Development and Use of an Evaluation Tool for Taste-Testing Activities by School-Aged Children

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ABSTRACT

We describe the development and application of a teacher-administered tool for routine program evaluation of food-tasting activities among low-income children and adolescents in a classroom or afterschool setting. This six-item evaluation tool is intended to capture student willingness to try new foods and ask for them at home. Phase 1 involved one-on-one interviews to determine the feasibility of the taste test tool among nine elementary school teachers in 2009 (168 students) and a validation pilot study in 2010 among 114 school-aged students participating in a University of California Supplemental Nutrition Assistance Program Nutrition Education (UC SNAP-Ed) summer program. Phase 2 determined instrument reliability and compared student response by grade level and food category in a convenience sample of 514 UC SNAP-Ed classrooms in 2010-2011. The mean proportion of the classroom ever having tried the foods before was 0.62±0.33, and 0.77±0.27 were willing to ask for the foods at home ($P<0.0001$). Compared with younger students (preschool through sixth grade), older students (seventh through 12th grade) were less likely to try the foods in class and less willing to try them again or ask for them at home ($P<0.05$). Students reported significantly greater previous exposure and willingness to try the food again for fruits than for vegetables ($P<0.0001$). A teacher-administered taste test tool is feasible to use in a group setting and capable of yielding valid, reliable information to evaluate student response and to guide SNAP-Ed program delivery.
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TO OPTIMIZE NUTRITION HEALTH, THE 2010 DIETARY Guidelines for Americans emphasize the importance of consuming more fruits and vegetables (F/V) in the context of an overall healthful diet.[1] However, consumption of F/V remains low among US schoolchildren and adolescents compared with recommendations.[2-4] Family and home environment factors explain >50% of the variation in F/V consumption among low-income elementary school-aged children.[5] Exposure early in life may be needed to develop preferences for F/V and to increase consumption of these foods.[6-9] In addition, parental role modeling and consumption of F/V are associated with greater intake of these foods in children,[10] although a child's sensitivity to taste and smell is a moderating factor.[11] Availability and accessibility of F/V and taste/food preferences are among the most consistent determinants of F/V consumption in school-aged children.[12,13]

To complement the home environment, school-based interventions have been successful in helping children learn to like and eat more F/V.[13-15] Promotion of F/V in a school setting tends to have a greater influence on children's fruit consumption than on vegetable intakes, which may be related to taste (more sweetness and less bitterness in fruits).[16-18] The school environment can offer repeated exposure without pressure to a wide variety of F/V, a process that appears to help children learn to like these foods.[19,20] Some studies suggest that repeated exposure may not consistently work, at least in the school setting and among children who are resistant to eating vegetables.[21,22] An attractive visual presentation, positive peer influence, and the pairing of novel foods with familiar, well-liked flavors or dips are other strategies that can increase the effectiveness of food-tasting activities and help children learn to like new foods.[21-24]

The University of California Supplemental Nutrition Assistance Program Education Program (UC SNAP-Ed) (this program is now known as UC CalFresh) provided nutrition education, frequently coupled with food tastings, to 124,105 low-income children and adolescents during 2010-2011.[25] Exposure to F/V in school is particularly important for children in low-income, food-insecure households where availability of F/V may be low.[26] One goal of UC SNAP-Ed was to increase willingness to try healthy foods and encourage children to ask for them at home, which is associated with greater household purchases and consumption of F/V.[27,28] Until recently, the program lacked a systematic and pragmatic way to evaluate food-tasting activities. Because of the large numbers of children and adolescents reached through the UC SNAP-Ed program, it is not feasible to interview students individually or ask students to complete surveys, as is typically done in research studies.[20,24] For rou-

tine program evaluation, a simple, teacher-administered tool is needed to capture student response in a classroom or afterschool setting. Evaluation based on a valid, reliable method can measure program influence and guide practitioners in making improvements.

This paper describes the development and application of a teacher-administered tool for routine program evaluation of food-tasting activities among low-income children and adolescents in a classroom or afterschool setting. Specific objectives included to assess convergent validity and internal reliability of the tool and to determine of the influence of grade level and food categories (ie, food groups) used in the food tasting on student response. Based on previous studies, specific hypotheses included the following: among children and adolescents, previous exposure and willingness to try a food again are expected to be higher for fruits than for vegetables, and response to food tasting is expected to differ between younger and older students.

