Research Brief

Developing a Questionnaire to Evaluate College Students' Knowledge, Attitude, Behavior, Self-efficacy, and Environmental Factors Related to Canned Foods

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ABSTRACT

Objective: Develop a questionnaire to measure students' knowledge, attitude, behavior, self-efficacy, and environmental factors related to the use of canned foods.

Methods: The Knowledge–Attitude–Behavior Model, Social Cognitive Theory, and Canned Foods Alliance survey were used as frameworks for questionnaire development. Cognitive interviews were conducted with college students (n = 8). Nutrition and survey experts assessed content validity. Reliability was measured via Cronbach α and 2 rounds (1, n = 81; 2, n = 65) of test-retest statistics. Means and frequencies were used.

Results: The 65-item questionnaire had a test-retest reliability of .69. Cronbach α scores were .87 for knowledge (9 items), .86 for attitude (30 items), .80 for self-efficacy (12 items), .68 for canned foods use (8 items), and .30 for environment (6 items).

Conclusions and Implications: A reliable questionnaire was developed to measure perceptions and use of canned foods. Nutrition educators may find this questionnaire useful to evaluate pretest–posttest changes from canned foods–based interventions among college students.

Key Words: college students, canned foods, nutrition survey, Knowledge–Attitude–Behavior Model, Social Cognitive Theory (*J Nutr Educ Behav*. 2016;■:1-8.)

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INTRODUCTION

Canned foods have many advantages for consumers, including a long shelf life without refrigeration, minimal storage space requirements, year-round variety, convenience for use in recipes,[1] and favorable cost and nutrition compared with fresh and frozen forms.[2-4] The Dietary Guidelines for Americans 2015–2020 (DGA) states, "All forms of foods, including fresh, canned, dried, and frozen, can be included in healthy eating patterns."[5] However, consumers have some misconceptions about canned foods and 42% of consumers surveyed in 2013 did not know that canned foods contribute to healthy eating patterns.[6]

A recent study suggested that adults and children who consume canned produce have better diet quality, higher nutrient intakes, and higher fruit and vegetable consumption, which help them come closer to meeting the DGA.[7] Few young adults, including college students, consume optimal diets consistent with the DGA.[8-10] Involvement in home food preparation for this age group was linked with better diet quality.[10-12] Barriers to home cooking for this demographic group include a lack of time in busy schedules to shop, cook, and clean up,[11,13-15] limited cooking skills,[11,14-16] and low confidence in preparing foods.[14-16] Cost is another barrier,[11,13-15] as are limited kitchen equipment and the belief that food will spoil before it can be eaten.[15] In addition, it is possible that an apartment shared by students may have inadequate food storage space in the refrigerator, freezer, or cupboards. Using canned foods may help students address barriers to home cooking by saving time, providing convenient ingredients for easy preparation, reducing costs, and requiring no refrigerated storage.

Researchers have recommended designing interventions to help improve college students' cooking skills.[11,14-17] A previous intervention study showed that college students who tasted recipes

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made with canned foods and prepared by others had significant positive changes in perceptions and use of canned foods.[18] To the authors' knowledge no other interventions with canned foods in college students have been reported. To reduce college students' barriers to home cooking, the authors developed an intervention to promote students' use of canned foods in recipes through a class assignment for an introductory nutrition course. To evaluate the intervention, the authors designed a questionnaire to measure students' knowledge, attitude, behavior, self-efficacy, and environmental factors related to the use of canned foods. The purpose of this article was to describe the development of the questionnaire.

METHODS

Questionnaire Development

The Perceptions and Use of Canned Foods (PUCF) online questionnaire (Qualtrics, Provo, UT) was developed by initially reviewing information from the Canned Food Alliance consumer survey[19] and Web site educational materials,[20] evaluating previous canned foods research with a college student population,[18] and considering misconceptions expressed by students in the authors' introductory nutrition courses, which had a diverse enrollment (92% were not nutrition majors). Using the Knowledge–Attitude–Behavior (KAB) Model and Social Cognitive Theory (SCT) as the theoretical framework,[21,22] the PUCF aimed to assess college students' knowledge, attitudes, and behavior about canned foods generally or about specific canned foods (legumes, meat, vegetables, and fruit), food storage space, cooking habits, and students' confidence (self-efficacy) in using canned foods in recipes (Table 1). The KAB Model suggests that knowledge about a topic leads to changes in a person's attitudes and, ultimately, behavior.[21] The SCT denotes a triadic relationship between a person's internal belief system, the external environment, and behavior.[22] Demographic questions applicable to college students and debriefing questions[23] including students' perceptions about the length of the questionnaire and level of ease or difficulty in completing the questionnaire were included. The Brigham Young University's Institutional Review Board for Human Subjects approved this research.

