

## Improving Children's Vegetable Taste Preferences: The Impact of a School-based taste Testing Pilot Program for Elementary School Students

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### Abstract

**Background:** Despite the high nutritional content of vegetables, children do not eat them at optimal levels. Research has recommended that interventions aimed at increasing vegetable preferences among children be developed and evaluated. **Purpose:** This study describes an evidence- and theory-informed school-based vegetable taste testing pilot program for fourth and fifth grade students and reports evaluative findings. **Methods:** Pre and post structured interviews with N=36 students were conducted at a public school in southern Indiana in 2013-2014. Paired samples t-tests were performed for most outcome analyses. Process evaluation was conducted using multiple methods including feedback from school personnel, observation, and student taste testing tracking. **Results:** The program improved children's familiarity with, perceptions of, and peer norms for most vegetables. It also improved children's taste preference for one of the four vegetables. The program was feasible to implement with high levels of student participation. **Conclusion:** Results justify further research on taste testing programs as a promising intervention to improve children's vegetable taste preferences and other determinants of vegetable consumption. Recommendations are provided to improve the utility of these programs.

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### Introduction

Fruit and vegetable (F/V) consumption is essential for health and well-being during childhood and beyond (Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2004; Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014) and dietary habits established during childhood set the stage for future eating patterns (Mikkilä et al., 2004). However, children are not consuming F/Vs at adequate levels (Centers for Disease Control and Prevention [CDC], 2014). Although children's fruit intake has increased over the past several years, their vegetable consumption has not (CDC, 2014). This is especially problematic given that vegetables may be more disease protective than fruits (Oyebode et al., 2014). Low F/V consumption rates among young

people are likely due, in part, to children's taste preferences. Food preference has been found to be a primary determinant of F/V consumption (Baxter & Thompson, 2002; Bere & Klepp, 2005; Blanchette & Brug, 2005), and children have even lower preferences for vegetables compared to fruits, likely because they are not as sweet (Baxter & Thompson, 2002; Blanchette & Brug, 2005). Because of this, researchers have called for the design and evaluation of programs that increase children's taste preference for and consumption of vegetables (Baxter & Thompson, 2002; Bere & Klepp, 2005; Perry et al., 2004).

The present study heeds this recommendation by describing a newly created school-based vegetable taste testing program called

SuperFood HEROES and disseminating preliminary findings from a pilot study. The hypothesis underlying the intervention is that students' taste preference for vegetables will improve through the provision of multiple vegetable taste test testing opportunities. Although previous studies have encouraged taste testing programs (Baranowski et al., 2000; Bere, Veierød, Bjelland, & Klepp, 2006; Perry et al, 2004; Reynolds et al., 2000; Somerville, Kessler, Wallace, & Burns-Whitmore, 2012), these programs were evaluated in the context of larger multi-component interventions; therefore, the impact of taste testing programs in and of themselves remains unclear. To the authors' knowledge, this is the first study to evaluate a stand-alone taste testing intervention in the school environment. These findings provide public health researchers and practitioners with preliminary data to determine the effectiveness of taste testing programs and demonstrate that additional research on taste testing interventions is warranted.

## Methods

### Intervention Description

SuperFood HEROES was developed by a private foundation located in Southern Indiana in consultation with academic partners at Indiana University. SuperFood HEROES was initially developed to supplement the HEROES Initiative, a school-based childhood obesity prevention program. More information on the HEROES Initiative is available elsewhere (King et al., 2014). The name of the program aligned with the HEROES brand, the more recent conceptualization of "super foods," and the "super powers" of vegetables. The design of SuperFood HEROES was evidence- and theory-informed, and based upon a conceptual framework grounded in previous literature. Prior studies have found that increased exposure and familiarity with foods may lead to improved taste preference (Cooke, 2007; Wardle, Herrera, & Cooke, 2003), and enhanced taste preference should lead to increased consumption (Baxter & Thompson, 2002; Bere & Klepp, 2005; Blanchette & Brug, 2005). Thus, the intent of the program was to increase students' familiarity with vegetables through multiple exposures,

therefore increasing vegetable taste preferences and consequently increasing vegetable consumption. As stated by Cooke (2007: p. 295), "Put simply, it appears that children like what they know, and eat what they like." The program consisted of two components: taste testing and supplemental nutrition education. For the taste testing component, four vegetables—sweet potatoes, mushrooms, broccoli, and cauliflower—were selected in consultation with school cafeteria staff. SuperFood HEROES focused on four vegetables to represent a variety of USDA-required vegetable subgroups for school meals and because this was the largest number of vegetables that could be feasibly taste tested during the program's time frame. Cafeteria staff were involved to garner buy-in and to ensure that the vegetables chosen could reasonably be served in the cafeteria.

