Nutrition & Food Science

Assessing food label literacy: development and validation of a psychometric scale for adults

Güldane Yildirim
Department of Nutrition and Dietetics, Faculty of Health Sciences, Istanbul Gelisim University, Istanbul, Turkey, and
Muhammet Ali Çakır
Department of Nutrition and Dietetics, Faculty of Health Sciences, Kırklareli University, Kırklareli, Turkey

Received 1 February 2025
Revised 16 August 2025
26 August 2025
Accepted 1 September 2025

Abstract

Purpose – Food labels are essential tools that communicate critical nutritional and health information to consumers, guiding healthier choices. This study aims to develop and validate the Food Label Literacy Scale (FLLS) for adults.

Design/methodology/approach – The scale evaluates four core competencies: accessing, understanding, appraising and applying food label information. The study followed a three-stage process: (1) item generation through literature review, exploratory study and expert opinions, (2) exploratory factor analysis with 240 adults aged 18–65 and (3) confirmatory factor analysis (CFA) with a separate sample of 354 adults. The scale's reliability and validity were assessed through internal consistency analysis, criterion validity testing and test-retest reliability.

Findings – The final FLLS consists of 32 items across five factors. CFA results demonstrated good model fit (χ^2/df = 2.255, RMSEA = 0.060, CFI = 0.956, GFI = 0.946, NFI = 0.944, SRMR = 0.066). Internal consistency was high (Cronbach's alpha = 0.945). The scale also showed acceptable test-retest reliability and positive correlations with existing food literacy measures.

Originality/value – The effectiveness of food labels depends on consumers' ability to interpret and use food label information. However, to the authors' knowledge, no validated tool exist to measure the ability to use food labeling with a health literacy approach in adults.

Keywords Consumer behavior, Food label literacy, Health literacy, Food labels, Scale development

Paper type Research paper

Abbreviations

χ^2	= Chi-square
α (Cronbach's α)	= Cronbach's Alpha
CFI	= Comparative Fit Index
CFA	= Confirmatory Factor Analysis
EFA	= Exploratory Factor Analysis
FLLS	= Food Label Literacy Scale
NFI	= Normed Fit Index
RMSEA	= Root Mean Square Error of Approximation
SD	= Standard Deviation
SPFL	= Self-Perceived Food Literacy
SPSS	= Statistical Package for the Social Sciences

Conflict of interest: All authors declare that they have no conflicts of interest.

Nutrition & Food Science

0034-6659
DOI 10.1108/NFS-02-2025-0039

Introduction

Food labels, described as the "identity card" of food products (Viviana Viola *et al.*, 2016), provide information on or near packaged foods. The numerical, visual and written statements on these labels inform consumers about price, content, consumption and quality. From a public health perspective, food labels are regarded as instruments for improving public health (Dudeja and Gupta, 2017). In particular, front-of-pack food labels have attracted attention in recent years as a tool that can be used to prevent noncommunicable diseases (Singh *et al.*, 2025). In addition, education programs on food labels contribute to individuals' ability to evaluate food content more consciously and improve their nutritional choices (Rana *et al.*, 2025). Besides health and nutrition, food labels also indicate product quality, origin, processing and preservation. Therefore, accurate and non-misleading labeling policies that facilitate the choosing of healthy foods are considered part of human rights (World Health Organization, 2021).

Food label literacy is considered part of health literacy (Amuta-Jimenez *et al.*, 2019). Making healthy food choices involves not only reading nutrition information but also how individuals interpret and apply it (Amuta-Jimenez *et al.*, 2019; Ringland *et al.*, 2016; Viviana Viola *et al.*, 2016). The level of consumer understanding and use of food labels is a significant factor determining the effectiveness of food labels. Therefore, understanding how consumers respond to food labels is crucial (Sørensen *et al.*, 2012a). One of the barriers to healthy food choices is the lack of ability to process nutritional information. This ability depends on both individual skills and knowledge levels, as well as environmental factors such as information overload (Schruff-Lim *et al.*, 2023). To make informed food choices, consumers need to be empowered to access, understand, appraise and apply nutritional information (Mansfield *et al.*, 2020).

Given the critical role of food labels in promoting health and guiding consumers toward informed food choices, it is essential to assess the extent to which individuals can effectively engage with this information. However, a tool specifically designed to measure food label literacy for adults has not yet been developed. Therefore, this study aims to develop a scale to assess food label literacy based on the health literacy approach.

Materials and methods

The study methodology consisted of three steps: item development, scale development and evaluation of validity and reliability (Boateng *et al.*, 2018). The workflow was shown in Figure 1.

Theoretical background

It has been emphasized in the literature that Nutbeam's three-level health literacy model is applicable to food labels (Mansfield *et al.*, 2020; Nutbeam, 2000; Sørensen *et al.*, 2012b). The core components of health literacy (accessing, understanding, appraising and applying) are the key elements that enable individuals to make informed decisions regarding their health and well-being (Sørensen *et al.*, 2012b; Taheri *et al.*, 2020). In this context, Mansfield *et al.* (2020) adapted this approach to food and nutrition information under the "Health Literacy Process in Food-Based Decision Making." The food-based decision-making process consists of the following four stages: access, which refers to the ability to find, search for and obtain food and nutrition information; understanding, which involves the ability to comprehend the accessed information for healthy food choices; appraising, which is the ability to interpret the information in the context of dietary goals and needs; and applying, which refers to the ability to communicate and use the information to meet dietary goals (Mansfield *et al.*, 2020). Based on this theoretical framework, the scale aims to measure individuals' abilities to access, understand, appraise and apply nutrition information through food labels.

