A Cafeteria-based Tasting Program Improved Elementary School Children's Fruit Preferences and Self-efficacy to Consume Fruits and Vegetables

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Received: January 9, 2012 Accepted: February 2, 2012 Published: May 1, 2012
doi:10.5539/jfr.v1n2p139 URL: http://dx.doi.org/10.5539/jfr.v1n2p139

This research was funded by the National Research Initiative Grant from the USDA Cooperative State Research, Education and Extension Service through a cooperative agreement with the Louisiana State University Agricultural Center (Award number 2009-35200-05287)

Abstract

This quasi-experimental study examined the influence of a cafeteria-based tasting program on children's fruit and vegetable (FV) preferences and self-efficacy, social norms and outcome expectations to consume FV. Third and fifth graders in the intervention schools were offered tastes of eightFV for eight weeks followed by two weeks of tasting four months post-intervention (follow-up). Preferences for 38 FV and self-efficacy, social norms and outcome expectations to consume FV were assessed at baseline, post-intervention and after follow-up tastings. Sixty-eight percent of the intervention-group children tasted fruits at least eight times and vegetables at least 20 times during the 8-week tasting program and were included in the analysis (52% third graders, 48% boys). Children who participated in tasting reported increased preferences for less commonly served fruits from baseline to post-intervention and frombaseline to follow-up and greater self-efficacy to consume FV from baseline to follow-up when compared to control-group children.

Keywords: Children, Fruits, Vegetables, Preference, Tasting program, Self-efficacy

1. Introduction

Children who prefer and who eat fruits and vegetables (FV) compared to energy-dense foods may have a lower risk for overweight or obesity (Lakkakula, Zanovec, Silverman, Murphy, & Tuuri, 2008;Ledoux, Hingle, & Baranowski, 2011). More than 35% of elementary school-aged children in the United States are overweight or obese and only about 25% of them consume the recommended amounts of FV (United States Department Health and Human Services and United States Department of Agriculture, 2005). Two antecedents of children's consumption of FV include the strength of their preferences for FV and confidence that they can change personal eating behaviors i.e., the social norms of their context and sense of self-efficacy (Baxter & Thompson, 2002; Domel et al., 1996; Loewen & Pliner, 1999). A predisposition to prefer sweet and salty foods and to avoid unfamiliar foods is a normative childhood characteristic (Birch, 1999) but in a supportive environment children can learn to like foods that they initially reject. When FV are available and children are encouraged to experience their flavors, children can learn to like and consume them (Loewen & Pliner, 1999; Lakkakula , Geaghan, Zanovec, Pierce, & Tuuri, 2010; Lakkakula et al., 2011; Wardle, Herrera, Cooke, & Gibson, 2003; He et al., 2009). It is particularly important for children from low-income households, who may lack access to FV (Champagne et al, 2004; Larson, Story & Nelson, 2009), to experience eating these nutrient-rich foods (Drewnowski & Spector, 2004). Fruits and vegetables are available to children who participate in the U. S. National School Lunch Program (United States Department of Agriculture, 2011). Fresh apples and oranges, and canned peaches and pineapples are the most commonly served fruits in school lunches while lettuce salads, French fries and cooked carrots are the most commonly offered vegetables (United States Department of Agriculture, 2007).

Schools are locations where children can learn and practice healthful behaviors (Bergman & Gordon, 2010). School-based interventions that are based upon accepted theoretical models such as Bandura's (2004) social cognitive theory (SCT) have increased children's nutrition knowledge (Tuuri et al., 2009), their preferences for FV (Wardle et al., 2003), and both positively (Tuuri et al., 2009; Thompson, Bachman, Baranowski, & Cullen, 2007; Cullen, Eagan, Baranowski, Owens, & de Moor, 2000) and negatively (He et al., 2009) influenced psychosocial predictors of children's FV consumption. School-based tasting programs intended to familiarize children with the flavors of FV and encourage FV consumption in a social setting surrounded by their peers have increased children's liking of these foods (Lakkakula et al., 2011; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Wardle, Herrera, Cooke, & Gibson, 2003). However, it is unknown if a change in children's liking of FV is accompanied by a change in other antecedents of actually eating FV, such as children's food preferences, self-efficacy, social norms and outcome expectations (Thompson, Bachman, Baranowski, & Cullen, 2007) or if a tasting program that promotes a limited number of FV increases preferences for a variety of similar items.

