Research report

Development and evaluation of WillTry. An instrument for measuring children’s willingness to try fruits and vegetables

Jessica L. Thomson a,*, Beverly J. McCabe-Sellers b, Earline Strickland b, Dalia Lovera b, Henry J. Nuss b,e, Kathleen Yadrick c, Sara Duke d, Margaret L. Bogle b

a Southern Regional Research Center, USDA ARS, 6400 Perkins Road, Baton Rouge, LA 70898, USA
b Delta Obesity Prevention Research Unit, USDA ARS, 900 South Shackleford Road, Suite 509, Little Rock, AR 72211, USA
c University of Southern Mississippi, College of Health, Department of Nutrition and Food Systems, 118 College Drive #5172, Hattiesburg, MS 39406-5172, USA
d Southern Plains Agricultural Research Center, USDA ARS, 2881 F&B Road, College Station, TX 77845, USA
e Louisiana State University Health Sciences Center, School of Public Health, Behavioral and Community Health Sciences Program, 1615 Poydras Street, Suite 1400, New Orleans, LA 70112, USA

ARTICLE INFO

Article history:
Received 26 June 2009
Received in revised form 16 January 2010
Accepted 21 January 2010

Keywords:
WillTry instrument
Predictive validity
Reliability
Internal consistency
Fruits and vegetables
Children

ABSTRACT

This paper describes the development and evaluation of the WillTry instrument, a psychometric tool designed to measure children’s willingness to try fruits and vegetables. WillTry surveys were interviewer-administered to 284 children in an elementary school and summer day camps located in rural Mississippi and Arkansas (United States) communities. Factor analysis was used to determine construct dimensionality. Additional evaluation included internal consistency, test-retest reliability, and predictive validity. Factor analysis suggested a single dimension for the food items. The WillTry food scale had substantial reliability (intraclass correlation coefficients between 0.61 and 0.80) and sufficient internal consistency (Cronbach’s α > 0.70). Results of the regression analysis for percent consumption of foods offered on WillTry response confirmed the predictive validity of the instrument. The results of these analyses provide psychometric evidence for the use of the WillTry instrument as a measure of willingness to try fruits and vegetables in rural, southern US children 5–14 years of age.

Introduction

Childhood obesity is a growing worldwide epidemic. If current trends continue, 46% of children in North and South America are projected to be overweight (>85th percentile BMI for gender and age) by the year 2010 (Wang & Lobstein, 2006). Furthermore, overweight children and adolescents are more likely to become overweight or obese adults (Baker, Olsen, & Sorensen, 2007; Bibbins-Domingo, Coxson, Pletcher, Lightwood, & Goldman, 2007). In an effort to curb this trend, an expert committee of the American Academy of Pediatrics (AAP) recently published recommendations regarding the assessment, treatment, and prevention of childhood overweight and obesity (Barlow & the Expert Committee, 2007). In their report, the committee cited one key recommendation by the United States Department of Agriculture (USDA), which was to encourage the consumption of the recommended servings of fruits and vegetables. Increasing fruit and vegetable consumptions in children, however, can be particularly difficult for many reasons.

Several potential barriers and risk factors have been shown to have a negative impact on fruit and vegetable consumptions including: low socioeconomic status, low preference, low parental intake, low availability/accessibility, low nutritional knowledge, low self-efficacy, and less frequent shared family meals (Rasmussen et al., 2006). Additionally, evidence suggests that children described as “picky eaters” (accept only a limited number of foods, unwilling to try unfamiliar foods, or unwillingness to try many familiar foods) have lower dietary quality and variety, and lower intake of fruits and vegetables (Carruth & Skinner, 2000; Carruth et al., 1998; Cooke, 2007; Gallaway, Lee, & Birch, 2003). This is particularly troubling since current guidelines for dietary adequacy are more likely to be met when a wide variety of foods are consumed on a regular basis (Carruth & Skinner, 2000).