Definitions of specific terms were provided on the questionnaire immediately preceding statements using the terms. Canned foods referred to foods that were shelf stable after being processed in metal cans, bottles, or plastic containers. Legumes were defined as including beans such as black, kidney, pinto, etc, but not green beans or green peas. Furthermore, dry legumes were defined as beans that must be soaked in water for a few hours to soften and then cook, whereas canned legumes were defined as beans that were already softened and cooked, packaged in cans, and ready to use. Canned meats were defined as meats such as chicken, tuna, salmon, Vienna sausages, and Spam. Canned vegetables and fruit were given no additional explanation.

Items in the knowledge construct (9 items) included verifiable statements of fact. Items about attitude (30 items) addressed students' opinions about canned foods, students' use of canned foods in preparing meals, and how much students liked or disliked each category of canned foods. Self-efficacy (12 items), a person's confidence in carrying out a behavior,[22] addressed students' self-reported ability to prepare meals or parts of meals and confidence in using canned vegetables, fruit, legumes, and meat in recipes. Students' canned foods use (8 items) were questions adapted from the National Cancer Institute's validated Diet History Questionnaire–II (DHQ II).[24] Specifically, the question stem, Over the past month, how often did you eat [food]? was modified in the questionnaire to the past 7 days (1-week) time frame and each canned food category replaced the DHQ II's selected food. Response options for frequency of consumption also modeled the DHQ II; the month time frame was replaced with in the past 7 days (Table 1). For the amount of canned foods consumed by participants in the current study, response options on the DHQ II were selected. For canned fruit, the amount listed for applesauce on the DHQ II was used (<0.5 cup; 0.5–1 cup; >1 cup). For canned vegetables, the amount listed for green beans was used (<0.5 cup; 0.5–1 cup; >1 cup). For canned legumes, the amount for cooked dried beans was used (<0.5 cup; 0.5–1 cup; >1 cup). For canned meats, the amount for canned tuna was used (<0.25 cup or <2 oz; 0.25–0.5 cup or 2–3 oz; >0.5 cup or >3 oz). Environment (6 items), external factors that provide opportunities or social support for the behavior,[22] was measured with items about household access to space in cupboards, refrigerators, or freezers to store food, the person(s) responsible for preparing main meals each day, and canned food use in students' households as children.

The knowledge, self-efficacy, attitude (for 22 of 28 items), and environment (1 of 6 items) constructs were formatted as 5-point Likert scales from strongly disagree to strongly agree, with a neutral midpoint of neither agree nor disagree and an I don't know option (Table 1). Response options for the remaining attitude and environment items varied and are presented in Table 1. Response options for level of ease or difficulty in completing the questionnaire were very easy, easy, somewhat easy, neutral, somewhat difficult, difficult, and very difficult. For opinions on the length of time for taking the questionnaire, response options were extremely too long, too long, just about right, too short, and much too short.

Cognitive Interviews

Cognitive interviews were conducted with 8 undergraduate students from a variety of colleges across campus (life sciences, n = 5; business, n = 1; physical and mathematical sciences, n = 1; and undecided major, n = 1) to determine overall clarity and understandability of all questionnaire items (Figure). Cognitive interviews are an in-depth evaluation method in which a trained interviewer asks subjects to think out loud for each question, meaning the subject will be asked to talk out loud about overall reactions to the question, including what the question is asking, what the subject thought of when answering the question, and the overall clarity of the question.[23] Students received a $10 university campus gift card for study participation.

