COMPARISON OF FIVE TEACHER ACTIONS TO ENCOURAGE CHILDREN'S NEW FOOD ACCEPTANCE[1,2]

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ABSTRACT

How can teachers encourage children to accept new fruits and vegetables? A quasi-experimental study with 64 preschool children (32 boys, 32 girls) compared the effectiveness of five teacher actions to encourage children's acceptance of four new fruits and vegetables presented during three preschool lunches. The five teacher actions included reward (special dessert), modeling, insisting children try one bite, choice-offering ("Do you want any of this?"), and a control condition of simple exposure.

In factorial analyses of variance (two genders × five teacher actions), the five teacher actions produced differences in number of foods sampled ($p < .001$), number of meals during which foods were sampled ($p < .004$), and total number of bites ($p < .002$). Paired comparisons revealed that reward, insisting, and choice-offering were more effective than simple exposure to encourage number of foods, number of meals, and number of bites. Dessert reward and choice-offering were equally effective for all three measures of new food acceptance, but insisting produced fewer bites than did choice-offering. Under the present conditions, teacher modeling was ineffective compared to simple exposure. No gender differences were found in new food acceptance or in interactions with the five teacher actions to encourage new food acceptance.

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INTRODUCTION

Foods eaten by young children can have a lasting effect on their physical, emotional, and cognitive development (1–3). Government agencies charged with promoting the health of Americans recommend that children learn to eat a variety of fruits and vegetables each day (4,5), and some theorists believe that the first few years of life are a sensitive period for the development of such food acceptance patterns (6,7). For many young children in the United States, however, parents must work long hours that leave little time for shared family meals to encourage children's acceptance of nutritious fruits and vegetables (8,9). Thus, preschool lunch often becomes the most consistent and social meal of a young child's day, offering a valuable opportunity to introduce children to nutritious new foods (10) and perhaps an opportunity to influence the food acceptance patterns of a generation.

What teacher actions during preschool lunch would encourage children to develop self-regulation of nutritious food acceptance behaviors (11,12), including both perceived ability and perceived willingness to sample new fruits and vegetables? Social Cognitive Theory (13,14) suggests that the following teacher actions would encourage children's perceived ability, or self-efficacy, to sample new foods: provide rewarding consequences for food-sampling behavior, provide a model who samples the foods, and verbally persuade children to at least try one bite, which will also build experience with the foods. Self Determination Theory (15,16) suggests that the following adult actions during meals would encourage children's willingness, or intrinsic motivation, to sample new foods: offer food choice, and avoid insisting that children try one bite because of the detrimental effects that perceived coercion has on intrinsic motivation.

Past experimental research in school settings has usually focused on one or two of the above adult mealtime actions to encourage children to eat during meals. For example, one early study suggests that children are more likely to eat foods if they see an adult model eat the foods (17). In addition, tangible rewards for eating have been found to encourage children to eat foods more (18–20), although later they may like those foods less (21–23). One explanation for the later drop in food preference when rewards are given is the aversive physiological consequences and negative affect produced by being verbally persuaded to consume foods beyond the point of satiation (24,25). Another more cognitive explanation for the later drop in food preference is the "over-justification effect" or the "discounting effect," which is a reduction of intrinsic motivation to eat foods if the child comes to think he/she eats them not because they taste good but because they are a "means to an end" (26–29). Finally, past experimental research in school settings has found that repeated exposure to foods can increase consumption, especially if it involves opportunities for the children to handle the food and taste it (19,24,30,31).

Past research has also found that children's food acceptance is influenced by physiological events surrounding eating, including gastrointestinal upset, satiety, and positive and negative affect (32–37). If the more forceful adult actions like insisting children try one bite tend to produce negative affect in children (anger, fear, disgust), they risk its dampening effect on food acceptance. Also, although insisting children try one bite and offering rewards are likely to produce very different immediate affective consequences in children, they both risk reductions in food acceptance if they produce satiation effects (by pushing food consumption too far) or

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overjustification effects (by changing the child's perception of why he/she eats the foods).

