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Adolescent Healthful Foods Inventory: Development of an Instrument to Assess Adolescents' Willingness to Consume Healthful Foods

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Abstract

Interventions to increase adolescents' healthful food and beverage consumption often fail to demonstrate change. An alternative is to measure a shift in willingness to consume these items as an indicator of movement toward change. A survey was developed to estimate willingness to consume a variety of foods and beverages. Twenty items were identified from five focus group interviews with adolescents. A survey of 234 youths indicated their willingness to consume each item. Exploratory factor analysis resulted in lists of high-fat/sugar-rich items and more healthful foods. Extension educators can use the survey instrument to demonstrate early positive participant change as they strive to deliver programs that meet mission mandates.

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Introduction

The current food environment, with highly marketed, energy-dense foods and sugar-sweetened beverages, may discourage youth from changing their eating behaviors (Committee on Food Marketing and the Diets of Children and Youth, 2006). Extension programs promoting healthful living for youth can build nutrition knowledge and the ability and confidence to make better dietary choices (Extension Committee on Organization and Policy Health Task Force, 2014). However, studies of nutrition education classes for pregnant and parenting teens (Alley, McCloud-Harrison, Peisher, & Rafter, 1995; Owen, Kendall, & Wilken, 1997) and experiential learning/immersion opportunities for youths attending a 4-H summer camp (Mabary-Olsen, Litchfield, Foster, Lanningham-Foster, & Campbell, 2015) demonstrated increases in nutrition knowledge, skills, and food safety behaviors but did not show improvement in self-reported dietary intake.

Learning theories such as the theory of planned behavior (TPB) (Azjen, 1991) posit that attitudes predict behavioral intentions and propose that changes in intentions occur before behavior change. In the study reported here, adolescents' willingness to consume more healthful foods is operationalized as the attitude that predicts behavioral intentions and, ultimately, better dietary choices. The ability to estimate willingness to consume more healthful foods and beverages would help Extension educators demonstrate movement toward dietary behavior change after participation in intervention programs.

Willingness to consume particular foods is motivated by cognitive and taste experiences (Ohtomo, 2013) and is thought to be driven by liking, wanting, and learning (Berridge, Robinson, & Aldridge, 2009; Litman, 2005). *Liking* describes subjective pleasure of behaviors, whereas *wanting* is associated with stimulation of eating behaviors and motivation to seek out particular foods or beverages (Berridge et al., 2009). *Learning* occurs as a result of consuming foods and beverages and can be promoted by repeated taste exposure (Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010), watching a peer or adult eat the item (Addessi, Galloway, Visalberghi, & Birch, 2005), or marketing of the desired food (Cornwell & McAlister, 2011). Although affected by all three components, willingness to consume particular foods and beverages most closely aligns with wanting due to its cognitive incentives and subjective ratings of desire (Berridge, 2009).

As Extension educators seek to help adolescents improve their diets, they must address adolescents' unwillingness to consume less preferred or unfamiliar foods and beverages. The rejection of familiar foods is described as "picky eating" (Dovey, Staples, Gibson, & Halford, 2008), whereas reluctance to eat unfamiliar foods is called food neophobia (Pliner & Hobden, 1992). The Food Neophobia Scale (FNS), developed by Pliner and Hobden (1992), and modified versions of this instrument are frequently used to evaluate food neophobia. Recently, the FNS was used to examine food neophobia in German adolescents, and scores were compared with dietary habits (Rossbach, Foterek, Schmidt, Hilbig, & Alexy, 2016). A modified version of the FNS called The Fruit and Vegetable Neophobia Instrument, capable of estimating willingness to consume these foods, was validated with 8- to 10-year-old children (Hollar, Paxton-Aiken, & Fleming, 2013). High-fat and sugar-rich foods are known to be well liked by adolescents (Reedy & Krebs-Smith, 2010), but adolescents' willingness to consume these items, as well as a variety of more healthful foods, has not been studied. A preliminary step toward positive behavior change could be demonstrated by decreased willingness to consume energy-dense foods and sugar-rich beverages and greater willingness to consume more healthful items.

Objective / Purpose

The purpose of the study described here was to develop and test a questionnaire designed to assess adolescents' willingness to eat less healthful foods and more healthful foods.

Methods

Subjects

Males and females aged 13 to 19 years (grades 9–12) were recruited to participate in focus group interviews or complete a survey seeking information about their willingness to consume particular foods or beverages. Youths were selected from southern Louisiana public high schools and afterschool programs. Caregivers consented for adolescents under the age of 18 to participate, and youths gave personal assent. Students aged 18 to 19 consented to participate. The study was approved by the Louisiana State University Agricultural Center Institutional Review Board.