Content Validity

The questionnaire was sent to 4 nutrition and survey research experts outside

Table 1. Items on Perceptions and Use of Canned Foods Questionnaire, by Theoretical Constructs

Item No.	Questionnaire Items, by Construct
	Knowledge[a]
1	I think that canned foods can count toward recommendations for good nutrition in the US.
2	I think that commercially canned foods (not home-canned) are a major source of food-borne outbreaks in the US.
3, 4	Fiber content is similar in canned and fresh [vegetables; fruits].
5, 6	Fiber content is similar in canned and frozen [vegetables; fruits].
7	Fiber content is similar in canned and dry legumes (beans) that have been cooked.
8, 9	Rinsing and draining canned [vegetables; legumes (beans)] reduces their sodium content.
	Attitude
1	How do you feel about cooking?[b]
2	How do you feel about preparing meals?[c]
3	I think that most of the sodium in the American diet comes from canned foods[a]
4	I think canned foods are high in sodium.[a]
5	I think canned foods are highly processed.[a]
6	I think canned foods contain preservatives.[a]
7	I think that canned foods help to make easy meals.[a]
8	I think that canned foods are useful for people with limited storage space.[a]
9–11	I think that canned [vegetables; fruits; meats] cost less than fresh [vegetables; fruits; meats].[a]
12	I think that canned legumes (beans) cost less than dry legumes (beans) that have been cooked.[a]
13, 14	I think that canned [vegetables; fruits] are less expensive than frozen [vegetables; fruits].[a]
15–17	I think that canned [vegetables; fruits; meats] are as nutritious as fresh [vegetables; fruits; meats].[a]
18, 19	I think that canned [vegetables; fruits] are as nutritious as frozen [vegetables; fruits].[a]
20	I think that canned legumes (beans) are as nutritious as dry legumes (beans) that have been cooked.[a]
21–23	I think that canned [vegetables; fruits; meats] are more convenient than fresh [vegetables; fruits; meats] to use in recipes.[a]
24, 25	I think that canned [vegetables; fruits] are more convenient than frozen [vegetables; fruits] to use in recipes.[a]
26	I think that canned legumes (beans) are more convenient to use in recipes than dry legumes (beans) that need to be soaked and then cooked.[a]
27–30	Considering your overall impression of each canned food in general, how much do you like or dislike each of the following canned foods? [Canned vegetables; canned fruits; canned legumes (beans such as black, kidney, pinto, garbanzo, lentils, etc); canned meats (such as chicken, tuna, salmon, Vienna sausages, Spam, etc)][d]
	Self-efficacy[a]
1	I can follow recipe directions.
2	I can prepare a meal.
3	I can prepare a lettuce and vegetable salad.
4	I can prepare a mixture such as a stir-fry.
5	I can prepare a mixture such as a casserole.
6	I can prepare baked goods (such as bread, cakes, cookies, or muffins) from scratch.
7	I can prepare a hot meal without needing to follow a recipe.
8	I am confident that recipes I prepare with canned foods can taste good.
9–12	I am confident that I can prepare recipes with canned [vegetables; fruits; legumes (beans); meats].
	Canned food use
1, 2	Over the past 7 d (1 wk), estimate how often you ate canned [vegetables; fruits].[e]
3, 4	Each time you ate canned [vegetables; fruit], how much did you usually eat?[f]
5	Over the past 7 d (1 wk), estimate how often you ate canned legumes (beans such as black, kidney, pinto, garbanzo, lentils, etc). This does not include green beans or green peas.[e]
6	Each time you ate canned legumes (beans such as black, kidney, pinto, garbanzo, lentils, etc), how much did you usually eat? This does not include green beans or green peas.[f]
7	Over the past 7 d (1 wk), estimate how often you ate canned meats (such as chicken, tuna, salmon, Vienna sausages, Spam, etc).[e]
8	Each time you ate canned meats (such as chicken, tuna, salmon, Vienna sausages, Spam, etc), how much did you usually eat?[g]

(continued)

Table 1. Continued

Item No.	Questionnaire Items, by Construct
	Environment
1	As I was growing up, canned foods were frequently used in meal preparation.[a]
2	Which best describes your circumstances for eating your main meal each day?[h]
3–6	To which of these do you have access in your household for storing food [full-size refrigerator space; mini-refrigerator space; freezer space; cupboard/pantry space]? Mark all that apply.[i]

