Reliability and Validity of a Questionnaire to Measure Consumer Knowledge Regarding Safe Practices to Prevent Microbiological Contamination in Restaurants

Paula Lazzarin Uggioni, PhD; Elisabete Salay, PhD

ABSTRACT

Objective: The objective of this study was to develop a validated and reliable questionnaire to measure consumer knowledge regarding safe practices to prevent microbiological contamination in restaurants and commercial kitchens.

Methods: Non-probabilistic samples of individuals were interviewed in the city of Campinas, Brazil. Questionnaire items were elaborated and reviewed. Content and construct validity, item analysis, test-retest, and internal consistency were developed.

Results: The questionnaire content validity index was 96%. The final instrument presented 23 items, a satisfactory Kuder-Richardson formula 20 of 0.66, construct validity ($P < .001$), and reproducibility ($r = 0.77$).

Conclusions and Implications: The developed questionnaire can be used to support consumer education action.

Key Words: knowledge, food safety, validity, consumer (*J Nutr Educ Behav*. 2013;45:250-257.)

INTRODUCTION

Foodborne illness is a widespread and growing public health problem, and the occurrence of different types of foodborne disease in foodservice establishments has been reported.[1,2]

Previous studies have suggested that consumers use several food safety cues in their choice of food service, such as observations of the general appearance, locale, and staff hygiene.[3-5] In fact, consumer food safety evaluation of restaurants is based on broad groups of indicators.[6] However, in the assessment of the safety of a locale for eating out, consumers can make mistakes because they sometimes use evaluation indicators not directly related to quality and safety, such as how crowded a restaurant seems.[7] In fact, the choice of restaurant occurs in the context of imperfect and asymmetric information, since food safety is, in general, an experience or credence characteristic (for example, the standards of hygiene, level of patronage, or overall quality observed) for the consumer.[6] For such a situation of imperfect information, several correction tools have been used, including consumer education.[8]

As a matter of fact, the need to educate the consumer about choice of safe restaurants has been pointed out by food and nutrition professionals.[2] Governmental entities have perceived this need, and action directed at consumer education in instances of eating out is beginning to develop. Examples of informational activities are publications containing consumer orientation such as "Restaurant and Take-out Safety"[9] and the "Food Safety Fact Kit: Dining Out Safely."[10] Another example is the Irish Citizens Information Web site, which provides information regarding how to avoid foodborne diseases when eating out.[11]

This scenario suggests that it is relevant to study consumer knowledge regarding food safety in restaurants. Measuring consumer knowledge regarding safe practices to prevent microbiological contamination can help governments to identify consumer segments in need of education, contributing to support the conception and further the evaluation of educational action. Food safety education is relevant to reduce risky eating behaviors and can contribute to the reduction of foodborne illness risk in the long term.[12,13]

To the best of the authors' knowledge, no previous research has been carried out to measure average consumer knowledge about safe practices to prevent microbiological contamination in restaurants. However, studies have analyzed the food safety knowledge of employees in various types of food service.[14-16] It should also be noted that there is a need for validated and reliable instruments to measure average consumer food safety knowledge.

The development of such a measurement instrument is labor intensive and involves a variety of studies. Content validity should be carried out first, with experts evaluating the relevance of the survey instrument items to the knowledge domains studied. Next, the development of the criterion-related and construct validity is recommended, such as the discriminative

Department of Food and Nutrition, University of Campinas, Campinas, São Paulo, Brazil Address for correspondence: Paula Lazzarin Uggioni, PhD, Department of Food and Nutrition, University of Campinas, R. Monteiro Lobato, n. 80, 13083-862, Campinas, São Paulo, Brazil; Phone: +55 19 35214081; Fax: +55 19 3521 4060; E-mail: paulaug25@yahoo.com.br

http://dx.doi.org/10.1016/j.jneb.2011.09.007

validity with the instrument being applied to 2 groups with different levels of the knowledge under study. For reliability, the evaluation of internal consistency and the test-retest procedures are generally used.[17,18]

In this sense, the present research aims to develop a validated and reliable questionnaire to measure consumer knowledge regarding safe practices to prevent microbiological contamination in restaurants and commercial kitchens.