The Lower Mississippi Delta (LMD) is a region that has long been plagued by poverty and is possibly the poorest part of the US (US Commission on Civil Rights). In many LMD school districts, 80% or more of the students qualify for the federal free lunch program (US Commission on Civil Rights). Additionally, the diet quality of adult LMD residents is significantly poorer than their national counterparts according to Healthy Eating Index (HEI) scores (McCabe-Sellers et al., 2007). Based on the USDA MyPyramid guidelines, less than 16% and 25% of LMD adults met the recommended number of servings for fruits and vegetables,
Comprehensive Participatory Planning and Evaluation (CPPE) process held the LMD in Arkansas, Mississippi, and Louisiana, a consortium of federal nutrition education (Ndirangu et al., 2007). The LMD white children consume 1.1 and 2.2 servings of fruits and vegetables, respectively (Champagne et al., 2004). However, neither white nor African American children in the LMD consume the recommended servings of fruits and vegetables, despite the inclusion of fried potatoes as a vegetable.

To address the poor diet and nutrition of residents in the LMD areas of Arkansas, Mississippi, and Louisiana, a consortium of federal government and university partners engaged in community-based participatory research in three LMD communities. Using the Comprehensive Participatory Planning and Evaluation (CPPE) process (Lefevre, Kolsteren, De Wael, Byekiwa, & Beghin, 2003), residents in two communities identified the top two nutritionally responsive problems as intake of unhealthy foods and lack of nutrition education (Ndirangu et al., 2007; Yadrick, Note 1). The LMD respondents perceived unwillingness to try new foods as one causal factor for a deficient intake of healthy foods among young people, but no empirical data were available to support this perception. To our knowledge this belief has not been tested in this population.

While the original intent was to test the hypothesis that children in the LMD are unwilling to try new foods, the focus quickly narrowed to fruits and vegetables. Observations from the field indicated that children's exposure to a variety of fruits and vegetables, both within and outside the home, was minimal at best. A review of the literature revealed two instruments designed to assess North American children's willingness to try novel foods—the Child Food Neophobia Scale (CFNS) (Pliner, 1994) and the Food Situation Questionnaire (FSQ) (Loewen & Pliner, 2000). The CFNS is designed to query the parents regarding their children's actual and perceived dietary behaviors, while the FSQ uses child self-report information. Neither instrument is specific to fruits and vegetables. Additionally, both the CFNS and FSQ address the issue of novel foods, while we wanted an instrument that could measure willingness to try both familiar and unfamiliar fruits and vegetables. The purpose of this paper is to describe the development and validation of the WillTry instrument which was designed to measure self-reported willingness to try fruits and vegetables (both novel and common) in rural, southern US children (ages 5–14 years).

**Methods**

**Subjects**

The data for these analyses came from three studies. The first study (designated as MS1 where MS indicates that the study was conducted in the US State of Mississippi) consisted of fourth through sixth grade children who attended an elementary school in rural Mississippi in 2006. Participants in this study were given a nutrition intervention (i.e. served fruits and vegetables as snacks). The second study (designated as MS2 where MS indicates that the study was conducted in the US State of Mississippi) consisted of children in kindergarten through sixth grade who attended a community-sponsored summer day camp located in rural Mississippi in 2007. Participants from this study were pseudo-controls (physical activity intervention but no nutrition intervention). The third study (designated as AR where AR indicates that the study was conducted in the US State of Arkansas) consisted of children in kindergarten through sixth grade who attended a community-sponsored summer day camp located in rural Arkansas in 2007–2008. Participants from this study were true controls (no intervention) from a larger nutrition intervention study. The inclusion criteria for the MS1 study were attendance at a local elementary school and in fourth, fifth or sixth grade. Inclusion criteria for the MS2 and AR studies were 5–14 years of age and school attendance in the respective school district.

Children were recruited through elementary schools by physical education and classroom teachers and by newspaper advertisements. Parental signed informed consent forms and children's assents were obtained for all participants. Approval for the studies was obtained from the Institutional Review Board (IRB), University of Arkansas for Medical Sciences, Little Rock, Arkansas and the IRB, University of Southern Mississippi, Hattiesburg, Mississippi.