METHODS

This study was conducted in two phases. The first phase involved feasibility testing of the draft taste test tool (TTT) among elementary school teachers in 2009 and a validation pilot study, conducted among children and adolescents in a UC SNAP-Ed summer day camp program during 2010 to assess convergent validity. This type of validity examines the agreement between two instruments that measure the same construct, where neither instrument can be considered a gold standard.[29,30] The second phase determined instrument reliability and the influence of grade level and food categories (ie, food groups) used in the food tasting on student response, as reported by a convenience sample of UC SNAP-Ed teachers and staff in 2010-2011. The protocols for the study were approved by the University of California at Davis Institutional Review Board. In Phase 1, the pilot study required informed consent forms.

TTT Development

The procedure for feasibility testing involved in-depth interviews with nine teachers who volunteered to conduct a food tasting with students in pre-kindergarten through third grade (n=168) and use the draft version of the TTT to record student responses. All classrooms were participating in the UC SNAP-Ed program and, therefore, comprised a low-income sample. The students tasted very small amounts of various foods, including blood oranges, dried apples, dried apricots, almonds, broccoli with dip, roasted chestnuts, jicama, and sweet potatoes.

The teachers followed an instruction guide during the food tasting and afterward responded to 10 open-ended questions during an individual interview. Examples of open-ended items included: "Share how you asked this question to your students," "Tell us how well students in this grade understand this question," and "Describe any challenges with this question for you or the students." The full list of questions focused on the teachers' interpretation of the TTT questions and the ease and accuracy of using the tool. Among the nine teachers, eight said they would be willing to use the TTT with each tasting. Eight said that it was easy to observe the children and to use the tool. To clarify the intent of each question, the teachers suggested several changes in wording. Teachers also made suggestions for the instruction guide on presentation of foods and collection of responses. For example, in the taste testing of blood oranges, a teacher commented that saying the name before the tasting would "turn students off" so instead she used the word "fruit." To avoid negative peer pressure, teachers made the following suggestions: telling the students to wait to express an opinion until all have tried the food; making the food sound "yummy"; explaining the link to health; having students make written responses; inviting students to try foods individually; and using a very positive tone in asking questions. Another suggestion was having the students sit at their desks and wait until the teacher gives a signal, prompting students to taste the food at the same time. Based on the teacher interviews, the authors modified the instruction guide and the TTT items to be used in Phase 2 (see the Figure).

Validation Pilot Study Procedure

The procedure for the pilot study involved conducting a food tasting among 114 boys and girls, aged ≥8 years, participating in UC SNAP-Ed during a summer day camp. The camps, targeting low-income families, were operated by local Parks and Recreation Departments in Shasta, Trinity, and Fresno Counties. Parents signed informed consent forms on the first day of camp. The counselors administered TTT to small groups of campers after they had tasted a fruit or vegetable presented by UC SNAP-Ed staff. At the same time, the campers recorded their responses on a log to show how much they liked each food: 3="It's great. I would ask for it at home," 2="It is okay. I might eat it again," and 1="I really did not like it." Based on the group TTT, the authors calculated the proportions of campers who would try the food again at camp, try the food again at home, and ask for the food at home. For the same group using the logs, the researchers also calculated the proportion of campers who responded "3" (it's great), "2" (it is okay), and "1" (did not like). Individual logs are a standard method used in older children to determine the degree of liking a particular food.[24]

Administration of the TTT Statewide

The procedure in the second phase involved a teacher-administered evaluation of classroom food-tasting activities. Each volunteer teacher was participating in UC SNAP-Ed, using an approved curriculum appropriate for the grade level of the class. The revised instruction guide provided teachers with food safety and presentation tips to follow during classroom food-tasting activities. Generally, UC SNAP-Ed staff decided which foods to provide for taste testing after considering both the focus of the lesson and local availability of food items that might be offered that week in class. Teachers were given a paper version of the TTT to record classroom responses to the target food. Each food tasting focused on one food item, although in many cases the target food was paired with another food (eg, broccoli—the target food—was presented with a dip). After presenting a food for tasting, the teacher asked the students and counted (by show of hands) how many had eaten the food before, were willing to try it again, and were willing to ask for the food at home (see the Figure for all questions). Teachers entered the data in an online survey or, where an Internet connection was not available, gave the paper version to UC SNAP-Ed staff members to enter later.