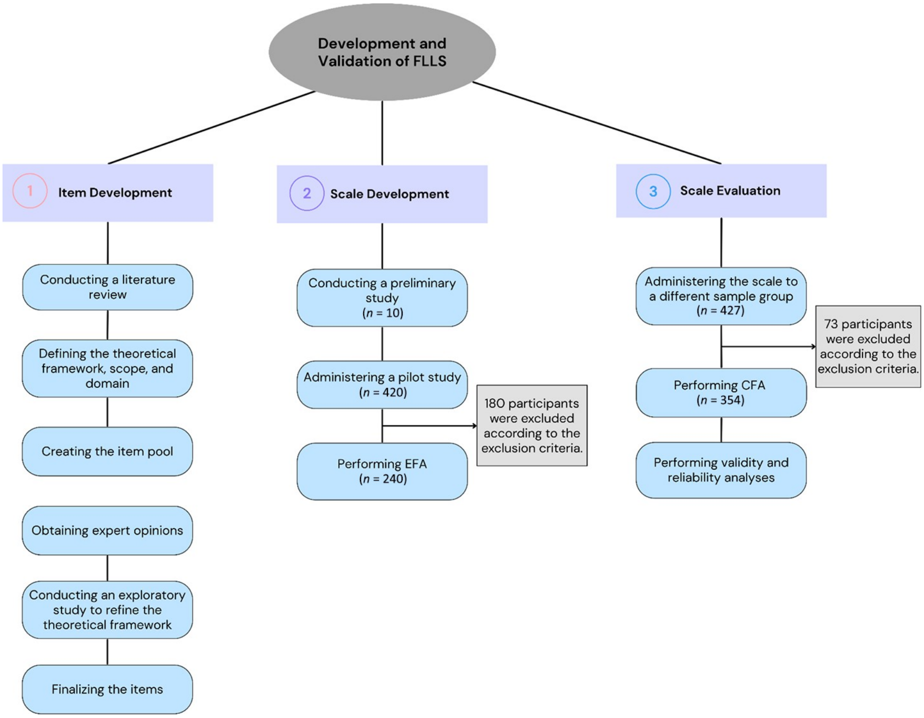

Figure 1. Workflow of the study
Source: Authors' own work

Participants
The study, conducted between February and May 2024, included 420 participants for exploratory factor analysis (EFA) and 427 for confirmatory factor analysis (CFA), in line with recommended sample sizes of is approximately 5–10 times the number of items in the scale (Bryman and Cramer, 2002; MacCallum *et al.*, 1999). The survey was distributed online to voluntary participants in Turkey.

The inclusion criteria for the study were being literate, aged 18–64 years and willing to participate. Exclusion criteria included incorrect responses to a control question (If you are reading this question, please tick "Very easy"), completion of the form below the minimum time limit, participants with food allergies, participants with formal training in nutrition and dietetics (students or dietitians) and statistical outliers (Z-scores > +3 or < −3). Participant characteristics are summarized in Table 1.

Ethical approval was obtained from the Kırklareli University Institute of Health Sciences Ethics Committee (Protocol No: PR0506R1, 18.03.2024), and informed consent was obtained from participants.

Phase 1) Item generation. Literature review. A deductive method was used to create an item pool (Boateng *et al.*, 2018). The literature review was conducted using "PubMed," "Google Scholar," "Science Direct" and "National Thesis Center" resulting in a 71-item pool categorized into four subscales consistent with the "health literacy process in food-based

Table 1. Participant characteristics

Characteristics	Exploratory ($n = 240$) x̄	SD	Confirmatory ($n = 354$) x̄	SD
Age (years)	30.70	10.29	26.00	7.94
BMI (kg/m²)	24.20	4.59	22.97	3.96
	n (%)		*n* (%)	
Education level				
No formal education	5 (2.1)		-	
Primary	8 (3.3)		6 (1.7)	
Lower secondary	15 (6.3)		2 (0.6)	
Secondary	62 (25.8)		169 (47.7)	
Associate	28 (11.7)		35 (9.9)	
Bachelor	88 (36.7)		108 (30.6)	
Master or PhD	34 (14.2)		34 (9.6)	
Marital status				
Married	140 (58.3)		77 (21.7)	
Single	100 (41.7)		277 (78.3)	
Employment status				
Employed	160 (66.7)		128 (36.2)	
Unemployed	80 (33.3)		226 (63.8)	
Income level				
Low	80 (33.3)		99 (28.0)	
Middle	96 (40.0)		181 (51.1)	
High	64 (26.7)		74 (20.9)	
Presence of chronic disease				
Yes	71 (29.6)		100 (28.2)	
No	169 (70.4)		254 (71.8)	
Nutrition education received				
Yes	56 (23.3)		102 (28.8)	
No	184 (76.7)		252 (71.2)	

Note(s): Categorical variables are expressed as percentages. SD = standard deviation
Source(s): Authors' own work

decision-making" (Mansfield *et al.*, 2020) (Table 2). Items were rated on a five-point Likert scale ranging from "Very difficult" to "Very easy."

First content validity. The content validity of the item pool was assessed by 14 experts including one professor, one associate professor, eight PhD-level faculty members and four dietitians with a master's degree in the field of nutrition and dietetics using the Lawshe technique (Lawshe, 1975).

Table 2. Items in the item pool and targeted skills

Item no.	Targeted skill
1–14	Access
15–31	Understanding
32–48	Appraising
49–71	Applying

Source(s): Authors' own work

Exploratory study. The exploratory study was designed to enhance the theoretical framework by conducting a literature review, addressing issues associated with poorly defined concepts, and improving the item pool. The study examined aspects of food labels relevant to consumers and explored factors influencing their interactions with food labels. The task included the 10-question label-reading task to evaluate participants' comprehension and decision-making abilities. The mean age of participants was 36.17 ± 12.02 years for women and 36.47 ± 12.51 years for men. Among participants, 26.1% were 25 years old or younger, while 27.8% were 46 years or older (Yıldırım and Çakır, 2025). Items that addressed significant components were revised, and additional elements were incorporated as needed. Following the revisions, the final items were once again submitted to eight experts following the revisions.

Phase 2) Scale development. Preliminary study. A preliminary study with 10 participants, representing the target population, was conducted to finalize the scale. It is suggested that 5–15 participants is optimal. Accordingly, the study was conducted with 10 participants (Boateng *et al.*, 2018).