METHODS

Questionnaire Construction

Data collection was carried out from June-November, 2009. The participants were over 18 years old, lived in Campinas, and ate away from home. No incentives were provided for the interviewees. Development of the questionnaire involved the following 6 steps.

Step 1: Preliminary item writing. To elaborate the questionnaire items, a review of the scientific literature and Brazilian food legislation regarding food safety practice in restaurants was first carried out,[14-16,19-21] and the relevant content domains were identified. The items were written according to recommendations found in the specialized literature, such as: (1) to design items with proper grammar; (2) to reduce the threat of knowledge questions, using the option "don't know" as an answer category; (3) to pay attention to technical or confusing terms that are not understood by the target population; (4) to develop adequate answer options in order to not confuse the interviewees; and (5) to write simple and clear questions.[18,22]

Step 2: Content validity. In this step, to establish content validity, food safety and nutrition experts (2 with PhDs, 4 with masters degrees, and 1 high school instructor) were invited to review the survey questionnaire. The experts were first invited to participate in the analysis by e-mail. The material—prepared according to Di Iorio,[18] with explanations regarding the research objectives, concepts related to the instrument (microbiological risk, food safety, knowledge), and procedures for the question assessment—was then sent by e-mail to the experts after they had agreed to participate. They analyzed the relevance of the items to the content domain (safe practices to prevent microbiological contamination in restaurants) and clarity, and they provided a score ranging from 1 (non-relevant) to 4 (very relevant). The need for new item inclusion, taking into consideration the content domain, was also studied by the experts. A content validity index (CVI) was then calculated for each item (CVI = [number of "3" and "4" scores/number of experts] × 100) and for the total set of the items (CVI = $\sum$ percentage of "3" and "4" scores from each expert/number of experts).[18] The questionnaire was then reviewed according to the experts' suggestions.

Step 3: Pilot test. In the pilot test, 120 participants (college students, workers, visitors, and college teachers) who frequented the restaurants and leisure areas located on the University of Campinas (UNICAMP) campus were interviewed. The subjects were approached in a non-systematic way, and the research objectives and methods were explained to them. After signing a consent form, the participants were interviewed face-to-face in Portuguese. The interviews were carried out by the first author of this paper and by 6 food engineering students from UNICAMP. All of the researchers were trained and received a manual elaborating the data collection procedures for the study. It should be pointed out that the participants were informed of the possibility of choosing more than 1 correct option to respond to the questions measuring knowledge. A reply was considered to be correct when the consumer chose all of the correct options for each question. If the interviewee marked an incorrect option or did not mark a correct option, the question was considered incorrect. A pilot test of the instrument was carried out, with the objective of evaluating the clarity and comprehensiveness of the written items and the response options according to the consumers. The time taken to apply the instrument was also evaluated. The internal consistency of the questionnaire was assessed by the Kuder-Richardson Formula 20 (KR_{20}).

Step 4: Item analysis. In this phase, 150 participants were interviewed, following the same general procedure (in a non-systematic way and face-to-face interview) and in the same university areas described in step 3. The difficulty index, the discrimination index, and the KR_{20} were calculated. The difficulty index measures the percentage of respondents who answered correctly. Items with a difficulty index outside the recommended range of 0.2 (20%)-0.8 (80%) were reformulated or eliminated.[23,24] The discrimination index, measured by the bi-serial correlation, shows the ability of the items to discriminate participants who answer correctly from those who answer incorrectly.[24,25] Items with correlations < 0.2 were eliminated.[23,26,27] The internal consistency reliability of the questionnaire was assessed by the KR_{20}. A value of 0.7 for this coefficient is considered adequate.[18,24]

