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RESEARCH ARTICLE

Call a Vegetable a Vegetable: Perceptions and Taste Ratings

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Abstract:

Background:

Research is mixed regarding how nutritional value of food can influence perceptions about taste, particularly among children. This study examined children's perceptions of vegetable-enhanced snacks and milk substitutes prior to and after tasting.

Methods:

Two taste tests were performed with two groups of elementary age children (n = 29 and n=22). Prior to each tasting, they were made aware of the food being tasted. Participants provided perceptions of taste prior to sampling and also after tasting. Data were analyzed with paired two sample t-tests. In Taste Test #1, children gave spinach brownies higher ratings after tasting (prior: M=2.24; after: M = 2.86, $p < .05$) and rated cheesy sweet potato crisps lower after tasting (prior: M = 2.45, after: M = 1.48, $p < .05$). In Taste Test #2, children rated both vanilla soymilk (prior: M = 1.91, after: M = 2.64, $p < .05$) and zucchini oatmeal cookies (prior: M = 1.73, after: M = 2.46, $p < .05$) higher after tasting.

Conclusion:

Consumption of vegetable enhanced foods or milk substitutes may be encouraged without deception in order to promote a more nutrient dense diet among elementary-aged children.

Keywords: Children's nutrition, Taste test, Vegetables.

INTRODUCTION

Obesity has become an epidemic in the United States, where an astounding 17 percent of all children and adolescents are obese. This number has tripled in the past thirty years, with one-third of all children being overweight or obese [1]. Twelve out of the fifty states in America now have obesity rates above 30 percent, whereas five years ago, there was only one state that met that standard [2]. This sweeping dilemma puts each child at a greater risk for cardiovascular disease, type two diabetes, stroke, osteoarthritis, various cancers, and a lifetime of obesity [3]. According to the American Diabetes Association, it is estimated that 5,089 youth are diagnosed with type 2 diabetes annually [4]. A lifestyle of adequate and efficient nourishment can decrease the risk for all of these associated chronic diseases. Even so, only one-fourth of children 2-11 years old consume the recommended three servings of vegetables each day, and less than half of those children consume at least two servings of fruit each day [5]. This is particularly startling considering eating habits are shaped early in life and carried into adulthood.

In order to prepare children for a lifetime of healthy eating habits and reduce the risk for chronic diseases, it may be

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beneficial to encourage taste testing of new healthy foods. Brouse, Wolf and Basch [6] found that the majority of school food service directors agree with this, suggesting that promoting taste testing would have a positive effect on the school food environment. If children are given the chance to try wholesome new foods and find they enjoy them, then parents and food service directors may not feel the pressure to serve foods that children currently report to enjoy versus healthy foods.

Previous research is mixed regarding how nutritional value of food can influence perceptions about taste, particularly among children. Wardle and Huon [7] discovered that children believe the tastiness and healthiness of foods are mutually exclusive characteristics. They suggest children are more likely to respond negatively to products labeled as "healthy". This poses a challenge concerning which approach to take when administering a taste test, *i.e.* whether to be honest and explain a food is healthy, or to act as if it is "fun and new". Marquis, Gould, Hyland and Kuris [8] elaborated on this, associating lower socio-economic status and age with reduced familiarity and willingness to try new fruits and vegetables. Based on this, we can conclude children are tentative regarding the consumption of new foods. Other research completed by Lakkakula, Geaghan, Zanovec, Pierce and Turi [9] expanded on this idea by examining whether repeated taste tests with vegetables yielded a more positive response. Their data suggest that children who start a taste test program disliking targeted foods may report an improved liking after multiple tastings, thus opening the door to new, healthful items.

Previously, popular cookbooks such as *Deceptively Delicious* and *The Sneaky Chef* have encouraged parents to hide vegetables in food so that children do not know they are consuming them. The purpose of this research was to inform children of the vegetables included in snacks prior to tasting to see if this would influence their ratings after trying the foods. Because research is inconclusive regarding how nutritional value of food can influence perceptions about taste, particularly among children, this study examined taste tests of vegetable-enhanced foods and milk substitutions in an elementary age population.

