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Introducing Preschool Children to Novel Fruits and Vegetables: A Pilot Study

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Please note that this study was published before the SY2014-15 implementation of the Smart Snacks Nutrition Standards for Competitive Food in Schools, as required by the Healthy, Hunger-Free Kids Acts of 2010. As such, certain research relating to food in schools may not be relevant today.

ABSTRACT

Purpose/Objectives

The purpose of this pilot study was to compare changes in preschool children's identification, preferences, and beliefs related to fruits and vegetables introduced to a child care center's menu before and after a nutrition education and food exposure intervention. The study also sought to determine how these changes were related to Body Mass Index (BMI).

Methods

This study utilized a one-group, pretest-posttest design. The children were offered a combined intervention featuring nutrition education and exposure to novel fruits and vegetables at meals in a preschool setting.

Results

Nineteen children aged 3.3 through 5.6 years completed the study. Children were able to identify several novel fruits and vegetables more accurately following the intervention. The mean calculated scores for *identification*, *preference*, *healthfulness*, and *exposure* all significantly changed from pre- to post-measures ($p < .05$). BMI z-score was inversely related to *identification* ($r = -.60$), *preference* ($r = -.46$), *healthfulness* ($r = -.66$), and *exposure* ($r = -.49$) scores following the intervention ($p < .05$) but not before the intervention.

Application to Child Nutrition Professionals

Children in this pilot study who learned about fruits and vegetables were more likely to identify them as healthy and want to eat them, so exposure at meals in combination with a nutrition education program may improve acceptance of novel food on the school's menu.

Keywords: preschool nutrition; fruits; vegetables; menu change; Body Mass Index

INTRODUCTION

Obesity prevention is a public health priority, and schools are at the forefront of the fight against childhood obesity in the U.S. The recent changes to the National School Lunch Program (NSLP) and School Breakfast Program (SBP) illustrate this role (U.S. Department of Agriculture [USDA], 2012). The rate of obesity among children in the U.S. is approaching 17% (Ogden, Carroll, Kit, & Flegal, 2012). Although some states are seeing rates decline (Robert Wood Johnson Foundation, 2012), most are not. Obese children are at increased psychosocial and health risk compared with their normal weight peers (Lobstein, Baur, & Uauy, 2004), and excessive weight in childhood places individuals at higher risk for obesity during adolescence and adulthood (Juonala et al., 2011; Starc & Sterl, 2010). Therefore, understanding which interventions are most effective to prevent obesity

among preschool (3-5 years of age) children is critical not only to curb but also to reverse obesity rates.

A key area of obesity prevention efforts has included dietary education and dietary behavior modification in the elementary school or after-school setting (Sigman-Grant et al., 2011). Older children do not always eat the healthful foods on their lunch trays (Baik & Lee, 2009; Cashman, Tripuranan, Englund, & Bergman, 2010); however, recent research has demonstrated the effectiveness of modifying elementary school cafeteria environments to improve nutrition (Williams, Han, Johnson, Martin, & Newton, 2013). While improving diets among older children is important, some studies suggest the need for interventions before children reach elementary school age (Harnack et al., 2012), and less is known about optimizing healthy eating in preschool child care and education settings.

Preschools can modify the environment to attempt to optimize healthful eating. Understanding how preschoolers respond to menu changes is critical, as future changes to the Child and Adult Care Food Program (CACFP) may be informed by additional research in this area. Although dietary recommendations to eat more fruits and vegetables for good health and reduced obesity risk are not new, less is known about the effectiveness of teaching preschool-aged children about the benefits of healthful foods and exposing them to new fruits and vegetables at mealtimes. The purpose of this pilot study was to compare changes in preschool children's identification, preferences, and beliefs related to fruits and vegetables introduced to a child care center's menu before and after a nutrition education and food exposure intervention. The study also sought to determine how these changes were related to Body Mass Index (BMI).

METHODOLOGY

Participant Characteristics

Participants included children enrolled at a university preschool located in the Upper Midwest region of the United States. Parents of recruited children were informed of the detailed procedures of the study and were provided with options to allow their child to participate or opt out without any consequences. All study protocols were approved by the university's institutional review board prior to initiation of the pilot study.