Step 5: Discriminative validity. To assess the discriminative validity of the questionnaire, 79 students were interviewed. The questionnaires were administrated in 2 groups with supposedly different microbiological risk knowledge levels: 40 students from the department of food engineering and 39 from the social sciences. Appointments were made with the teacher responsible for the class by the person responsible for carrying out the interviews. The surveys were self-administered in the school classrooms and took approximately 15 minutes. The self-administered form of interview was chosen as a function of the time available for the interviews, since if the face-to-face form were used (as in the previous steps), it would take a relatively longer time, which might not be authorized by the person responsible for the classes. Each correct answer received a score of 1, whereas wrong answers received a score of 0. The total knowledge score was obtained from the sum of the correct answer scores, and the maximum score was 23. The Student *t* test (for independent samples) was used to analyze the differences between the total knowledge scores of the groups, with a confidence level of 95%.

Step 6: Reliability. The test-retest of the instrument was carried out with

the social science student class (n = 28). The data collection procedure was the same as described in step 5 (self-administered in the school classrooms). To assess its ability to measure the knowledge in a reproducible way, the test-retest method is the administration of the instrument at 2 distinct periods of time.[18] The Pearson coefficient of linear correlation was estimated for the knowledge score of each participant for the different time periods. For reproducibility, a coefficient of 0.7 is generally considered acceptable, and 0.8 is better.[18,23]

The software Statistical Package for the Social Sciences (version 17.0, SPSS Inc, Chicago, IL, 2009) and XLSTAT (version 06, Addinsoft USA, New York, NY, 2006) were used in the data analysis. It should be pointed out that the normality of the distribution of the variables was verified by the Kolmogorov-Smirnov (KS) test.

The research protocol was approved by the Ethics Committee for Research with Human Beings of the Faculty of Medical Sciences, UNICAMP (protocol no. 1062/2008).

RESULTS AND DISCUSSION

Study Participants

The samples used in the pilot test and item analysis step were approximately half female and half male, and all frequented the restaurants and leisure

Table 1. Sociodemographic Characteristics of Interviewed Population at Different Steps, Campinas-SP, Brazil, 2009 (n = 349)

					Discriminative Validity[a]				Reliability	
	Pilot Test (n = 120)		Item Analysis (n = 150)		Food Engineering (n = 40)		Social Science (n = 39)		Test-Retest (n = 28)	
Characteristics	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Sex										
Male	60	50.0	75	50.0	10	25.0	15	38.5	13	46.4
Female	60	50.0	75	50.0	30	75.0	24	61.5	15	53.6
Age (y)										
18-24	62	51.7	47	31.3	35	87.5	29	74.3	20	71.4
25-39	46	38.3	38	25.3	5	12.5	9	23.1	7	25.0
40-59	12	10.0	57	38.0	-	-	1	2.6	1	3.6
≥ 60	-	-	8	5.4	-	-	-	-	-	-
Monthly household income										
≤ 2 SM	8	6.7	25	16.7	2	5.0	3	7.7	2	7.1
2-5 SM	35	29.2	48	32.0	2	5.0	7	17.9	11	39.3
5-10 SM	24	20.0	24	16.0	8	20.0	12	30.8	4	14.4
10-15 SM	8	6.7	3	2.0	6	15.0	3	7.7	3	10.7
> 15 SM	13	10.8	8	5.3	9	22.5	5	12.8	5	17.8
No income	1	0.8	-	-	1	2.5	2	5.1	-	-
Do not know	16	13.3	19	12.7	5	12.5	3	7.7	1	3.5
Do not want to answer	14	11.7	23	15.3	7	17.5	4	10.3	2	7.2
Education level										
Primary incomplete	2	1.7	20	13.3	-	-	-	-	-	-
Primary complete	3	2.5	10	6.7	-	-	-	-	-	-
High school incomplete	-	-	6	4.0	-	-	-	-	-	-
High school complete	7	5.8	32	21.3	-	-	-	-	-	-
Higher education incomplete	63	52.5	40	26.7	39	97.5	30	76.9	22	78.6
Higher education complete	6	5.0	16	10.7	-	-	7	17.9	6	21.4
Postgraduate incomplete	32	26.7	16	10.7	1	2.5	1	2.6	-	-
Postgraduate complete	7	5.8	9	6.0	-	-	1	2.6	-	-
Did not study	-	-	1	0.7	-	-	-	-	-	-
Frequency of meals eaten away from home (per wk)										
1	3	2.5	9	6.0	1	2.5	5	12.8	3	10.7
2-5	56	46.6	98	65.3	26	65.0	22	56.4	17	60.7
6-10	50	41.7	38	25.3	11	27.5	11	28.2	8	28.6
> 11	11	9.2	5	3.4	2	5.0	1	2.6	-	-