**Instrument development and administration**

Based upon the information obtained in the CPPE process, the WillTry instrument was developed iteratively using telephone interviews with parents of children and pilot studies in three small rural Delta communities. In the original interviews, questions pertaining to many types of foods were asked. However, it quickly became apparent that opportunities for exposing children to a wide variety of fruits and vegetables were sorely lacking. Evidence from the pilot studies indicated that while children may recognize a photograph of a common fruit or vegetable (e.g. apples and baby carrots), a surprising number had never actually tasted the food. Thus, the focus of the questions switched from novel foods to fruits and vegetables (both novel and common). Additional information obtained from the parents indicated that parental willingness was dependent on location. To identify locations that would be acceptable to children for trying foods, items concerning where children would be willing to try new foods were included. This information is important for directing future research interventions in the LMD since cultural elements play an important role in the region's diet. Additionally, children's perception of their and their parents' eating behaviors such as pickiness and healthy eating were of interest.

The instrument was pilot tested using fruit and vegetable snack feedings in Arkansas and Mississippi summer day camp programs. Fruit and vegetable snack feedings were also used as the criterion against which the WillTry instrument was validated. While others have used food tasks (Loewen & Pliner, 2000; Pliner, 1994) or self-report dietary intake for criterion validity (Cullen, Watson, & Zakeri, 2008; Nelson & Lytle, 2009; Neuhouse, Lilley, Lund, & Johnson, 2009), we chose to use direct observation of food intake because we were able to do so and because we felt it would avoid biases inherent in self-report data (e.g. recall bias and social desirability).

WillTry was designed to be fluid in the specific food items that are tested, enabling the researcher to test specific foods of interest. The most recent (AR) version of the WillTry instrument consisted of 31 items (Fig. 1): 14 specific food questions supported by flash cards (Guthrie, Rapoport, & Wardle, 2000; Rubio, Rigal, Boireau-Ducept, Mallet, & Meyer, 2008), three general food questions, six questions addressing where the child would be willing to try new foods (fruits and vegetables), two items addressing assessment of being a picky eater (one for self and one for parent), two items addressing assessment of being a healthy eater (one for self and one for parent), and four demographic items (age, gender, number of brothers, and number of sisters). Corresponding flash card photographs were used to show how the fruits and vegetables (raw, whole, cut, or sliced) were going to be served during snack time. However, in some cases (e.g. celery, cantaloupe, and oranges) the photograph depicted a whole or sliced fruit or vegetable while the served food was in a sliced or cubed form. Originally, the food and location items had four response categories—yes, may be, not certain, and no. To make the items Likert-type responses (i.e. bivalent and symmetrical about a
neutral middle) and because the not certain category was rarely chosen, the maybe and not certain categories were collapsed into one category for the MS1 and MS2 studies. The AR study used only three response categories—yes, maybe, and no. Hence, the refined food and location items had three Likert-type response categories.

Fig. 1. WillTry instrument (AR version).

---

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>Maybe</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Would you be willing to taste a new food if offered?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Would you be willing to taste a new vegetable?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Would you be willing to taste a new fruit?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Would you be willing to taste a new dish; e.g. casserole?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Would you be willing to taste broccoli?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Would you be willing to taste an apricot?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Would you be willing to taste a plum?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Would you be willing to taste baby carrots?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Would you be willing to taste celery sticks with dip?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Would you be willing to taste mandarin oranges?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Would you be willing to taste blueberries?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Would you be willing to taste cucumber?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Would you be willing to taste yellow squash?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Would you be willing to taste green squash?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Would you be willing to taste grape tomato?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Would you be willing to taste honeydew melon?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Would you be willing to taste cauliflower?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. In general, Do you consider yourself a healthy eater?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. In general, Do you consider your parent a healthy eater?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Which of these best describes you?</td>
<td>Eat only favorite foods</td>
<td>Eat most foods</td>
<td>Will eat any food offered</td>
</tr>
<tr>
<td>21. Which of these best describes your parent?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Three responses are provided for the following 2 questions. Please select the one that best describes you or your parent/guardian.

---

22. Demographics
   a. Your Age ______
   b. Gender (Please circle one)  Female  Male
   c. Number of Sisters ______
   d. Number of Brothers ______

Thank you for your assistance!

