## Original Article

# Development of a tool for food literacy assessment for young adults: findings from a Korean validation study

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**Background and Objectives:** There is little research on the development and validation of measurement tools to evaluate integrative concepts of food literacy; however, this is a growing research area. **Methods and Study Design:** A food literacy measurement tool for young Korean adults was developed in three phases: (1) tool development and content validation using the Delphi method (2) pilot testing (n=108) and (3) confirmatory study (n=435) and internal consistency using Cronbach's α and the test-retest for reliability. $p<0.05$ was considered statistically significant. **Results:** Feedback from the Delphi rounds resulted in modification and rewording of nine items, yielding 105 items with acceptable content validity ratio (CVR). Exploratory factor analysis (EFA) revealed an eight-factor construct: food and nutrition knowledge, food safety, food systems, sociocultural context, food skill, food choice, self-efficacy, and food resource management. Confirmatory factor analysis (CFA) indicated that the validated tool met the acceptable indices of basic psychometric standards, and internal consistency was satisfactory for all subscales (Cronbach's α >0.70). **Conclusions:** A validated food literacy assessment tool for young Korean adults was developed.

**Key Words: food literacy, tool development, factor analysis, food choice, dietary behavior**

## INTRODUCTION

Lack of competency in food preparation is a primary barrier to make healthier food choices.[1] A societal decline in home meal preparation has led to an increase in consumption of food prepared away from home and convenience foods that are calorie-dense with high amounts of sugar, sodium, and fat and have low iron, fiber, and calcium content.[1-3] This increase in unhealthy diet among young adults may cause negative health outcomes throughout their lifespan. There is evidence that food preparation and structured meals are associated with good dietary intake, especially in young adults.[3-5]

In the last two decades, food literacy (FL) has become an increasingly important concept in health promotion. FL is a complex and broad topic that extends beyond nutritional recommendations and cookery lessons to foster important and vital connections between food, people, health, and the environment on theoretical and practical levels.[6] A widely cited definition of FL is described as "a collection of inter-related knowledge, skills and behaviors required to plan, manage, select, prepare and eat foods to meet needs and determine food intake. FL is the scaffolding that empowers individuals, households, communities and nations to protect diet quality through change, and support dietary resilience over time." Vidgen[6] explains that "food literacy" has emerged as a term that acknowledges the all-encompassing roles of food and eating in our lives, as well as the empowerment that is gained from adequately meeting one's food needs. Individuals who possess the capability to make daily healthy food choices in different contexts, settings, and situations are considered "food literate."[7] Several conceptual models suggest

how improved FL might influence nutrition behavior and wellbeing.[6,8]

Many researchers, policy-makers, campaigners, scientists, and food and nutrition practitioners emphasize the importance of FL. Measuring FL is demanding, and the wording of questions and the social context are particularly important for eliciting meaningful responses.[9] FL measurement, therefore, needs to be culturally aligned.[5]

The Korean government has recognized the importance of "enhancing people's ability to understand and practice healthy diets" to reduce the burden of chronic disease, and has identified this as a significant task area for promotion of public health and nutrition.[10] However, there is a lack of research on development and validation of measurement tools that evaluate the integrative concepts of FL. Previous research on FL in Korea demonstrated that no such tools exist.[11] There are no validated assessment tools appropriate for use with this target group.

As no tools have been designed for application in the Korean context, this study developed a tool to measure FL for young Korean adults and assessed its content validity, construct validity, and internal reliability.

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## METHODS

### Phase1: development and content validation

The FL assessment tool for young Korean adults was developed using methods of Churchill (1979) and DeVellis (2003).[12,13] A comprehensive literature review of published tools and educational resources was performed to identify food literacy attributes.[5-7,14-21] This study is based on a scoping review which categorized FL into 11 components.[15] These 11 FL components were developed with reference to the literature and include knowledge, food skills, food choice, self-efficacy, meal management, food safety, food security, food systems, food resource management, emotions, and sociocultural context. A pool of 121 items was generated after reviewing existing questionnaires. In August 2019, 15 experts with undergraduate degrees in nutrition and either a Master's Degree or PhD in nutrition or another food or another related discipline evaluated the content and face validity of the questionnaire through three rounds of the Delphi survey. The survey was conducted to investigate whether any elements of FL were missing from the literature that needed to be included and validate the tool content before pilot testing. Eleven university experts and four practitioners were invited via e-mail to comment on the necessity and clarity of the questions and to indicate whether the groups of questions for each attribute were applicable to young Korean adults. The 15-person panel examined the initial questionnaire, and items were modified based on the experts' comments. The expert panel was asked to evaluate the necessity of attributes using a 7-point scale. Thus, in this study, a Korean definition was developed for FL as a construct, with knowledge and skills/ability domains and related attributes. A content validity ratio (CVR) was used to analyze content validity: CVR=[ne-(N/2)]/[N/2] where N is the number of panelists, and ne is the number of panelists scoring attributes as "essential"[22] in the first round and each question item during the second and third rounds.