SM indicates household minimum wage; 1 SM = Reais $465.00 (at the time of the interviews, this amount was equivalent to US $268.78).

[a]No significant difference was observed between the groups regarding sex (Fisher exact test; $P = .23$), age (Student t test; $P = .11$), monthly household income (chi-square; $P = .07$), and frequency of eating away from home (Student t test; $P = .91$). However, a significant difference was noted regarding educational level (Fisher exact test; $P = .007$).

areas of a university campus. In these samples, the income and education levels were in the range from 2-10 times the minimum wage per household, with an incomplete college education (Table 1). The average ages were 28.7 (± 11.0) and 36.5 (± 5.0) years in these studies. Considering the frequency of eating away from home, the individuals from the pilot test and item analysis phases showed higher proportions, 6.4 (± 3.3) times for the pilot test and 5.0 (± 2.5) for the item analysis phase.

For the discriminative validity, the food engineering and the social science student samples contained slightly higher proportions of females (75.0% for the food engineering group and 61.5% for the social science group, respectively). The average age in the food engineering class was 23.1 (± 1.2) years, and for the social science class it was 25.4 (± 7.5) years. The average for the frequency of meals eaten outside the home was 5.0 times/wk (± 2.3) and 4.9 times/wk (± 3.5), respectively. In the social science and food engineering groups, respectively, 56.4% and 30.0% had incomes of up to 10 times the minimum wage/household (Table 1).

Step 1: Preliminary Item Writing

From the literature review, the following knowledge domains of food service practices were identified: food handler hygiene, food pre-preparation and preparation, food acquisition and storage, installation and utensil hygiene, and food distribution. Twenty-two items were written concerning these subjects. The answers were multiple choice, with 3 or 4 options in addition to the option of "I don't know."

Step 2: Content Validity

After the evaluation of the 22 items by the group of experts, the CVI calculated for the total questionnaire was 91%, with a variation from 60%-100%. Questions with CVI < 90% were excluded or reformulated, and new items were included following the experts' suggestions. One example of an excluded question was: "Which is the ideal internal meat temperature for cooking?" This item was considered by the experts to be very specific and not relevant for the consumers. One example of a question suggested for inclusion was: "How long should one immerse lettuce in a bleach solution, in order to sanitize it?" The questionnaire was then re-evaluated by the experts. The reviewed questionnaire presented 19 items and a satisfactory CVI (96%).

Step 3: Pilot Test

The pilot test of the 19-item questionnaire showed that some items required further review to be better understood by the interviewees. Some items were thus reworded, and new options of answers were included. In addition, it was noted that the inclusion of questions would be necessary to increase the questionnaire's internal consistency (0.45). Therefore, 7 new questions were included, such as: "When serving themselves from a display unit, which consumer behavior can contaminate food?" and "During food preparation, which situations require the mandatory use of disposable gloves?" The reviewed instrument presented 26 items with 3-5 answer options, and 1 or more answer options was correct. The answer was considered correct when all the correct options were indicated. The instrument administration time of approximately 10-15 minutes was considered satisfactory.