Design and Procedure

This one-group, pretest-posttest study evaluated preschool children's responses to novel fruits and vegetables offered at meals in a child care setting and simultaneous exposure to a nutrition education program featuring these new foods. Study participants were introduced to six new food items: blueberries, sugar snap peas, raspberries, kiwi, winter squash, and jicama. The center's rotating menu was modified by serving one new fruit or vegetable in addition to the regular menu items at breakfast, lunch, and snack meals during the intervention. Each of the six new fruits and vegetables were offered eight times over a four-week period. Storage, cost, variety, and presentation were all important considerations when novel foods were chosen for the study. Therefore, kiwi and jicama were served fresh, frozen blueberries and raspberries were served partially thawed, and frozen winter squash and sugar snap peas were steamed to demonstrate a range of presentation options.

A nutrition educator offered participants four 30-minute lessons which were held on a weekly basis to introduce the six novel fruits and vegetables. The educator utilized an adapted version of the *Color Me Healthy!* Curriculum (Dunn, Thomas, Pegram, Ward, & Schmal, 2004). A detailed description of the methods utilized for the education program has been published elsewhere (Niemeier, Tande, Hwang, Stastny, & Hektner, 2010).

Data were collected through structured interviews appropriate for the ages of participants. The interview questions were reviewed by two developmental psychologists to ensure that the questions were developmentally appropriate for preschool children. The interviews were designed to assess children's ability to identify foods and to measure their preferences for and beliefs about the foods presented to them. Researchers presented seven food items during the interview in the following order, selected by random drawing, at both pre- and post-intervention: blueberries, soda pop, winter

squash, sugar snap peas, jicama, candy, and kiwi. For each food, study participants were asked "What is this?", "Is it healthy?", and "Have you ever eaten this?" If they responded that they had eaten a food, they were asked two follow-up questions: "Did you like it?" and "Would you eat it again?" If they responded that they had not eaten a food, they were asked "If we had some for lunch or supper or snack, would you eat it?" Soda pop and candy were included for two reasons: to assess preschool children's ability to identify healthy vs. unhealthy foods and to assess reliability of the interview questions. Five of the six novel fruits and vegetables were included in the interview, with raspberries omitted due to the length of the interview.

Responses were coded one of two ways: correct responses and "yes" as 1; incorrect responses, no response, and "no" as 0. One point was tabulated for a correct answer related to each fruit or vegetable for the following categories (scores ranged from 0 - 5):
Identification – identifying fruits and vegetables
Healthfulness – identifying fruits and vegetables as healthy foods
Exposure – reporting previously eating the fruits and vegetables
Preference – reporting "liking" fruits and vegetables
Exploration – reporting willingness to eat fruits and vegetables at future meals or snacks
The scale for each score was 0 to 5 with 5 being the maximum score possible for correct or "yes" responses for all 5 fruits and vegetables in each category.

Heights and weights of the children were measured at both pre- and post-intervention as part of the interview protocol, and BMI, BMI z-score, and BMI percentile were calculated. Childhood overweight and obesity were defined as = 85th percentile and = 95th percentile, respectively (Centers for Disease Control and Prevention, 2012).

Nonparametric, related samples tests were conducted to measure changes in distributions of values for identification, preference, and belief for each interviewed item from pre- to post-intervention. Correlations (Spearman's Rho, nonparametric) were utilized to evaluate relationships between BMI z-score and identification, preference, and belief scores pre- and post-intervention. Dependent *t*-tests identified changes in identification, preference, and belief scores from pre- to post-intervention. Data were analyzed in SPSS, version 18 (IBM, Armonk, NY).

