis

At this stage of the study, the factors identified by EFA were subjected to CFA to evaluate their suitability for the factor structure determined based on the hypothesis. Measurement models aim to reveal how and to what extent a group of observable variables (as a measurement tool) explain latent variables called factors. In this study, a CFA model was constructed, and latent factors and interdependent effects between these factors were tested by using AMOS v. 23.0 software. The modification index was also examined to determine if the model needed any improvement. It was determined that the model was interpretable, with acceptable and good fit values for each criterion (Table 5).

Discussion

The concept of sustainable food consumption has been attracting growing attention as a result of the increase in the world population and threats of climate change. Food production and consumption are among the main drivers of environmental degradation. The scientific community frequently raises the issue that global food systems are not sustainable. In addition to production systems, consumer behaviors also play an important role in sustainable food consumption. Although public interest in sustainability is growing and consumer attitudes are mostly positive, behaviour patterns are not significantly consistent with attitudes. Sustainable consumption is based on a decision-making process that includes individuals' needs and wants as well as the social responsibility of the consumer. Daily consumption practices are still largely driven by convenience, habit, money, personal health concerns, hedonism and individual responses to social and institutional norms and, most importantly, are likely to be resistant to change. Therefore, although consumer interest in sustainable products is growing, sustainable food markets remain niche markets that attract consumers with a specific profile. In this context, identifying individuals' sustainable dietary behaviour is a first step towards addressing this gap (Vermeir and Verbeke, 2006).

Measure*	Good fit	Acceptable fit	Research model value	Fit status
General model fit				
χ^2/SD	3	4–5	2.0	Good
Comparative Fit Statistics				
NFI	0.95	0.94–0.90	0.93	Acceptable
TLI (NNFI)	0.95	0.94–0.90	0.93	Acceptable
IFI	0.95	0.94–0.90	0.98	Good
CFI	0.97	0.95	0.97	Good
RMSEA	0.05	0.06–0.08	0.02	Good
Absolute fit indices				
GFI	0.90	0.89–0.85	0.93	Good
AGFI	0.90	0.89–0.85	0.92	Good
Residual-based fit index				
RMR	0.05	0.06–0.08	0.03	Good

Table 5. Confirmatory factor analysis model fit indices

Notes: *The CFA was applied for construct validity. SD, standard deviation; NFI, normed fit index; TLI, Trucker–Lewis index; NNFI, non-normed fit index; IFI, incremental fit index; CFI, comparative fit index; RMSEA, root mean square error of approximation; GFI, goodness-of-fit index; AGFI, adjusted goodness-of-fit index; RMR, root mean square residual
Source: Authors' own creation

However, there is a serious gap in the literature concerning measurement tools in this area (Miller and Xie, 2020; Duane, 2020). As a result of our review of the literature, we did not find any scale developed to determine the sustainable eating habits of individuals. However, there are studies on the development of sustainable agriculture and health systems (Miller and Xie, 2020; Duane, 2020). This situation formed the motivation of the study.

As sustainable healthy food consumption is a complex and multidimensional concept (Zakowska-Biemans *et al.*, 2019), the developed scale was designed to have a multidimensional structure and included elements related to pro-ecology behavior, such as avoidance of food waste and consumption of local and seasonal foods, in addition to food preferences. The first factor of the developed scale, food preference, questioned whether consumers paid attention to their environmental effects while making their food choices. Although there is a growing interest in health and environmental sustainability issues among industrialized countries, research results show that the level of behaviors remains insufficient (Cavaliere *et al.*, 2014; Rejman *et al.*, 2019). According to the estimations of the environmental impact of products project, food and beverage consumption constitutes 20%–30% of the ecological footprint of individuals in European Union countries and other developed countries (Tukker and Jansen, 2006). Among all consumed food groups, meat and meat products have the most negative impact on the environment, followed by milk and dairy products (Tukker and Jansen, 2006). The results of a recent study conducted with Polish consumers indicated that they were not familiar with the concept of sustainability, and only 6% of the population surveyed stated that the environmental effects of sustainable consumption were linked to nutrition. The authors concluded that there was a need to disseminate information on sustainability issues for consumers to make more sustainable food choices and implement more effective food policy measures (Rejman *et al.*, 2019).

Food waste, an important indicator of sustainability, was the second factor of our scale. Cultivated land refers to the sum total of resources used to produce uneaten food, including agricultural chemicals, such as fertilizers and pesticides, and irrigation water (Conrad *et al.*, 2018). While food waste occurs at all points in the food supply chain, the majority (53%) of total food waste in Europe occurs at the household level. Consumer-related food waste is a complex issue affected by cultural, social, political, economic and geographical factors, as well as cognitive, motivational and structural factors, food-related behaviors and eating habits (Grasso *et al.*, 2019). Food waste reduces the sustainability of food systems, as more production is required to feed the same number of people, which results in wasting seeds, fertilizers irrigation water, labor, fossil fuel and other agricultural inputs (Food and Agriculture Organization of the United Nations, 2014). All stakeholders, especially policymakers, have responsibilities in cutting down food waste, including the development of advertising strategies, policies and education programs to help reduce food waste (Attiq *et al.*, 2021).

The third factor of our scale, seasonal and local food consumption, is considered an excellent way of connecting sustainability and health by using common benefits for both the planet and people (Zakowska-Biemans *et al.*, 2019). The intensification of agriculture, use of new technologies, extension of natural production and growing seasons and increased international trade have made it possible to supply fresh produce throughout the year. While this provides a more diverse diet in many countries, it also results in loss of species and crop diversity due to more energy and land use and increased use of monocultures in farming. The consumption of more seasonal and local foods, especially fruit and vegetables, is one of the recommended dietary changes to achieve a more sustainable diet. This has become a popular message advocated by nongovernmental organisations and promoted

through media campaigns and is accepted as part of sustainable food consumption guidelines (Macdiarmid, 2014).

The last factor included in our scale is food purchase, which addresses issues such as local and ecological labels and expiry date of products. Sustainability labelling information such as regional certificates and organic labels help consumers apply sustainable food consumption principles in their daily lives. Identifying environmentally sustainable products at the point of purchase allows consumers to make the right choice. This contributes to a better understanding of consumers' sustainability-related food choices and behaviors (Zakowska-Biemans *et al.*, 2019).

Our study has certain limitations. First, it was expected that the participants expressed their true views and thoughts when responding to the items and chose the options that described the actual situation without any reservation. It was also assumed that the real meanings of the statements included in the items were clearly understood during the completion of the scale. Errors that could be caused by misconceptions were not taken into consideration. Despite all these limitations, our study also has strengths. First, to the best of our knowledge, the developed scale is the first measurement tool developed in Turkey to evaluate sustainable eating behaviors. Second, it was determined that the scale had construct validity with an exploratory variance percentage of over 60%. Finally, the scale was found to be a reliable tool with a CA coefficient value of over 0.80.

Conclusion

It is important to transform consumers' interest in sustainable life and food consumption into relevant behavior. Overall, our study provides with a scale to assess the sustainable nutrition behaviors of individuals. Our scale will be a suitable tool for nutritionists, agricultural engineers, food R&D units and academicians who will work in this field. This measurement tool was developed based on a five-point Likert type and consists of a total of 29 items under four sub-scales. The validity and reliability analyses of the scale were undertaken and indicated adequate results. As the points of the individuals to whom the sustainable nutrition behaviors scale increases, it will help to determine that the sustainable nutrition behaviors of the individuals is also higher at this level. It is recommended to compare the results of this research with future studies to be conducted with larger samples and different sample groups.

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