METHOD

Subjects

Children from two different southeastern coastal community elementary schools were recruited to participate in Taste Tests during their school lunch periods. Parental and child consent was obtained for all participants and the study was approved by the university's Institutional Review Board. Both schools were Title I schools, meaning federal financial assistance was offered to these schools due to high numbers of low-income families.

Procedure

In order to expose children to new foods such as vegetable-enhanced snacks/desserts and milk substitutions, taste tests were held in the school cafeterias at empty tables during the participants' lunch periods. The children sat at the table together for the tastings prior to lunch being served. Once in the cafeteria, the children were given a paper-pencil survey and a pencil. The paper-pencil survey had a 3-point Likert-type scale for ratings (3 = very good: 1 = very poor). In both taste tests, the children were first informed of the food to be sampled and were asked to record perceptions of taste on the survey. Next, they tasted each food/beverage individually and recorded actual ratings. Children in the first taste test sampled small portions of vanilla soy milk, chickpea chocolate chip cookies, zucchini oatmeal cookies, and baked carrot chips. Those children in the second taste test sampled small portions of vanilla almond milk, spinach brownies, cheesy sweet potato crisps, and hummus with crackers. Recipes for items that received higher taste test ratings and their related nutritional information are provided in Appendix.

Statistical Analysis

After the taste tests for the two groups of elementary age children, administered data were analyzed using Excel. Age was analyzed with means and standard deviations and the two taste tests were analyzed with t-tests of two means to determine significant changes in rating. A p-value of $<.05$ was established for statistical significance.

RESULTS

Fifty-one students participated in taste tests at two different elementary schools within the same southeast coastal community. At the first elementary school, Taste Test #1 consisted of 2nd to 4th graders (*mean age*: 7.8 years, SD = 2.4, N = 29). At the second elementary school, Taste Test #2 consisted of 5th graders (*mean age:* 10.8, SD = 2.4, N = 22).

In Taste Test #1 (n = 29), children gave the spinach brownies higher ratings (*i.e.*: greater approval) after tasting (*prior:* M = 2.24, *after:* M = 2.86, p = .001) and rated the cheesy sweet potato crisps lower after tasting (*prior:* M = 2.45, *after:* M = 1.48, $p < .001$). For the two other foods tested, vanilla almond milk and hummus with crackers, there were no significant differences in ratings prior to and after tasting.

At the completion of Taste Test #1, means were examined for top taste ratings among the two foods presented. The highest taste approval was given for spinach brownies (M = 2.86), followed by vanilla almond milk (M = 2.44). Lower means were found (less likely to prefer) for hummus with crackers (M = .79) and cheesy sweet potato crisps (1.48) (See Table **1**).

Table 1. Pre/post t-test ratings for taste test #1 with children's perceptions of food taste prior to and after tasting (n = 29).

Taste test item		*Pre-*	*Pre-SD*	*Post-*	*Post-SD*	*p-value*
Spinach brownies		2.24	0.83	2.86	0.44	p < .05
Vanilla almond milk		2.31	0.76	2.45	0.83	0.40
Hummus with crackers		1.86	0.87	1.79	0.90	0.73
Cheesy sweet potato crisps		2.45	0.78	1.48	0.78	p < .05
Rank	*Food children perceived to prefer prior to tasting (mean rating)*			*Food children favored after tasting (mean rating)*		
1	Cheesy sweet potato crisps (2.45)			Spinach brownies (2.86)		
2	Vanilla almond milk (2.31)			Vanilla almond milk (2.45)		
3	Spinach brownies (2.24)			Hummus with crackers (1.79)		
4	Hummus with crackers (1.86)			Cheesy sweet potato crisps (1.48)		

Likert-scale: 1 = very poor: 3 = very good

In Taste Test #2 (n = 22), children rated both the vanilla soymilk (prior: M = 1.91, after: M = 2.64, p < .05) and zucchini oatmeal cookies (*prior:* M = 1.73, *after* M = 2.46, p < .05) significantly higher after tasting (see Table **2**). There were no differences in ratings prior to and after tasting the chickpea chocolate chip cookies and baked carrot chips.