Step 4: Item Analysis

The mean difficulty index for the questionnaire items was 0.49. Previous studies regarding the measurement of knowledge showed mean difficulty indexes of 0.61,[20] 0.62,[13] and 0.41.[26]

The calculated difficulty indexes showed that some of the questions were very easy, such as item 7 ("proper uniform uses"), with 94.7% correct answers, and item 8 ("types of food with higher contamination risk"), with 85.3% correct answers. Questions 18 ("egg type, uncooked for dessert") and 19 ("proper disposable glove use") were classified as difficult, since only 20% of the interviewees answered these correctly.

Regarding the discrimination index, a full 61.5% of the questions showed a satisfactory index (> 0.3), and 11.5% showed a weak discrimination index (< 0.2). The mean discrimination index score for the questions was 0.31. Previous studies obtained values for this index of 0.33,[20] 0.35,[13] and 0.40.[26]

Two items ("proper uniform uses" and "types of food with higher contamination risk") were excluded because they presented difficulty index values of 0.05 and 0.15, and discrimination indexes of 0.05 and 0.01, respectively. One item, "silverware sanitization," showed a discrimination index of 0.18 and was also eliminated. Two items that were identified as difficult ("uncooked egg for dessert" and "proper disposable glove use") were reformulated.

After the exclusion of the questions cited above, the KR_{20} coefficient was satisfactory (0.66). Previous research to develop a questionnaire to measure food safety knowledge obtained a Livingston coefficient of 0.92 and varied from 0.72-0.87 in the instrument sections,[20] or with a Cronbach α coefficient of .75-.82.[13] Instruments used to measure nutrition knowledge showed a value for the Cronbach α coefficient between .70-.90[28] and a KR_{20} value of 0.60.[29]

Step 5: Discriminative Validity

Considering a total of 23 questions, the mean score for correct answers

Table 2. Descriptive Statistics for Knowledge Scores Regarding Safe Practices to Prevent Microbiological Contamination in Restaurants for Food Engineering and Social Science Students, Campinas-SP, Brazil, 2009 (n = 79)

Group	Mean	SD	Minimum	Median	Maximum[a]	*P* Value[b]
Food Engineering	16.7	3.3	9.0	17.0	22.0	< .001
Social Science	8.3	3.5	1.0	9.0	16.0	

[a]The maximum possible score was 23; [b]Level of significance of 5%.

Table 3. Safe Practices to Prevent Microbiological Contamination in Restaurants: Knowledge Instrument[a]

Questions	Response Options
Food handler hygiene	
Which of the following items can food handlers not use during meal preparation?	**a. Ring** b. Disposable gloves **c. Beard** **d. Make-up** **e. Watch** f. I don't know
Under which of the following health conditions can food handlers not work with food preparation?	a. Acquired immune deficiency syndrome **b. Fever** **c. Tooth decay** **d. Cold** e. I don't know
Which kind of soap must food handlers use to sanitize hands?	a. Scented liquid soup b. Neutral antiseptic soup bar **c. Antiseptic liquid soup** d. I don't know
Which materials are best for food handlers to dry hands?	a. Cloth towel **b. Hot air dryer** **c. White paper towel** d. Recycled paper towel e. I don't know
Indicate all the situations in which food handlers have to sanitize their hands:	**a. After collecting the trash** b. Before touching money **c. After touching the face** **d. Before putting on disposable gloves** e. I don't know
Indicate all practices that are forbidden for food handlers during meal preparation:	**a. Chewing gum** b. Going to the bathroom **c. Eating** **d. Touching hair** e. I don't know
Food acquisition and storage	
Which kind of food should be stored on the upper shelves of the refrigerator?	**a. Ready-to-eat food** b. Raw meat c. I don't know
Which of the following food items must have the temperature checked when received by the restaurant?	a. Beans **b. Feta cheese** c. Eggs d. I don't know
What is the ideal period of time for raw fish to be stored under refrigeration at 4°C?	**a. 1 d** b. 5 d c. 8 d d. I don't know
What is the ideal temperature in restaurant freezers?	**a. − 18°C** b. − 8°C c. 0°C d. I don't know
Food pre-preparation and preparation	
The food sanitization process is comprised of these steps: wash the product in running tap water, immerse the product in bleach solution, and rinse the product in running water. Indicate which of the following food items do not need to be sanitized:	a. Orange for juice b. Tomato for salad **c. Tangerine for dessert** d. I don't know
For how long should one immerse lettuce in a bleach solution, in order to sanitize it?	a. 25-30 minutes **b. 15-20 minutes** c. 5-10 minutes d. I don't know