After receiving support and approval from the school principal, Foundation staff members provided a training session for teachers and food service personnel to describe the intervention and expectations, review materials, and address questions. Ten taste tests, the number of exposures suggested by research that may be necessary to change children's taste preferences (Wardle et al., 2003; Williams et al., 2008), were conducted for each vegetable over a 20-week period, for a total of 40 total taste tests. Cafeteria staff prepared the vegetables in a variety of ways to highlight the diverse manner in which vegetables can be eaten.

Vegetables were served in two-ounce tasting cups and brought to the students' classrooms by food service staff. Teachers then facilitated the taste tests and supplemental nutrition education in their classrooms. Conducting the taste tests in the group setting and with teachers' encouragement was intended to prompt observational learning and reinforcement, primary elements of Social Cognitive Theory. This approach also aimed to impact students' beliefs that tasting and eating vegetables were normative behaviors among their peers and positively regarded by teachers, thereby influencing students' subjective norm, a key construct of the Theory of Planned Behavior

(Baranowski et al., 2000; McAlister, Perry, & Parcel, 2008; Montaña & Kasprzyk, 2008; Perry et al., 2004). Students tracked their participation in each taste test by placing a stamp on a poster next to their name for each tasting opportunity. Incentives, such as stickers and pencils, were used to encourage participation (Belot, James, & Price, 2014; Just & Price, 2013).

Supplemental nutrition education was provided simultaneously with the taste tests. This consisted of displaying posters with memorably named superheroes representing each vegetable (e.g., Callie Cauliflower) as prior research suggests that attractive names for vegetables may increase their consumption (Wansink, Just, Payne, & Klinger, 2012) and that comic characters may positively influence fruit and vegetable intake (Leung, Tripicchio, Agaronov, & Hou, 2014; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). Each superhero poster had a message highlighting the corresponding “super power” of each vegetable (e.g., “healing”). Teachers provided a series of talking points about each vegetable when children tasted them, ranging from health information to fun facts.

### **Sample**

A public elementary school in southern Indiana piloted SuperFood HEROES during the 2013-2014 academic year. All fourth and fifth graders in the school, from four classrooms total, were asked to participate in the program. Participants (N=36) consisted of 11 fourth graders and 25 fifth graders. Sixty-nine percent (n=25) were female. Almost all students were white (n=35), and 33.3% (n=12) were eligible for free/reduced lunch, a proxy for lower socio-economic status. Sample demographics were fairly comparable to those of the school, although participants were slightly more likely to be female and ineligible for free/reduced lunch. Initial parental consent was 62% and student assent was 100%; n=8 students were eliminated from the dataset either because they were absent or no longer enrolled in the school on the day of the post-test interview.

### **Study Procedure and Measures**

Students verbally reported their answers to the study team through the use of structured

interviews. The interviews were conducted by trained researchers on a one-on-one basis before the initiation and after the completion of the program. The interview protocol was developed based on the conceptual framework using measures from the literature, as cited below. Prior to implementation, the protocol was pre-tested with children and underwent expert review for content validity. The study was approved by the authors’ Institutional Review Board. Written consent was provided by parents and assent was attained from students.

During the interviews, the vegetables were presented in raw form on a tray as a visual cue. Two of each vegetable were displayed, one in its entirety and one cut up so students could see it externally and internally. Identical protocols were administered at pre- and post-test and the same set of questions was asked for all four vegetables. The post-test interview included supplemental questions to garner additional feedback about the intervention. The interviews took approximately 15-20 minutes each.

The primary outcome of interest was taste preference. Students were asked to sample each vegetable, provided in a small tasting cup. All vegetables were tasted in their raw form, except for the sweet potato, which was peeled, sliced into French-fry sized portions, and then baked with no added ingredients. After tasting each vegetable, students were asked: “How much do you like [x vegetable]?” (Loewen & Pliner, 1999; Wardle et al., 2003) with the response options: not at all, a little, some, mostly, or a lot. Students were provided with a visual prompt for this measure and all other Likert-type response options to aid in recall of the answer choices.

Secondary outcome variables were familiarity, perceived healthiness, peer norm, (i.e., perceptions of if peers would engage in the behavior), and consumption intention. Familiarity was measured with the question “How familiar are you with [x vegetable]?” (Loewen & Pliner, 1999) and perceived healthiness was assessed by the question “How healthy do you think [x vegetable] is for you?” Both items had the response options not at all, a little, some, mostly, or a lot. Peer norm was

assessed by “How many kids in your class do you think would eat [x vegetable]?” Response options were none, a couple, some, most, or all. All variables were measured on a scale of 1 through 5. Intention to consume each vegetable was measured by “Would you eat [x vegetable] if it were served for lunch tomorrow?” with answers yes, no, or not sure.

