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# Just dessert: Serving fruit as a separate “dessert” course increases vegetable consumption in a school lunch



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## ABSTRACT

Consumption of vegetables is related to overall health. American children, particularly low income students who qualify for free school meals, consume a majority of their calories at school. The United States Federal Government sets regulations for those school meals to promote healthy eating, encouraging the consumption of well-liked fruits and less-liked vegetables. Given that hedonic contrast can affect liking for foods served simultaneously, this study investigated whether a well-liked fruit served at the same time as a less-liked vegetable in a school lunch would reduce consumption and liking for that vegetable compared to when the fruit was served subsequent to vegetable consumption. All of the third and fourth grade subjects consumed some of the vegetable when the fruit was served after the vegetable. When the fruit and vegetable were served simultaneously 40% of the subjects consumed none of the vegetable (Cramer's  $V = 0.52$ ). There was no difference in liking ratings for the vegetable as reported by subjects, though they may have felt peer pressure to positively rate their meal. Serving the fruit component after the rest of the meal is recommended as a standard practice to encourage vegetable consumption in school children.

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## 1. Introduction

The quantity and variety of vegetables consumed in the US has been found to be below recommended levels (Kantor, 1999). This affects people's health since sufficient fruit and vegetable consumption has been found to help prevent diseases such as cancer and cardiovascular disease (see Boeing et al., 2012 for a review). In addition, lack of sufficient fruit and vegetable consumption might also be related to increased rates of obesity (see Tohill, Seymour, Serdula, Kettel-Khan, & Rolls, 2004 for a review) and of associated chronic diseases such as diabetes (Centers for Disease Control and Prevention [CDC], 2014; Ford & Mokdad, 2001).

A suboptimal rate of consumption of vegetables, in particular, might be related to the obesity epidemic. Research has found that the greater the quantity and variety of vegetables consumed, the lower the levels of body fat in adults (McCrorry et al., 1999) and male children and adolescents (Field, Gillman, Rosner, Rockett, & Colditz, 2003). Since childhood obesity has become a world-wide problem (Wang & Lobstein, 2006) efforts should be made to increase vegetable consumption in children.

What foods children like guide what they eat (Baxter & Thompson, 2002). In general, children dislike the taste of vegetables more than they do fruits (Baxter & Thompson, 2002). In fact, fruits have been found to be one of the most highly liked foods whereas vegetables are rated low on liking (Cooke & Wardle, 2005). This difference between degrees of liking for fruits and vegetables is at least partly due to the fact that many vegetables are bitter and many fruits are sweet. These taste properties influence food acceptance (Dinehart, Hayes, Bartoshuk, Lanier, & Duffy, 2006) as do other properties of vegetables such as their low energy density compared to fruits (Gibson & Wardle, 2003).

In the US many students consume two meals a day (breakfast and lunch) and get about a third of their daily calories in their school (Briefel, Wilson, & Gleason, 2009). Therefore many studies are now investigating how manipulating school lunch programs might increase vegetable consumption (e.g., Caraher, Seeley, Wu, & Lloyd, 2013; Cohen et al., 2015; Reynolds et al., 2000).

Recently the United States Department of Agriculture (USDA) which is in charge of the nationally subsidized school lunch program in the US made changes to the requirements for school lunches that are reimbursable from the government, in order to increase fruit and vegetable consumption (United States Department of Agriculture [USDA], 2013). Lunches now have to include weekly minimum servings of vegetables from five different

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subgroups (USDA, 2013). Although these different vegetables are required to be offered to the students, they do not have to be chosen or consumed. In order for the meal to be reimbursed by the government the student has to select 1/2 cup (118 ml) of vegetables or 1/2 cup of fruits or 1/2 cup total from the fruits and vegetables offered or 1/2 cup of an item containing both fruits and vegetables (USDA, 2013). Since most lunches are served cafeteria-style, a child chooses from an array of fruits and vegetables presented to them on a service line. All items wind up on the same tray and a student eats from a tray containing all of the food items selected.

In this situation, where a student can select either fruits or vegetables, they will most likely choose fruits. In fact, Schwartz, Henderson, Read, Danna, and Ickovics (2015) found that the institution of these rules did increase fruit selection and decreased vegetable selection. This type of service does not encourage vegetable consumption because it does not encourage vegetable selection.

Although cafeteria-style service is commonplace in the US, the USDA does allow pre-plated meals, pre-packaged meals, and family style meals (USDA, 2013). In these cases the students receive a meal that usually consists of five components (meat/meat alternative, vegetable, fruit, grain, and milk; USDA, 2013). If all of the five components are served simultaneously, the students are most likely getting a well-liked fruit with a less-liked vegetable.