One way to avoid negative affect, satiation effects, and overjustification effects would be for adults to give children a choice of whether to eat and how much to eat the foods offered at meals. In past experimental research, however, offering children food choices has been used only as a measure of the dependent variable of children's food acceptance, rather than as an independent variable that can itself influence food acceptance. According to Self-Determination Theory (15,16), choice-offering would be the most effective mealtime action teachers could use to encourage children to develop a lasting, intrinsic motivation to eat foods even later when adults are not present.

The purpose of the present study was to compare the effectiveness of a number of adult mealtime actions to encourage children's acceptance of novel foods, rather than focusing on one or two actions as in most past research. In addition, the present study adds food choice-offering as an independent variable, rather than only as a dependent variable as in past experimental research. Finally, the present study examines gender differences in the effectiveness of different adult actions for encouraging children's food acceptance, which is rarely seen in past research with children's eating habits. Girls are at greater risk for disordered eating behavior and concerns from as early as six years of age (38–41), so children of preschool age may already show signs of gender differences in food acceptance when adults encourage them to accept new foods during shared meals.

METHODS

Participants

Sixty-four preschool children (32 boys, 32 girls) participated from 19 preschool classrooms throughout a rural county in eastern Pennsylvania. Over 95% of the children were White, their mean age was 54.8 months (SD = 8.2), and their mean body mass index (kg/m^2) was 16.1 (SD = 2.3). Participants were recruited with the assistance of the Nutrition Coordinator and teachers of Schuylkill County Child Development, who circulated study descriptions and informed consent forms to parents of the preschool children. Of the 276 children in the 19 preschool classrooms, parents of 199 (72.1%) agreed to let their children participate (110 boys, 89 girls). Of the 199 children whose parents gave permission for participation in the study, 166 children (83.4%) were eligible to participate in the study (94 boys, 72 girls). Thirty-three children were considered ineligible to participate (16 boys, 17 girls): 27 children because their parents reported that they had had "many" experiences with two or more of the four new foods used in the present study, 5 because their parents provided no information about their previous experience with the foods, and 1 because parents would not allow the child to be offered dessert rewards. From the 166 children eligible to participate in the study, 80 children were randomly selected and seated with a boy and a girl participant at each lunch table. Of the 80 children observed during new food presentations, 64 children (80%) were included in the final data set (32 boys, 32 girls). Sixteen of the observed children were eliminated from the final data set: 6 because their table was incomplete and did not have both a boy and girl available, 4 because of absence for more than one of the three new food presentations, and 6 because their teacher strayed from the experimental conditions.

Procedure

To select 4 new foods that would be presented to preschool children, a list of 20 possible foods was developed in consultation with the Executive Director and the Nutrition Coordinator of Schuylkill County Child Development. Foods considered for the study had to be fruits or vegetables, include a variety of colors and textures, be finger foods that young children could handle without utensils, be available throughout the months of the study, and most importantly, be foods with which most preschool children have had little experience. A list of the 20 possible foods was included on the informed consent form distributed to parents, and they were asked to indicate how much experience their children had had with each food. A food was considered new to a child if the parent checked "never" or "once or twice," but not if they checked "tried many times." The 4 new foods eventually selected for presentation were kiwi, sweet red pepper, chickpeas, and fresh coconut. (When fresh coconut became unavailable during the course of the study, canned water chestnuts or bamboo shoots were substituted as also being a white fruit or vegetable, with the restriction that the same set of 4 new foods be used consistently throughout testing for any one school.)

The four new foods were presented in separate bowls in the center of the table during preschool lunch for 3 consecutive days within 1 week. Each lunchtime presentation of new foods was observed for 20 minutes, the usual time it takes preschool children to complete a meal (42). As mandated by law, the four or five other foods offered as lunch always included milk, grain products, fruit or vegetable, and meat or meat substitute. During the new food presentations, children were seated together at tables that included one teacher and at least one boy and one girl. The mean number of other children present at the table who were not part of the study included 1.4 girls (SD = 0.9) and 1.4 boys (SD = 0.6). Boys, girls, and teachers in a classroom were randomly assigned to a table, and the table was randomly assigned to one of five teacher actions to encourage children's food acceptance.