A few questions were asked only at post-test to gather additional feedback about the program. An open-ended question asked for what reasons students decided to participate in the taste tests. Another question asked if students talked with their parents about the taste tests or vegetables they learned about (response options: yes, no, not sure), and if yes, what they talked about. An additional question asked if students or their parents did anything differently at home as a result of what they learned about vegetables (response options: yes, no, not sure), and if so, what was different.

### **Analyses**

Data presented are from those students with parental consent, student assent, and who completed both of the pre- and post-intervention interviews (n=36). Data were entered into and analyses were conducted in SPSS Version 22. Differences from pre- to post-test were examined using paired samples t-tests for continuous variables and paired samples proportion z-scores for consumption intention. Significance was set a priori at  $p < .05$ . For open-ended responses, content analysis was conducted using representative quotes as exemplars. Process evaluation data were gathered through various methods throughout the intervention. A conference call was held with school personnel towards the beginning of the program to assess initial fidelity and address any unforeseen questions or concerns, and a site visit was conducted to directly observe a classroom taste testing session. Teachers tracked student participation in their classrooms by having students place stickers by their names for each taste test they participated in on a large chart

posted on the wall. The cafeteria staff kept a log of the dates and preparations of the taste tests. After the completion of the program the cafeteria manager was interviewed and an online survey for teachers was administered.

## **Results**

### **Outcome Evaluation Results**

As shown in Table 1, children’s taste preference for mushrooms significantly improved from pre-test ( $M=2.75$ ,  $SD=1.46$ ) to post-test ( $M=3.38$ ,  $SD=1.54$ );  $t(31)=2.129$ ,  $p=.041$  with an effect size of  $d=.38$  and  $R^2=.13$  demonstrating a small to medium effect. Changes were not seen for the other vegetables. Children’s familiarity with sweet potatoes, mushrooms, and cauliflower all increased at post-test ( $p < .05$ ). The program also improved perceptions of healthiness for all four vegetables ( $p < .05$ ) and improved students’ perceived peer norm of eating mushrooms, broccoli, and cauliflower ( $p < .05$ ). The percentage of students that stated they would eat each vegetable at lunch on the next day did not change between pre- and post-test.

Based on the post-test supplemental questions, students reported enjoying the program. Over half (n=20) stated they participated in the taste tests due to their inquisitiveness about the vegetables or to try something new (e.g., “to see how they tasted” and “because some I never tried before”). Other primary reasons for participation were the desire to do something healthy (e.g., “I want to try to get healthier”) (n=9), and incentives (e.g., “I heard there were prizes”) (n=4). Seventy-eight percent of students reported talking with their families about the program, and 54% affirmed that they or their family did something different at home because of the program, typically parents purchasing and serving more vegetables and children liking or consuming more vegetables (e.g., “My parents cooked more vegetables” and “I started eating a lot more vegetables”).

**Table 1:**

Pre- and Post-Test Results for Intervention Outcomes

	Familiarity			Perception of Healthiness			Peer Norm			Taste Preference			Consumption Intention		
	<i>Pre</i>	<i>Post</i>	<i>p</i>	<i>Pre</i>	<i>Post</i>	<i>p</i>	<i>Pre</i>	<i>Post</i>	<i>p</i>	<i>Pre</i>	<i>Post</i>	<i>p</i>	<i>Pre</i>	<i>Post</i>	<i>p</i>
Sweet Potato	2.69 (1.28)	3.83 (1.13)	<.001	3.39 (.96)	4.34 (.84)	.008	2.89 (.75)	3.11 (.71)	.147	3.97 (1.12)	4.26 (1.09)	.067	83.3%	83.3%	1.00
Mushroom	3.53 (1.30)	4.06 (1.22)	0.026	3.47 (.88)	4.17 (.78)	<.001	2.72 (.74)	2.72 (.74)	.014	2.75 (1.46)	3.38 (1.54)	.041	44.4%	52.8%	.221
Broccoli	4.56 (.81)	4.58 (.69)	0.869	4.67 (.48)	4.83 (.38)	.032	3.19 (.95)	3.19 (.95)	.002	4.33 (.96)	4.22 (1.07)	.579	88.9%	83.3%	.317
Cauliflower	3.58 (1.36)	4.11 (.99)	0.012	4.08 (.77)	4.61 (.55)	<.001	3.00 (.94)	3.00 (.94)	.005	4.09 (1.36)	4.30 (1.19)	.325	77.8%	80.6%	.480

*Note:* Means are presented with standard deviations in parentheses. Familiarity, healthiness, and taste preference were measured with a scale of 1–5, with 1 being “Not at all” and 5 being “A lot.” Peer norm was measured with a scale for 1–5, with 1 being “None” and 5 being “All.” Consumption intention is the percentage of participants who stated they would eat the vegetable with their lunch tomorrow.