Fig. 1. (Continued).
with their respective score given in parentheses—yes (3), maybe (2), and no (1). Higher scores indicated a greater willingness to try a particular food item. The healthy eater items had three response categories—yes (3), sometimes (2), and no (1). The picky eater items also had three response categories with a higher score indicating a less picky eating pattern—will eat anything offered (3), eat most foods (2), and eat only favorite foods (1). The two questions regarding number of brothers and sisters were used as a surrogate measure of family size.

As stated previously, WillTry was designed to be fluid in the specific food items that are tested. Hence, the exact number of specific foods items as well as the items themselves may vary depending on food availability at the time and place of the study. Only those items that were on both the MS2 and AR versions of the WillTry instrument were included in the combined analyses of these two data sets.

The WillTry instrument was interviewer-administered to the children in a one-on-one setting by community research assistants (MS1) and summer research interns who were honor graduates from the local high schools (MS2 and AR). The research assistants and interns were trained in general interviewing techniques and in administration of the WillTry instrument. For the MS1 study, surveys were administered 2 days prior to snack feedings in October 2006. For the MS2 and AR studies, test surveys were administered in June (2007 and 2008 respectively) and retest surveys were administered approximately 6 weeks later.

**Snack feeding procedure (MS1 study)**

Snack feedings consisted of 18 foods (13 fruits and five vegetables) of known portion sizes offered over a 6-week period. Only those fruits and vegetables that were included on the WillTry instrument were used in the analyses concerning predictive validity. The school allotted a 20-min period in the afternoon for children to be taken to the cafeteria where they received a fruit or vegetable snack. Teachers ate with the students and assisted in distribution and collection of all containers and refuse.

Using a calibrated Tanita kitchen scale, each snack was pre-weighted to the nearest whole gram and labeled with an identification number. A 30–100 g sample was provided to each participant with most foods cut into appropriate units: slices (apples and kiwi), cubes (cantaloupe), wedges (fresh oranges and tangerines), or halves (canned apricots), or served as small whole pieces (grapes, baby carrots, and grape tomatoes). Food containers were either a 4-ounce portion cup with lid or a small plastic sandwich bag tared prior to filling. For all children, a single serving goal weight was used with an acceptable range of ±5 g. All fruits and vegetables were served raw. When fresh produce was not available, canned food (apricots), or served as small whole pieces (grapes, baby carrots, and grape tomatoes). Food containers were either a 4-ounce portion cup with lid or a small plastic sandwich bag tared prior to filling. For all children, a single serving goal weight was used with an acceptable range of ±5 g. All fruits and vegetables were served raw.

**Statistical analysis**

For the MS2 and AR combined data, analyses were performed on only those items that were contained on both versions of the WillTry instrument. Factor analyses were run to determine if the WillTry items represented a single dimension of willingness to try fruits and vegetables or if there were sources of variance representing different characteristics of willingness. The principal factors method with an oblique (promax) rotation was used to allow for correlation among factors (Costello & Osborne, 2005). Internal consistency of the WillTry scales was assessed using Cronbach’s α coefficients. Test–retest reliability for the scales was assessed using two-way random intraclass correlation coefficients (ICCs) where both subject and survey administration effects were considered random. The strength of the reliability measures was determined using the following general guidelines (Landis & Koch, 1977): reliability statistic <0.00 poor, 0.00–0.20 slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect. Additionally, because of the concern over the large age range of the subjects in the MS2 and AR studies, analyses were conducted overall and by two age groups, 5–8 (lower elementary) and 9–14 years (upper elementary). Predictive validity was assessed using regression analysis with a beta distribution for the outcome variable, percent food consumed (MS1 data). The beta distribution is used for variables whose values range from 0 to 1 (inclusive). The categorical explanatory variable used in the regression model was WillTry response (no, maybe or yes). Subsequent post hoc testing for group differences using the Tukey method was performed using least square means (LS means) for WillTry response category. All statistical analyses were performed using SAS® software, version 9.1 or 9.2 (SAS Institute Inc., Cary, NC) and SPSS® software, version 16.0 (SPSS Inc., Chicago, IL). Results were considered significant at the 0.05 level and all reported P-values (P) were two-sided.