RESULTS AND DISCUSSION

Nineteen children, aged 3.3 through 5.6 years (*M* = 4.6 years, *SD* = .63), completed this pilot study. Fifteen of 19 children were White with 11 girls and 8 boys completing the study. Eight of the 19 and 7 of the 19 participants were overweight or obese at the beginning, and at the end of the study, respectively. The mean BMI z-score did not significantly change from the beginning of the study to the conclusion of the study (*M* = .758, *SD* = .849 and *M* = .710, *SD* = .927, respectively). Children were able to identify several novel fruits and vegetables more accurately following the intervention, including winter squash, sugar snap peas, jicama, and kiwi ($p < .001$, $p = .002$, $p = .002$,$p = .001$, respectively) (Table 1). More children also reported having eaten jicama and liking it ($p < .001$) and "liking" sugar snap peas, which approached significance ($p = .06$). Following the intervention, preschool children were more likely to report that winter squash was a "healthy" food ($p = .031$) and that they had eaten the food ($p = .039$).

Table 1. *Comparison of Preschool Children's Identification, Preferences, and Beliefs about Foods before and after a Nutrition Education and Food Exposure Intervention*

Food Item	Response (*N* = 19)	ID		HLTH		EXPSR		PREF		EXPLR	
		[a]Pre	[ß]Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Blueberries	Yes	15	19	15	18	14	16	13	16	16	18

	No	4	0	4	1	5	3	6	3	3	1
Soda pop	Yes	15	17	5	6	13	17	14	14	14	17
	No	4	2	14	13	6	2	5	5	5	2
Squash	Yes	6	18***	11	17*	10	17*	8	9	16	14
	No	13	1	8	2	9	2	11	10	3	5
Sugar snap peas	Yes	8	18**	15	17	14	16	10	15	15	16
	No	11	1	4	2	5	3	9	4	4	3
Jicama	Yes	0	10**	12	16	1	13***	1	13***	14	16
	No	19	9	7	3	18	6	18	6	5	3
Candy	Yes	15	13	3	5	16	18	16	18	15	17
	No	4	6	16	14	3	1	3	1	4	2
Kiwi	Yes	5	16***	12	16	13	16	9	13	14	15
	No	14	3	7	3	6	3	10	6	5	4

Note. Responses are listed in 5 categories: ID = Identification (correctly identifying the food); HLTH = Healthfulness (reporting that the food is healthy); EXPSR = Exposure (reporting previously eating the food); PREF = Preference (reporting "liking" the food); and EXPLR = Exploration (reporting willingness to eat the food at future meals or snacks).
Response: Yes = correct response; No = incorrect response or no response.
[a]Pre = before intervention; [ß]Post = after intervention.
McNemar's tests were used to test frequency distribution differences before and after intervention.
*p < .05, **p < .01, ***p < .001.
Further analysis that grouped the fruits and vegetables together identified many changes reported by children. Scores for *identification* ($t(18) = 7.35$, $p < .001$), *healthfulness* ($t(18) = 3.38$, $p = .003$),*preference* ($t(18) = 3.31$, $p = .004$), and *exposure* ($t(18) = 4.75$, $p < .001$)all significantly increased from pre- to post-measures (Figure). These results indicate that after the intervention,

children identified more of the fruits and vegetables, identified more of these foods as healthy, reported liking more of them, and had eaten more of the fruits and vegetables at meals and snacks.