### Phase 2: pilot study

A cross-sectional online survey was conducted among a random sample of young Korean adults (n=108; 44% male and 56% female) to validate the reliability of the tool using a 5-point Likert scale. The internal consistency of the tool was evaluated by calculating Cronbach's α to verify how well individual questions fit the assigned construct. The participants were recruited and screened through an online research company. Young adults aged 20–29 years who lived in Seoul or Gyeongi province from Korea were eligible to participate. Participants were paid $20 as incentive to complete the questionnaire. The study protocol was approved by the Institutional Review Board at Ewha Womans University (Ewha-201906-0016-02).

### Phase 3: confirmatory study

In the final phase, EFA and CFA were used to estimate construct validity and test-retest reliability among a larger sample of young Korean adults (n=435) in September 2018. CFA was performed to confirm the suitability of the eight-factor hierarchical model. For a subset of young adults (n=307), two test-retest reliability tests were conducted one week apart. Figure 1 shows the development and validation process included for this study.

### Statistical analyses

Cronbach's α was used to ascertain internal consistency reliability. Values equal to 0.7 and above were considered satisfactory.[23] Cumulative frequencies and percentages were calculated for participant demographic characteristics. Bartlett's test of sphericity ($p<0.05$) and the Kaiser-
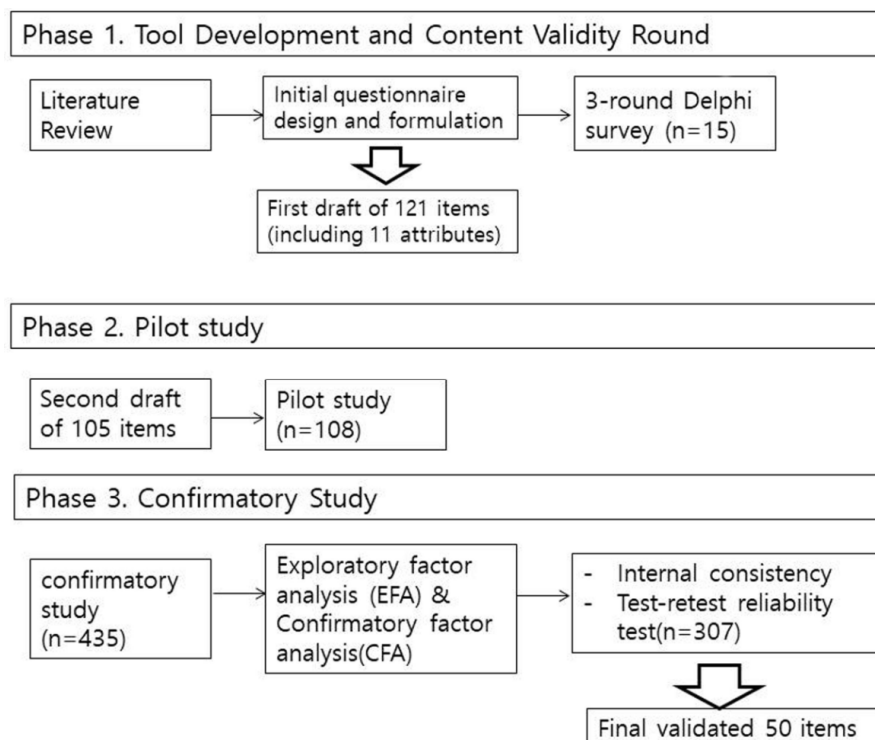


**Figure 1.** Flow chart of study development and validation.

Meyer-Olkin test (KMO; cut-off for adequacy >0.70) were used to assess whether the data were suitable for EFA. Responses to the survey were subjected to principal axis factoring with promax rotation. Factor loading (>0.40) and an additional Cronbach's α test were used to remove items. CFA was performed to test whether the data fit the hypothesized measurement model, which was extracted by EFA using the indicies of root mean square error of approximation (RMSEA; <0.08), comparative fit index (CFI; >0.9) and Tucker-Lewis Index (TLI; >0.9).[24] All data was analyzed using SPSS 21.0 (SPSS Inc., Chicago, Illinois, U.S.) and Amos 21.0. Significance level was set at $p<0.05$ for all analyses.