The purpose of the Building Preferences for Fruits and Vegetables Program was to introduce low-income elementary school-aged children to the flavors of four fruits and four vegetables offered by the National School Lunch Program and to increase their FV liking, visual preferences, and psychosocial predictors of FV consumption. Children's willingness to taste the FV that were offered to them was tracked to identify non-compliant children. The program's positive impact on the children's liking of the tasted FV reported immediately after tasting the foods has been previously reported (Lakkakula et al., 2011). It was hypothesized that the program would also increase the children's self-described preferences for a variety of FV after viewing a picture of each item and their psychosocial predictors of FV consumption. The primary objective of the present study was to examine the influence of participatingin this school-based FV tasting program on children's self-reported preferences for a variety of FV and their self-efficacy, social norms, and outcome expectations to consume FV. A secondary

objective was to examine the relationship between children's visual preference for FV and their risk for being overweight or obese.

2. Methods

2.1 Participants

Third- and fifth-grade children attending four low-income public elementary schools (Cullen et al., 2004) in southeastern Louisiana were recruited to participate in a seven-month quasi-experimental study. All children were invited to participate in the program but underweight children were excluded from the analysis. Prior to participation, parent consent and personal assent were obtained. The program was approved by the Louisiana State University Agricultural Center Institutional Review Board.

2.2 Design

Two intervention schools and two control schools were matched based upon the percentage of students eligible to receive free or reduced-price lunch (57%-80% of students) and racial/ethnic representation. Children enrolled in each of the four schools were measured for height and weight and completed questionnaires estimating their FV preferences and psychosocial variables associated with FV consumption at baseline. Following this initial data collection, children in the intervention schools began a FV tasting program. Four vegetables (bell peppers, carrots, peas and tomatoes) and four fruits (apricots, cantaloupe, peaches and pears) were chosen for tasting based upon results from a previous study with a similar population of children who reported that these FV were neither greatly liked nor disliked (Lakkakula, Zanovec, Silverman, Murphy & Tuuri, 2008). The children tasted small pieces of either the four vegetables or the four fruits twice a week on a rotating basis for eight weeks. Four months following the completion of the 8-week tasting program children again tasted the four vegetables or the four fruits twice a week for two weeks. Details of the tasting protocol and evaluation of the children's liking of these eight tasted items are described in a previously published manuscript (Lakkakula et al., 2011). Children who tasted the four fruits an average of two times and the four vegetables an average of five times were considered to have experienced sufficient tasting exposures to be included in the present study (Lakkakula et al., 2011). Children in the control schools did not participate in tasting but were exposed to a variety of brightly colored posters promoting FV that were displayed in the cafeteria on a weekly basis. Both intervention- and control-group children completed questionnaires at baseline, post-8-week intervention and after follow-up tastings.

2.3 Questionnaire

The child's self-reported preferences for 17 fruits and 21 vegetables, and self-efficacy, social norms, and positive and negative outcome expectations to consume FV were obtained from a questionnaire administered by the researchers in the classroom using a standard protocol. The FV preferences and SCT constructs questions had been previously validated with a similar population group (Baranowski et al., 2000; Cullen et al., 2003) but the FV preference questions were modified to include a color picture of each food item. Fruits were presented in alphabetical order and were followed by vegetables also listed alphabetically. To the right of each food picture there were the following columns seeking the child's response: 1) a broadly smiling cartoon face and the words "I like it a lot," 2) a smiling cartoon face with the words "I like it a little," 3) frowning cartoon face with the words "I do not like it," and 4) neutral cartoon face with the words "I have never tasted it." The FV items included were those commonly consumed by a nationally representative sample of children (United States Department of Agriculture, 1998). The four social norms questions that estimated the child's normative beliefs about "What do you think about eating FV?" included the following possible responses: 1) a very good thing, 2) a good thing, 3) not important, and 4) I don't know. Children rated their positive and negative outcome expectations about eating FV everyday using a 5- point Likert scale that ranged from "I disagree very much" to "I agree very much." Self-efficacy to consume FV estimated from questions asking "How sure are you that you can consume FV?" were similarly evaluated using a 5-point Likert scale that ranged from "I am sure I cannot" to "I am sure I can."

2.4 Anthropometry

Children's heights and weights were collected at all schools under the supervision of the school nurse using a standard protocol. Standing heights and weights were measured with portable digital scales (Seca 880, Seca Co. Hanover, MD) and stadiometers (Shorr Productions Inc. Olney, MD). Each child's gender-specific BMI-for-age percentile was determined, and he/she was categorized as underweight, healthy weight, overweight or obese (Centers for Disease Control & Prevention, 2011).