Recent research (Jimenez et al., 2015) suggests that having the well-liked fruit on the same plate as the less-liked vegetable might reduce liking for the vegetable, reducing consumption of that vegetable. This reduction in liking for one food (in this case the vegetable), which is presented, with another better-liked food (in this case the fruit) is called hedonic contrast.

One change that could be made to the school lunch, which should eliminate this potential reduction in liking and consumption of vegetables due to presenting the vegetable and fruit simultaneously, is to change to a coursed service. The “coursed meal”, adopted from the *service a la russe* (Visser, 1991/2008), is the common way to eat in the US (Carroll, 2013). A typical American meal has a separate sweet dessert course at the end of the meal (Carroll, 2013). The sweet dessert is often fruit (Clairborne, 1972). This sequence might ensure that the often well-liked dessert course does not reduce how much the diner enjoys the other courses in the meal through the mechanism of hedonic contrast.

This study investigates the impact of serving the well-liked fruit course at the same time as or after the less-liked vegetable in a school lunch, served family style to 3rd and 4th grade students. On two different days, the same meal, which included a vegetable (kale salad) served in one serving dish and a fruit (apple-berry medley) served in another serving dish, was observed. On one of those two days the vegetable and the fruit were served at the same time as the other components of the meal. On the other day the fruit was served after the other components, as a dessert would be in a typical coursed meal. Consumption of and liking for the vegetable was measured.

## 2. Method

### 2.1. Subjects

Subjects were 3rd grade and 4th grade students (22 students on one day and 25 students on the other) from a private school in Philadelphia. Because of their low socio-economic status, all students at the school qualified for a government subsidized free school lunch. They were all African-American and their ages ranged from 8 to 10 years of age. The study was approved by the Montclair State University Institutional Review Board.

### 2.2. Procedure

Children were observed during their 30-min lunch period. The lunch observed was part of the Vetri Foundation for Children's Eatiquette program. This lunch was served on one day/week (Fridays). On the other four days the children were served heat-and-serve packaged meals.

The Eatiquette program lunch meals meet the USDA requirements for school lunches (Nutrition Standards, 2012). In addition, the meal is chef-designed and prepared. All food is made from scratch with fresh ingredients. The day's menu is placed on each table so that the children know what food they will be served that day. In addition, the chef comes into the lunch room and explains the meal and how it is prepared to the children so that they are aware of what they are eating.

The meals are served family style at round tables seating 4–5 people. Children are assigned to a table. Based on prior assignment, one child serves as the table captain for that table. He/she arrives before the other children donning a chef-coat appropriate for their size and is responsible for setting the table, including pouring the water into the glasses. Non-disposable plates, glasses and cutlery are used. Once the other children arrive, the table captain brings the food to the table. The table captains serve the food to each person at their tables (often with the assistance of an adult seated at each table) and then sit down to eat with their tablemates.

During the days in which the study occurred all children were seated at round tables with, on average, four children per table plus an adult. Although the 4th graders ate lunch with the 5th graders and the 3rd graders ate with the 2nd graders, any one table had students from the same grade (with the exception of one 3rd grader who ate with 2nd graders). Many volunteers and staff members were also present in the lunchroom.

On two separate occasions, more than two months apart, the same children (on one day three students were absent) were observed eating the same lunch. The lunch consisted of chicken-chickpea curry, pita bread, kale salad, apple-berry medley, and milk. On the first observation day, the fruit/dessert component was served after the meal. On the second observation day, the fruit/dessert was served at the same time as the rest of the meal.

While the children were eating their meal, trained observers recorded how much of the kale salad was consumed by the children during the meal. Training of observers occurred during previous lunches and the observations of the three observers were compared to ensure agreement and consistency in the use of the scale. One observer recorded consumption of the children at 1–2 tables. A child's consumption was recorded as falling into one of three categories. If the children ate none of the kale, or only tasted it, their consumption was recorded as “none”. If they ate some of the kale, but less than all of it, their consumption was recorded as “some”. If they ate all of the serving put on their plate or they consumed seconds (which was often possible with the family-style presentation) their consumption was recorded as “all/seconds”.

In addition, toward the end of the meal, the children were asked to rate how much they liked the kale (“How much do you like the kale salad today?”) on each occasion by marking a square under one of four faces on a slip of paper. The faces included one that was smiling a lot (labeled “really good” and given a score of 1), one that was smiling a little (labeled “a little good” and given a score of 2), one frowning slightly (labeled “a little bad” and given a score of 3), and one frowning a lot (labeled “really bad” and given a score of 4).