**Results**

Out of 192 children who enrolled in the MS1 study, 187 (97.4%) completed the WillTry survey while 186 (96.9%) completed the feeding trial. Out of 95 and 37 children, respectively, who enrolled in the MS2 and AR studies, 66 (69.5%) and 31 (83.8%) completed both test and retest surveys. Analyses were performed on only those 97 children (MS2 and AR combined) who completed both administrations of the instrument. For the MS1, MS2, and AR studies, males accounted for 54.6%, 68.2%, and 41.9%, respectively, of the children. Mean ages were 10.9, 8.5, and 9.3 years for the MS1, MS2, and AR studies, respectively. For all three studies, the mean numbers of brothers and sisters were approximately two each, indicating family sizes larger than average for the US (US Census Bureau American FactFinder).

Results from the MS1 study indicated that all but one of the foods (grape tomatoes) and all but two locations (relative’s and friend’s houses) had high mean values (≥2.5) indicating an overall willingness to try these foods and try new foods in the given locations. Grape tomatoes, relative’s house, and friend’s house had mean values between 1.5 and 2.4 indicating ambivalence towards trying the food and trying new foods in the given locations. Additionally, the two (self and parent) picky eater and two (self and parent) healthy eater items had mean values greater than 1.4 indicating non-picky and healthier eating responses. Results from the combined MS2 and AR studies indicated that all but three of the foods (new fruit, plums, and mandarin oranges) and all but one location (home) had mean values between 1.5 and 2.4 indicating ambivalence towards trying these foods and trying new foods in the given locations. New fruit, plums, mandarin oranges, and home had high mean values (≥2.5) indicating an overall willingness to try these foods and trying new foods in the given location. Additionally, the two (self and parent) picky eater and two (self and parent) healthy eater items had mean values between 1.5 and 2.4 indicating non-picky and healthier eating responses.

**Factor analysis**

Based upon recommendations for Likert and Likert-type items (Gliem & Gliem, 2003), factor analyses were run to determine if scales could be created from the individual WillTry items. Because
the fruits and vegetables used in the MS1 study differed considerably from those used in the MS2 and AR studies, factor analyses were run separately for the MS1 data. Results based upon scree plots of the MS1 data suggested that one factor accounting for 42% of the variance was significantly distinct. Based upon item loadings greater than 0.30 (Costello & Osborne, 2005), this factor consisted of relative's house, healthy eater self, and all food items except cantaloupe, red apples, grapes, and oranges (item loadings = 0.27, 0.25, 0.17, and 0.24, respectively). Results based upon scree plots of the combined MS2 and AR test data suggested that two factors accounting for 42% and 22% of the variance, respectively, were significantly distinct. The first factor consisted of friend's house and all food items except mandarin oranges (item loading = 0.14). The second factor consisted of blueberries, picky eater self and parent, and healthy eater self. Results based upon scree plots of the combined MS2 and AR retest data suggested only one distinct factor accounting for 41% of the variance. This factor consisted of all items except mandarin oranges (item loading = 0.24), relative's house, friend's house, picky eater self, and picky eater parent. Taking all three analyses into account, one scale representing food items (fruits and vegetables) was created. For the MS1 study, the food scale consisted of the 15 food items (including cantaloupe, red apples, grapes, and oranges despite their low loadings). For the combined MS2 and AR studies, the food scale consisted of the 13 food items (including mandarin oranges despite its low loadings). Results of the factor analysis indicated that the location, picky, or healthy eating items could not reliably contribute to a single dimension representing willingness to try food items (both novel and common). Nor did the results indicate that these items could be grouped together to represent a single underlying construct of their own. Additionally, results of the factor analyses did not indicate that fruits and vegetables represented different characteristics of willingness to try food items. For the MS1 study, average responses (mean score/number of scale items) for the food, fruit, and vegetable scales were 2.8, 2.8, and 2.5 respectively (Table 1). For the combined MS2 and AR studies, average responses for the food, fruit, and vegetable scales were 2.3, 2.5, and 2.1 respectively (Table 1).