Pilot study and EFA. The EFA process involves making critical decisions such as applying rotation techniques and determining the number of factors (Orçan, 2018). Following the preliminary study, EFA was performed to identify underlying dimensions and refine the number of items in the scale (DeVellis, 2003; Orçan, 2018). Since the scale was theoretically designed with a multifactorial structure, the Varimax (an orthogontal rotation technique) was used to maximize interpretability (Büyüköztürk, 2002). Consistent with similar studies items with factor loadings below 0.40 were excluded (Gough *et al.*, 2024; Onbaşı and Türker, 2023). In addition, any item inconsistent with other items in the factor to which they loaded were also excluded from the model (Gough *et al.*, 2024).

Phase 3) Scale evaluation. Evaluation of dimensionality using CFA. Dimensionality tests evaluate whether the assumed factors or factor structure hold at a different point in time or ideally on a new sample (Boateng *et al.*, 2018). Model fit can be evaluated through various indices that capture different aspects of fit, such as absolute, comparative and residual-based measures (Goretzko *et al.*, 2024). In our study, chi-square (χ^2/df), root mean square error of approximation (RMSEA), normed fit index (NFI), comparative fit index (CFI), standardized root mean square residual (SRMR) and goodness-of-fit index (GFI) fit indices were used.

Validity assessment. Content validity, was measured by calculating content validity ratio (CVR) and content validity index (CVI) using expert. To compute the CVR, the number of experts who rated the item as "relevant" is divided by half the total number of experts, and 1 is subtracted from the result. The average of CVR values was used to calculate the scale's CVI (Lawshe, 1975).

The Self-Perceived Food Literacy (SPFL) scale developed by Poelman *et al.* (2018), validated in Turkish by Tarı Selçuk *et al.* (2020) was selected as a concurrent measure due to its relevance to food literacy and its "examination of food labels" subscale, enabling direct comparison. The correlation between scores on the two scales was analyzed to establish criterion validity (Boateng *et al.*, 2018).

As an additional method for evaluating validity, convergent validity was tested to assess "the extent to which different measures of the same construct produce similar results" (Boateng *et al.*, 2018). Convergent validity was assessed by administering the 10-question label-reading task during the exploratory study (Yıldırım and Çakır, 2025). The 10-question label reading task consisted of images illustrating real food labels, followed by a multiple-choice question assessing the understanding, calculation, or using nutritional information (e.g. identifying the highest sugar content, calculating the calories in a serving). Each correct answer was scored as 1, and the total possible score was 10. The internal consistency of the task was acceptable (Cronbach's alpha = 0.821) and demonstrates the ability to assess food label comprehension skills. This survey was adapted from validated tools used in nutrition literacy research (Poelman *et al.*, 2018; Ringland *et al.*, 2016). The correlation between correct answers and scale scores was tested to determine whether the construct measured by different methods produced similar results (Boateng *et al.*, 2018). The final scale was administered to 30 individuals who participated in the exploratory study.

Reliability assessment. In reliability analyses, Cronbach's alpha coefficient, a widely used measure of internal consistency was calculated to ensure that the items within each subscale were aligned and measured the same construct (Boateng *et al.*, 2018). In addition, test-retest reliability was used to assess stability over time, 45 participants from the main study completed the scale twice, with a two-week interval between administrations.

Data analysis

The Kaiser–Meyer–Olkin (KMO) test and Bartlett's Test of Sphericity were used to assess the suitability of the data for factorization. EFA was conducted to evaluate construct validity, followed by CFA to confirm the factor structure. Internal consistency and reliability were assessed using Cronbach's alpha coefficient. Item-total correlations, measurement stability through the test-retest method, and other correlations were analyzed using Spearman's correlation. Data analysis was performed with IBM SPSS 27.0 and AMOS 24.0, with the significance level set at $p < 0.05$.

Results

Phase 1) Item generation

First content validity. Items 8, 10, 11, 14, 24, 38, 49, 50, 55, 58, 63 and 64 were removed as they fell below the critical threshold (Ayre and Scally, 2014). In the item reduction process, several steps were followed. Several items were subsequently merged due to content similarity as highlighted by experts (e.g. former items 15, 16 and 2; 18, 19 and 23; 20–22; 29, 32 and 33; 34 and 35; 36 and 37; 40 and 43; 41, 46 and 47; 12 and 13; 59 and 61; 57, 60 and 62; 52–56; 66 and 67). Former item 25 was split into two items (16 and 17), and some items (e.g. former items 10, 11 and 38) were revised and resubmitted to experts because, although their qualitative feedback was generally positive, the majority of experts did not mark them as "relevant," which led to low CVR values. In addition, although statistically acceptable, items 39 and 42 were excluded because experts considered them redundant for general consumer competencies. The wording of the items was adjusted to be clearer and more action-oriented.

Exploratory study. The findings from the exploratory study expanded the scope of the scale and allowed for a comprehensive assessment of food label literacy across different dimensions. Particular attention was given to ensuring that the scale items were easily understood by participants, and extensive feedback led to the reformulation of certain items. In alignment with the general health literacy theory, the items primarily covered the steps for healthy food choices. Additional items were included to align with consumers' perceptions and intended uses of food labels. In particular, new items were incorporated into the scale (e.g. items 22, 23, 26, 39, 40, 42, 47, 48 and 49) to reflect participants' insights and to ensure a more comprehensive assessment of food label literacy. At this stage, the revised items were resubmitted for expert evaluation (Dragostinov *et al.*, 2022). After the exploratory study, all items met the critical value required by eight experts. The overall CVI value of the scale was calculated as 0.959.

Phase 2) Scale development

Pilot study and EFA. EFA was performed with 240 participants, excluding 180 participants based on exclusion criteria. After removing items with a loading below 0.40 and excluding Item 10 due to conceptual inconsistency, it was reduced to 32 items under five factors. Factor loadings ranged from 0.475 to 0.816, supporting the scale's reliability and validity. Factor loadings and variances explained were presented in Table 3.