**Process Evaluation Results**

The primary concern identified during the conference call early in the intervention related to communication and coordination between the teachers and cafeteria staff. Although an initial taste testing calendar was distributed, it did not specify which vegetables would be served on each date, making it difficult for the teachers to prepare for the accompanying educational component. Further, cafeteria staff were not consistently following the schedule, causing frustration among teachers. To remedy these issues, Foundation staff contacted the food service manager and asked her to modify the schedule to specify the vegetables that would be taste tested. Additional efforts were made to ensure the cafeteria staff fully understood the program and to reiterate the importance of following the schedule. Teachers were asked to more directly communicate their concerns to cafeteria staff.

Following these adjustments, which occurred approximately four weeks into the program, both parties reported that the intervention ran smoothly. Cafeteria staff requested and were provided with more standardized recipes, which provide details on how to produce consistent quality and yield and are required by the Department of Education for cafeteria food service. All students participated in the majority of the taste tests according to the tracking posters. After the completion of the program,

school personnel indicated that SuperFood HEROES was feasible to implement and that students enjoyed participating in the program.

**Discussion**

SuperFood HEROES resulted in several positive outcomes, including children’s increased familiarity, perceptions of healthiness, and positive peer norm for almost all vegetables. These have all been identified as determinants of vegetable consumption. However, children’s taste preferences only changed for one vegetable, and consumption intentions stayed consistent for all vegetables. This may have been due to the relatively high preferences and consumption intentions students reported at pre-test for most of the vegetables. With the exception of mushrooms, participants reported that they “mostly” liked the other vegetables, and over three-quarters of students said they would eat each vegetable at lunch the next day.

While it is possible that the program may not have been effective at changing preferences, it seems likely that, given the high initial responses, there was little room for growth, and therefore a ceiling effect may have occurred (Keppel & Wickens, 2004). This is further supported by the finding that mushrooms, the one vegetable that had lower preferences at pre-test, did significantly improve by the end of the program. Why children reported such high

preferences and consumption intentions is unclear. It is possible that this was driven by social desirability, but also conceivable that students were already more accustomed to the three other vegetables, and that the novel vegetable garnered lower ratings initially. However, previous literature has identified different exposure quantities as necessary to change taste preferences, and some have indicated a greater number of exposures may be needed than how many were part of the current intervention (Cooke, 2007). Therefore, it is possible that an increased number of taste tests would have led to more pronounced changes in children's vegetable taste preferences.

A particularly exciting finding was the large percentage of students who talked with their families about the program. Family involvement is a component of the Centers for Disease Control and Prevention's recommended coordinated school health approach and parental engagement in school activities has been associated with multiple positive outcomes for children (CDC, 2012). Further, children who ask their parents to make fruits and vegetables available at home are more likely to consume fruits and vegetables than children who do not ask (Middlestadt et al., 2013); therefore, the program may have also led to increased home vegetable consumption.

### **Limitations**

Given this was a pilot study, there are several limitations. The study included a small sample size, took place in one school in the Midwest, and there was no control group. Given the sample size, analyses could not be conducted to test the conceptual framework and potential mediating variables. Although one-third of the

students were of lower socio-economic status, almost all were White. Vegetable consumption could not be assessed because the schools did not regularly serve the taste testing vegetables at pre-test. Consumption intention, however, was measured given that people's intention to engage in a given behavior (i.e., intention to eat the vegetable) is considered a major predictor of whether they will actually perform the behavior (i.e., eat the vegetable) (Montaño & Kasprzyk, 2008). Further, the study focused on four specific vegetables; other vegetables may have yielded different findings.

### **Conclusion**

Although preliminary, this pilot study provided many positive findings that demonstrate school-based vegetable taste testing programs may be worth implementing. The program was feasible to conduct in a real world setting, was low-cost and sustainable, and children liked it. Process findings revealed the importance of buy-in and coordination among school staff. The study results warrant expanded evaluation studies with larger samples and experimental designs that measure actual vegetable consumption with a wider variety of novel vegetables. These studies should control for possible classroom-level differences in implementation fidelity and assess differences in outcomes based on students' demographics.

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