(continued)

Table 3. Continued

Questions	Response Options
Which is the best way to defrost food?	a. In running tap water, at room temperature **b. In the refrigerator** c. I don't know
Regarding ready-to-eat food that was defrosted but not totally used:	**a. It cannot be refrozen** b. It can be refrozen, if packaged correctly c. I don't know
Can the same cutting board be used for raw and cooked vegetables?	a. Yes, after being washed in running tap water **b. No, it is recommended to use different cutting boards** c. I don't know
Which egg types must be used in raw desserts?	**a. Pasteurized** b. Raw **c. Dehydrated** d. I don't know
During food preparation, which situations require the mandatory use of disposable gloves?	**a. Handling ready-to-eat cooked food** b. Handling raw food ingredients that will be cooked **c. Handling sanitized fruits and vegetables.** d. I don't know
Installation and utensil sanitization	
With which of the following products must the kitchen floor be sanitized daily:	a. Water and soap **b. Water, soap and sanitizing product** c. Hot water and soap d. I don't know
Regarding restaurant utensil cleaning, identify the inappropriate practices:	**a. Use a brillo pad to clean the pan** b. After washing the equipment, let it dry naturally **c. Sweep the dried kitchen floor** d. All of the above options e. I don't know
Food display	
How should the meal item be repositioned in a self-service display balcony platter?	**a. Reposition the food and change the platter** b. Reposition the food on the same platter c. The 2 previous alternatives are correct d. I don't know
How long can heated food (at 60°C) in the distribution display be exposed for consumption?	**a. Maximum of 6 hours** b. Maximum of 8 hours c. Maximum of 12 hours d. I don't know
Can food left over from the self-service display be placed in the display the next day?	a. Yes, if the food was stored appropriately **b. No, the leftover food cannot be reused** c. Yes, all leftover food can be reused d. I don't know
When serving themselves from a display unit, which consumer behavior can contaminate food?	**a. Talking over food** b. Washing hands before serving **c. Using the serving utensils from one preparation in another** **d. Touching their hair** e. I don't know

Note: The correct answers are bolded. Questions can have more than 1 correct answer.

for the food engineering group was 16.7, which was significantly higher than the score for the social science group (8.3; Student t test; $P < .001$). The highest scores observed in the 2 groups were 22 and 16, respectively (Table 2). It can be seen that the data for the evaluation of knowledge followed a normal distribution (KS = 0.815; $P = .52$).

No significant difference was observed between the 2 student groups with respect to sex ($P = .23$), age ($P = .11$), monthly household income ($P = .07$), or frequency of eating away from home ($P = .91$). However, the educational level of the social science class was significantly higher ($P = .007$) than that of the food engineering class. Apparently, this difference did not influence the results of

the questionnaire's discriminative validity test, since the social science class obtained the lowest knowledge score on safe practices to prevent microbiological contamination in restaurants. The internal consistency values in this research phase were 0.64 and 0.67 for the food engineering group and the social science group, respectively.

Step 6: Reliability

The Pearson linear correlation coefficient presented a satisfactory value ($r = 0.77$). This value of approximately 0.80 indicates that 59% of the classification in the first test was identical to that in the retest, therefore the questionnaire can be considered precise.

When carrying out test-retest analyses, some researchers observed difficulties in performing the retest.[18,24,30] For example, financial resources, time availability, and finding participants willing to collaborate were problematic. This step analyzed the same sample. However, the sample size was different (39 students in the test and 28 in the retest analysis), but this difference did not interfere with the statistical analysis.