## RESULTS

### Phase 1: development and content validation

A review of the FL literature, other published tools, and government and educational resources addressing FL topics was undertaken before tool development.[6-8,14-21] Based on the literature, a first draft of 121 questions was developed. As a next step, the Delphi process was conducted to evaluate the relevance of components and items and to assess question clarity. The Delphi method is an excellent method for finding consensus or agreement from a sample of experts in a particular field.[5] The first round was completed to attain content validation and a stable consensus definition of FL for South Korea. Two-thirds of the reviewers did not agree that two proposed components (food security and emotions (e.g., attitudes and motivations)) were essential (CVR <0.51). The second and third rounds were used to ascertain the food experts' opinions regarding inclusion (or uncertainty or exclusion) of the 121 specific FL-scale items as part of a broader effort to develop an instrument of FL measurement. Sixteen items that the majority of participants ranked as not essential were removed, and the tool was revised for pilot testing. Several items were revised, inte-

grated, or reworded according to the Korean cultural context (e.g., "I am confident about cooking with given ingredients."; "I am confident that I can cook instantly using given food ingredients.", "I am able to cook vegetable sauté"; "I am able to grill meat and fish and poach vegetables for na-mul (Korean vegetable dishes)." Finally, the measurement tool was modified from 121 questions to 105 questions.

### Phase 2: pilot study

The tool was pilot tested with a sample of young Korean adults (n=108) in the summer of 2019. Cronbach's α was used to ascertain internal consistency, or how well individual questions fit the assigned construct for the knowledge and skills/ability domains. The reliability of FL domain scores was estimated by determining whether a question should be removed based on the impact on α of removing it. All items met the acceptable value of Cronbach's α (>0.7).[25]

### Phase 3: confirmatory study

A total of 435 young adults aged 20–29 participated in the confirmatory study. The demographic characteristics of the panels are shown in Table 1. EFA was performed to assess the construct validity of the scale, and CFA was performed to test whether the data fit the hypothesized measurement model extracted by EFA. For both domains, the KMO test showed sampling adequacy (KMO>0.70; KMO=0.924 in the knowledge domain, KMO=0.952 in the skills/ability domain). Bartlett's test confirmed that factor analysis was appropriate for both domains ($p<0.50$). Four factors with 25 items were extracted for the knowledge domain, including 11 items for food and nutrition knowledge, four items for food safety, four items for food systems, and six items for sociocultural context (Table 2). "Meal management" was eliminated by EFA; therefore four factors consisting of 25 items were extract-

**Table 1.** General characteristics of validity and confirmatory study subjects (N=435)

| Characteristics | Mean | SD |
|---|---|---|
| Age | 24.6 | 2.6 |
|  | Number | % |
| Sex |  |  |
|     Male | 193 | 44.4 |
|     Female | 242 | 55.6 |
| Education attainment |  |  |
|     High school | 62 | 14.3 |
|     Bachelor's degree or less | 352 | 80.9 |
|     Master's degree or higher | 21 | 4.8 |
| Employment status |  |  |
|     Student | 153 | 35.2 |
|     Employee | 179 | 41.2 |
|     Business owner | 11 | 2.5 |
|     Professional | 29 | 6.7 |
|     Homemaker | 5 | 1.1 |
|     Freelancer | 27 | 6.2 |
|     Others | 31 | 7.1 |
| Monthly household income |  |  |
|     <₩ 1,000,000 | 17 | 3.9 |
|     ₩1,000,000–₩3,000,000 | 111 | 25.5 |
|     ₩3,000,000–₩5,000,000 | 153 | 35.2 |
|     >₩5,000,000 | 154 | 35.4 |