Phase 3) Scale evaluation

Evaluation of dimensionality using CFA. CFA was performed with 354 participants, excluding 73 participants based on exclusion criteria. Initially, the NFI, CFI and GFI fit indices were found to be below the reference thresholds. In the model output, covariance paths between error terms were created based on modification indices (MI) for the following item pairs: 16 and 17 (MI = 83.88), 22 and 23 (MI = 70.86), 31 and 32 (MI = 42.56), 5 and 6 (MI = 41.18), 1 and 2 (MI = 39.07), 28 and 29 (MI = 24.14), 19 and 20 (MI = 20.62), 37 and 38 (MI = 13.15). Fit statistics after modifications are shown in Table 4, and Figure 2 presents the validated factor model through CFA.

Internal consistency. The overall Cronbach's alpha value for the scale is 0.945. The Cronbach's alpha values for each factor are as follows: 0.900 for Factor 1, 0.856 for Factor 2, 0.822 for Factor 3, 0.863 for Factor 4 and 0.829 for Factor 5.

Test-retest reliability. The correlation coefficient between the total test score and the retest score was found to be 0.600, which is statistically significant ($p < 0.001$). Correlation analysis results for factors were 0.642 for Factor 1 ($p < 0.001$), 0.572 for Factor 2 ($p < 0.001$), 0.487 for Factor 3 ($p = 0.001$), 0.528 for Factor 4 ($p < 0.001$) and 0.446 for Factor 5 ($p = 0.004$).

Criterion validity. A positive and significant correlation was observed between the total FLLS scores and the SPFL scale scores ($r = 0.269$), as well as between the total FLLS scores and the "Examination of Food Labels" subscale scores ($r = 0.277$) ($p < 0.01$). In addition, a positive and significant relationship ($p < 0.01$) was found between the FLLS factors and the SPFL scale, as well as its "Examination of Food Labels" subscale. The correlation values between the FLLS factors and the SPFL scale ranged from $r = 0.119$ to 0.367, while the correlations with the "Examination of Food Labels" subscale ranged from $r = 0.176$ to 0.302.

Convergent validity. The scores obtained from a 10-question test designed to measure the understanding, appraising and interpretation of food labels showed a significant positive correlation with FLLS scores ($r = 0.451$, $p = 0.012$).

Discussion

In this study, the FLLS was developed to assess individuals' knowledge, access, understanding, evaluation and use of food label information. As food environments and consumer behaviors become increasingly complex, the ability to interpret food labels plays a vital role in promoting informed decision-making and healthier eating habits (Mansfield *et al.*, 2020). Food label reading is a component of both health literacy and food and nutrition literacy. Regarding food label literacy, consumers need to be knowledgeable about nutrition, food and nutrition labeling (Cassar *et al.*, 2018). Various tools and scales, such as the Newest Vital Sign (NVS) (Weiss, 2005) and the Food Label Literacy and Nutrition Knowledge Questionnaire (FLLANK), developed to assess the nutrition education of primary school children (Reynolds *et al.*, 2012) have incorporated food label components to measure nutrition knowledge and health literacy. Also, food label literacy was used in the health, nutrition and food literacy scales to question their ability to calculate, compare and identify through food label visuals (Doustmohammadian *et al.*, 2017; Ringland *et al.*, 2016). Several nutrition literacy scales used in Turkey have included food labels (Cesur *et al.*, 2015; Demir and Özer, 2022; Tarı Selçuk *et al.*, 2020). The scales may

Table 3. Factor loadings of items

Factor 1: Ability to appraise and apply label information (EV% = 51.601, *α* = 0.944)	*λ*
41. Plan meals according to nutritional goals using the food label	0.710
34. Make choices appropriate for certain health conditions (e.g. heart disease) using the food label	0.692
38. Use the food label effectively to monitor energy and nutrient intake	0.665
37. Make food choices using the food label	0.667
33. Assess the suitability of a food for a specific diet (e.g. low-fat) using the information on the food label	0.641
29. Interpret the amounts of energy and nutrients listed on the food label	0.636
43. Create recipes using the information on the food label	0.622
28. Interpret the amounts of components on the food label that may be harmful when consumed excessively	0.607
31. Evaluate how the values on the food label and the portion consumed contribute to daily energy and nutrient requirements	0.607
32. Calculate the energy and nutrient content of the portion consumed using the values provided per 100 grams/100 ml on the food label	0.475
Factor 2: Ability to access label information (EV% = 6.663, α = 0.921)	
4. Obtain information about the product's ingredients from the food label	0.698
3. Access the necessary information on the food label to compare differences between foods	0.688
2. Research to obtain the information provided on the food label	0.671
6. Read the table of energy and nutrient values on the food label	0.663
5. Access information about the energy and nutrient content of the product via the food label	0.662
1. Access the business information (origin, weight, production method, etc.) on the food label	0.662
8. Read the food label to make informed decisions about food choices	0.584
Factor 3: Ability to understand and apply instructions (EV% = 4.779, α = 0.932)	
23. Understand the instructions for use on the food label	0.812
46. Store the purchased product according to the instructions on the food label	0.783
22. Understand the storage and usage conditions on the food label	0.766
45. Prepare the purchased product according to the instructions on the food label	0.722
44. Purchase foods based on their consumption date (expiration, recommended) and the date they were frozen	0.699
Factor 4: Ability to understand label components (EV% = 3.788, α = 0.907)	*λ*
17. Understand the logos on the food label	0.816
16. Understand the symbols on the food label	0.800
20. Understand the "E" code on the food label	0.672
19. Understand the "Reference Intake (RI)" rate on the food label.	0.593
21. Understand the contents written in bold and italics on the food label	0.536
18. Understand the ingredients list (components or contents) on the food label	0.535
Factor 5: Ability to Understand Health and Nutrition Information (EV% = 3.097, α = 0.905)	
11. Understand the importance of the food label for health	0.709
14. Understand the health claim on the food label (e.g., "iron contributes to normal cognitive development in children")	0.701
12. Understand the importance of the energy and nutrient amounts on the food label for health	0.672
13. Understand the nutrition declaration on the food label (nutrient amounts, reference intake rate, etc.)	0.570