Regarding the period of time between the first and second tests, 4 weeks was chosen. This period was considered satisfactory by Streiner et al,[24] who pointed out the difficulties of smaller or larger time intervals.

The complete instrument, translated from Portuguese, with the 23 items and the multiple-choice answers, structured into 5 sections, can be seen in Table 3. The instrument model was developed for administration in a face-to-face interview.

Limitations

The questionnaire developed was intended to be administered to consumers over the age of 18 years who eat out. However, a limitation of the present research was that the sample was not representative of the target population, since it consisted of a group of individuals who frequented the university campus in the city of Campinas, Brazil. Thus, it is recommended that the questionnaire be administered to other population groups (such as less educated consumers) and to address the need for eventual adaptations.

The questionnaire presented satisfactory validity and reliability indicators. Further research could improve the instrument by including new questions, for example, on the subject of meat product preparation, vegetable storage, and product shelf-life. Note also that the questionnaire was based on Brazilian food safety legislation. Its administration to consumers in different countries would require adaptation to the local laws and ordinances.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The validity and reliability procedures used to develop the questionnaire showed satisfactory results, suggesting that the 23-item version could be used in further studies to discriminate consumer knowledge regarding safe practices aimed at preventing microbiological contamination in restaurants and commercial kitchens. It is important to note that a valid and reliable questionnaire would directly influence the accuracy and interpretation of further research results.

Educational programs regarding food safety could help consumers choose safer restaurants. A food safety knowledge questionnaire is a powerful tool to design, implement and evaluate consumer education programs. The instrument could be used mainly to differentiate between consumer segments regarding their knowledge level. Consequently, the most urgent consumer categories for educational action can be identified. In addition, the consumer's level of knowledge for each question included in the questionnaire can be verified, thus suggesting which areas to prioritize in an educational program.

In some towns in Brazil, as in other countries, the consumer is guaranteed the right, by law, to visit restaurant kitchens. An educational program could encourage consumers to visit the kitchens and provide information for a better understanding of safe food handling in these locations. Thus, education regarding safe handling practices in restaurants could provide subsidies to consumers to choose safer establishments and hence reduce the risk of foodborne illnesses.

ACKNOWLEDGMENTS

The authors are grateful to the São Paulo Research Foundation (FAPESP) for providing funding for this research, to the National Council for Scientific and Technological Development (CNPq) for providing a fellowship to the first author, and to the EasyStat company for statistical consultancy.

REFERENCES

1. Haapala I, Probart C. Food safety knowledge, perceptions, and behaviors among middle school students. *J Nutr Educ Behav*. 2004;36:71-76.
2. Sneed J, Strohbehn CH. Trends impacting food safety in retail foodservice: implications for dietetics practice. *J Am Diet Assoc*. 2008;108:1170-1177.
3. Fatimah UZAU, Boo HC, Sambasivan M, Salleh R. Foodservice hygiene factors: the consumer perspective. *Int J Hosp Manag*. 2001;30:38-45.
4. Sienny T, Serli W. The concern and awareness of consumers and food service operators toward food safety and food hygiene in small and medium restaurants in Surabaya, Indonesia. *International Food Research Journal*. 2010;17:641-650.
5. Sanches M, Salay E. Eating away-from-home of consumers from Campinas city, São Paulo, Brazil. *Rev Nutr*. 2011; 24:295-304.
6. Henson S, Majowicz S, Masakure O, et al. Consumer assessment of the food safety of restaurants: the role of inspection notices and other information cues. *J Food Saf*. 2006;26:275-301.
7. Tse ACB, Sin L, Yin FHK. How a crowded restaurant affects consumers attribution behavior. *Int J Hosp Manag*. 2002;21:449-454.
8. Caswell JA, Mojduszka EM. Using infomational labeling to influence the market for quality in food products. *Am J Agric Econ*. 1996;78:1248-1253.
9. Food and Drug Administration Office of Women's Health. Restaurant and Take-Out Safety. http://www.fda.gov/downloads/ForConsumers/ByAudience/ForWomen/UCM121907.pdf. Accessed January 9, 2012.
10. National Sanitation Foundation International. Dining Out Safely. http://www.nsf.org/consumer/newsroom/pdf/fact_fs_diningout.pdf. Accessed January 9, 2012.
11. Citizens Information Centre. Food safety and eating out. http://www.

