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Impact of Vegetable Preparation Method and Taste-Test on Vegetable Preference for First Grade Children in the United States

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Impact of Vegetable Preparation Method and Taste-Test on Vegetable Preference for First Grade Children in the United States

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Abstract: How children rate vegetables may be influenced by the preparation method. The primary objective of this study was for first grade students to be involved in a cooking demonstration and to taste and rate vegetables raw and cooked. First grade children of two classes (N= 52: 18 boys and 34 girls (approximately half Hispanic) that had assented and had signed parental consent participated in the study. The degree of liking a particular vegetable was recorded by the students using a hedonic scale of five commonly eaten vegetables tasted first raw (pre-demonstration) and then cooked (post-demonstration). A food habit questionnaire was filled out by parents to evaluate their mealtime practices and beliefs about their child's eating habits. Paired sample *t*-tests revealed significant differences in preferences for vegetables in their raw and cooked states. Several mealtime characteristics were significantly associated with children's vegetable preferences. Parents who reported being satisfied with how often the family eats evening meals together were more likely to report that their child eats adequate vegetables for their health (p=0.026). Parents who stated that they were satisfied with their child's eating habits were more likely to report that their child was trying new foods (p<.001). Cooking demonstrations by nutrition professionals may be an important strategy that can be used by parents and teachers to promote vegetable intake. It is important that nutrition professionals provide guidance to encourage consumption of vegetables for parents so that they can model the behavior of healthy food consumption to their children.

Keywords: Children, elementary school, vegetable consumption, hedonic scale vegetables, cooking demonstration, mealtime behaviors, tasting.

Nutrients in fruits and vegetables, such as dietary fiber, micronutrients, and phytochemicals, have numerous protective factors for health [1]. Fruit and vegetable consumption was inversely associated with the risk of coronary heart disease based on a meta-analysis of cohort studies [2]. Consuming the recommended amount of fruits and vegetables has been attributed to a reduced risk of many chronic diseases including obesity, diabetes, stroke, and some forms of cancer in numerous observational studies. There is evidence that young adults are influenced by early childhood memories of family eating practices [3, 4]. Despite these findings, children have not met the Dietary Guidelines for Americans' recommended servings of fruits and vegetables [5]. Specifically, less than 10% of children from the United States ages 4-8 years meet their fruit and vegetable recommendation [6]. Children ages 6-11 years from the United States consume only 58% of their recommended vegetable intake (excluding French fries) based on a nationally representative sample [5]. The benefit of increasing young children's consumption of vegetables has become more apparent today due to the rates of obesity and juvenile chronic diseases [7].

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The home and school environment can serve as venues for exposing young children to vegetables; however, fruits and vegetables are available in limited quantities or absent in schools as reported in a systematic review [8]. Presenting a positive social environment and pleasing vegetable textures may increase vegetable consumption among young children [7, 9, 10]. Among psychosocial determinants of vegetable intake, preference may be the most important [11, 12]. Sensory attributes: taste, mouth feel, appearance, quality, freshness, method of preparation, and familiarity were found to be facilitators for children' vegetable preferences [13]. A barrier to liking vegetables for young children could be their tendency to reject bitter and sour tastes as well as their fear of new foods (neophobia) [14].

Family mealtimes and parental style may influence a child's eating behavior. Parents can impact on children's eating habits by providing nutrition information, role modeling and frequency of eating together [15]. Studies concerning the relationship between a child's vegetable consumption and their parent's attitudes, beliefs corresponding parenting style have shown inconsistent results [16]. The primary objective of this study was to observe whether or not method of food preparation (raw versus cooked), in an elementary school setting, was associated with preference of vegetables. We hypothesized that cooked vegetables will be preferred to raw vegetables.

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Secondary objectives included evaluating mealtime practices and parenting style with parental beliefs concerning their child's eating.

SUBJECTS AND METHODS

Participants

The study was conducted, in accordance with the approval of the Institutional Review Board (IRB) at Florida International University, at a private elementary school setting in South Florida. Site verification letter was sent to the school, approval was obtained, the research was conducted and the data was collected.

Informed Consent

Permission was obtained through the school principal and the teachers in order to conduct this study. Permission to participate in this classroom study was generated through parental consent and child assent. An introductory letter was sent home to parents, along with consent form in order to qualify participants. Both parental consent and child assent had to be returned before any child participated. Medical forms were also sent home to be filled by parents. Only the data from children with parental consent and child assent were included in the analyses. Children ages 6 and 7 were recruited from two first grade classes totaling 59 students, 24 boys and 35 girls of which, a total of 52 students (n = 18 boys and n = 34 girls) participated.