Item	Response options
Number of students in the class	Fill in blank with number
County	Pull-down menu with list of all counties (choose 1)
Grade level	Multiple choice (choose 1 only): preschool, kindergarten, first-third, fourth-sixth, seventh-eighth, ninth-12th
Which nutrition curriculum was used in the class today?	Multiple choice (choose 1 only): with list of all approved curricula
Name the target food tasted in class today by students (list 1 food only; for example, apple, almonds, yogurt)	Fill in blank with name of food
Which category best describes the target food tasted in class today?	Multiple choice (choose 1 only): grain, fruit, vegetable, beans, nuts/seeds, milk product, other protein
How was the food presented?	Multiple choice (choose 1 only): raw, cut-up; cooked; paired with other food
Before today's class, how many students had seen this food before?	Fill in blank with number
Before today's class, how many students had tasted this food before?	Fill in blank with number
How many students ate (or tasted) the food today?	Fill in blank with number
How many students were willing to eat the food at school again?	Fill in blank with number
How many students were willing to eat this food at home?	Fill in blank with number
How many students were willing to ask for this food at home?	Fill in blank with number
Comments?	Teacher may write in any comments

Figure. Items and response options included in the final taste test tool for school-aged children used in California (n=514 classrooms).

Statistical Analyses

Excel (version 14.04756.1000, 2010, Microsoft Corp) spreadsheet data were imported for analysis into the Statistical Analysis System (version 9.2, 2008, SAS Institute Inc). Basic descriptive statistics included means and standard deviations. In Phase 1, Spearman correlation coefficients were calculated to determine convergent validity between the proportion of the group responding affirmatively to TTT and the participants' logs.[31] In Phase 2, Cronbach's α coefficient was calculated to examine internal consistency of the TTT.[32] Analysis of variance and the Tukey-Kramer post hoc test were used to determine response differences by grade level and by food category.[31] In the analysis of variance, the classroom was the unit of analysis. A P value <0.05 was considered significant.

RESULTS

The 2010 pilot study included 114 children and adolescents (52% girls, 47% boys) participating in UC SNAP-Ed summer day camp nutrition education in three California counties. All were from low-income, SNAP-eligible families, and 90% were either Latino or African American. In 2010-2011 statewide administration of the TTT, 17 counties were represented, including 514 classrooms (reporting for 16,644 students).

Convergent Validity from the Pilot Study

To examine how well the group-administered TTT agreed with participants' food preference logs, data were analyzed for 29 groups with a mean of 9.2 participants per group (range=7 to 12 per group). A strong degree of liking a food, based on the logs, was positively correlated with willingness to try the food again at school ($r=0.52$; $P=0.004$), to try the food again at home ($r=0.37$; $P=0.05$), and to ask for the food at home ($r=0.36$; $P=0.06$).

Internal Consistency (Reliability)

Consistency of classroom-level responses to the TTT questions, shown in the Figure, was very good. For all grade levels combined, the overall Cronbach's α coefficient was .86 (cutoff

for acceptability is >.70).[32] When each grade level was examined separately, all Cronbach's α coefficients were >.82.

Influence of Grade Level and Food Category on Student Response

During 2010-2011, the mean proportion of students who had ever tried the foods was 0.65, and 0.82 were willing to try the foods again at school ($P<0.0001$) (Table 1). No significant differences by grade level were observed in the proportion of students who had seen the food before. However, the oldest students were less likely to try the foods during class ($P<0.01$) and less willing to try them again or ask for them at home ($P<0.05$), compared with younger students.

More than half (66%) of the food tastings involved F/V (Table 2). Differences in exposure and response were observed across the categories of foods. Overall, previous exposure was lowest for the bean group and highest for the fruit. Students reported significantly greater previous exposure and willingness to try the food again (at school and at home) for fruits than for vegetables ($P<0.0001$). No difference was observed in the proportion of the class who tried the food (fruits vs vegetables) during the food tasting.

DISCUSSION

This study found that teachers can administer the TTT in a classroom or afterschool setting to capture students' previous exposure and response to foods presented during food-tasting experiences. Administrative burden is reduced by having a teacher ask the questions and record the answers for the group, rather than requiring one-on-one interviews as typically used in research settings. A group-administered TTT is also capable of yielding reliable information and data that are as valid as individually administered methods.