The five teacher actions included:

Simple Exposure (The Control Group): The four new foods were simply placed in the center of the table, each in a separate bowl. The teacher was allowed to briefly answer children's questions about the foods, but otherwise the teacher said nothing about them. The teacher did not eat any foods during the meal. The control condition included 12 children (6 boys, 6 girls).

Modeling: The teacher placed each of the four new foods on his/her own plate and ate at least two bites of each food twice during the meal. To increase the probability that the children noticed the teacher eating the new foods, the teachers also said, "I like to try new foods," twice during each of the three observed meals. The modeling condition included 14 children (7 boys, 7 girls).

Reward: Twice during the meal the teacher told all the children, "If you try two of these new foods with at least one bite, you can have a special dessert. If you try all of these new foods, you can also have candy to take home for later." From the suggestions by the Executive Director and Nutrition Coordinator of Schuylkill County Child Development, as well as the approval by the parent on the informed consent forms, the special desserts included a frozen fruit-juice bar or chocolate-covered ice cream, and the candy included a small bag of fruit-flavored gummy candy or a chocolate bar. (One exception to the random assignment of tables to conditions was that if one table in a classroom was

randomly assigned to the reward condition, all tables in that classroom were assigned to the reward condition so no child would see rewards being given across the room and feel left out.) The reward condition included 14 children (7 boys, 7 girls).

Insist Try One Bite: The teacher placed a small amount of each of the four new foods on each child's plate and said twice during the meal, "Please try one bite of each new food." Children were never forced to eat the foods and teachers said nothing besides these two requests to try one bite. The insist condition included 14 children (7 boys, 7 girls).

Choice-Offering: For each of the four new foods, for each child, the teacher asked, "Do you want any of this?" twice during the meal. Teachers were instructed not to react positively or negatively, verbally or nonverbally, to whatever the children did in answer to this question, except to give them a small sample of the food if they said "yes," to go on to the next child if they said "no." The choice condition included 10 children (5 boys, 5 girls).

In all conditions, teachers were allowed to briefly answer children's questions about the new foods, but otherwise they said nothing about them and did not eat any other foods during the meal. During teacher training, teachers were given written and oral descriptions of the purpose of the study and their assigned role in it. In addition, they were given an opportunity to practice their roles on a day before new foods were presented, and observers provided feedback after each new food presentation. Also, observers monitored whether teachers remained within their assigned condition during each new food presentation. Finally, if a teacher failed to provide the assigned condition, or if the teacher strayed into another condition, data for the children at that teacher's table were discarded from the analyses ($n = 6$). All teachers were female with the exception of one male teacher who was randomly assigned to the choice-offering teacher action. (Because all later statistical analyses showed the same pattern of results with this teacher in or out of the analyses, reported results include the boy and girl randomly assigned to this male teacher's table.)

Children in the observed preschools were accustomed to frequent visits by parents and other adult visitors, so they quickly habituated to the presence of observers, but a policy of "polite refusal to interact" (43) was used if children approached the observer. During the three preschool lunches, one of ten observers stood quietly to the side of each table and used event sampling to record all bites of the four new foods by the boy and girl participant at that table. A bite of food was defined as touching the food to the lips, teeth, or tongue. From these recorded bites of food, three dependent measures of new food acceptance were obtained: number of foods sampled with at least one bite, number of meals during which new foods were sampled, and total number of bites of new foods. In addition, observers recorded with a checkmark whether the teacher correctly provided the assigned experimental condition during each meal.

Interobserver reliability was measured by having all possible pairs of the ten observers watch one boy and one girl for three 20-minute preschool lunches using event sampling to record all bites of four target foods. From each observer's records, scores were obtained for number of foods sampled with at least one bite, number of meals for which at least one of the four target foods was sampled, and total number of bites of target foods. For each of the three observed meals, observers also recorded whether or not the teacher provided the required mealtime condition (which for these interobserver–reliability tests was a simple question, "Did everyone get all they wanted?"). Interobserver agreement scores were then calculated for each observer pair as a percentage of the smaller number of observations, divided by the larger number of observations. Means for interobserver agreement scores were 100% for number of foods, 100% for number of meals, 94.9% for number of bites (range = 88% to 99%), and 100% for number of meals for which the teacher provided the required action.