**Table 2.** Factor analysis results and item statistics of knowledge domain of food literacy

| Scale items | | Food and nutrition knowledge | Food system | Socio-cultural context | Food safety |
|---|---|---|---|---|---|
| 9 | I know the foods I get energy from. | 0.681 | 0.004 | 0.219 | 0.077 |
| 11 | I know healthy cooking techniques. | 0.671 | 0.223 | 0.052 | 0.228 |
| 7 | I understand nutrition labels (e.g., low sugar, low sodium) and choose food items accordingly. | 0.666 | 0.068 | 0.256 | 0.018 |
| 10 | I know how to manage nutrition for my health conditions (e.g., obesity, constipation) and life cycle characteristics. | 0.630 | 0.258 | 0.144 | 0.072 |
| 3 | I know the natural forms of processed foods. (e.g., bacon, corn-starch) | 0.629 | 0.331 | 0.060 | 0.006 |
| 1 | I can distinguish vegetable and animal food groups. | 0.620 | 0.319 | 0.006 | 0.064 |
| 6 | I know which food groups the foods I eat belong to and the roles of the nutrients in those foods. | 0.606 | 0.342 | 0.123 | 0.140 |
| 13 | I know which cooking techniques that minimize nutrient destruction. | 0.586 | 0.443 | 0.119 | 0.110 |
| 4 | I know the egg ratings and egg coding system. | 0.559 | 0.390 | 0.143 | 0.051 |
| 12 | I can use a measuring spoon, measuring cup, and scale properly. | 0.544 | 0.046 | 0.182 | 0.323 |
| 2 | I can distinguish different parts of vegetable plants (e.g., sweet potatoes= root, spinach= leaves, broccoli=flowers). | 0.524 | 0.406 | 0.074 | 0.066 |
| 80 | I understand the food supply chain of my food. | 0.285 | 0.741 | 0.133 | 0.067 |
| 85 | I know the origin of imported food (e.g., beans or wheat). | 0.284 | 0.720 | 0.129 | -0.017 |
| 83 | I care about the environment when consuming food. | 0.271 | 0.680 | 0.169 | 0.114 |
| 82 | I understand food waste systems. | 0.231 | 0.644 | 0.290 | 0.065 |
| 91 | I have a positive attitude towards food producers. | 0.092 | 0.245 | 0.680 | 0.047 |
| 92 | I value meal manners. | -0.051 | 0.097 | 0.678 | 0.346 |
| 94 | I appreciate and enjoy the characteristics and meaning of traditional food culture. | 0.258 | 0.219 | 0.673 | 0.081 |
| 100 | I find it important to have social eating experience with friends and family. | 0.190 | 0.059 | 0.664 | 0.122 |
| 93 | I understand and respect other countries' food culture. | 0.225 | 0.027 | 0.642 | 0.324 |
| 101 | I support and encourage healthy eating habits of my family and friends. | 0.171 | 0.426 | 0.516 | 0.036 |
| 60 | I wash the knife used to cut raw meat or fish. | 0.029 | 0.130 | 0.093 | 0.813 |
| 59 | I wash my hands before preparing meals, after handling raw meat, and after handling garbage. | 0.089 | 0.051 | 0.137 | 0.777 |
| 63 | I know what foods causes allergies and how to prevent such reactions. | 0.152 | -0.133 | 0.236 | 0.658 |
| 64 | When I buy food items, I calculate the expiry date. | 0.293 | 0.269 | 0.199 | 0.534 |
| Eigenvalue | | 8.37 | 2.47 | 1.56 | 1.11 |
| Explained variance (%) | | 33.46 | 9.90 | 6.22 | 4.45 |

ed from the skills/ability domain (Table 3). Factor loading, eigenvalue, and explained variance percentage of the domains are shown in Tables 2 and 3. Root mean square error of approximation (RMSEA),[26] CFI, and TLI, the most popular chi-square model fit indices were used and all met the acceptable value (Table 4).[26,27,28] Cronbach's α was generated to assess the internal consistency of each domain (Table 5), and both met the acceptable value of 0.7 (Cronbach α = 0.73-0.88). In the test-retest for reliability of a subsample of 307, all attributes were within the acceptable range (0.76-0.88, $p < 0.001$; Table 5). The total intraclass correlation coefficient (ICC) was 0.90, which indicates satisfactory stability of the developed tool.

## DISCUSSION

This paper describes the development and validation of a reliable and valid instrument to assess FL in young Korean adults. One of the strengths of this study is the design of multiple steps used to evaluate the tool.[29] The measures were developed to include a full range of FL concepts from a literature review, Delphi survey, and pilot testing. As FL becomes an increasingly important concept in health promotion, there is a need to research the effects of both knowledge (food knowledge, food safety, food systems, sociocultural context) and skills/ability (food skills, food choice, food resource management, self-efficacy) on chronic diseases and food behaviors. However, the existing tools tend to emphasize individuals' cooking skills from the perspectives of meal planning, food acquisition, food resource management, attitude, nutritional knowledge, and dietary intake.[30-33] FL is an expanding concept, and its use in interventions in recent work underscores the need for rigorous tools to evaluate and monitor FL.[6,15,18,34,35] The questionnaire presented here was established based on Churchill's guideline for instrument development, which consists of item collection, item refinement, data collection, and reliability and validity verification.[12] A three-phase process of Delphi survey, pilot study, and confirmatory study was used to develop a validated tool for FL assessment of young Korean adults. It is particularly important to have a broad working definition based on established concepts to embed the basic idea of validity (i.e., the instrument must measure what it intends to measure). During the first expert validity phase, participants agreed that the "food se-