[a]Response options were on a 5-point Likert scale (strongly agree; agree; neither agree nor disagree; disagree; strongly disagree) and I don't know; [b]Response options were: I really like to cook; I kind of like to cook; I do not like to cook; I really do not like to cook; I am not sure if I like to cook; [c]Response options were: I really like preparing meals; I kind of like preparing meals; I do not like to prepare meals; really do not like to prepare meals; I am not sure if I like to prepare meals; [d]Response options were: dislike very much; dislike moderately; dislike slightly; neither like nor dislike; like slightly; like moderately; like very much); [e]Response options were: never; 1–2 times in the past 7 days; 3–4 times in the past 7 days; 5–6 times in the past 7 days; 7 times in the past 7 days (1 time/d); >7 times in the past 7 days (>1 time/d); [f]Response options were: <0.5 cup; 0.5–1 cup; >1 cup. This question was asked only to those who responded affirmatively to consuming the canned food in the past 7 days; [g]Response options were: <0.25 or <2 oz; 0.25–0.5 cup or 2–3 oz; >0.5 cup or >3 oz. This question was asked only to those who responded affirmatively to consuming the canned food in the past 7 days; [h]Response options were: someone else (spouse, roommate, parent, cafeteria, restaurant/fast-food, etc) prepares most main meals; I am responsible for preparing most main meals; I share responsibility with someone else (spouse, roommate, dinner group, etc) for most main meals; [i]Response options were: I do not have access to this item; I am the only one in my home who has access to this item; I share this item with 1 other person; I share this item with ≥2 people.

the university (Figure). Reviewers were asked to evaluate questionnaire items based on criteria outlined in Mackison et al[25] in relation to clear phrasing, the importance of the item, and content appropriateness for answering the research purpose, using a scale of 0 = poor to 10 = exceptional. Reviewers also evaluated how each item was classified by theoretical construct. Not all reviewers provided numerical scores for each survey item with regard to phrasing, importance, and appropriateness, but they provided comments about ways to improve phrasing and suggested questions to add. Reviewers were consistent in providing comments regarding survey items they felt did not measure the construct. Thus, the researchers did not consider these items to be relevant to the theoretical construct.

Reliability

The university provided e-mails for a random sample of 301 full-time undergraduate students, which was deemed sufficiently large to allow for nonresponse. An e-mail was sent to each student explaining the purpose of the study and the link to the online questionnaire, with a follow-up reminder e-mail a few days later to complete the time 1 survey (test).[23] Respondents were sent a link to complete the questionnaire again 1 week later (time 2, retest), with a follow-up e-mail a few days later for those who had not yet responded (Figure). Respondents who completed the questionnaire both times received a $10 university campus gift card.

After the first round of reliability testing and expert reviews, a second independent sample of 300 full-time undergraduates was drawn and invitations were e-mailed to students in the same manner as the first round, to complete a second reliability test-retest (Figure).

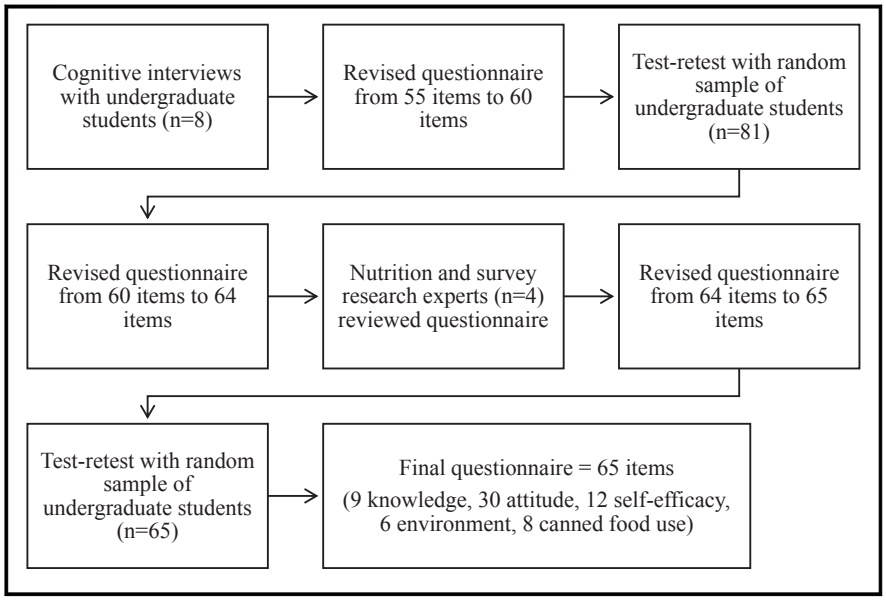

Figure. Questionnaire development process.