Design

The study was conducted in two classrooms for two hours each in 2012 with the principal's approval. The intervention consisted of two parent volunteers, one teacher, one assistant teacher, and the principal investigator, a chef and a nutrition specialist. The school nurse was made available in case of any emergency. A two hour "show and tell" presentation for each first grade class separately with (n=25) students in one class and (n=26) in the other.

Prior to the taste-test, information about vegetables eaten at home was gathered as a class activity with the teacher and the primary investigator. The vegetables chosen for the taste-test (cauliflower, bell peppers, carrots, green beans, and celery) were among those that were commonly consumed by the children but were not favored (at least 35% of the children responded they disliked or were not sure if they liked the particular vegetable).

Materials and Personnel

The primary investigator, a trained chef and nutrition specialist conducted this experiment along with the teachers, teacher's aide and volunteers. The vegetables of choice were purchased from an organic farmers market along with additional ingredients needed to execute the recipe. The recipe was standardized and appropriate for children. Equipment placed on a table included: portable single electrical stove, sauté pan, wooden spoon, disposable plates, tasting spoons, napkins, water, cups, and crackers.

Procedure

Objective 1: Comparison of children's vegetable taste-test raw and then cooked (using a blanched and then sautéed method). Comparisons will be for 1) of overall liking for raw as compared to cooked vegetables and 2) each vegetable preference (raw versus cooked). The raw taste-test and the cooking demonstration were designed in accordance with the first grade level. Children were given a brief nutrition education on the importance of vegetable consumption. A brief background of the vegetables was given, following with strict instruction of what they need to do. The children who participated in this study were placed in groups of 5 totaling 5 groups in a central setting. The children were directed to taste the vegetables first raw and then cooked using a standard script. This study was conducted in a child friendly manner in order to assure a very positive atmosphere. This was age appropriate and suitable for the short attention span of children. Specifically, they were asked to choose the response for each vegetable that explains how they feel about the vegetables that they just ate. They were told to circle the picture and words that matches how they feel about the vegetable. They were told that first they would taste the vegetable raw and fill out the score card. Then they would see a cooking demonstration and taste the vegetable cooked and fill out the score card for how they felt about the taste of each vegetable. Each time, pre and post cooking, the children were administered the hedonic vegetable preference survey (score card) to fill out at their group's table under supervision. They were asked not to talk to minimize group influence. The children were required to follow strict guidelines. When the children were asked to taste the raw vegetable, the vegetables were provided cleaned and in strips. They were instructed to eat the vegetable and then come to the table to fill out their score card. This procedure took place for the tasting of each vegetable. The score cards were

considered tests and they remained face-down on the table. Making faces, talking and laughing were not permitted.

Children were given a hedonic scale questionnaire (score card) with the pictures of the selected vegetables which they scored from like to dislike (*I like it*, *I think I like*, *I don't like it*) for the raw vegetable and then the cooked vegetable after a cooking demonstration (Figure **1**). The hedonic vegetable preference survey was given pre- and post- cooking demonstration within the two-hour period. The survey, designed for children and constructed by the investigator, had emotion responses labeled on the bottom of the four sections of vegetable photographs and names on the top. Children were asked to note their preferences by circling the emotion under the matching preference level for each vegetable for both tests. The same set of instruction and procedures given for the raw vegetables were used for the cooked vegetables.

Following evaluation of raw vegetables, the cooking "show and tell" demonstration presented a method of cooking that same vegetable (blanched then sautéed). Brief information was provided on the different cooking methods for educational purposes. Approximately one tablespoon of seasoning (Tuscany Kraft dressing, garlic and onion powder) was added to 30 strips of vegetables when sautéed. The cooking demonstration, illustrating a two-step preparation method (blanched, then sautéed) for the chosen vegetables.

Post-Test Procedure

Objective 2: To evaluate parental beliefs about their child's vegetable consumption with their parenting style and the mealtime environment. After the demonstration was conducted, a food questionnaire was sent home in order to assess mealtime habits and parental beliefs about their child's eating behavior. A suitable validated questionnaire was not available, so the investigators composed questions based on knowledge of the population and by using guidance from the previous studies available (Table **3**). All questionnaires were completed and returned to the classroom. The investigator tested the questionnaire for internal consistence by each subscale: mealtime environment; perceived child's vegetable consumption; and parenting style. Since the subscales were not consistent, questions were used individually.