2.5 Statistical analysis

Data were examined using Statistical Analysis Software (SAS, Version 9.1.3; Cary, NC, 2003). Descriptive statistics for gender, grade and weight status were collected. The internal reliability of the constructs of

self-efficacy, social norms, and outcome expectations derived from the questionnaire data were examined using Cronbach's alpha tests. A reliability score of ≥ 0.7 was considered to be an acceptable measure of behavior (Cooper, 1983).

A factor analysis with a varimax rotation was used to determine the number and nature of underlying factors affecting the relationship between each set of variables (fruit preference, vegetable preference, self-efficacy, social norm, positive outcome expectations and negative outcome expectations). Mixed-model analyses of variance (PROC MIXED) evaluated change in children's FV preferences and psychosocial variables at the three study phases (baseline, post-intervention and follow-up). Using multi-level modeling, fixed effects included treatment and test; children and school were considered a random effect. To examine the differences between and within groups in each factor, a post-hoc analysis with a Tukey-Kramer adjustment of the least square means for each factor was conducted.

Each child's average FV preference score at baseline was determined based upon his/her responses to the 38 FV items (I don't know what this is = 0; I don't like it = 1; I like it a little = 2; I like it a lot = 3) and then compared to the his/her weight classification. Children were categorized as healthy weight (BMI-for-age 5^{th} to < 85^{th} percentile) or overweight/obese (BMI-for-age ≥ 85^{th} percentile) (Centers for Disease Control and Prevention, 2011). Underweight children were excluded from the analysis. The relationship of FV preference with weight category was examined using logistic regression. The level of significance was set at $p < 0.05$.

3. Results

3.1 Demographics

Two hundred sixty-nine children were measured for height and weight and completed the baseline questionnaire. One hundred fifty-five children (57.6%) were considered to be a healthy weight (BMI ≥ 5^{th} and < 85^{th} percentile), 104 children (38.7%) were overweight or obese (BMI ≥ 85^{th} percentile) and 10 children (3.7%) were underweight (BMI < 5^{th} percentile). After excluding the 10 underweight children, the remaining 259 students included 141 fifth graders (54%) and 136 boys (53%). Racial/ethnic representation included: 138 white (53%), 116 black (45%), and two Hispanic, one Asian, and two biracial (2%) children. The children's grade, gender, and race/ethnicity were not associated with their weight status.

Two hundred sixteen of the 259 children who completed the baseline questionnaire (79% intervention group; 52% 3^{rd} grade children; 52% girls) also completed the same survey following the 8-week-intervention and after the four-month follow-up tastings (follow-up). Sixty-eight percent of the children in the intervention group (116 of 171children) completed the required number of tastes to be included in the data analysis. Fifty-two percent of the children ($n = 83$) were in the third grade and 48% ($n = 78$) were boys. Participants included 57% ($n = 91$) white, 39% ($n = 63$) black, 2% ($n = 4$) Hispanic, 1% ($n = 1$) Asian and 1% ($n = 2$) "other" (bi-racial backgrounds) children. Table 1 presents the characteristics of the intervention and control group participants.

3.2 Questionnaire

Survey questions describing fruit preferences, vegetable preferences, self-efficacy and positive outcome expectations to consume FV were acceptable based upon their Cronbach's Alpha scores (Table 2). The questions examining social norms and negative outcome expectations were considered to be unreliable measures of behavior because the reliability scores were less than 0.7 and wereomitted from further analysis. The number of factors extracted to measure preferences, self-efficacy, and positive outcome expectations were determined by the eigenvalues approximating one. Rotated factor matrix items with loading scores greater than or equal to 0.4 were loaded on each given factor (Munro, 2001).

A four-factor fruit preference pattern explained 78% of the variance and a five-factor vegetable grouping explained 35% of the variance. The fruit grouping included the following four factors: Factor 1, apricots, avocados, cantaloupe, kiwi, mangos, and papayas; Factor 2, bananas, peaches, pears, pineapple, strawberries, and watermelon; Factor 3, oranges, plums and tangerines; and Factor 4, apples and grapes. Vegetable factors included the following five factors: Factor 1, bell peppers, broccoli, cauliflower, celery, cabbage, cucumbers, lettuce, spinach, and tomatoes; Factor 2, baked potatoes, green beans, and potato salad; Factor 3, carrots, corn and peas; Factor 4, garlic and onions; and Factor 5, greens and sweet potatoes.