Internal consistency and test–retest reliability

Although results of the factor analyses did not indicate that fruits and vegetables represented two different underlying constructs of willingness to try food items, separate fruit and vegetable scales were created. This decision was based upon results from past studies that indicated preference and consumption of these groups differ (Domel et al., 1993; Edwards & Hartwell, 2002; Zeinstra, Koelen, Kok, & de Graaf, 2007). Based on the results of the MS1 study, the food scale had sufficient internal consistency (Cronbach's $\alpha = 0.70$). Improvement in the food scale's internal consistency was found by deletion of grapes (Table 2). Both the fruit and vegetable scales had less than optimal internal consistency (Cronbach's $\alpha = 0.66$ and 0.46). Improvement in the vegetable scale's internal consistency was found by deletion of cantaloupe (Table 2). No improvement in the vegetable scale's internal consistency was found by item deletion (Table 2).

Based on the results of the combined MS2 and AR studies, the food scale had sufficient internal consistency (Cronbach's $\alpha = 0.70$) both at test and retest. Improvement in the food scale's internal consistency was found by deletion of mandarin orange at test, but not at retest (Table 2). Both the fruit and vegetable scales had less than optimal internal consistency (Cronbach's $\alpha = 0.66$ and 0.46). Improvement in the vegetable scale's internal consistency was found by deletion of cantaloupe (Table 2). All three scales, food, fruit, and vegetable had substantial reliability (ICC = 0.68, 0.62 and 0.72 respectively; Table 2).

Interestingly, internal consistency for the food and vegetable scales differed between the two age groups for the test data. The younger age group had higher Cronbach's $\alpha$ values of 0.81 and 0.74 (food and vegetable respectively) compared to the older age group's less than optimal values of 0.67 and 0.60 (food and vegetable respectively; data not shown). Internal consistency for the fruit scale was less than optimal for both the younger and older age groups (Cronbach's $\alpha$ values = 0.55 and 0.51 respectively). For the younger age group (5–8 years), the food and vegetable scales had substantial reliability (ICC = 0.68 and 0.68 respectively), while the fruit scale had moderate reliability (ICC = 0.54; data not shown). For the older age group (9–14 years), all three scales, food, fruit and vegetable had substantial reliability (ICC = 0.65, 0.72, and 0.69 respectively).

Table 1

<table>
<thead>
<tr>
<th>MS1 study</th>
<th>n</th>
<th>Mean</th>
<th>Med</th>
<th>SD</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food scale</td>
<td>181</td>
<td>41.4</td>
<td>42.0</td>
<td>2.80</td>
<td>2.8</td>
</tr>
<tr>
<td>Fruit scale</td>
<td>183</td>
<td>31.2</td>
<td>32.0</td>
<td>2.09</td>
<td>2.8</td>
</tr>
<tr>
<td>Vegetable scale</td>
<td>184</td>
<td>7.5</td>
<td>8.0</td>
<td>1.09</td>
<td>2.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MS2 and AR studies</th>
<th>Test</th>
<th>Retest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>Food scale</td>
<td>96</td>
<td>29.4</td>
</tr>
<tr>
<td>Fruit scale</td>
<td>97</td>
<td>14.9</td>
</tr>
<tr>
<td>Vegetable scale</td>
<td>97</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Med, median and SD, standard deviation.

- $^a$ Avg = average; mean/number of scale items.
- $^b$ Food scale = all items except locations, healthy eater self and parent, and picky eater self and parent (15 items; range 0–45).
- $^c$ Fruit scale = new fruit + kiwis + red apples + apricots + grapes + cantaloupe + oranges + tangerines + red grapes + pears + tangelos (11 items; range 0–33).
- $^d$ Vegetable scale = new vegetable + baby carrots + grape tomatoes (three items; range 0–9).
- $^e$ Food scale = all items except locations, healthy eater self and parent, and picky eater self and parent (13 items; range 0–39).
- $^f$ Fruit scale = new fruit + apricots + plums + mandarin oranges + blueberries + honeydew (six items; range 0–18).
- $^g$ Vegetable scale = new vegetable + new dish/casserole + broccoli + baby carrots + celery with dip + cucumber (six items; range 0–18).
revealed that children who responded yes to being willing to try the food, consumed on average 74.8 ± 0.02% of the food offered, children who responded maybe averaged 66.6 ± 0.03%, and children who responded no averaged 58.8 ± 0.03%. When adjusted for multiple comparisons, the percent intake of children who responded yes was significantly greater than the percent intake of children in both the maybe and no response categories (P ≤ 0.01). No significant difference in percent intake was found between children responding maybe and children responding no.