Top ratings for Taste Test # 2 were for vanilla soy milk (M = 2.63), zucchini oatmeal cookies (M = 2.45), and chickpea chocolate chip cookies (M = 2.18). Although the children originally perceived that the baked carrot chips would taste the best prior to the taste testing, these received the lowest post-test mean (M = 1.86) (see Table **2**).

Table 2. Pre/post t-test ratings for Taste Test #2 with children's perceptions of food taste prior to and after tasting (n = 22).

Taste test item		*Pre-*	*Pre-SD*	*Post-*	*Post-SD*	*p-value*
Vanilla soy milk		1.91	0.87	2.64	0.73	p < .05
Zucchini oatmeal cookies		1.73	0.88	2.46	0.74	p < .05
Chickpea chocolate chip cookies		2.09	0.81	2.18	0.79	0.69
Baked carrot chips		2.23	0.75	1.86	0.88	0.09
Rank	*Food children perceived to prefer prior to tasting (mean rating)*			*Food children favored after tasting (mean rating)*		
1	Baked carrot chips (2.23)			Vanilla soymilk (2.63)		
2	Chickpea chocolate chip cookies (2.09)			Zucchini oatmeal cookies (2.45)		
3	Vanilla soy milk (1.91)			Chickpea chocolate chip cookies (2.18)		
4	Zucchini oatmeal cookies (1.73)			Basked carrot chips (1.86)		

Note: Likert-scale: 1 = very poor: 3 = very good.

DISCUSSION

This study examined elementary-age children's perceptions of vegetable-enhanced snacks and milk substitutes prior to and after tasting. The taste tests were arranged and administered in a non-deceptive manner, meaning the taste test survey administrator was truthful and allowed the children to be aware that "healthy" foods would be tasted. Upon completion, statistically significant differences prior to and after tasting were found. After tasting, the children gave greater approval to the spinach brownies, vanilla soymilk, and zucchini oatmeal cookies, while the cheesy sweet potato crisps were given a lower approval after tasting. Additionally, top taste ratings among the two groups were calculated and combined in rank-order as follows: spinach brownies, vanilla soy milk, zucchini oatmeal cookies, vanilla almond milk, chickpea chocolate chip cookies, and hummus with crackers.

Based on these findings, similar programs may have potential for encouraging healthier eating habits in children *via* non-deceptive taste testing of new healthy foods. These findings are in congruence with those of Wardle and colleagues [7] who suggest that children are more likely to respond negatively to foods labeled as "healthy". With that said, although the children in our study may have initially responded negatively to the thought of the new "healthy" food they were being introduced prior to tasting, they discovered they liked it after tasting it. Combining our results with those of Wardle [7], it may be beneficial to allow children to taste test foods labeled as "healthy" without deception so they have the opportunity to discover the tastiness that healthy foods can produce.

Brouse and colleagues [6] found that many food service directors' agree with this, suggesting that taste testing in schools would provide a positive, healthy influence on the school food environment. Parents and food service directors' often feel pressured to serve food that most children report to enjoy, rather than healthy food items they perceive to dislike. If children are encouraged to try nourishing new foods in a taste test, and find they enjoy them, parents and schools would be more motivated to serve healthy food items [6].

Marquis and colleagues [8] found that low socio-economic status and age are related with willingness to try fruits and vegetables. These findings show that elementary-age children may be uneasy regarding the consumption of new foods, especially fruits and vegetables. As our study involved foods with "hidden" vegetables, the results were similar to those from Marquis and others being that the children in our study had an initial perception of a lesser approval prior to tasting. Even so, in accordance with our results and other research completed by Lakkakula and colleagues [9], we can conclude that taste tests involving vegetables or other items labeled as "healthy" have a strong possibility of yielding a positive response from children who start the taste test program disliking or perceiving to dislike the targeted foods. These findings show that children may report an improved liking after tasting, even when taste test administrators are truthful regarding the food's level of healthiness.