**Table 3.** Factor analysis results and item statistics of skills/ability domain of food literacy

| | Scale items | Food resource management | Self-efficacy | Food choice | Food skills |
|---|---|---|---|---|---|
| 74 | I use a grocery shopping list and plan ahead for the amount of food I need to manage my food budget. | 0.750 | 0.126 | 0.225 | 0.114 |
| 71 | I can plan and manage a budget for food. | 0.673 | 0.276 | 0.330 | 0.163 |
| 75 | I manage the budget for buying food items. | 0.661 | 0.200 | 0.260 | 0.180 |
| 70 | I plan a grocery shopping list to better manage the time required to purchase food. | 0.656 | 0.142 | 0.244 | 0.160 |
| 79 | I use and manage cooking tools to simplify food preparation. | 0.634 | 0.323 | 0.056 | 0.282 |
| 72 | I choose on-sale products or best-priced fruits and vegetables. | 0.633 | 0.181 | 0.030 | 0.264 |
| 68 | I can plan and manage my time spent grocery shopping. | 0.593 | 0.294 | 0.348 | 0.174 |
| 69 | I can plan and manage time spent preparing meals and washing food before cooking. | 0.583 | 0.356 | 0.257 | 0.241 |
| 78 | I have enough cooking tools and equipment for preparing meals. | 0.577 | 0.362 | 0.035 | 0.155 |
| 73 | When I buy food items, I compare the amount of product among manufacturers. | 0.550 | 0.256 | 0.024 | 0.248 |
| 77 | I know how to care for cooking equipment to prolong their lifespan. | 0.472 | 0.274 | 0.431 | 0.179 |
| 45 | I am confident in how I prepare and cook meals. | 0.237 | 0.788 | 0.255 | 0.172 |
| 44 | I am confident that I can cook something using given food ingredients. | 0.201 | 0.765 | 0.314 | 0.159 |
| 48 | I am confident that I can follow a recipe. | 0.342 | 0.719 | -0.107 | 0.178 |
| 47 | I am confident that I can prepare meals according to an available budget. | 0.329 | 0.712 | 0.184 | 0.179 |
| 46 | I am confident that I can prepare nutritious dishes that do not take a long time. | 0.292 | 0.639 | 0.425 | 0.232 |
| 49 | I think it's important to cook and prepare meals. | 0.359 | 0.559 | 0.125 | 0.295 |
| 34 | I prepare and bring my own healthy snacks with me every day. | 0.188 | 0.149 | 0.811 | 0.107 |
| 33 | I do not choose unhealthy snacks even when I'm emotionally stressed. | 0.105 | 0.125 | 0.768 | 0.070 |
| 31 | I plan meals and eat food from all the food groups every day. | 0.233 | 0.119 | 0.686 | 0.346 |
| 30 | I eat a variety of foods (e.g., whole grain, low fat, high protein, vegetables and fruits) every day. | 0.214 | 0.184 | 0.554 | 0.384 |
| 24 | I can identify the reliability of nutrition-related information provided by TV or internet. | 0.180 | 0.247 | 0.107 | 0.754 |
| 26 | I know where to find food and nutrition information. (e.g., books, school, hospital, etc.) | 0.326 | 0.197 | 0.151 | 0.723 |
| 27 | I can identify and critically analyze food-related information. | 0.254 | 0.160 | 0.342 | 0.696 |
| 25 | I am able to apply the nutrition information to my own situation. | 0.294 | 0.205 | 0.230 | 0.691 |
| Eigenvalue | | 11.229 | 1.742 | 1.330 | 1.231 |
| Explained variance (%) | | 44.91 | 6.97 | 5.32 | 4.92 |

**Table 4.** Results of confirmatory factor analysis for the first-order and second-order model

| Model | Domain | $\chi^2$ | df | RMSEA | CFI | TLI |
|---|---|---|---|---|---|---|
| First-order model | Knowledge | 719.435 | 269 | 0.062 | 0.966 | 0.966 |
| | Skills/Ability | 775.043 | 269 | 0.071 | 0.979 | 0.979 |
| Second-order model | | 2767.341 | 1166 | 0.064 | 0.976 | 0.975 |

$\chi^2$: Chi square; df: degree of freedom; RMSEA: root mean square error of approximation; CFI: comparative fit index; TLI: Tucker-Lewis index.