Data Analysis

Analysis of variance was used in 2 × 5 factorial designs to compare gender (male, female) and teacher action conditions (control, model, reward, insist, choice) in effectiveness for encouraging children's new food acceptance. To be included in the analyses, three of the four foods had to be new to the child as indicated on the parental consent form, and the child had to be present for at least two of the three observed meals. If only three foods were new for the child, or if the child was only present for two meals, the child's scores (number of foods, number of meals, number of bites) were prorated to three meals and four foods.

Separate analyses of variance were performed for three dependent variables: number of foods sampled with at least one bite, number of meals during which at least one of the new foods was sampled, and total number of bites of new foods across all meals. For any significant analysis of variance result, t-tests were used to make paired comparisons.

To consider covariates for these analyses, Pearson correlation coefficients were examined between each of the three measures of food acceptance and age, body mass index (kg/m^2), number of boys present at the table, and number of girls present. However, none of the above variables was significantly related to any of the three dependent measures (number of foods, number of meals, number of bites).

RESULTS

Descriptive statistics appear in Table 1. Separately for boys and girls, they show the three measures of new food acceptance (number of foods, number of meals, number of bites) under each of the five teacher actions.

From analyses of variance, the five teacher actions produced significant differences in new food acceptance for all three measures (number of foods sampled, number of meals during which foods were sampled, total number of bites sampled across all meals), with no gender differences or interactions effects. For number of foods, $F(4, 54) = 6.17$, $p < .001$, and paired comparisons then revealed that reward, insist, and choice-offering were equally effective to each other and all more effective than control conditions, $t(24) = 6.31, p < .001$; $t(24) = 4.03, p < .007$; $t(20) = 3.05, p < .007$; respectively (see Figure 1). For number of meals, $F(4, 54) = 4.53$, $p < .004$, and paired comparisons also found reward, insist, and choice-offering equally effective to each other and all more effective than control conditions, $t(24) = 4.58$, $p < .001$; $t(24) = 4.03$, $p < .001$; $t(20) = 2.55$, $p < .02$; respectively (see Figure 2). For number of bites, $F(4, 54) = 5.71$, $p < .002$, and paired comparisons again found reward, insist, and choice-offering to be more effective than control conditions, $t(24) = 3.86, p < .002$; $t(24) = 2.63, p < .02$; $t(20) = 3.04, p < .007$; respectively, but they also indicated that choice-offering produced more total bites of new foods than did insist, $t(22) = 2.34, p < .03$ (see Figure 3).

Because the number of mealtime presentations could also be considered as an independent variable that may influence new food acceptance, additional 2 × 5 × 2 repeated measures analyses of variance were conducted (two genders, five teacher actions, two

TABLE 1

Means and Standard Deviations for Acceptance of Three New Foods by 32 Male and 32 Female Preschool Children During Five Teacher Actions to Encourage New Food Acceptance: Number of Foods Sampled with at Least One Bite, Number of Meals During Which at Least One New Food Was Sampled, Total Number of Bites of New Foods Across All Meals (Equal Numbers of Boys and Girls Received Each Teacher Action)

	Teacher Action									
	Control (N = 12)		Model (N = 14)		Reward (N = 14)		Insist (N = 14)		Choice (N = 10)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Number of foods										
Boys	0.7	(0.8)	0.8	(1.1)	2.9	(0.9)	2.2	(1.4)	2.6	(1.9)
Girls	0.6	(0.6)	2.1	(1.8)	3.3	(1.5)	2.8	(1.6)	2.1	(1.8)
Number of meals										
Boys	0.7	(0.8)	0.8	(1.1)	2.1	(0.9)	2.1	(1.1)	1.5	(1.1)
Girls	0.6	(0.7)	1.6	(1.4)	2.2	(1.1)	2.1	(1.1)	1.8	(1.3)
Number of bites										
Boys	1.7	(2.3)	1.6	(2.8)	11.5	(12.4)	7.3	(8.2)	16.5	(19.3)
Girls	1.8	(3.1)	7.4	(11.2)	15.1	(7.8)	7.3	(6.1)	30.5	(29.8)