Note(s) *λ* = factor loadings; EV = explained variance; *α* = Cronbach's *α*
Source(s): Authors' own work

Table 4. Model fit results of the FLLS model

Fit index	Acceptance criteria	Model fit values (without modification)	Model fit values (with modification)
χ^2/df	≤ 3	3.013	2.255
Root mean square error of approximation (RMSEA)	≤ 0.08	0.076	0.060
Normed fit index (NFI)	≥ 0.90	0.788	0.944
Comparative fit index (CFI)	≥ 0.90	0.847	0.956
Standardized RMR (SRMR)	≤ 0.08	0.069	0.066
Goodness-of-fit index (GFI)	≥ 0.90	0.797	0.946

Note(s): In confirmatory factor analysis (CFA), fit indices such as χ^2/df, RMSEA, SRMR, NFI, CFI and GFI are used to evaluate model fit. The acceptance criteria shown in the table represent commonly applied thresholds, indicating whether the model provides an acceptable or good fit to the data
Source(s): Authors' own work

include the expiration date, nutritional content or several label components. However, our study did not evaluate food labels as a literacy component, but instead identified the components of food label literacy. Although previous studies have evaluated existing behaviors or knowledge levels related to food label literacy in different populations (Arunkumar *et al.*, 2025; Jefrydin *et al.*, 2019), to our knowledge, this is the first study to rigorously develop and psychometrically validate a comprehensive instrument specifically designed to measure food label literacy among adults. The five-factor model explaining the 67% of total variance was considered sufficient (Supplementary File, Table 1 and Table 2). High explained variance is interpreted as an indicator of how well the related concept or construct is being measured (Büyüköztürk, 2002). The exploratory study showed that people care about food labels not only from a health perspective but also from a food safety perspective. Accordingly, the scale was revised to include health, food safety, product quality and other product information. The subscales were designed to assess food label literacy in four dimensions. The items of the "Access" subscale were labeled as "Ability to Access Label Information" in the current structure. The initial "Understand" subscale was divided into three distinct subscales: "Ability to Understand Label Components," "Ability to Understand Health and Nutrition Information" and "Ability to Understand and Apply Instructions." This division revealed that understanding different types of nutrition-related information on food labels and elsewhere requires independent skills. The "Appraise" and "Apply" subscales were combined into "Ability to Appraise and Apply Label Information." This highlights the integrated process whereby individuals evaluate label information and apply this information to make conscious and healthy food choices. This relationship is not seen in the original health literacy framework (Sørensen *et al.*, 2012b) but observed in the present study's findings. These findings may be related to additional factors such as the intention to apply food label information, which shapes the use of food labels. For example, individuals who do not intend to apply food label information may not be genuinely interested in appraising this information. Another possible explanation is that consumers do not clearly distinguish between these two subdimensions at the perception level, contributing to a common loading on a single factor.

The response format for the scale was designed as a five-point Likert scale, ranging from "Very Difficult" to "Very Easy" to measure the difficulty or ease of performing specific tasks. While there is no consensus in the literature regarding the optimal number of response categories for Likert scales, five-point Likert scales are considered less confusing and more likely to be completed (Bouranta *et al.*, 2009). Therefore, a five-point Likert scale was used to assess the

