RESEARCH
Research and Practice Innovations

The Addition of a Plain or Herb-Flavored Reduced-Fat Dip Is Associated with Improved Preschoolers' Intake of Vegetables

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ABSTRACT

This quasiexperimental study used a within-subjects experimental design to determine whether adding herbs and/or spices to a reduced-fat dip increased children's willingness to taste, liking of, and consumption of vegetables. Participants were preschool children aged 3 to 5 years who attended a child-care center in Central Pennsylvania in late 2008 and early 2009. First, children's familiarity with and liking of six raw vegetables and five dips (reduced-fat plain, herb, garlic, pizza, and ranch) were assessed. In Experiment 1 (n=34), children tasted a vegetable they liked, one they disliked, and one they refused, with a reduced-fat plain dip and their favorite reduced-fat herb-flavored dip. In Experiment 2 (n=26 or n=27), they rated their liking of celery and yellow squash, with and without their favorite reduced-fat herb dip (pizza or ranch), and their intake of those vegetable snacks was measured. In Experiment 1, the herb-flavored dip was preferred over the plain dip ($P<0.01$), and children were three times more likely to reject the vegetable alone, compared with eating the vegetable paired with an herb dip ($P<0.001$). In Experiment 2, children ate significantly more of a previously rejected or disliked vegetable (celery and squash) when offered with a preferred reduced-fat herb dip than when the vegetable was served alone ($P<0.05$). These findings suggest that offering vegetables with reduced-fat dips containing familiar herb and spice flavors can increase tasting and thereby promote liking, acceptance, and consumption of vegetables, including vegetables previously rejected or disliked.
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MOST PRESCHOOL CHILDREN DO NOT MEET recommended intakes for vegetables,[1] with some consuming <0.5 serving/day,[2] and a considerable number not consuming any vegetable on a typical day.[3] These findings are worrisome because vegetables are sources of essential nutrients and contain bioactive compounds that may help reduce the risk of chronic disease.[4-6] Because food preferences and nutrient intakes track during childhood,[7-9] helping preschool children develop a liking for vegetables may create a foundation for long-term, healthy eating habits.

Numerous strategies for increasing children's willingness to taste unfamiliar vegetables and other foods have been tried successfully, including repeated tastings,[10-14] pairing an unfamiliar flavor with a liked one,[15,16] and using peers to influence their food preferences.[17,18] Many children, however, remain wary of tasting new vegetables, even when parents make vegetables available in the home,[19] lead the vegetable exposure,[13,20] or reward them for tasting a vegetable.[20,21] Although children generally dislike sour and bitter tastes,[22,23] their willingness to taste and consume vegetables can be increased by offering vegetables with flavored dips.[24,25] A concern with this approach is that although dips may be convenient for parents, they have the potential to contribute excess energy, fat, and sodium to preschool children's diets.

Enhancing the palatability of vegetables also increases children's consumption of them.[16,26-28] In our study, the palatability of vegetables was enhanced by offering them with reduced-fat dips formulated with added herbs and spices to achieve familiar flavors. Herbs and spices are common to many culinary traditions, and their addition to foods improves palatability and can make unfamiliar foods seem familiar.[15,29]

The purpose of this research was to compare the effects of dips (with and without familiar herb and spice combinations) with serving vegetables alone (without dip) on children's willingness to taste, liking of, and consumption of vegetables. This study was unique in encouraging preschool children to taste both liked and disliked vegetables with a preferred herb-flavored dip low in energy density (1.16 kcal/g). It was hypothesized that serving a palatable reduced-fat dip containing herbs and spices would increase preschool children's willingness to taste and liking of vegetables (Experiment 1), and that children offered a palatable reduced-fat dip containing herbs and spices would consume more vegetables (Experiment 2).

METHODS

Study Design and Participants

A within-subjects, quasiexperimental protocol was used to evaluate the effects of herb/spice-flavored, reduced-fat dip on children's willingness to taste, liking of, and consumption of vegetables. Participants were a convenience sample of preschool children ranging in age from 3 to 5 years who attended a local child-care center in central Pennsylvania during late 2008 and early 2009. They were recruited via a letter given to their parents. The Pennsylvania State University Institutional Review Board approved the study procedures, and all parents provided written consent for their child's participation in the study. Parents completed a short questionnaire on marital and employment status, education, family income, and their child's race, general eating habits, and familiarity with certain vegetables. Children were excluded if they had known food allergies.