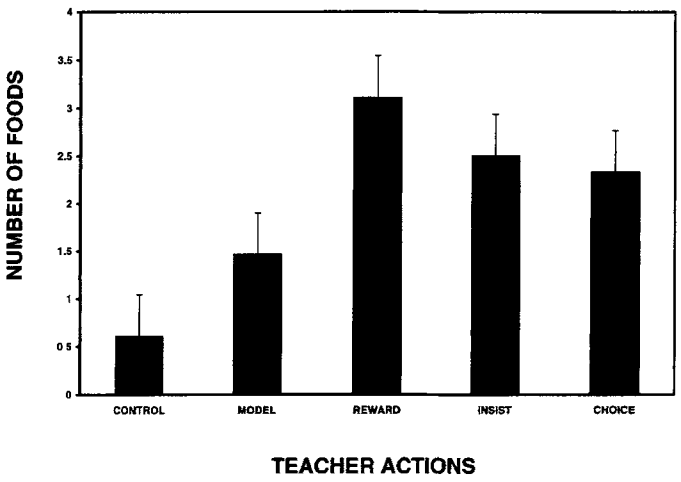

FIGURE 1: Number of foods sampled with at least one bite by preschool children presented with four new foods, for three meals, during one of five teacher actions: N = 12 for the control group (simple exposure), N = 14 for modeling, N = 14 for reward, N = 14 for insist, and N = 10 for choice-offering ("Do you want any of this?"). Scores shown are combined across gender.

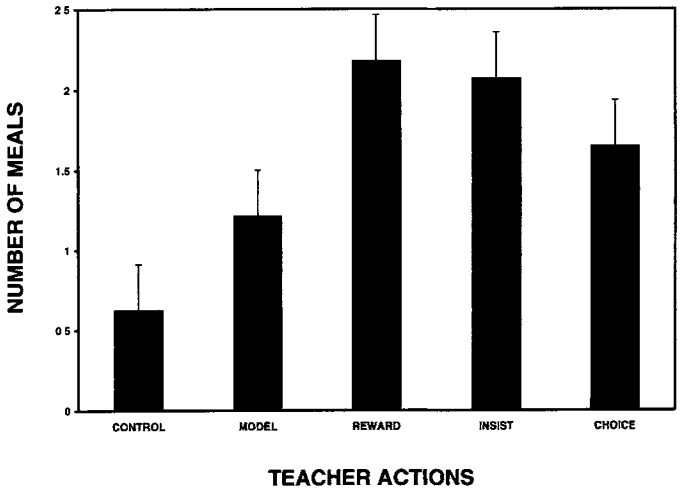

FIGURE 2: Number of meals during which at least one new food was sampled by preschool children presented with four new foods, for three meals, during one of five teacher actions: N = 12 for the control group (simple exposure), N = 14 for modeling, N = 14 for reward, N = 14 for insist, and N = 10 for choice-offering ("Do you want any of this?"). Scores shown are combined across gender.

meals), using number of foods and number of bites as dependent variables and number of meals as the within-subject factor. To keep the sample size and statistical power as large as possible, only the first two meals were considered because all 64 participants (32 boys, 32 girls) were present for at least two mealtime presentations. Results showed the same pattern as in the original analyses of variance for both dependent measures of number of foods and number of bites, with the five teacher actions significantly different in effectiveness, $F(4, 54) = 5.43, p < .002$; $F(4, 54) = 6.15, p < .001$; respectively, again with no gender differences or interaction effects. In addition, a significant main effect for number of meals was found, $F(1, 54) = 10.42, p < .003$; $F(1, 54) = 6.65, p < .013$; respectively, with more foods sampled and more bites taken during the very first presentation of new foods.