A three-factor description of self-efficacy to consume FV explained 30% of the variance and two positive outcome expectations factors explained 97% of the variance. Self-efficacy Factor 1 included items describing drinking fruit juice and choosing fruit instead of a usual dessert, and Factor 2 dealt with consuming raw vegetables instead of chips and cookies. Self-efficacy Factor 3 responses included adding fruit to cereal, eating a green salad or vegetable served at lunch at school, consuming a salad or big serving of vegetables for dinner and eating three or

more servings of vegetables and five or more servings of fruit and vegetables each day. Positive Outcome Expectation Factor 1 suggested that the child perceived FV consumption as promoting beauty, friendship and strength while Factor 2 described having more energy, less risk for becoming fat, and greater opportunity to make the family proud.

This school cafeteria-based FV tasting program positively influenced children's preferences for Fruit Preference Factor 1 and Self-efficacy Factor 3 (Table 3). In the intervention group, preferences for apricots, avocados, cantaloupe, kiwi, mangos and papaya increased from baseline to post-intervention (p=0.04) and from baseline to follow-up (p = 0.01), but did not change in the control group. Children in the intervention group also reported greater confidence that they could consume fruits, vegetables and salad (Self-efficacy Factor 3) between baseline and follow-up (p = 0.01) although there were no significant differences between the intervention and control groups (p = 0.07). Preferences for vegetables and positive outcome expectations did not change in either the intervention or control groups.

3.3 FV preferences and risk of being overweight and obese

In order to examine the association between children's self-described preferences for the 38 FV pictured in the questionnaire and their weight status, children were placed into one of three FV preference groups and one of two weight categories (healthy weight or overweight/obese). The FV preference groups were as follows: Group 1, low preference (mean score 1.0 to 1.6, n = 8), Group 2, moderate preference (mean score 1.7 to 2.3, n = 97), and Group 3, high preference (mean score 2.4-3.0, n = 154). No differences were observed between the low and high (p = 0.96) and moderate and high preference groups (p = 0.37) and the risk of being overweight or obese. This lack of association was in contrast to findings from a similar study with low-income black children residing in the same geographical location (Lakkakula, Zanovec, Silverman, Murphy & Tuuri, 2008). Both groups of children attended low-income schools, but the present study included a majority of white children while the former study included only black children. In addition, the FV questionnaire used in the present study included a picture of each FV item while the study by Lakkakula and colleagues did not, and the children may have responded differently because they had a visual image of the food.

4. Discussion

The Building Preferences for Fruits and Vegetables school cafeteria-based tasting program positively impacted known predictors of food consumption including preferences for fruits less commonly served by the United States National School Lunch Program and self-efficacy to consume FV. Because food preferences are strong predictors of intake (Baxter & Thompson, 2002; Neumark-Sztainer, Wall, Perry, & Story, 2003; Loewen & Pliner, 1999) these findings suggest that the children became more accepting of less familiar fruits and began consuming more of these nutrient-rich items. The tasting program appeared to decrease the children's neophobia and made them more willing to consume a variety of fruits. The "learned safety" hypothesis (Kalat & Rozin, 1973) would suggest that the children found eating less familiar fruits to be acceptable to their gastrointestinal systems and pleasurable to their palates. The fruits may have elicited an endogenous response to the sweet tastes and encouraged a new-found preference for these foods (Gosnell & Levine, 2009). The lack of change in opinion for vegetables may reflect a less pleasurable response after tasting and consuming these items and supports the fact that vegetables have been reported to be one of children's least liked foods (Perez-Rodrigo, Ribas, Serra-Majem & Aranceta, 2003; Skinner, Carruth, Bounds & Ziegler, 2002; Nu, MacLeod & Barthelemy, 1996). A lack of change in self-reported preference for vegetables, however, may not preclude an increase in actual consumption. A recent study by Zeinstra and colleagues observed that offering children a choice between vegetables did not impact their self-described liking or consumption of these items (Zeinstra, Renes, Keolen, Kok & de Graaf, 2010). However, without comparing self-reported information about food preferences with actual food consumption it is not possible to determine if the FV tasting program impacted consumption of these items.