Questionnaire Development and Distribution

A list of foods and beverages commonly consumed by adolescents was elicited from focus group interviews. Adolescents were asked to respond to such questions as "What types of food do you prefer to eat?" Four constructs resulted on the basis of focus group themes and theory: medium-to-high energy-dense foods (energy dense; ≥1.5 kcal/g), very-low-to-low energy-dense foods (energy dilute; <1.5 kcal/g) (Centers for Disease Control and Prevention, 2005), sugar-sweetened beverages (beverages containing added sugar), and unsweetened beverages. Youths were also asked whether they preferred a 9-choice or 7-choice Likert scale, and they selected the 7-choice scale. They also indicated that they understood the neutral point of *neither willing nor unwilling*.

Each construct included five foods that youths preferred for a total of 20 survey items. The survey content validity was established by a panel of nutrition experts and by comparing the nutrient values of the foods with those listed in the U.S. Department of Agriculture database (U.S. Department of Agriculture [USDA], 2013). Possible responses were scored as follows: 1 = *extremely unwilling*, 2 = *unwilling*, 3 = *slightly unwilling*, 4 = *neither willing nor unwilling*, 5 = *slightly willing*, 6 = *willing*, 7 = *extremely willing*. A small group of high school students pilot tested the instrument to identify response bias issues. Because no response bias problems emerged, the finalized survey instrument was distributed to high school students in East Baton Rouge and Ascension Parishes, Louisiana. One trained investigator administered the surveys to a cross-sectional representation of students.

Data Analysis

Focus group data were analyzed using confirmatory analysis (Guest, MacQueen, & Namey, 2012). A deductive approach used to confirm the types of foods adolescents commonly consumed was based on theory while accounting for emergent themes from the data. Data were collected about age, gender, race, grade level, school type (public or private), and willingness to consume each of the foods and beverages. Exploratory factor analysis was conducted with principal axis factoring and promax (oblique) rotation. The correlation matrix was examined to determine that the survey items did not have multicollinearity (values greater than .9). The Kaiser-Meyer-Olkin (KMO) test and the Bartlett's test of sphericity determined whether the overall correlations were large enough to allow variables to cluster into constructs. To determine the number of factors to be interpreted, eigenvalues greater than 1 were chosen and the scree plot was considered (Field, 2009). Food or beverage items with factor loadings on the pattern matrix less than .4 were removed (Guadagnoli & Velicer, 1988). Factors containing two or fewer items were deemed uninterpretable (Velicer & Fara, 1998) and were not included. Internal consistency reliability was assessed using Cronbach's alpha. Data were examined using SPSS statistical software (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

Results

Focus Group Interviews

Five focus group interviews were conducted and included a total of 36 adolescents. Twenty-seven of the participants were female (75%). Twenty participants were Caucasian (56%); 13 were African American (36%). With regard to race or ethnicity, one student chose the classification of "other," and two did not indicate their race or ethnicity. The sample was racially/ethnically representative of the schools from which adolescents were

recruited but slightly underrepresented the male population.

The items chosen to represent each of the four constructs are as follows:

- energy-dense foods—French fries, nuts or nut butters, glazed donuts, cookies, and pizza with meat topping;
- energy-dilute foods—raw or steamed broccoli, low-fat or fat-free yogurt, carrot sticks (with no more than 2 tbsp of low-fat dressing), grapes, and bananas;
- sugar-sweetened beverages—Kool-Aid made with sugar, regular cola drinks, lemonade, low-fat chocolate milk, and tea sweetened with sugar; and
- unsweetened beverages—water, unsweetened or artificially sweetened tea, low-fat unflavored milk, diet cola drinks, and coffee with 1 tsp or one packet of sugar or less.

Food Preference Surveys

A convenience sample of 234 students from three public high schools in East Baton Rouge and Ascension Parishes, Louisiana, completed surveys. Of the participants, 126 were female (54%). Racial/ethnic representation included 145 Caucasians (62%), 63 African Americans (27%), seven Hispanics/Latinos (3%), and 16 classified as "Other." For statistical analysis, the participants were classified as either "White" or "non-White."

Three exploratory factor analyses were conducted. Each test showed adequate item correlation (KMO test > .70; Bartlett's test < 0.001) and a sufficiently large determinant (> 0.00001). The initial factor analysis returned six factors that explained 46.5% of the variance. In this first test, coffee and water had pattern matrix loadings less than .4 and were removed. The second analysis returned six factors that explained 50.2% of the variance. Three factors had eigenvalues less than 1 and included only two items. Factor 3 had an eigenvalue greater than 1 but included only two items. Foods and beverages in Factors 3, 4, 5, and 6 were removed. The final factor analysis retained two factors that explained 37.7% of the variance. The foods and beverages in these two factors are displayed in Table 1. Factor 1 includes foods and beverages high in fat and sugar, whereas more healthful foods are included in Factor 2.

Table 1.