**Table 5.** Internal consistency (n=435) and test-retest reliability (n=307) of the FL assessment for young Korean adults

| Domain | Internal consistency (Cronbach's α) | ICC (intraclass correlation coefficient, 95% CI) |
|---|---|---|
| Knowledge | | |
|     Food and nutrition knowledge | 0.886 | 0.881*** |
|     Food safety | 0.807 | 0.766*** |
|     Food system | 0.798 | 0.803*** |
|     Sociocultural context | 0.737 | 0.815*** |
| Skills/Ability | | |
|     Food skills | 0.910 | 0.810*** |
|     Self-efficacy | 0.898 | 0.864*** |
|     Food choice | 0.813 | 0.793*** |
|     Food resource management | 0.845 | 0.862*** |

***$p<0.0001$.

curity" and "emotions" (comprising attitudes and motives) attributes were not relevant in the Korean context. Furthermore, 16 items were reworded, and others were eliminated from the draft questionnaire.

The EFA indicated construct validity and that the tool captured the concept of FL effectively. The tests of internal consistency reliability of the two domains (knowledge and skills/ability) were demonstrated to generally exceed the standard of 0.70. After completion of face validity and construct validity phases, the FL measurement tool for young Korean adults consisted of 50 items (25 each) across the two domains comprising eight attributes. For the confirmatory study, all indices were within the acceptable range for all domains. All structural equation models yield optimal results.

The tool focuses on individual knowledge and skills needed for healthy food choices. Young adults' dietary habits are among the poorest of all age groups, with high rates of fast food and soft drink consumption, and low adherence to national recommendations for fruit and vegetable intake.[36-38] Additionally, some food habits developed by young adults are often associated with poor diet quality, including irregular meal patterns, meal skipping, frequent snacking, and frequent consumption of commercially prepared food such as takeaway food, pre-packaged food, and restaurant meals.[39-44] Increases in cooking skills, knowledge, and self-efficacy influence food choices.[45] Therefore, each attribute of the framework can potentially impact food choices, and ultimately, health and wellbeing.[9] The broad attributes of FL that emerged from this study are aligned with several existing food literacy definitions and frameworks.[7,9] Another strength of this study is that it takes into account the roles of culture and norms regarding health and eating for a Korean cultural context, recognizing that FL is influenced by culture and society.[5] Because food is culturally bound, FL measurement needs to be culturally aligned.[6] This study focused on a specific age group. For confirmation of the validity properties of this FL tool in other age groups, further studies should be conducted with other Korean population sub-groups.

### Conclusion

As shown by the evidence of construct validity through a Delphi survey, EFA, and CFA, our findings indicate a valid tool for measuring FL among young Korean adults. Thus, this study is meaningful in that it lays the theoretical foundations for broader future research.