Statistical Analyses

The hypothesis that cooked vegetables will be preferred to raw vegetables was tested by the *Wilcoxon Sign Rank Test* for medians then the paired *t*- test for higher mean of 'liking'. To test the difference between the medians of raw and cooked vegetable preferences, the *Wilcoxon Sign Rank Test* was used. To test which

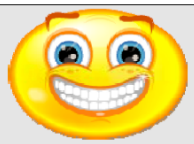
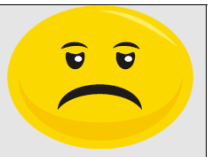
Vegetables Picture	Vegetables Name	 Like It	 think I like it	 don't Like it
	Cauliflower			
	Bell Peppers Red/Yellow/ Green			
	Carrots			
	Green Beans			
	Celery			

Figure 1: Hedonic scale questionnaire for raw and cooked vegetables.

Table 1: Percent of Children who Reported Liking each Vegetable Pre- and Post- Cooking

Vegetable	Raw (pre-demonstration)	Cooked (post-demonstration)	p
*Cauliflower	28.8	71.2	<0.001
Bell peppers	36.5	48.1	0.202
Green beans	48.1	67.3	0.117
Carrots	86.5	71.2	0.043
Celery	48.1	50.0	0.572

*Note: cauliflower was preferred cooked; while carrots were preferred raw.

vegetables were preferred, the *McNemar-Bowker Test* was used for ordinal ranking of vegetables. Gender differences were evaluated for liking raw and cooked by a paired *t*-test.

Secondary objectives included evaluating mealtime practices and their relationship to vegetable preferences and parental beliefs concerning their child's eating. The *Chi-Squared Test* (Pearson's Chi-Square) was used to assess differences in level of liking a vegetable by parental mealtime characteristics. The *Chi-Squared Test* was also used to assess parenting style with their beliefs about their child's eating. The number of vegetables reported liked was crossed with several parenting style questions and tested with *linear-by-linear* association. Analysis were performed using IBM SPSS Statistics 20.0 and a p-value of < 0.05 was considered significant.

RESULTS

The participants were students from a private school in South Florida where approximately 89% were White of which 43% classified themselves as Hispanic and 54% as non-Hispanic, 4% were Black, and the remaining 7% were, Asian or mixed ethnicity/race. Of the 59 students that were asked to participate in the taste test and demonstration, consent was obtained for 52 who participated (n=34 girls and n=18 boys).

The hypothesis that cooked vegetables will be preferred to raw vegetables was confirmed by the *Wilcoxon Sign Rank Test* for medians (p=0.007) then the paired *t-test*. The results of a paired *t*-test showed that cooked vegetables received a higher mean score for 'liking' (2.37) as compared to raw vegetables (2.16), p<0.001. Significant difference in vegetable preference cooked for cauliflower (p<.001) and raw for carrots (p=0.046) were found by ordinal ranking (*McNemar-Bowker Test*); however, preference changes were not significant for bell peppers (p=0.202), green beans (p=0.117), and celery (p=0.572). There were no significant differences between boys and girls with respect to liking raw or cooked vegetables (*paired t-test*). The percent of children who reported liking each vegetable in their raw and cooked states is shown in Table **1**.

Table 2: Parental Characteristics Regarding Meals and their Child's Eating

Parental characteristics (N=52)	N (%) responding 'yes'	p
Satisfied with how often your family eats evening meals together	38 (73.1)	0.001
Child eats enough vegetables to keep them healthy	28 (53.8)	0.677
Child is use to trying new foods	34 (65.4)	0.038
Established strict rules	35 (68.6)	0.012
I guide or regulate my child's eating	48 (92.3)	<0.001
I have to monitor my child constantly to make sure they eat	19 (36.5)	0.071
Teach my child to always eat all of the food on their plate	25 (48.1)	0.890
Force my child to eat even though they are not hungry*	15 (30)	0.007
Intentionally keep certain foods out of my child's reach	28 (53.8)	0.677
Allow television during mealtime	20 (42.6)	0.381
I answer the telephone during mealtime	19 (36.5)	0.071
I text during mealtime	2 (3.8)	<0.001
Work schedule makes it difficult to eat together	26 (30.8)	0.008

*There were 2 missing responses (N=50).

Table 3: Food Habits Questionnaire (Parental Questionnaire)

Please answer these questions to the best of your ability. These answers will be kept anonymous and will enable us to draw a correlation between eating habits and its role toward the children liking vegetables.