Data Analysis

The researchers used means and frequencies to describe sociodemographic characteristics and questionnaire responses. Comments from cognitive interviews and expert reviewers were summarized and evaluated by researchers with discussion regarding which questionnaire items or definitions to change. The percentage of

Table 2. Participant Characteristics and Reported Easiness and Length of Time to Complete the Perceptions and Use of Canned Foods Questionnaire

	Cognitive Interviews (n = 8)		First Round Test-Retest (n = 81)		Second Round Test-Retest (n = 65)	
Characteristics	**n**	**%**	**n**	**%**	**n**	**%**
Gender[a]						
Male	3	38	40	49	30	47
Female	5	63	41	51	34	53
Age (mean ± SD)	21.3 ± 2.2		22.5 ± 4.1		21.3 ± 2.6	
Year in college						
Freshman	2	25	5	6	13	20
Sophomore	2	25	18	22	13	20
Junior	2	25	21	26	21	32
Senior	2	25	37	46	18	28
How easy or difficult was the online survey to complete?[b]						
Very easy	5	63	18	22	20	31
Easy	3	38	16	20	29	45
Somewhat easy	0	0	20	25	11	17
Neutral	0	0	16	20	5	8
Somewhat difficult	0	0	10	12	0	0
Difficult	0	0	1	1	0	0
What is your opinion about the length of time it took you to complete the survey?[c]						
Much too long	0	0	31	38	0	0
Too long	3	38	50	62	22	34
Just about right	5	63	0	0	43	66
Minutes to complete survey (mean ± SD)	25.0 ± 9.3		12.1 ± 7.4		9.4 ± 5.1	

[a]Missing data, n = 1 for second round test-retest; [b]No subjects from cognitive interviews, first round test-retest, or second round test-retest reported the online survey was very difficult to complete; [c]No subjects from cognitive interviews, first round test-retest, or second round test-retest reported the online survey was too short or much too short to complete.
Note: Some percentages do not total 100% owing to rounding.

items each expert reviewer felt needed to be revised was calculated for each theoretical construct, and then percentages were compared across reviewers to calculate an average congruency percentage.[26] Test-retest reliability statistics were performed for both rounds of testing. Cronbach α scores were calculated for each theoretical construct on the final questionnaire. All analyses were performed in Statistical Analysis System software (version 9.2, SAS Institute, Inc, Cary, NC, 2007).

RESULTS

Most participants in the cognitive interviews were female; however, the proportion of males and females in the test-retest reliability was fairly even (Table 2). The initial questionnaire consisted of 55 items. Key findings from the cognitive interviews included confusion about the following items: the sodium content of canned foods, because some have higher and others have lower sodium; uncertainty about canned foods as a major cause of food-borne illnesses because of different risks of home vs commercial canning; the amount of waste associated with canned foods, because waste could refer to inedible parts of foods prepared from scratch at home, discarded cans or bags, or waste during commercial canning processes; the definition of dry legumes (beans), which could mean dry beans in a bag, unprepared legumes, or dry legumes (beans) that had been cooked; and confusion about the types of canned meats to consider when answering questions in this section. Based on these findings, 5 new items were added, 9 items were modified, 2 terms were defined, and an I don't know response option was included for each item using a Likert scale.

For the first round test-retest, 101 students completed the first test; 81 of those (80.2%) completed the retest (Figure). The test-retest reliability score was .76. An entire grouping of questions (students' perception of the canned food categories leaving less food waste than fresh or frozen counterparts) had low reliability (.33). Although a definition was added for food waste on the questionnaire to clarify concerns raised in the cognitive interviews, reliability testing showed that these items were still likely confusing for students to answer; thus, these questions were dropped. The authors further reviewed the questionnaire to ensure that all questions were necessary and to determine whether any concepts were missing. Seven additional self-efficacy questions were added and intake of canned foods was expanded from 1 to 8 questions modeled after the DHQ II.

Table 3. Individual and Average Congruency Percentages of Expert Reviewers

	Expert Reviewers (%)				
Theoretical Construct	**1**	**2**	**3**	**4**	**Average**
Attitude	13	96	61	100	67.5
Knowledge	100	92	100	100	98.0
Behavior	100	100	100	100	100
Self-efficacy	100	100	100	100	100
Environment	100	100	100	100	100

Overall, 17 items were added to the questionnaire, 4 items were modified, and 13 items were deleted. The revised questionnaire was then sent to nutrition and survey research experts. Table 3 outlines average congruency percentages; all constructs had an average of 100% except attitude, which averaged 67.5%. Based on expert reviewers' feedback, the revised questionnaire was further modified, with 2 questions deleted, 24 questions and 2 definitions modified, and 3 questions added (Figure).