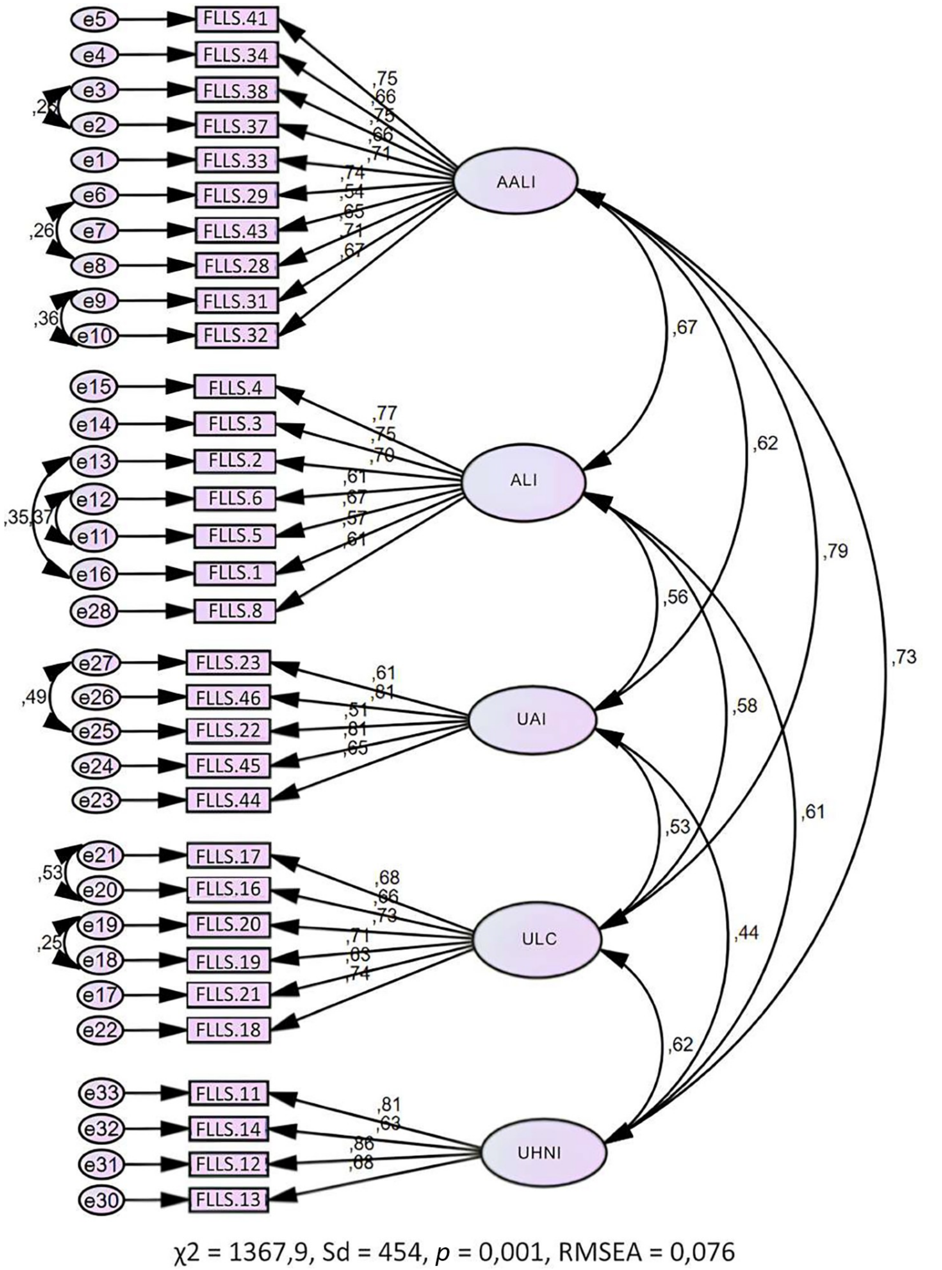

Figure 2. CFA model for the FLLS

Note(s): AALI = ability to appraise and apply label ınformation; ALI = ability to access label ınformation; UAI = ability to understand and applying ınstructions; ULC = ability to understand label components; UHNI = ability to understand health and nutrition ınformation

Source: Authors' own work (by using AMOS 24.0) difficulty and ease of each item. Each item is scored from 1 (Very difficult) to 5 (Very easy). Higher overall and subscale scores indicate greater competency and proficiency in specific skills.

The sample size is crucial in reliability testing. Bujang *et al.* (2024) demonstrated in their studies that a minimum sample size of 30 is necessary to test a scale's reliability. Data from 354 participants were used for internal consistency analysis and 47 participants took part in the test-retest. Cronbach's alpha for Factor 1 and the overall FLLS is ≥ 0.9, and between 0.7 and 0.9 for factors 2–5. Correlation coefficients for the total FLLS score and Factor 1 were above 0.6, while the coefficients for Factors 2–5 ranged between 0.5 and 0.6. Nevertheless, similar to the internal consistency results, it can be stated that the FLLS and Factor 1 have strong reliability, while Factors 2–5 have moderate reliability. These findings suggest that the internal consistency of the scale is good to excellent and that it presents a reliable construct and yields similar results at different times (Kilic, 2016).

There is a bidirectional relationship between food and nutrition literacy and the ability to read and understand food labels (Karademir *et al.*, 2022). An analysis of the relationship between FLLS scores and SPFL and the "Examination of Food Labels" subscale scores showed that there was a significant positive correlation between the scores. The low correlation coefficients may likely be due to the lack of a tool specifically designed to measure food label literacy. Similarly, Roy *et al.* (2023) encountered low correlations when evaluating criterion validity related to stress measurement due to the absence of a tool specifically measuring job stress.

The correlation test revealed a significant positive correlation between the 10-question label-reading task scores and the FLLS scores. These findings indicate that participants' responses to the scale are associated with their actual behaviors. This suggest that the FLLS can predict real-life behaviors. The correlation coefficient between the scores was found to be 0.451. In the literature, weak correlations ranging from 0 to 0.20 between self-reports and behavioral measures have been reported (Dang *et al.*, 2020).

This study has several limitations. First, the sample lacked a demographically homogeneous distribution. In 2023, the median age was 33.2 years for men and 34.7 years for women nationally [Türkiye İstatistik Kurumu (TÜİK), 2023], whereas the mean age in both study groups was below these values, indicating an overrepresentation of younger adults. Second, participants with formal nutrition training (nutrition/dietetics students and dietitians) were excluded to avoid bias from professional-level knowledge; however, future validation studies could also consider controlling for informal nutrition knowledge to assess its potential impact. In addition, the online survey format excluded individuals without digital access, potentially skewing the sample toward participants with higher education and digital literacy. Moreover, since no other scale directly measuring food label literacy exists in the literature, the criterion scales used in validity analyses provided only indirect comparisons, which may have limited correlation strengths. The modifications made to improve CFA model fit further highlight the need to test the scale in diverse samples.

Future studies should examine the factors that influence skills in using information on food labels, the effects of existing food labeling systems on this issue and consumer education. Furthermore, with the increase in purchases from digital stores, digital food label literacy is also an area that has the potential to be explored. In addition, it can examine whether the assessment and application components influence each other and whether the empirical integration of these competencies can be attributed to similarities at the item level or to an integrated perception of these skills. Including performance-based tasks in addition to self-reported measures may help determine whether this integration is observed in actual consumer behavior. The findings may be limited in their generalizability to populations with lower educational levels, older age groups or limited digital access. Future research could replicate the study using stratified random sampling to provide greater representativeness.

Conclusions

In conclusion, the FLLS, developed for adults aged 18–65, is a valid and reliable scale. This scale can be used to examine consumer behavior in similar groups, measure the effectiveness of educational programs, monitor the effectiveness of policies and investigate the impact of food label literacy on individuals' eating habits and health status. FLLS can also provide information for policy studies as part of developing evidence-based policies, measuring the current situation and measuring the effectiveness of implemented policies. Therefore, understanding consumers' knowledge gaps on the subject can guide the industry in improving food labeling standards. In addition, testing the scale across different sociocultural and age groups, supporting it with behavioral measurements and repeating it with broader geographic representation will help to address its limitations and increase its generalizability.

Acknowledgements

This study was conducted as part of a master's thesis. The authors appreciate all the participants and experts who contributed to this study for their valuable insights and support.

Funding

No funding was received for this study.

Authorship

Güldane Yildirim, Muhammet Ali Çakır: conceptualization, data curation, formal analysis, methodology, investigation; Güldane Yildirim: resources, validation, visualization, writing – original draft; Muhammet Ali Çakır: project administration, supervision, writing – review and editing.

References

Amuta-Jimenez, A.O., Lo, C., Talwar, D., Khan, N. and Barry, A.E. (2019), "Food label literacy and use among US adults diagnosed with cancer: results from a national representative study", *Journal of Cancer Education*, Vol. 34 No. 5, pp. 1000-1009, doi: 10.1007/s13187-018-1403-z.