**Discussion**

These studies revealed good psychometric properties of an instrument designed to measure children’s willingness to try fruits and vegetables (both novel and common) in terms of factorial structure, internal consistency, test–retest reliability, and predictive ability. The increasing consumption percentages (relative consumption amounts) seen with increasing positive responses to willingness to try fruits and vegetables provide evidence for the usefulness of the WillTry instrument in predicting children’s actual consumption of fruits and vegetables.

It is important to note that even children who indicated they were unwilling to try the fruits and vegetables offered consumed on average over half the amounts served to them. These results suggest that parents’ perception that their children’s unwillingness to try healthy foods (e.g., fruits and vegetables) is responsible for lack of consumption of such foods is untrue. Additionally, mean responses for the WillTry food items and the fruit and vegetable scales confirm previous studies that report a higher mean responses for the WillTry food items and the fruit and vegetable scales. Indeed, the internal consistency of the fruit scale with the largest number of items (11 items) approached sufficiency (Cronbach’s α = 0.66), evidence that increasing the number of items on these scales may improve their internal consistency.

Reliability was similar between the two age groups for both the food and vegetable scales. However, reliability for the fruit scale was somewhat lower in the younger age group (5–8 years; moderate reliability) compared to the older age group (9–14 years; substantial reliability). Conversely, internal consistency was higher for the younger age group for both the food and vegetable scales compared to the older age group. These results were somewhat surprising as greater consistency was expected for the older age group due to their advanced psychological development in comparison to the younger age group. It is possible that the older age group’s lower internal consistency can be attributed to changes taking place in their food preferences. It has been shown that children’s fruit and vegetable preferences expand and increase in complexity as they age (Zeinstra et al., 2007). Additionally, preferences for sweet taste and sugar consumption drop sharply between childhood and adolescence (around 12–14 years of age) (Drewnowski, 1989). These changes may also explain the higher scale scores seen in the MS1 study compared to the combined MS2 and AR studies. The greater willingness to try fruits and vegetables (especially vegetables) exhibited by the predominantly older children in the MS1 study may be a function of changing taste preferences. This issue needs to be examined further in future studies. Due to small group sizes, these results should be interpreted cautiously.

The food scale created based on these results had substantial reliability and sufficient internal consistency. The two scales based upon food type, fruit or vegetable also had substantial reliability but less than optimal internal consistency (Cronbach’s α < 0.70). This may in part be due to the relatively small number of items on the fruit and vegetable scales. Indeed, the internal consistency of the fruit scale with the largest number of items (11 items) approached sufficiency (Cronbach’s α = 0.66), evidence that increasing the number of items on these scales may improve their internal consistency.

<table>
<thead>
<tr>
<th>Scale</th>
<th>MS1 study</th>
<th>Removed</th>
<th>MS2 and AR studies combined</th>
<th>Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cronbach’s α</td>
<td></td>
<td>Test</td>
<td>Retest</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>All Best Removed</td>
<td>n</td>
<td>All Best Removed</td>
</tr>
<tr>
<td>Food</td>
<td>181</td>
<td>0.71</td>
<td>77</td>
<td>0.71</td>
</tr>
<tr>
<td>Fruit</td>
<td>183</td>
<td>0.66</td>
<td>Mandarin Orange</td>
<td>97</td>
</tr>
<tr>
<td>Vegetable</td>
<td>184</td>
<td>0.46</td>
<td>Mandarin Orange</td>
<td>97</td>
</tr>
<tr>
<td>Food</td>
<td>96</td>
<td>0.76</td>
<td>Mandarin Orange</td>
<td>97</td>
</tr>
<tr>
<td>Fruit</td>
<td>97</td>
<td>0.51</td>
<td>Mandarin Orange</td>
<td>97</td>
</tr>
<tr>
<td>Vegetable</td>
<td>97</td>
<td>0.70</td>
<td>Mandarin Orange</td>
<td>97</td>
</tr>
</tbody>
</table>