The results are consistent with those of other studies that measured food liking or preferences in children and adolescents. A study among elementary school children in the southern United States found higher preferences for, and consumption of, fruits, compared with vegetables.[33] Among high school students participating in the US Department of Agriculture Free Fruit and Vegetable Program, exposure and preferences for most fruits were higher than those reported for vegetables.[34] Others have also observed differences by grade level or age. Younger children respond more to appearance and texture of F/V, whereas older children respond more to taste factors and social norms.[35] Similarly, an Italian study reported that older students are more critical in their choices compared with younger children.[36]

Difference in response by grade level implies that further formative research and testing of the method is needed in middle school and high school students. New technology using clickers for student response may not only be more accurate than a show of hands but also might help minimize negative effects of peer pressure in older students. More research is also needed in older students to determine how to encourage them to sample novel healthy foods, as well as how to evaluate outcomes. Although no differences were observed among preschool– compared with older elementary school–aged children, this finding needs to be replicated in other studies. Finally, because this research was conducted in low-income populations, application of the TTT should be explored in middle-income populations.

Table 1. Proportion of students within the class responding affirmatively to the taste test tool (TTT) questions, by grade level[a]

TTT question	Preschool (n=94 classrooms)	Kindergarten (n=56 classrooms)	First–third grade (n=247 classrooms)	Fourth–sixth grade (n=95 classrooms)	Seventh–12th grade (n=22 classrooms)	All levels (N=514 classrooms)	*F*	*P* value
	←			*mean±standard deviation*		→		
Have you ever seen this food before?	0.74±0.35	0.74±0.28	0.71±0.30	0.71±0.31	0.71±0.40	0.72±0.31	0.23	NS[b]
Have you ever tried this food before?	0.72±0.35	0.71±0.31	0.64±0.31	0.62±0.33	0.55±0.35	0.65±0.33	2.36	0.05
Did you try this food today?	0.93±0.12	0.94±0.16	0.94±0.16	0.95±0.16	0.79**±0.27	0.94±0.16	4.67	0.001
Would you try this food again at school?	0.82±0.26	0.86±0.21	0.83±0.20	0.84±0.22	0.66*±0.31	0.82±0.22	3.64	0.006
Would you try this food again at home?	0.79±0.29	0.85±0.19	0.82±0.20	0.80±0.25	0.63*±0.30	0.80±0.24	3.97	0.003
Would you ask for this food at home?	0.76±0.31	0.81±0.26	0.78±0.23	0.76±0.27	0.56*±0.32	0.77±0.27	4.09	0.003

[a]Unit of analysis is classroom. Analysis of variance and Tukey-Kramer post hoc test were used to examine grade level differences.
[b]NS=not significant.
*Significantly different from other values in this row at $P<0.05$.
**Significantly different from other values in this row at $P<0.01$.

Table 2. Proportion of students in the class responding affirmatively to taste test tool (TTT) questions, by food category[a]

TTT question	Grains[b] (n=29 classrooms)	Vegetables[c] (n=168 classrooms)	Fruit[d] (n=175 classrooms)	Dairy[e] (n=29 classrooms)	Beans[f] (n=10 classrooms)	Nuts/seeds[g] (n=67 classrooms)	Protein[h] (n=12 classrooms)	All (n=514 classrooms)	*F*	*P* value
	← *mean±standard deviation* →									
Have you ever seen this food before?	0.81±0.35	0.64±0.29	0.83*±0.28	0.59±0.26	0.43±0.33	0.75±0.31	0.48±0.43	0.72±0.31	10.16	0.001
Have you ever tried this food before?	0.81±0.35	0.53±0.30	0.78*±0.29	0.51±0.27	0.36±0.29	0.72±0.31	0.57±0.41	0.65±0.33	14.19	0.001
Did you try this food today?	0.99±0.06	0.91±0.17	0.93*±0.18	0.98±0.04	0.86±0.24	0.96±0.17	0.96±0.11	0.94±0.16	1.81	NS[i]
Would you try this food again at school?	0.96±0.09	0.71±0.23	0.86*±0.21	0.81±0.23	0.57±0.25	0.92±0.15	0.91±0.12	0.82±0.22	13.52	0.001
Would you try this food again at home?	0.97±0.11	0.72±0.24	0.84*±0.22	0.82±0.17	0.53±0.25	0.89±0.20	0.86±0.22	0.80±0.24	12.14	0.001
Would you ask for this food at home?	0.94±0.16	0.66±0.26	0.82*±0.26	0.79±0.19	0.49±0.24	0.89±0.16	0.85±0.15	0.79±0.26	14.21	0.001