**CONFLICT OF INTEREST AND FUNDING DISCLOSURES**

**REFERENCES**
1. Condrasky MD, Hegler M. How culinary nutrition can save the health of a nation. Journal of Extension 2010;48:1-6.
2. Smith LP, Ng SW, Popkin BM. Trends in US home food preparation and consumption: analysis of national nutrition surveys and time use studies from 1965-1966 to 2007-2008. Nutr J. 2013;12:45. doi: 10.1186/1475-2891-12-45.
3. Larson NI, Nelson MC, Neumark-Sztainer D, Story M, Hannan PJ. Making time for meals: meal structure and associations with dietary intake in young adults. J Am Diet Assoc. 2009;109:72-9. doi: 10.1016/j.jada.2008.10.017.
4. Larson NI, Perry CL, Story M, Neumark-Sztainer D. Food preparation by young adults is associated with better diet quality. J Am Diet Assoc. 2009;109:72-9. doi: 10.1016/j.jada.2006.09.008.
5. Fisher H, Erasmus AC, Viljoen A. Developing a food literacy definition for South Africa. African Journals. 2019; 8:1-22
6. Vidgen HA, Gallegos D. Defining food literacy and its components. Appetite. 2014;76:50-9. doi: 10.1016/j.appet.2014.01.010.
7. Poelman MP, Dijkstra SC, Sponselee H, Kamphuis CB, Battjes-Fries MC, Gillebaart M et al. 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. Int J Behav Nutr Phys Act. 2018;15:54. doi: 10.1186/s12966-018-0687-z.
8. Colatruglio S, Slater J. Challenges to acquiring and utilizing food literacy: Perceptions of young Canadian adults. Canadian Food Studies/La Revue canadienne des études sur l'alimentation. 2016;3:96-118. doi: 10.15353/CFS-RCEA. V3I1.72.
9. Krause C, Sommerhalder K, Beer-Borst S. Nutrition-specific health literacy: development and testing of a multi-dimensional questionnaire. Ernahrungs Umschau. 2016;63: 214-20. doi: 10.4455/eu.2016.046.
10. Ministry of Health and Welfare. 2nd 2017~2021 master plans for national nutrition management. Seoul: Korea Health Promotion Institute.; 2017.
11. Park D, Shin MJ, Son S. Food literacy in South Korea: operational definition and measurement issues. Clin Nutr Res. 2019:8:79-90. doi: 10.7762/cnr.2019.8.2.79.
12. Churchill Jr GA. A paradigm for developing better measures of marketing constructs. J Market Re. 1979;16:64-73. doi: 10.1177/002224377901600110.
13. DeVellis RF. Scale development: theory and applications. University of North Carolina, USA; 2003. doi: 10. 1177/014662169101500413.
14. Amin SA, Lehnerd M, Cash SB, Economos CD, Sacheck JM. Development of a tool for Food Literacy Assessment in Children (TFLAC). J Nutr Educ Behav. 2019;51:364-9. doi: 10.1016/j.jneb.2018.12.006.
15. Azevedo Perry E, Thomas H, Samra HR, Edmonstone S, Davidson L, Faulkner A et al. Identifying attributes of food literacy: a scoping review. Public Health Nutr. 2017;20: 2406-15. doi: 10.1017/S1368980017001276.
16. Cullen T, Hatch J, Martin W, Higgins JW, Sheppard R. Food literacy: definition and framework for action. Can J Diet Pract Res. 2015;76:140-5. doi: 10.3148/cjdpr-2015-010.
17. Truman E, Lane D, Elliott C. Defining food literacy: A scoping review. Appetite. 2017;116:365-71. doi: 10.1016/j.appet.2014.01.010.
18. Truman E, Elliott C. Barriers to food literacy: a conceptual model to explore factors inhibiting proficiency. J Nutr Educ Behav. 2019;51:107-11. doi: 10.1016/j.jneb.2018.08.008.
19. Thomas H, Azevedo Perry E, Slack J, Samra HR, Manowiec E, Petermann L et al. Complexities in conceptualizing and measuring food literacy. J Acad Nutr Diet. 2019;119:563-73. doi: 10.1016/j.jand.2018.10.015.
20. Hyland RM, Wood CE, Adamson AJ, Mathers JC, Hill M, Seal CJ, et al. Peer educators' perceptionsof training for and implementing a community-based nutrition intervention for older adults. J Nutr Elder 2007;25:147-71. doi: 10.1300/ J052v25n03_10.

21. Krause C, Sommerhalder K, Beer-Borst S, Abel T. Just a subtle difference? Findings from a systematic review on definitions of nutrition literacy and food literacy. Health Promot Int. 2018;33:378-89. doi: 10.1093/heapro/daw084.

22. Wilson FR, Pan W, Schumsky DA. Recalculation of the critical values for Lawshe's content validity ratio. Measurement and evaluation in counseling and development 2012;45:197-210. doi: 10.1177/0748175612440286.

23. George D, Mallery M. Using SPSS for Windows step by step: a simple guide and reference. Boston: Allyn & Bacon; 2003.

24. Doustmohammadian A, Omidvar N, Keshavarz-Mohammadi N, Abdollahi M, Amini M, Eini-Zinab H. Developing and validating a scale to measure Food and Nutrition Literacy (FNLIT) in elementary school children in Iran. PLoS One. 2017;12:e0179196. doi: 10.1371/journal.pone.0179196.

25. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate data analysis. NJ: Prentice hall Upper Saddle River; 1998.

26. Browne MW, Cudeck R. Alternative ways of assessing model fit In: Bollen KA, Long JS, editors. Testing structural equation models. Beverly Hills, CA: Sage 1993. pp. 11-35.