citizensinformation.ie/en/health/food_safety/food_safety_and_eating_out.html. Updated September 20, 2010. Accessed May 10, 2012.
12. Byrd-Bredbenner C, Abbot JC, Wheatley V, Schaffner D, Bruhn C, Blalock L. Risky eating behaviors of young adults: implications for food safety education. *J Am Diet Assoc*. 2008;108:549-552.
13. Medeiros LC, Hillers VN, Chen G, Bergmann V, Kendall P, Schroeder M. Design and development of food safety knowledge and attitude scales for consumer food safety education. *J Am Diet Assoc*. 2004;104:1671-1677.
14. Bas M, Ersun AS, Kivanç G. The evaluation of food hygiene knowledge, attitudes, and practices of food handlers in food businesses in Turkey. *Food Control*. 2006;17:317-322.
15. Bolton DJ, Meally A, Blair IS, McDowell DA, Cowan C. Food safety knowledge of head chefs and catering managers in Irland. *Food Control*. 2008;19:291-300.
16. Omemu AM, Aderoju ST. Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria. *Food Control*. 2008;19:396-402.
17. De Vellis RF. *Scale Development Theory and Applications*. 2nd ed. Thousand Oaks, CA: Sage Publications; 2003.
18. Di Iorio CK. *Measurement in Health Behavior Methods for Research and Education*. San Francisco, CA: Jossey-Bass; 2005.
19. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. *Resolução RDC n°. 216 de 15 de setembro de 2004*. Aprova o regulamento Técnico de Boas Práticas para Serviços da Alimentação. Brasília: MS; 2004.
20. Byrd-Bredbenner C, Wheatley V, Schaffner D, Bruhn C, Blalock L, Maurer J. Development and implementation of a food safety knowledge instrument. *Journal of Food Safety Education*. 2007;6:46-55.
21. Food and Drug Administration. FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types (2004). http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodborneIllnessandRiskFactorReduction/RetailFoodRiskFactorstudies/ucm089696.htm. Published September 14, 2004. Accessed January 12, 2012.
22. Bradburn NM, Sudman S, Wansik B. *Asking Questions. The Definitive Guide to Questionnaire Design. For Market Research, Political Polls, and Social and Health Questionnaires*. San Francisco, CA: Jossey-Bass; 2004.
23. Parmenter K, Wardle J. Evaluation and design of nutrition knowledge measures. *J Nutr Educ*. 2000;32:269-277.
24. Streiner DL, Norman GR. *Health Measurement Scales: A Practical Guide to Their Development and Use*. 4th ed. New York, NY: Oxford University Press; 2008.
25. Pasquali L. *Psicometria dos testes na psicologia e na educação*. 3 ed. Petrópolis: Vozes; 2009.
26. Miller CK, Achterberg CL. Reliability and validity of a nutrition and food-label knowledge test for women with type 2 diabetes mellitus. *J Nutr Educ*. 2000;32:43-48.
27. Steyn NP, Labadarios D, Nel JH, Heidi-Lee R. Development and validation of a questionnaire to test knowledge and, practices of dietitians regarding dietary supplements. *Nutrition*. 2005;21:51-58.
28. Parmenter K, Wardle J. Development of a general nutrition knowledge questionnaire for adults. *Eur J Clin Nutr*. 1999;53:298-308.
29. Klohe-Lehman DM, Freeland-Graves J, Anderson ER, et al. Nutrition knowledge is associated with gereater weight loss in obese and overweight low income mothers. *J Am Diet Assoc*. 2006;106:65-75.
30. Byrne D, Golightly C, Capaldi EJ. Construction and validation of the food attitude scale. *J Consult Psychol*. 1963;27:215-222.