[a]Unit of analysis is classroom. Analysis of variance and the Tukey-Kramer post hoc test were used to examine differences in response to fruit and vegetables. Twenty-four of the food tastings involved >1 food group and could not be categorized.
[b]Grains: 7-grain bread, homemade corn tortillas, cornbread, granola, whole-grain pasta, whole-wheat crackers, whole-wheat tortillas, popcorn.
[c]Vegetables: artichoke, asparagus, bean sprouts, beets (canned and fresh), bok choy, broccoli, butternut squash, cabbage (green and purple), carrots, celery, corn on cob, cucumber, edamame, jicama, lettuce, peas (snap), potatoes, pumpkin, spinach, sweet potatoes, zucchini.
[d]Fruit: apples, avocado, banana, berries (blackberry, raspberry, strawberry), cantaloupe, cherries, grapefruit, honeydew, kiwifruit, oranges (mandarin), papaya, persimmons, pineapple.
[e]Milk products: low-fat cheese, cottage cheese, low-fat yogurt.
[f]Beans: garbanzo, hummus, 3-bean chili.
[g]Nuts/seeds: almonds, pumpkin seeds, pecans, trail mix, natural peanut butter.
[h]Other protein: hard-boiled eggs, lean ham.
[i]NS=not significant.
*Significantly different from vegetables at $P<0.0001$.

Program managers can use the TTT to develop targets or objectives for food-tasting activities that are coupled with nutrition education and subsequently to evaluate outcomes. For example, an objective might include <60% of students will report previous exposure to the foods introduced during the tasting activities and >80% will be willing to try the food again at school. Being able to set realistic targets and report accurate outcomes with valid, reliable sources of data is critical to achieving excellence in program delivery and advocating for continued support.

In addition to use for evaluation in a community setting, a main advantage of the TTT is the potential to generate information to plan what foods to offer and how to present the foods to increase consumption among students at school. At present, decisions related to what and how to offer foods are often based largely on local availability of produce and food donations. Although only the response by food category was reported here, the TTT also generates data related to student willingness to try and/or ask for specific foods. Thus, nutrition educators can use the data to categorize foods into one of four categories: high previous exposure and high response (eg, in our study, apples, berries, carrots, and cucumbers), low previous exposure and high response (eg, beets, edamame, grapefruit, and red pepper), high previous exposure and low response (eg, green bell pepper), or low previous exposure and low response (eg, butternut squash and hummus). Categorizing the results can reveal which F/V are good candidates for pairing with F/V that had low previous exposure and high response and low previous exposure and low response. For example, cucumbers might be selected for pairing with hummus at another food tasting. Sharing the results with foodservice administration, school wellness committees, and teachers may encourage offering certain foods, particularly those with low previous exposure and good response, more frequently at school. Optimally, teachers should receive background information on the food and lesson tips on ways to tie the food tasting to other subjects such as social studies.

To reinforce classroom experiences, nutrition educators working with the parents can highlight those healthy foods that students find most appealing. For example, showing families a videotape of a food tasting in the classroom may help convince parents that their children can be receptive to trying new foods. That information, coupled with advice on selection, storage, and simple recipe preparation tips, may be useful in increasing the availability, variety, and accessibility of F/V at home.

Strengths of the study include development and testing of an evaluation tool in a community setting, facilitating the transfer of the findings from research to practice. A large, multicounty sample in Phase 2 allowed for closer examination of student response across grade levels and for different types of foods. The nonrandom sample limits generalizing the findings, especially those related to the degree of liking specific foods, beyond this sample. Another limitation is that only nine teachers (of preschool through third grade) were included in the feasibility testing of the TTT. Finally, validity was only evaluated in a small sample (n=114) of participants at a day camp.

CONCLUSIONS

A teacher-administered TTT can be used to evaluate classroom-level response to food tastings and is capable of yielding valid, reliable, and useful information not only to capture important outcomes, but also to guide program delivery. However, further research related to refinement and testing of evaluation methods is needed in older students. Future longitudinal research should also examine the relationship between willingness to try or ask for new foods, as measured by the TTT, and subsequent food intakes.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

D. Ginsburg is director of the University of California CalFresh Nutrition Program. The other authors have no conflicts to report.

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