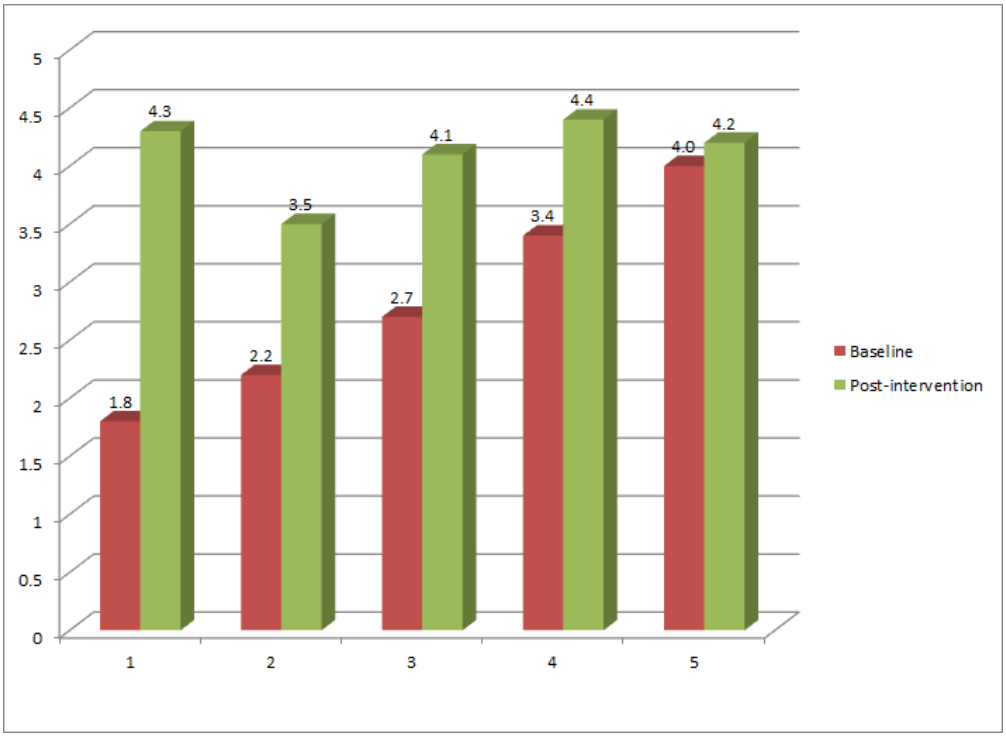

Figure. *Mean scores for identification, preference, and beliefs (i.e. exposure, healthfulness, and exploration) about novel fruits and vegetables among preschool children.*
Cumulative scores were based on children's responses to questions about 5 fruits and vegetables: blueberries, squash, sugar snap peas, jicama, and kiwi. Scale for each score was 0 to 5, with 5 being the maximum score possible for correct or "yes" responses for all 5 fruits and vegetables in each category. Dependent *t*-tests, $df = 18$, *$p < .01$, ** $p < .001$.
At baseline, children who correctly identified fruits and vegetables novel to the child care menu were more likely than those who could not identify them to report liking them ($r = .55$, $p = .016$), believing the foods were healthy ($r = .61$, $p = .005$), eating them before ($r = .55$, $p = .016$), and trying them again ($r = .65$, $p = .002$) (Table 2). Following the intervention, children who reported liking the new foods were also more likely than those who did not like them to believe the fruits and vegetables were healthy ($r = .62$, $p = .005$) and indicate a willingness to try them again in the future ($r = .60$, $p = .007$).

Table 2. *Relationships between Preschool Children's Responses regarding Novel Foods before and after a Nutrition Education and Food Exposure Intervention (N = 19)*

Responses	**BMI Z-score**	**ID**		**HLTH**		**EXPSR**		**PREF**		**EXPLR**
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre
[a]Pre-ID	-0.76									
[ß]Post-ID	-0.60**	0.34								
Pre-HLTH	-0.43	0.61**	0.38							

Table 2. *Relationships between Preschool Children's Responses regarding Novel Foods before and after a Nutrition Education and Food Exposure Intervention (N = 19)*

Post-HLTH	-0.66**	0.31	0.48*	0.62**						
Pre-EXPSR	0.00	0.55*	0.06	0.34	0.14					
Post-EXPSR	-0.49*	0.33	0.67**	0.43	0.51*	0.50*				
Pre-PREF	0.16	0.55*	-0.11	0.27	-0.01	0.87***	0.26			
Post-PREF	-0.46*	0.10	0.22	0.33	0.62**	0.16	0.34	0.23		
Pre-EXPLR	-0.27	0.65**	0.35	0.63**	0.32	0.77***	0.69***	0.66**	0.17	
Post-EXPLR	-0.22	0.11	0.12	0.43	0.61**	0.17	0.34	0.23	0.60**	0.34