Please only answer these questions based on the child participating in this study.

Child eating habits

1. Please list the vegetables your child likes to eat._____

   _____

2. Are you satisfied with your child eating habits? **Yes or No**

3. Does your child eat enough vegetables to keep them healthy? **Yes or No**

4. Is your child used to trying new foods? **Yes or No**

Mealtime interruptions

1. Have you established strict rules in your household regarding mealtime?

   Yes or No

2. If Yes, Do you allow any television during mealtime?

   Yes or No

3. How often is the television on during the evening meal?

   _____Hours

4. Do you text during the evening meals?

   Yes or No

5. Do you answer the phone during mealtime?

   Yes or No

Cooking skills

1. Do you enjoy cooking for your family?

   Yes or No

2. Are you a confident cook?

   Yes or No

3. Are you open to try cooking a wide range of foods including trying new recipes from

   different culture? **Yes or No**

4. Are you knowledgeable in different cooking methods? **Yes or No**

   Which nes? _____

5. If you do not enjoy cooking, who does the cooking in your house (i.e.) Extended family,

   personal chef, restaurants? _____

Parental influences

1. Do you guide or regulate your child's eating?

   Yes or No

2. Do you have to monitor your child constantly to make sure they eat?

   Yes or No

3. Does your work schedule often make it difficult to have the evening meal together?

   Yes or No

4. How often does your whole family sit down together for the evening meal?

   _____

5. Are you satisfied with how often your family eats evening meals together?

   Yes or No

6. Do you force your child to eat anyway even though they say they are not hungry?

   Yes or No

7. Do you teach your child to always eat all of the food on his/her plate?

   Yes or No

8. Is it ok in your family for the children to eat separately from the adults?

   Yes or No

9. Do you intentionally keep some food out of your child's reach?

   Yes or No

   Which Foods? _____

10. Do you keep track of the snack foods that your child eats?

    Yes or No

    Which Foods? _____

11. Do you buy vegetables? Yes or No If not circle the reason why you don't buy them.

    a. Waste **b.** Costly **c.** Family dislikes

12. Do you consume conventional or organic foods?

    Yes or No

13 Is the fresh produce in your area of a high quality?

   Yes or No

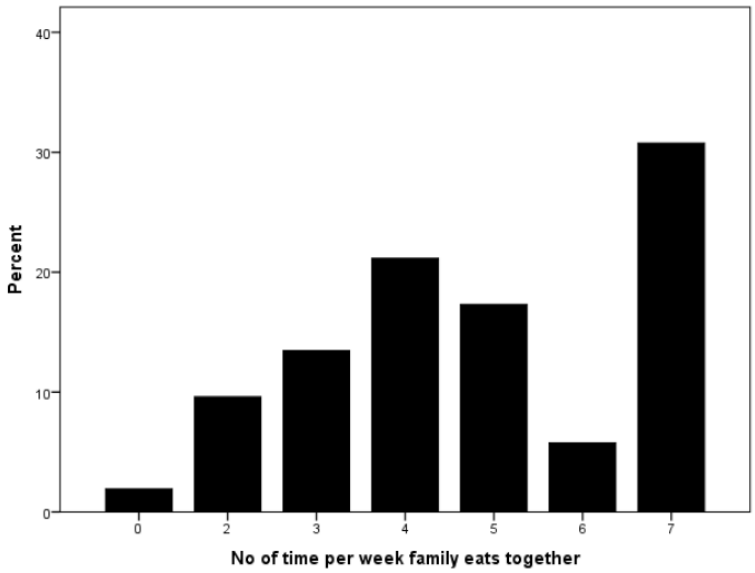


Figure 2: Percent response of parent to the number of times per week the family eats together. The median number of days was 5.

Parenting styles regarding their child's eating behavior and family mealtime are shown in Table **2**. The majority of parents were satisfied with how often their family eats their evening meals together. The number of times per week that the parents reported having their meals together is shown by the Figure **2**. Even though the majority of parents reported that their child is accustomed to trying new foods, only half reported that their child eats 'enough vegetables to stay healthy' (adequate vegetables for their health).

Parental characteristics and parental beliefs about their child's vegetable preferences were compared using the *Chi-Squared Test*. There was a significant difference in preference for raw cauliflower when parents monitor their children constantly to make sure they eat, [χ^2 (2, N=52) = 7.8 (p=0.019)]. Children showed preference for raw carrots when parents regulated or guided their child's eating, [χ^2 (2, N=52) = 6.3 (p=0.043)]. There was a significant difference in the preference for raw celery when parents have difficult schedule affect eating a meal together [χ^2 (2, N=52) = 7.3 (p=0.026)]. There were no significant relationships with other characteristics of mealtime with vegetable preferences.