CONCLUSION

Taste tests implemented in the elementary school system have the power to produce desirable public health outcomes. Because diabetes is often underreported as a cause of death and is a risk factor for many serious health consequences, improving nutritional quality to incorporate more fruits and vegetables during childhood can prevent or delay type 2 diabetes [4]. Taste tests can increase children's willingness to try new healthy foods, allowing them to discover healthy foods and tastiness can be mutually inclusive. Following taste testing, children may be more likely to positively respond to foods labeled as "healthy," thus being a favorable component to aid in the current childhood obesity epidemic. The new perceptions children develop following taste testing have the capability to promote healthy food choices at home with their families, as well as to encourage school administrators and food service directors' to serve healthier foods in schools.

APPENDIX

	Recipe and instructions	**Nutritional Information/ Serving**
Zucchini oatmeal cookies	1 cup all-purpose flour 1 ¼ teaspoons ground cinnamon ½ teaspoon baking soda ½ teaspoon baking powder	*Makes 40 servings Calories: 56 Carbohydrate: 7.5 g (53.6% from carbs)
	½ teaspoon salt 1 stick unsalted butter ½ cup granulated sugar ½ cup light brown sugar 1 large egg ½ teaspoon pure vanilla extract 1 cup finely grated zucchini 1 cup old fashioned oats	Fat: 2.4 g (38.6% of calories from fat) Protein: 8 g (5.7% of calories from protein) Sugar: 5 g Sodium: 8 mg
	Instructions: Preheat oven to 350 degrees. Mix dry ingredients. Beat butter and sugar until fluffy, then beat in egg and vanilla. Mix dry ingredients with butter mixture. Stir in zucchini and oats. Refrigerate one hour or until firm. Drop dough on baking sheet, using about 2 tablespoons at a time. Bake for 17 minutes or until the edges are golden.	
	Recipe and instructions	**Nutritional Information/ Serving**
Chickpea chocolate chip cookies	1 cane chickpeas, drained ½ cup cashew butter (or almond butter) ½ cup light brown sugar 2 teaspoon vanilla 1/8 teaspoon salt 1/8 teaspoon baking powder ½ cup chocolate chips	*Makes 20 servings Calories: 93 calories Carbohydrate: 12.5 g (53.7% of calories from carbs) Fat: 4.5 g (43.5% of calories from fat) Protein: 2.25 g (9.6% of calories from protein) Sugar: 7 g Sodium: 78 mg
	Instructions: Preheat oven to 350 degrees. Combine all ingredients, except chocolate chips, in a high blender and mix well. Once no whole chickpeas remain, stir in chocolate chips. Drop 1 inch thick balls onto a greased cookie sheet and flatten with a spatula. Bake for 15-20 minutes, or until chocolate chips are melted.	

Appendix contd.....

Spinach brownies	3/4 cup all-purpose flour 3 ounces semisweet chocolate 1/2 cup carrot puree 1/2 cup spinach puree 1/2 cup light brown sugar 1/4 cup unsweetened cocoa powder 2 tablespoons margarine spread 2 teaspoons pure vanilla extract 2 large egg whites 1/2 teaspoon baking powder 1/2 teaspoon salt	*Makes 20 servings Calories: 68 Carbohydrate: 9.4 g (55.3% of calories from carbs) Fat: 2.5 g (33.1% of calories from fat) Protein: 2 g (11.8% of calories from protein) Sugar: 6 g Sodium: 88 mg
	Instructions: Preheat the oven to 350 degrees and grease 8x8 inch pan with cooking spray. Melt the chocolate in a double boiler. Combine melted chocolate with vegetable purees, sugar, cocoa powder, margarine, and vanilla, and whisk until smooth and creamy, 1 to 2 minutes. Whisk in egg whites and stir in the flour, baking powder, and salt. Bake for 35-40 minutes.	

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Institutional Review board at CCU. All research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2008 (http://www.wma.net/en/20activities/10ethics/10helsinki/).

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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Declared none.

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