DISCUSSION

Thus, during presentations of new foods to male and female preschool children, insist, reward, and choice-offering were consistently more effective than control conditions of simple exposure to encourage the children to sample a number of new foods, with many bites, and across many meals. Under the present conditions, teacher modeling was ineffective compared to control conditions of simple exposure.

Insisting that children try one bite was as effective as reward or choice-offering to encourage children to sample at least one bite of the four new foods, across most of the three meals they were offered. However, insist was less effective than choice-offering to encourage children to take many bites of the new foods. Perhaps insisting that children "try one bite" provides poor conditions for development of food self-regulation and intrinsic interest for eating new foods (11,15,16), especially if children perceive that they eat the new foods only because of verbal persuasion from a powerful or admired adult and not because they can choose and enjoy them on their own. In any case, results from the present study suggest that to encourage children to eat enough of the new fruits and vegetables to obtain recommended amounts of essential

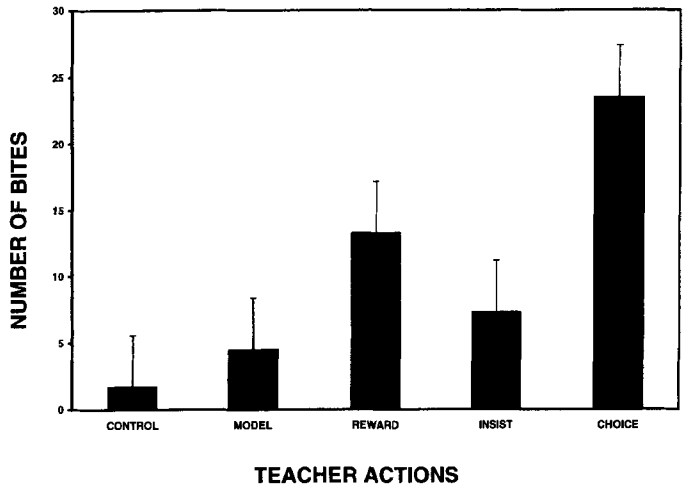

FIGURE 3: Number of bites of new foods across all meals by preschool children presented with four new foods, for three meals, during one of five teacher actions: $N = 12$ for the control group (simple exposure), $N = 14$ for modeling, $N = 14$ for reward, $N = 14$ for insist, and $N = 10$ for choice-offering ("Do you want any of this?"). Scores shown are combined across gender.

nutrients, "please try one bite" is not the most effective teacher action.

Offering dessert rewards was found to be an effective teacher action to encourage children to accept a number of new foods, across most meals they were offered, and with more bites than required to obtain the rewards. Thus, within the three meals observed in the present study, no evidence appeared for an "over-justification effect," a drop in intrinsic motivation to eat the foods if it has been a "means to an end" (27–29,44). Perhaps, as suggested by Boggiano and Main (26), preschool children in the present study were too young to show the sophisticated attributional cognitions underlying the over-justification effect associated with rewards. In addition, Eisenberger and Cameron (45) review research on the over-justification effect and conclude that rewards can be used without producing a later drop in intrinsic motivation for the rewarded behavior. They suggest that verbal rewards are better than tangible rewards, small rewards are better than large rewards, behaviorally similar rewards are better than behaviorally distracting rewards (e.g. desserts rather than toys to reward eating behavior), and rewards given for the quality of behavior are better than rewards given for the quantity of behavior. Thus, future research could compare new food acceptance for children offered various teacher-provided rewards: verbal versus tangible, food versus nonfood, and rewards for simply eating a required number of bites of foods offered by others versus rewards given for choosing a nutritious variety of foods independently.

Although dessert rewards were effective for encouraging children's new food acceptance, it seems unnecessary for teachers to use them when the less expensive, less nutritionally problematic, and simpler teacher action of choice-offering works just as well. Choice-offering as used in the present study ("Do you want any of this?") was as effective as dessert rewards to encourage children to sample a number of new foods, with many bites, and across most meals they were offered. According to Self-Determination Theory (15,16), repeatedly offering children a choice of whether or not to eat the new foods enhances development of intrinsic motivation and the perception that they eat the foods because they enjoy them.