Study Protocol

The study protocol was conducted over a 6-week period. First, children's familiarity with and liking of six common vegetables and five dips (reduced-fat plain, herb, garlic, pizza, and ranch) were assessed to identify a vegetable that was liked, a vegetable that was disliked, and a dip that was liked by each participant. Two experiments were then conducted to evaluate the effects of a reduced-fat dip (plain or herb) on preschool children's willingness to taste and liking of vegetables (Experiment 1), and the effects of serving vegetables with and without an herb-flavored dip on their consumption of vegetables (Experiment 2). Each experiment lasted 2 weeks; both were within-subjects experiments, with children receiving all experimental conditions. Children in both experiments visited the tasting station one at a time in a room apart from their classmates.

Dip and Vegetable Familiarity and Liking. The familiarity and liking protocol was composed of three sessions: demonstration/practice of a "tasting game," followed by liking assessments of fresh, raw vegetables and reduced-fat herb dips. In the first session, a researcher demonstrated the tasting game using a form of role play. The researcher pretended to taste a piece of realistic-looking, plastic fruit, made a face, and then showed his assessment by choosing one of three cartoon faces: "yummy" (liked), "just okay," or "yucky" (disliked). The validity and reliability of the protocol for assessing children's food preferences were published previously.[30] In studies where this rating scale was used, children provided consistent information about their food preferences,[31,32] and their liking of a food predicted[25,33] or was associated with an increase in[24] their intake of it.

In the second session, children were asked to rate six different vegetables: carrots, cucumbers, celery, green beans, red peppers, and yellow squash. Each sample constituted 1/2 cup (~50 g) of vegetable placed in an unlabeled, 4-oz cup. The tray of vegetables was arranged with three vegetable samples set in front and the other three set behind, and the arrangement on the trays was varied so that half of the children were presented with carrots, cucumbers, and celery in the front row and the other half with those vegetables in the back row to reduce any effect of placement on tasting order. The order in which the vegetables were tried was recorded. Children reported whether they had eaten the vegetable before and then, after tasting it, categorized it as "yummy," "yucky," or "just okay" by choosing one of the three cartoon drawings of facial expressions. After all of the foods were categorized based on liking, children were asked to order the foods within each category, yielding a complete rank order. For example, if two vegetables were categorized as "yummy," children were asked to select the "yummiest" of those vegetables and so forth. In the third session, liking data for five dips (reduced-fat plain, herb, garlic, pizza, and ranch) were assessed using the procedure described above. A small sample (43 g or 3.5 tablespoons) of each dip was served in a 2-oz cup labeled with a number. Using the same rating scale, children ranked their preference for dips as was done for the vegetables. Two dips (herb and garlic) were determined to be least liked and were eliminated.

Experiment 1. Each child participated in two short tasting sessions, tasting three vegetables (one liked, one disliked, and one refused) with a preferred herb dip and plain reduced-fat dip. The vegetables, which had been identified in the familiarity and liking protocol described above, differed for each child and were in keeping with their preferences. Half of the children were given the plain dip and half their favorite herb-flavored dip in the first tasting session, and the order was reversed for the second session, with a 10- to 15-minute break between the sessions. The child was told the names of the vegetables given, encouraged to taste the liked vegetable/dip combination first, and then allowed to choose which vegetable to taste next with the dip. After tasting the combination, the child rated it as "yummy," "just okay," or "yucky." The order in which the samples were tasted and whether the sample was rejected were recorded. Herbs and spices were added to a dip rather than directly on the vegetable because there was concern that the flavor principle present in the dip paired with a vegetable would differ substantially from the flavor principle of herbs and spices added directly to vegetables.

Experiment 2. Each child participated in four snack sessions, administered on four different days, to assess the impact of dip condition (with or without the child's preferred pizza or ranch dip) on ad libitum intake of two vegetables. Yellow squash and celery were chosen because parents had indicated that their children were unfamiliar with these vegetables at study entry and because these were the most disliked vegetables in the familiarity and liking session. One condition was tested each day: celery with the preferred dip, celery without dip, steamed squash with the preferred dip, steamed squash without dip. The order in which children received each of these conditions was counterbalanced, such that children were randomized to receive either yellow squash or celery first. After each tasting session, the child rated the sample as "yummy," "just okay," or "yucky." A record was made of the order in which the samples were tasted and whether the sample was rejected. Food weights to the nearest 0.1 g were recorded before and after consumption using digital scales (Mettler-Toledo PR5001 and Mettler-Toledo XS4001S, Mettler-Toledo Inc). The amount of each food item consumed (in grams) was determined by subtracting the postsnack weight from the presnack weight.