Parental beliefs about family mealtime and their child's eating behaviors were assessed with the *Chi-Squared Test*. Parents who reported being satisfied with how often the family eats evening meals together were more likely to report that their child eats adequate vegetables for their health 'enough vegetables to keep them healthy' [χ^2 (2, N=52) = 4.9 (p=0.026)]. Parents who stated that they were satisfied with their child's eating habits were more likely to report that their child was trying new foods [χ^2 (2, N=52) = 12.6 (p<.001)] and that they were 'eating enough vegetables to keep them healthy' [χ^2 (2, N=52) = 17.1 (p<.001)].

Parenting style and belief about their child's eating behaviors was tested by the *Chi-Squared Test* using Pearson's Chi Square and linear-by-linear association where applicable. An authoritarian parenting style was assessed with the child's eating behavior. The association of parents that reported teaching their child to always eat what is on their plate and the satisfaction with their child eating enough vegetables to keep them healthy was not significant (p=0.392). Parents who reported not forcing their child to always eat what is on their plate also report that their child does not eat enough vegetables to keep them healthy (p=0.047). Teaching children to always eat what is on their plate was not significantly associated with trying new foods (p=0.840). Monitoring their child constantly to make sure they eat was not associated with the number of vegetables that the child consumed (*linear-by-linear* association, p=0.344); nor, was it associated with their child eating enough vegetables to keep them healthy (p=0.894). Similarly, reporting that they established strict rule during mealtime by parents was not significantly associated with the number of vegetables liked by children (*linear-by-linear* association, p=0.528) nor was it associated with their belief that their child was eating enough vegetables to keep them healthy (p=0.091).

DISCUSSION

The main findings of this study show that preparation method either raw or cooked was associated with vegetable preference for Hispanic and non-Hispanic White 6 and 7 year olds. Specifically, overall liking was higher for cooked than raw vegetables. Carrots were preferred raw while cauliflower was preferred cooked. Cooked vegetables were prepared by blanching and then sautéed with seasoning (Tuscany Kraft dressing, garlic and onion powder) while raw vegetables were presented without any seasoning. This may have influenced taste preferences. The principal investigator followed-up by visiting the school. Approximately one-third of the parents wished to replicate the recipe to encourage their children to consume more vegetables.

This study is in agreement with Zeinstra *et al.* [10] who found the favorable preparation method of vegetable for children was boiled and steamed. The cooking preparation method used in our study (blanched/sautéed) is very similar in texture to that of boiled and steamed. Conversely, Baxter *et al.* [17] reported that raw vegetables and salads were more accepted than cooked by children; however, this study is 15 years old and tastes may have changed. One of the first steps to increasing consumption and liking of vegetables is to identify a number of strategies [14]. However, successful strategies may vary by population or application of the method. Vegetable preference was a significant predictor of vegetable consumption for a diverse group of 4^{th} and 5^{th} grade students in the United States [11]. According to Poelman *et al*. [9] preparation methods and as well as the color or texture of food play a direct role in food preferences among young children. The preparation methods used (mashed, steamed, boiled, stir fried, grilled and deep fried) resulting in differences in appearances, texture, bitterness, and smell and were found to play a direct role in children's preferences and consumption of vegetables [10]. Similarly, Donadini *et al*. [18] found the particular vegetable type and the method of preparation influenced hedonic responses to vegetables for preschoolers ages four to five.

Another method used to increase the acceptance of vegetables by children is repeated exposure. It is possible that reintroducing the same vegetables in a two-hour period could have increased acceptance for children in our study. This effect may have occurred despite the different preparation methods. Increase in vegetable liking was achieved in a group of predominately Caucasian 2-6 year olds, by a randomized trial of repeated vegetable tasting exposure by their parents [19]. Anzman-Frasca *et al.* [14] reported the significant improvement in vegetable preference by the sixth exposure in children ages 3-6 years, in a 4-week randomized control trial. In a randomized control trial in two private preschool with 97 children ages 3- 6 years, O'Connell *et al.* [20] found peers (sitting at the same table) influenced the type and amount of vegetable consumed; albeit, they found no relationship with repeated exposure of unfamiliar vegetables and increased vegetable consumption. Conversely, the parent-led exposure group (14 days) had an increase in vegetables liked as compared to the nutrition education group in a randomized trial of 2-6 year olds (N=143) [19].