Although Social Cognitive Theory (13,14) suggests that teacher modeling would be one of the most effective methods to encourage children to develop self-efficacy for eating new foods, modeling was surprisingly ineffective for encouraging children's new food acceptance in the present study. Factors that have been found to influence the effectiveness of modeling include the number of exposures to models, if the model is reinforced, if the model is perceived as powerful or competent, and if the model is similar to the observer (14,46). Therefore, perhaps teacher modeling would have been effective in the present study if more than three presentations of new foods had been used. Although children in the present study did not take many bites of the new foods during the teacher modeling conditions, they often appeared to look at them, sniff them, handle them, make facial expressions and vocalizations about them ("Yuck!"), and even place them on their plates. Therefore, in addition to recording bites of new food, future research could record such microstructure of feeding behavior (47) to identify stages in the sensory and social investigation of new foods so that teachers do not give up too soon on the use of modeling to encourage children's new food acceptance. In addition, teacher modeling in the present study may also have been more effective if the teacher had displayed more enthusiasm for the foods, showing that rewarding consequences come from eating them. Thus, rather than merely saying, "I like to try new foods," the teacher could have said, "Mmmm! I love ___! They taste delicious!" Finally, teacher modeling effects in the present study may have been overshadowed by peer modeling effects (or what observers began to call the "Yuck Factor"). Although teachers could be expected to be more effective models because they are powerful, peers could be expected to be more effective because they are similar (14,46). In the only available comparison of child and teacher models for food acceptance, child models were more effective (17). Thus, future research could compare children's new food acceptance when modeled by teachers and/or peers.

No gender differences or gender X teacher action interaction effects were found for any measure of new food acceptance (number of foods, number of meals, number of bites). In addition, for both boys and girls, Pearson correlation found no relationships between any of the three measures of new food acceptance and the number of boys or girls present at the table. Overall, boys and girls were similar in acceptance of new foods, response to five teacher actions to encourage them to eat the foods, and relationships between new food acceptance and the presence of peers. Thus, the preschool-age children in the present study show little sign of gender differences in food refusal and social concerns about eating behavior reported for older children and adolescents (38–41). However, the present study recorded only the number of boys and girls present, not their behavior during the new food presentations. Past research has shown that preschool children model the specific actions of "expert peers" who have been taught to manipulate new objects in precise ways (48). Perhaps preschool children would also model specific interactions peers have with new foods (sniff, touch, bite, display facial affect, offer food to others, vocalize). Past research also suggests that preschool boys imitate and are imitated more by peers than are girls during free play (49), and girls share foods with friends more than do boys (50). Therefore, future research could examine how same- and opposite-gender peers affect children's new food acceptance.

A limitation of the present research is that its participants were mostly rural, White, and mostly low income. Future research could expand consideration of how teacher actions affect new food acceptance for children who are more regionally, ethnically, and

socioeconomically diverse (51,52). Future research could also consider older children (12,53), as well as how effective the five teacher actions are when used at home by parents and/or siblings (54–57). In addition, future research could consider whether some combination of adult actions is most effective for encouraging children's new food acceptance, and which actions are effective not only immediately while adults are present, but later when they are not. Another question for future research is whether heritability of food preferences can limit the effectiveness of social actions during mealtime to influence children's food acceptance (58–60).

Finally, how can children be offered "food choice" in a manner that is most likely to result in the development of lasting self-regulation of nutritious eating habits? Results of the present study suggest that the option of food refusal ("Do you want any of this?") while being offered a limited set of new foods encouraged children's food acceptance. Also, in an old but often-cited study by Davis (61), institutionalized children were offered a limited and nutritious set of foods, and they appeared to choose balanced diets independently. However, if excessive food variety is available and the choices include foods that are high in sugar, fat, and salt, then poor nutrition and overweight are often the result (62). Thus, the teacher action of offering children food choice may be most effective if it not only includes the option of food refusal (as in the present study), but also if the foods offered include only limited and nutritious options.

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