a Food scale = all items except locations, healthy eater self and parent, and picky eater self and parent (15 items; range 0–45).
b Fruit scale = new fruit + kiwis + red apples + apricots + grapes + cantaloupe + oranges + tangerines + red grapes + pears + tangelos (11 items; range 0–33).
c Vegetable scale = new vegetable + baby carrots + grape tomatoes (three items; range 0–9).
d Food scale = all items except locations, healthy eater self and parent, and picky eater self and parent (13 items; range 0–39).
e Fruit scale = new fruit + apricots + plums + mandarin oranges + blueberries + honeydew (six items; range 0–18).
f Vegetable scale = new vegetable + new dish/casserole + broccoli + baby carrots + celery with dip + cucumber (six items; range 0–18).

a Cronbach’s α < 0.001
b ICC = intraclass correlation coefficient (two-way random effects).
Recommendations for future use of WillTry instrument

Although the WillTry instrument did exhibit good stability and internal consistency for the food scale, we recommend several changes to the instrument to improve its psychometric properties. We recommend the use of a multi-item Likert scale versus individual items for drawing conclusions about the instrument and the constructs it purports to measure since the use of single items is not reliable (Gliem & Gliem, 2003). Based upon the factor analysis and the results of the internal consistency analysis, all food items on the WillTry instrument should be summed (or averaged) to provide an overall score for general willingness to try food items. Additionally, more fruit and vegetable items should be added to the instrument to improve the internal consistency of the fruit and vegetable scales. Removal of the two picky eater questions from the instrument is not recommended since the concept of picky eating has been associated with reduced intake of fruits and vegetables in children (Cooke, Wardle, & Gibson, 2003; Cooke, Carnell, & Wardle, 2006). Additional items that measure the concept of picky eating should be added to the instrument and subsequently summed (or averaged) to create a picky eater scale. Similarly, removal of the healthy eater questions from the instrument is not recommended since these items may have intrinsic value in creating sub-groups of participants based on their responses to these questions.

Our study had several limitations. First, the sample sizes of the three studies are relatively small and may have negatively impacted the reported psychometric properties of the instrument. Second, generalizability of the study results is limited because the study was conducted in very similar geographic regions that are predominantly African American and of low socioeconomic status. Third, due to the limited collection of demographic information, there were stratification factors (e.g., race/ethnicity, socioeconomic status, education level of parents) that could not be adequately explored with these data. Fourth, the snack feedings were conducted at or near the end of the school day, in a group setting, with teachers serving as role models. Hence, hunger, group consumption (Lumeng & Hillman, 2007), and the role modeling provided by the teachers (Hendy & Raudenbush, 2000; Horne et al., 2004) may have been motivating factors in the children’s consumption of the fruits and vegetables offered. Conversely, the time of day for these snack feedings may not have been optimal for vegetables. Although children perceive the afternoon as one of several appropriate times for eating fruit, only dinner is seen as an appropriate time for eating vegetables (Zeinstra et al., 2007). Finally, the external validity of the instrument may be in question since we used only those food items on the instrument to determine general willingness to try fruits and vegetables. However, future studies should confirm the instrument’s external validity as it is designed to be fluid and adaptable with respect to the specific food items included. Despite these limitations, we believe the WillTry instrument can be a valuable tool for measuring children’s willingness to try fruits and vegetables. The use of such a tool is especially important since childhood obesity continues to rise and consumption of fruits and vegetables in recommended amounts is one healthy eating habit that may prevent excessive weight gain in children (Barlow & the Expert Committee, 2007). Future work in this area will help to identify strategies for interventions that improve children’s willingness to try fruits and vegetables as measured by this instrument. The predictability of the instrument for fruit and vegetable behavioral changes, and ultimately weight outcomes, will help refine overweight/obesity prevention strategies.

References