Foods and Beverages Included in the Final Two-Factor Analysis

	Pattern matrix			Structure matrix	
Item	**Factor 1**	**Factor 2**	**h^2**	**Factor 1**	**Factor 2**
French fries	**.770**	.000	.593	**.770**	.098
Donuts	**.651**	−.078	.417	**.641**	.004
Cookies	**.631**	.050	.409	**.637**	.130
Kool-Aid	**.598**	−.003	.357	**.597**	.073
Pizza	**.541**	−.040	.289	**.536**	.029
Lemonade	**.503**	.108	.253	**.491**	.168
Bananas	.000	**.765**	.585	.098	**.765**

Grapes	.082	**.604**	.385	.159	**.615**
Yogurt	−.132	**.558**	.310	−.061	**.541**
Nuts	.071	**.403**	.175	.122	**.412**

Note. h^2 = Communalities. Extraction method used principal axis factoring with a Promax rotation; KMO = 0.76; Bartlett's test < 0.001; determinant = .108; Factor 1-eigenvalue for the summed squared factor loading = 2.388, percent of variance = 23.9%, rotated model = 2.349; Factor 2-eigenvalue for the summed squared factor loading = 2.383, percent of variance = 13.8%, rotated model = 1.487; Cronbach's alpha = 0.770 for Factor 1 and 0.664 for Factor 2. Total variance explained by the model = 37.7%.

The adolescents' willingnesses to consume items in Factors 1 and 2 were examined, and mean scores are shown in Table 2. Adolescents were most willing to eat grapes, French fries, cookies, and pizza and drink lemonade and least willing to eat yogurt. When willingness to consume Factor 1 foods was compared between genders, males had significantly higher scores than females ($t_{226.7} = 2.421$; $p < .05$). Adolescents across the four grades and White and non-White students were similarly willing to consume Factor 1 foods. No differences in willingness to consume Factor 2 foods was observed relative to gender, grade level, or race (White vs. non-White).

Table 2.

Adolescent Willingness to Consume Foods/Beverages in Factors 1 and 2 (n = 234)

Factor 1 items	***M* ± *SD***	**Factor 2 items**	***M* ± *SD***
French fries	6.18 ± 1.20	Grapes	6.25 ± 1.40
Cookies	6.18 ± 1.14	Nuts	5.59 ± 1.58
Pizza	6.16 ± 1.33	Banana	5.56 ± 1.83
Lemonade	6.03 ± 1.32	Yogurt	5.13 ± 1.85
Donuts	5.66 ± 1.77		
Kool-Aid	5.48 ± 1.69		

Note. Mean values based on the 7-point Likert-type scale 1 = *extremely unwilling*, 2 = *unwilling*, 3 = *slightly unwilling*, 4 = *neither willing nor unwilling*, 5 = *slightly willing*, 6 = *willing*, 7 = *extremely willing*.

Conclusion and Implications

Nutrition educators frequently categorize energy-dense and energy-dilute foods and sweetened and unsweetened beverages into four separate categories, but this study found that adolescents' willingness to consume these items clustered into only two groups. Energy-dense foods and sugar-sweetened beverages clustered into a single group with four foods and two beverages. Nutrient-rich items, such as grapes, bananas, nuts, and yogurt, clustered into a separate category.

Willingness-to-eat mean scores were higher for the group of foods high in fat and sugar and sugar-sweetened

beverages when compared to the group containing fruits, nuts, and yogurt, but responses did not differ between White and non-White youths or relative to grade levels. In response to the 2015–2020 Dietary Guidelines for Americans (USDA, 2015), Extension programs stress the importance of healthful eating patterns. A tool such as the Adolescent Healthful Foods Inventory (AHFI) may be used when evaluating Extension programs to assess program participants' eating pattern changes.

The finding that males were more willing than females to consume energy-dense foods and sugar-sweetened beverages was similar to that reported by Drewnowski (1989), who found that preferences for sweet tastes declined sharply between 12 and 14 years of age in females but that males continued to like intensely sweet stimuli into late adolescence. Gender differences have also been reported in ability to detect and discriminate odors on the basis of their complexity (Jellinek & Köster, 1979; Koelega & Köster, 1974). Collectively, this research suggests that Extension programming may need to be tailored to the audience, with an emphasis on shifting males' preferences for energy-dense foods and sugar-sweetened beverages. Behavior change in the form of increased healthful food consumption is often stymied by adolescents' lack of control over food choices at home and at school. However, shifting their willingness to consume more healthful foods may be possible. Extension programs may use targeted food tasting to help youths realize that they like healthful foods.

The study discussed here had several limitations. All participants attended public high schools in the southeastern United States. In addition, the racial/ethnic groups were not equally represented as more students were Caucasian. The two factors explained approximately 40% of the variance. Future studies are needed to expand the list of foods and beverages.

As Extension educators strive to develop and deliver programs that affect the prevalence of childhood obesity, evaluation instruments that are modeled on the TPB and capable of assessing early participant changes in attitude, such as the AHFI, are critical to demonstrating participant movement toward behavior change.

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