Arunkumar, M., Varakumari, E., Thozhanenjan, I.M.V., Pandian, S., Bhandari, A. and Grace, A. (2025), "Decoding food labels: a study on the knowledge, attitudes, and practices of young medical students in Chennai", *Cureus*, doi: 10.7759/cureus.82657.

Ayre, C. and Scally, A.J. (2014), "Critical values for lawshe's content validity ratio", *Measurement and Evaluation in Counseling and Development*, Vol. 47 No. 1, pp. 79-86, doi: 10.1177/0748175613513808.

Boateng, G.O., Neilands, T.B., Frongillo, E.A., Melgar-Quiñonez, H.R. and Young, S.L. (2018), "Best practices for developing and validating scales for health, social, and behavioral research: a primer", *Frontiers in Public Health*, Vol. 6, doi: 10.3389/fpubh.2018.00149.

Bouranta, N., Chitiris, L. and Paravantis, J. (2009), "The relationship between internal and external service quality", *International Journal of Contemporary Hospitality Management*, Vol. 21 No. 3, pp. 275-293, doi: 10.1108/09596110910948297.

Bryman, A. and Cramer, D. (2002), *Quantitative Data Analysis with SPSS Release 10 for Windows, Routledge*, doi: 10.4324/9780203471548.

Bujang, M.A., Omar, E.D., Foo, D.H.P. and Hon, Y.K. (2024), "Sample size determination for conducting a pilot study to assess reliability of a questionnaire", *Restorative Dentistry and Endodontics*, Vol. 49 No. 1, doi: 10.5395/rde.2024.49.e3.

Büyüköztürk, Ş. (2002), "Faktör analizi: Temel kavramlar ve ölçek geliştirmede kullanımı", *Kuram Ve Uygulamada Eğitim Yönetmeliği*, Vol. 32, pp. 470-483.

Cassar, A., Denyer, G., O'Connor, H. and Gifford, J. (2018), "A qualitative ınvestigation to underpin the development of an electronic tool to assess nutrition literacy in Australian adults", *Nutrients*, Vol. 10 No. 2, p. 251, doi: 10.3390/nu10020251.

Cesur, B., Koçoğlu, G. and Sümer, H. (2015), "Evaluation ınstrument of nutrition literacy on adults (EINLA): a study of validity and reliability", *Integrative Food, Nutrition and Metabolism*, Vol. 2 No. 3, pp. 174-177, doi: 10.15761/IFNM.1000114.

Dang, J., King, K.M. and Inzlicht, M. (2020), "Why are self-report and behavioral measures weakly correlated?", *Trends in Cognitive Sciences*, Vol. 24 No. 4, pp. 267-269, doi: 10.1016/j.tics.2020.01.007.

Demir, G. and Özer, A. (2022), "Development and validation of food and nutrition literacy ınstrument in young people, Turkey", *Progress in Nutrition*, Vol. 24 No. 4, p. e2022133, doi: 10.23751/pn.v24i4.13051.

DeVellis, R.F. (2003), *Scale Development: Theory and Applications*, 2nd ed.Sage Publication, Newbury Park, doi: 10.1177/10982140930140021.

Doustmohammadian, A., Omidvar, N., Keshavarz-Mohammadi, N., Abdollahi, M., Amini, M. and Eini-Zinab, H. (2017), "Developing and validating a scale to measure food and nutrition literacy (FNLIT) in elementary school children in Iran", *Plos One*, Vol. 12 No. 6, p. e0179196, doi: 10.1371/journal.pone.0179196.

Dragostinov, Y., Harðardóttir, D., McKenna, P.E., Robb, D.A., Nesset, B., Ahmad, M.I., Romeo, M., *et al*. (2022), "Preliminary psychometric scale development using the mixed-methods delphi technique", *Methods in Psychology*, Vol. 7, p. 100103, doi: 10.1016/j.metip.2022.100103.

Dudeja, P. and Gupta, R.K. (2017), "Nutritional labeling", *Food Safety in the 21st Century*, Elsevier, pp. 481-489, doi: 10.1016/B978-0-12-801773-9.00039-X.

Goretzko, D., Siemund, K. and Sterner, P. (2024), "Evaluating model fit of measurement models in confirmatory factor analysis", *Educational and Psychological Measurement*, Vol. 84 No. 1, pp. 123-144, doi: 10.1177/00131644231163813.

Gough, T., Christiansen, P., Hardman, C.A. and Keenan, G.S. (2024), "The development and validation of the food insecurity physical activity concerns scale", *Appetite*, Vol. 200, p. 107516, doi: 10.1016/j.appet.2024.107516.

Jefrydin, N., Md Nor, N. and Abd. Talib, R. (2019), "Nutrition labelling: an exploratory study on personal factors that influence the practice of reading nutrition labels among adolescents", *Malaysian Journal of Nutrition*, Vol. 25 No. 1, pp. 143-153, doi: 10.31246/mjn-2018-0123.

Karademir, E., Bayrak, E. and Cebirbay, M.A. (2022), "Gıda ve beslenme okuryazarlığının besin etiket bilgilerinin anlaşılması açısından önemi", in Aktaş, N. (Ed.), *Gıda Ve Beslenme Okuryazarlığı*, Türkiye Klinikleri, Ankara, pp. 48-52.

Kilic, S. (2016), "Cronbach's alpha reliability coefficient", *Journal of Mood Disorders*, Vol. 6 No. 1, p. 47, doi: 10.5455/jmood.20160307122823.

Lawshe, C.H. (1975), "A quantitative approach to content validity", *Personnel Psychology*, Vol. 28 No. 4, pp. 563-575, doi: 10.1111/j.1744-6570.1975.tb01393.x.

MacCallum, R.C., Widaman, K.F., Zhang, S. and Hong, S. (1999), "Sample size in factor analysis", *Psychological Methods*, Vol. 4 No. 1, pp. 84-99, doi: 10.1037/1082-989X.4.1.84.