The program's positive impact on self-efficacy to consume FV also suggested that the children responded to participating in the cafeteria-based tasting program by eating more FV served by the National School Lunch program and consuming greater amounts of these foods served at home (Thompson, Bachman, Baranowski & Cullen, 2007). Self-efficacy is one of the key constructs of the Social Cognitive Theory (Bandura, 2004) and describes a person's confidence in his/her ability to take action and overcome barriers to performing a behavior. It is one of the key factors that affect the likelihood that a person will change a behavior. The program helped the children change their self-efficacy toward consuming FV by encouraging them to taste small bites of selected FV on a consistent basis surrounded by their peers in the social setting of the school cafeteria.The lack of preference change for vegetables and other fruits reported by the intervention-group children on the FV questionnaire contrasted with their positive opinions expressed immediately aftertasting the eight FV items (Lakkakula et al.,

2011). These findings suggest that while the children began to like the flavors of the tasted FVs they may not have beenwilling to choose them when given an alternative. A lack of willingness to choose a fruit or vegetable may be problematic in today's environment that is rich in highly palatable and heavily marketed foods high in calories, sugar, fat and salt(Institute of Medicine, 2004; Institute of Medicine, 2005). Marketing and availability are known to influence children's food preferences, purchasing requests and dietary intake (Institute of Medicine, 2005). Perhaps the abundance of these highly marketed and flavorful items including candies, cookies, ice cream and fruit-flavored beverages (Williams, 2005) interfere with preference change for FV.

The study had several limitations. The lack of random assignment of schools limited the strength of the argument for a causal effect. The study was conducted with low-income third- and fifth-grade public elementary students in the southern United States and may not represent the general elementary school population. However, because schools that participate in the U. S. Child Nutrition Program follow standard procedures and purchase similar items to be offered to children, the program should be appropriate for children in other geographical regions and socio-economic groups. This study was also limited by the fact that data were self-reported and validity wasdependent upon the self-knowledge and truthfulness of the children.

5. Conclusion

Children who participated in a school cafeteria-based FV tasting program described greater preferences for less commonly served fruits and more self-efficacy to consume FV. The program can be adopted by teachers and parents as a way to increase children's acceptance of a variety of nutrient-rich foods and has the potential to change behavior and improve the diet. Future research should focus on ways to incorporate FV tasting programs into routine practice in the school setting and increase the participation rate of children. Furthermore, additional research is needed to determine if the children's self-described increase in preferences and self-efficacy resulted in greater FV consumption. Future behavioral interventions should also address factors in the child's environment that may interfere with preference change and FV consumption including developed preferences for highly marketed and palatable foods. Comprehensive approaches that encourage new foods while addressing barriers that limit preference change are needed so as to positively impact children's food choices and encourage healthful dietary behaviors.

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Table 1. Demographics of children in the study sample

Characteristic	Intervention (n=116)	Control (n=45)
Grade		
Third	58	25
Fifth	58	20
Gender		
Boy	63	15
Girl	53	30
Race-Ethnicity		
White	66	25
Black	45	18
Hispanic	3	1
Asian	1	0
Other	1	1

Table 2. Sample questionnaire items and standardized Cronbach's alpha reliability scores

Measure	# of items	Response scale	Sample item	Alpha reliability		
				Pre	Post	Follow-up
Fruit preferences	17	a	How much do you like an apple?	0.94	0.91	0.91
Vegetable preferences	21	a	How much do you like a bell pepper?	0.88	0.91	0.90
Self-efficacy	18	b	For dinner, I think I can eat a green salad	0.92	0.94	0.93
Outcome expectations	13	c				
Positive	9	c	If I eat fruits and vegetables every day, I will be healthier	0.84	0.80	0.83
Negative	4	c	If I eat fruits and vegetables every day, my friends will make fun of me	0.52	0.36	0.53
Social norms	4	d	Most kids my age think that eating 2 or more servings of fruit juice each day is a good thing	0.66	0.66	0.67

The possible response scales included the following:

[a] 1 = I do not like it, 2 = I like it a little, 3 = I like it a lot, 4 = I have never tasted it.

[b] 1 = I am sure I cannot, 2 = I don't think so, 3 = I am not sure, 4 = I think so, 5 = I am sure I can.

[c] 1 = I disagree very much 2 = I disagree a little 3 = I am not sure 4 = I agree a little 5 = I agree very much.

[d] 1 = A very good thing, 2 = A good thing, 3 = Not important, 4 = I don't know.

Table 3. Least square means for treatment by test interactions (n = 161)

Survey Construct	**Intervention**			**Control**		
	Baseline	Post-Intervention	Follow-up	Baseline	Post-Intervention	Follow-up
Fruit Preference Factor 1[a]	-0.242	0.208*	0.220*	-0.154	-0.389	-0.499
Self-efficacy Factor 3[b]	-0.187	0.046	0.170†	-0.024	-0.236	0.028