Note. BMI = Body Mass Index; ID = identification; HLTH = healthfulness; EXPSR = exposure; PREF = preference; EXPLR = exploration.
Cumulative scores were calculated in 5 categories: ID (correctly identified fruits and vegetables); HLTH (reporting fruits and vegetables as healthy); EXPSR (reporting previously eating the fruits and vegetables); PREF (reporting "liking" fruits and vegetables); EXPLR (reporting willingness to eat fruits and vegetables at future meals or snacks). BMI z-score is based on baseline data. Duration between measures was approximately 4 weeks.
aPre = before intervention; ßPost = after intervention.
Bivariate Spearman's Rho correlations were used to measure relationships between participant responses.
*p < .05, **p < .01, ***p < .001.
BMI z-score was not correlated with any of the interview scores at baseline. However, at the conclusion of the study, the baseline BMI z-score was significantly inversely related to the post-measures of *identification*, *preference, healthfulness*, and *exposure* (df = 18, p < .05 for all measures), indicating the lower children's baseline BMI, the higher their scores were, on average, for*identification*, *healthfulness*, *exposure*, and *preference* at the conclusion of the study. The relationships between BMI z-scores and the change in scores from pre- to post-intervention were also evaluated with baseline BMI inversely related to change in *exposure* (r = -.512, p = .025) and *preference* (r = -.468, p = .043) scores from pre- to post-intervention. Study results suggest that BMI status predicted changes in trying new fruits and vegetables and liking them.

Discussion

This pilot study is the first to report data gathered by interviewing preschool-aged children individually and directly about their fruit and vegetable identification, preference, and beliefs before and after exposure to novel fruits and vegetables at meals accompanied by nutrition education lessons. When examining the new fruits and vegetables collectively, children's ability to identify them improved. Children who accurately identified these foods were also more likely to report them as healthy foods, that they liked these foods, and that they had eaten them before. When examining the foods on an individual basis, however, preference increased for only jicama, suggesting that more exposures may be needed or a larger sample to identify changes in individual food acceptability.

The findings in this pilot study suggest that how preschool children respond to exposure and education could be correlated with BMI status. Children with more favorable BMI statuses may be more likely to accept novel foods than their counterparts from similar interventions. Thus, those preschool children at highest risk of obesity and overweight or who currently have BMI percentiles in these categories may need additional education or fruit and vegetable exposures, or perhaps, they may benefit from a different intervention strategy altogether. Limited research has compared the response of normal weight and overweight children to dietary interventions.

Limitations of this study include a small sample size of a relatively homogenous group of preschool children and the lack of a control group. An important future study would include control and intervention groups with a larger, more diverse sample. The intervention would require 20 exposures for each fruit and vegetable new to the child care menu along with nutrition education. Measures including heights, weights, food beliefs, food intake, and food costs would be collected at baseline, 6 months, and 12 months.

CONCLUSIONS AND APPLICATION

Early childhood is a critical time for development of food likes and dislikes and a period of opportunity to impact current and future health (Northstone & Emmett, 2008). Schools remain at the forefront of the childhood obesity fight, and preschools can modify the environment to optimize healthful eating. The recent changes to the NSLP and SBP (USDA, 2012) emphasize the importance of learning more about how preschool children and toddlers (1-3 years of age) respond to menu changes and nutrition education to optimize food acceptability and minimize food waste. The fruits and vegetables in this study were chosen because of their long-term viability on preschool child care menus. Other practical menu choices include pre-cut finger foods, fresh lettuce and spinach, frozen fruit snacks, thawed frozen peas (not cooked), dried fruit, and chickpea-based dips such as hummus. Some fresh foods are cost-prohibitive so frozen (sugar snap peas, squash, mixed vegetables), dried (cranberries, blueberries, apricots, bananas), and canned (pumpkin, oranges, fusion 100% juice drinks) foods can offer variety and options all year.

Understanding how preschoolers respond to menu changes is critical, as future changes to the CACFP may be informed by additional research in this area with a larger, more diverse sample with financial costs measured and potential benefits estimated. This information is important to inform both current and future practices in foodservice management, nutrition education, and behavior change.

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