The second round of test-retest reliability had 80 students who completed the first test; 65 of those (80%) completed the retest (Figure). Test-retest reliability was .69. Cronbach α scores for the theoretical constructs were .87 for knowledge, .86 for attitude, .80 for self-efficacy, .68 for canned food use, and .30 for environment. No modifications were made to the questionnaire after the second round of testing.

The final questionnaire consisted of 65 items (9 knowledge, 30 attitude, 12 self-efficacy, 6 environment, and 8 canned food use) and had a Flesch-Kincaid grade-level reading score of 5.6 (Table 1). Mean time to complete the questionnaire was about 9.5 minutes; 66% of students thought it was just about the right length and 75% of students indicated that it was easy or very easy to complete (Table 2).

DISCUSSION

The PUCF questionnaire was designed to measure college students' knowledge and attitudes about canned foods, self-efficacy in preparing foods in general and with canned foods, use of canned foods, and environmental conditions that may influence knowledge, attitudes, self-efficacy, and use of canned foods. The questionnaire was judged to have content validity because overall, the reviewers deemed the questionnaire to measure appropriately what it intended to measure.[27] Although the test-retest reliability of .69 for the final questionnaire did not meet the ideal of .7–.8,[28] it was fairly close. Further reliability analysis through Cronbach α testing suggested good reliability for the knowledge, attitude, and self-efficacy constructs, with scores ranging from .80 to .87. Canned food use was slightly below the ideal and environment was a much lower value, which was anticipated. Some of the questions about use of canned foods did not apply to subjects; thus, totals for all items grouped together for this variable were not equal, which was likely the reason for lower Cronbach α scores. The environment variable statements all had different response options, with only 1 of 4 statements using a Likert scale; the other 3 statements gathered information about the context of students' environment.

The questionnaire had an appropriate readability level for health-related materials, which is between the fifth- and sixth-grade reading level.[29] The majority of students found the questionnaire length to be just about right and felt it was easy to complete. Students may have perceived the questionnaire to be easy to complete because it was administered online (it was mobile friendly) and the study's target population (college students) was generally technology savvy and could easily access the Internet.[30,31] Mean time to complete the final version of the questionnaire was <10 minutes, which was within the optimal range noted to influence the survey response rates of college students positively.[32] The questionnaire response rate was comparable to or higher than that of recent studies collecting health-related information from college students through online surveys.[33,34]

A strength of this study was the multiple steps of questionnaire evaluation performed, including cognitive interviews, expert reviews, 2 rounds of test-retest reliability, and Cronbach α reliability testing.[23,27,28] In addition, it involved random sampling strategies with adequate power and a high response rate for time 2 of test-retest rounds 1 and 2. The questionnaire was delivered online and took minimal time for students to complete. A limitation was that the questionnaire was developed in 1 geographical region with a homogeneous population from 1 university, so its use with more diverse age or racial or ethnic groups would need to be tested for consistency of findings. The questionnaire also did not include questions about the use of canned foods from the grains or dairy food group. In addition, the lower Cronbach α score on the environmental construct limited the reliability of this construct. Another limitation was that data on canned food use was self-reported, with no test of external validity. The authors also acknowledge that other forms of instrument validity such as criterion and construct validity can be measured; however, content validity was the most feasible to measure in this study. No reference standard instrument currently exists related to perceptions and use of canned foods; thus, criterion (concurrent) validity could not have been measured.[27]

IMPLICATIONS FOR RESEARCH AND PRACTICE

Nutrition educators may find this questionnaire useful to evaluate pretest–posttest changes from canned food–based interventions among college students. The questionnaire also has the potential to provide nutrition educators with initial insights about the perceptions and use of canned foods that might be addressed through educational interventions (ie, to decrease negative perceptions or reinforce positive ones). Furthermore, repeated use of this questionnaire over time could

provide the means to calculate construct validity,[27] thus providing additional evidence of its overall validity. Additional research is needed to determine other environmental items influencing at-home canned food use that should be included on the questionnaire to strengthen the reliability of this construct. The current study focused on at-home environmental factors that were anticipated to influence food preparation of canned foods; however, external environmental factors such as food stores on college campuses and in the surrounding neighborhood[35] should also be considered in future research.

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.