Family mealtime is another venue that may help children to increase their preference for vegetables. Our secondary objective was to compare mealtime and parenting style with parental belief about their child's vegetable consumption. The association between family characteristics and mealtimes and its effect on children's vegetable consumption is a recent and ongoing area of investigation. How often the family eats together was not associated with vegetable preference in our study. However, we found that parental satisfaction with how often the family ate together was associated with the parent's estimation of their child's vegetable intake adequacy. Our results are supported by a cross-sectional study of 2-5 year olds in the UK where frequency of eating together did not affect their vegetable intake [15].

Parenting style was associated with parental belief about the adequacy of their child's vegetable intake for only one parenting style (less authoritarian, more child-centered). Parents who reported not forcing their child to always eat what is on their plate also report that their child does not eat enough vegetables to keep them healthy ($p=0.047$). Caucasian preschoolers, ages 2.5-3 years, from 46 Belgian schools, were associated with eating more vegetables when their parents consumed more vegetables and had child-centered feeding practices [16].

Watching television or answering the telephone during meals was not associated with preference for vegetables or the number of vegetables preferred by children in our study. Television-watching negated benefit of adequate vegetables and other diet quality indicators for a group of 1-4 year old children whose families ate meals together [21].

STUDY LIMITATIONS

The intervention was not longitudinal in order to evaluate the effect of repeated exposure. Third and 4th grade children from low-income parents in the Southern United States increased consumption of disliked vegetables after a ten-week repeated exposure experiment in a school cafeteria [22]. The investigators found significant improvements in liking carrots, peas, and tomatoes, which are naturally sweet as opposed to bell peppers, were increased; whereas liking of bell peppers, which are bitter, did not change [22]. Peer influences might have also changed children's individual preferences and this was not measured. However, the testing environment created by the principal investigator and personnel when filling out the score cards minimized the interchange of opinions among children. Another limitation is that neophobia, fear of new foods, may have confounded the results since it has been shown to peak between 2 and 6 years of age [23, 24]. There were no gender differences for vegetable preference in this study. It is possible that the lack of significance could have been a result of the sample being underpowered to determine gender differences, based on the estimated marginal means and the smaller proportion of boys as compared to girls. In contrast, Bere *et al.* [25] found that preference mediated gender differences in fruit and vegetable intake for a group of Norwegian (Caucasian) 6th and 7th graders. The authors attributed these differences to psychological and physical differences of this age group (early adolescence); but, these differences may not be as pronounced in young children.

CONCLUSIONS

The primary objective of this study was to observe whether or not method of food preparation (raw versus cooked), in an elementary school setting, was associated with preference of vegetables. Secondary objectives included evaluating mealtime practices and their relationship to vegetable preferences and parental beliefs concerning their child's eating. When the total likes and dislikes were compared for raw and cooked vegetables, there was a higher degree of liking vegetables when they were cooked (blanched and then sautéed) and lightly seasoned as opposed to raw for multicultural sample of elementary school children. When measured individually, preference for raw or cooked was only significant for cauliflower and carrots. Albeit, for certain vegetables (cauliflower) being blanched/sautéed increased their appeal, while other vegetables (carrots) were preferred in their raw state.

Several parental characteristics and parental beliefs about their child's vegetable preferences were significantly related. Parents who reported being satisfied with how often the family eats evening meals together were more likely to report that their child eats adequate vegetables for their health. Parents who stated that they were satisfied with their child's eating habits were more likely to report that their child was trying new vegetables and that they were eating adequate vegetables to maintain their health. Only one parenting style characteristic was associated with parental belief in their child's eating. Specifically, parents who reported not forcing their child to always eat what is on their plate also report that their child does not eat adequate vegetables to maintain their health.

Future research is needed to understand the interrelationships between preparation methods, exposure to vegetables at home and in school, and mealtime dynamics in children's vegetable preferences. Further research should evaluate a repeated exposure, cooking demonstration in a cross-over, randomized trial in private and public schools. Follow-up studies are needed that evaluate the effect of repeated cooking demonstrations on vegetable preferences. The degree to which parents influence their child's vegetable consumption should be evaluated in association with vegetable preferences pre- and post- demonstration. A wider variety of vegetables and cooking methods should be included in the future studies. Future studies should evaluate enablers and barriers for vegetable consumption of elementary school children considering parental sociodemographic factors.

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