27. Bentler PM. Comparative fit indexes in structural models. Psychol Bull 1990;107:238. doi: 10.1037/0033-2909.107.2.238.

28. Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. Psychometrika. 1973;38:1-10. doi: 10.1007/BF02291170.

29. Palumbo R, Adinolfi P, Annarumma C, Catinello G, Tonelli M, Troiano E et al. Unravelling the food literacy puzzle: Evidence from Italy. Food Policy. 2019;83:104-15. doi: 10.1016/j.foodpol.2018.12.004.

30. Richards R, Brown LB, Williams DP, Eggett DL. Developing a questionnaire to evaluate collegstudents' knowledge, attitude, behavior, self-efficacy, and environmental factors related to canned foods. J Nutr Educ Behav. 2017;49:117-24. doi: 10.1371/journal.pone.0187208

31. Ellis J, Brown K, Ramsay S, Falk J. Changes in student-athletes' self-efficacy for making healthful food choices and food preparation following a cooking education intervention. J Nutr Educ Behav. 2017;50:1056-8. doi: 10.1016/j.jneb.2017.10.002.

32. Davis JN, Martinez LC, Spruijt-Metz D, Gatto NM. LA Sprouts: A 12-week gardening, nutrition, andcooking randomized control trial improves determinants of dietary behaviors. J Nutr Educ Behav. 2016;48:2-11. doi: 10.1016/j.jneb.2015.08.009.

33. Pooler JA, Morgan RE, Wong K, Wilkin MK, Blitstein JL. Cooking matters for adults improves food resource management skills and self-confidence among low-income participants. J Nutr Educ Behav. 2017;49:545-53. doi: 10.1016/j.jneb.2017.04.008.

34. Knol LL, Robb CA, McKinley EM, Wood M. Very low food security status is related to lower cooking self-efficacy and less frequent food preparation behaviors among college students. J Nutr Educ Behav. 2019;51:357-63. doi: 10.1016/j.jneb.2018.10.009.

35. Ronto R, Ball L, Pendergast D, Harris N. Adolescents' perspectives on food literacy and its impact on their dietary behaviours. Appetite. 2016;107:549-57. doi: 10.1016/j.appet.2016.09.006

36. Vaitkeviciute R, Ball LE, Harris N. The relationship between food literacy and dietary intake in adolescents: a systematic review. Public Health Nutr. 2015;18:649-58. doi: 10.1002/14651858.

37. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity 2008;16:2205-11. doi: 10.1038/oby.2008.365.

38. Pelletier JE, Laska MN. Balancing healthy meals and busy lives: associations between work, school, and family responsibilities and perceived time constraints among young adults. J Nutr Educ Behav. 2012;44:481-9.

39. Paeratakul S, Ferdinand DP, Champagne CM, Ryan DH, Bray GA. Fast-food consumption among US adults and children: dietary and nutrient intake profile. J Am Diet Assoc. 2003;103:1332-8. doi: 10.1016/S0002-8223(03)01086-1.

40. Šatalić Z, Colić Barić I, Keser I. Diet quality in Croatian university students: energy, macronutrient and micronutrient intakes according to gender. Int J Food Sci Nutr. 2007;58:398-410. doi: 10.1080/09637480701252393.

41. Al-Rethaiaa AS, Fahmy AA, Al-Shwaiyat NM. Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. Nutr J. 2010;9:39. doi: 10.1186/1475-2891-9-39.

42. Burns C, Jackson M, Gibbons C, Stoney RM. Foods prepared outside the home: association with selected nutrients and body mass index in adult Australians. Public Health Nutr. 2002;5:441-8. Doi: 10.1079/PHN2001316.

43. French SA, Story M, Neumark-Sztainer D, Fulkerson JA, Hannan P. Fast food restaurant use among adolescents: associations with nutrient intake, food choices and behavioral and psychosocial variables. Int J Obes. 2001;25:1823-33. doi: 10.1038/sj.ijo.0801820.

44. Nicklas TA, Myers L, Reger C, Beech B, Berenson GS. Impact of breakfast consumption on nutritional adequacy of the diets of young adults in Bogalusa, Louisiana: ethnic and gender contrasts. J Am Diet Assoc. 1998;98:1432-8. doi: 10.1016/S0002-8223(98)00325-3.

45. An S, Shin W, Kim Y. Effect of dietary education of health, environment, and consideration among undergraduate students. Korean Society of Food Culture. 2018;33:176-85. doi: 10.1016/j.jneb.2008.07.001.