Mansfield, E., Wahba, R. and De Grandpré, E. (2020), "Integrating a health literacy lens into nutrition labelling policy in Canada", *International Journal of Environmental Research and Public Health*, Vol. 17 No. 11, pp. 1-7, doi: 10.3390/ijerph17114130.

Nutbeam, D. (2000), "Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century", *Health Promotion International*, Vol. 15 No. 3, pp. 259-267, doi: 10.1093/heapro/15.3.259.

Onbaşı, Ö. and Türker, P.F. (2023), "e-sağlıklı beslenme okuryazarlığı ölçeğinin geçerlik ve güvenirliğinin incelenmesi", *Journal of Nutrition and Dietetics*, Vol. 51 No. 2, pp. 24-33, doi: 10.33076/2023.BDD.1728.

Orçan, F. (2018), “Açımlayıcı ve doğrulayıcı faktör analizi: İlk hangisi kullanılmalı?”, *Eğitimde Ve Psikolojide Ölçme Ve Değerlendirme Dergisi*, Vol. 9 No. 4, pp. 413-421, doi: 10.21031/epod.394323.

Poelman, M.P., Dijkstra, S.C., Sponselee, H., Kamphuis, C.B.M., Battjes-Fries, M.C.E., Gillebaart, M. and Seidell, J.C. (2018), “Towards the measurement of food literacy with respect to healthy eating: the development and validation of the self perceived food literacy scale among an adult sample in The Netherlands”, *International Journal of Behavioral Nutrition and Physical Activity*, Vol. 15 No. 1, p. 54, doi: 10.1186/s12966-018-0687-z.

Rana, T., Konapur, A., Mishra, P., Kour, M., Rao, A., Arora, M. and Gavaravarapu, S.M. (2025), “The impact of educational interventions on food label comprehension and food choices among adolescents: a scoping review”, *BMC Public Health*, Vol. 25 No. 1, p. 2682, doi: 10.1186/s12889-025-23940-5.

Reynolds, J.S., Treu, J.A., Njike, V., Walker, J., Smith, E., Katz, C.S. and Katz, D.L. (2012), “The validation of a food label literacy questionnaire for elementary school children”, *Journal of Nutrition Education and Behavior*, Vol. 44 No. 3, pp. 262-266, doi: 10.1016/j.jneb.2011.09.006.

Ringland, E.M., Gifford, J.A., Denyer, G.S., Thai, D., Franklin, J.L., Stevenson, M.M., Prvan, T., *et al*. (2016), “Evaluation of an electronic tool to assess food label literacy in adult australians: a pilot study”, *Nutrition and Dietetics*, Vol. 73 No. 5, pp. 482-489, doi: 10.1111/1747-0080.12271.

Roy, R., Sukumar, G.M., Philip, M. and Gopalakrishna, G. (2023), “Face, content, criterion and construct validity assessment of a newly developed tool to assess and classify work–related stress (TAWS– 16)”, *Plos One*, Vol. 18 No. 1, p. e0280189, doi: 10.1371/journal.pone.0280189.

Schruff-Lim, E.-M., Van Loo, E.J., van Kleef, E. and van Trijp, H.C.M. (2023), “Turning FOP nutrition labels into action: a systematic review of label+ interventions”, *Food Policy*, Vol. 120, p. 102479, doi: 10.1016/j.foodpol.2023.102479.

Singh, A., Singh, A. and Bhattacharya, S. (2025), “Front-of-package food labeling and noncommunicable disease prevention: a comprehensive bibliometric analysis of three decades”, *Medical Journal Armed Forces India*, Vol. 81 No. 2, pp. 126-138, doi: 10.1016/j.mjafi.2024.12.003.

Sørensen, H.S., Clement, J. and Gabrielsen, G. (2012a), “Food labels – an exploratory study into label information and what consumers see and understand”, *The International Review of Retail, Distribution and Consumer Research*, Vol. 22 No. 1, pp. 101-114, doi: 10.1080/09593969.2011.634072.

Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z. and Brand, H. (2012b), “Health literacy and public health: a systematic review and integration of definitions and models”, *BMC Public Health*, Vol. 12 No. 1, p. 80, doi: 10.1186/1471-2458-12-80.

Taheri, A., Langarizadeh, M., Dehkordi, J. and Yousefianzadeh, O. (2020), “Development of health literacy among postgraduate students: from information literacy perspective”, *Journal of Education and Health Promotion*, Vol. 9 No. 1, pp. 338, doi: 10.4103/jehp.jehp_340_20.

Tarı Selçuk, K., Çevik, C., Baydur, H. and Meseri, R. (2020), “Validity and reliability of the Turkish version of the self-perceived food literacy scale”, *Progress in Nutrition*, Vol. 22 No. 2, pp. 671-677, doi: 10.23751/pn.v22i2.9662.

Türkiye İstatistik Kurumu (TÜİK) (2023), “Adrese dayalı nüfus kayıt sistemi sonuçları”, available at: www.tuik.gov.tr/ (accessed 16 August 2025).

Viviana Viola, G.C., Bianchi, F., Croce, E. and Ceretti, E. (2016), “Are food labels effective as a means of health prevention?”, *Journal of Public Health Research*, Vol. 5 No. 3, pp. 139-142, doi: 10.4081/jphr.2016.768.

Weiss, B.D. (2005), “Quick assessment of literacy in primary care: the newest vital sign”, *The Annals of Family Medicine*, Vol. 3 No. 6, pp. 514-522, doi: 10.1370/afm.405.

World Health Organization (2021), *Implementing Nutrition Labelling Policies: A Review of Contextual Factors*, Geneva.

Yıldırım, G. and Çakır, M.A. (2025), "Evaluation of consumers' ability to use and understand food labels", *İstanbul Gelişim Üniversitesi Sağlık Bilimleri Dergisi*, No. 25, pp. 140-152, doi: 10.38079/igusabder.1645418.

Supplementary material

The supplementary material for this article can be found online.

Corresponding author
Muhammet Ali Çakir can be contacted at: m.ali.cakir@klu.edu.tr