### 3. Results

#### 3.1. Consumption measure

Each child was categorized as consuming either “none” (ate no more than a bite of kale), “some” (more than a bite of kale but less than what was put on their plate), or “all or seconds” (ate all the kale that was put on their plate or ate kale in addition to that). A Chi-square test found that more children consumed more kale when the fruit/dessert was served after the rest of the meal rather than at the same time,  $\chi^2(2) = 12.74$ ,  $p = .0017$ , Cramer's  $V = 0.52$ . Table 1 shows that 40% of the children ate none of the kale when the fruit/dessert was served at the same time as the rest of the meal, whereas, all of the children ate kale when the fruit/dessert was served after the main part of the meal. Many more children ate all of the kale put on their plate or had seconds (55%) when the fruit/dessert was served after the rest of the meal than when fruit/dessert was served at the same time (20%).

#### 3.2. Liking ratings

Children rated the kale salad as being either (1) “really good”, (2) “a little good”, (3) “a little bad”, or (4) “really bad”. A Chi-square test found no difference in the distribution of the hedonic ratings given to the kale under the two conditions,  $\chi^2(3) = 5.44$ ,  $p = 0.14$ , Cramer's  $V = 0.34$ . There was also no significant difference in the mean hedonic ratings between the group getting the kale after the main course ( $M = 2.0$ ,  $SD = 0.95$ ) and those getting the kale at the same time ( $M = 1.92$ ,  $SD = 1.22$ ),  $t(44) = 0.24$ ,  $p = 0.81$ . In both cases the kale was rated as hedonically positive.

### 4. Discussion

Serving the fruit/dessert component of a school lunch after students eat the rest of the meal, including the vegetable, significantly increases consumption of that vegetable. When the fruit/dessert component was served at the same time as the rest of the meal many students did not eat any of the vegetable (40% compared to 0% when served after the meal). Instead, the observers noted that many of the children ate the fruit/dessert to the exclusion of the less sweet vegetable and often the protein component. One might worry that students will not consume the fruit/dessert when it is served after they have eaten the rest of the meal, however, the fruit/dessert course is well-liked (Cooke & Wardle, 2005) and therefore consumed readily by the students after the main part of the meal.

These results suggest that serving the fruit/dessert component of the meal after the rest of the meal, which includes a vegetable, is an effective way to increase the vegetable intake of students in a school lunch. In addition, it increases the variety of plant foods the children consume by increasing consumption of the less-liked vegetable in addition to the fruit. Thus, a meal with at least two courses (main course plus dessert) can be used to increase vegetable intake in children.

Since fruits are liked more than other components in a school lunch (Cooke & Wardle, 2005), the serving of the fruit at the same

time as the other components might make the other components less attractive. Although we did not find a decrease in hedonic ratings, which would be expected if hedonic contrast occurred, we suspect that our failure to find such a decrease in rating was because the children were afraid to say they disliked anything about their Friday Eatiquette meal. They perceive that meal as a treat and prefer it to the heat-and-serve packaged food they receive on other days of the week. Some of the students reprimanded their tablemates who said that they disliked the kale by saying that if they gave it a “bad” rating they would stop getting the lunch. Although we tried to assure them that this was not the case, we do think this fear affected the ratings we received. Future studies should emphasize that the ratings will be used to improve the meals rather than discontinue them.

Because of this possible influence on the hedonic ratings we are not sure what caused the drastic difference in vegetable consumption between the two methods of presentation. Although it could be that hedonic contrast caused the vegetables to be perceived as worse than they would have been without the fruit present at the same time there are other possible explanations for the findings. For example, hunger might have played a role. If only kale was available during the main meal they might have eaten more of that because they were hungry and it was the only thing available. If, however, the fruit was available, they ate that first because it was sweet, reducing their hunger to the point where they were either sated or the pleasantness of the kale was decreased so much that it was not acceptable (Cabanac, 1971). No matter the reason for the results, the study suggests that to increase vegetable consumption a separate fruit/dessert course is needed.

Increasing vegetable consumption is particularly important in the population we studied. This increase in vegetable consumption occurred in low income, African-American children. Because this population has been shown to have higher rates of obesity than others (Drewnowski & Specter, 2004; Haas et al., 2003) it is important to find ways to increase vegetable consumption in this demographic. The present manipulation, using the school lunch to increase vegetable consumption, should be particularly effective in these children since many of them qualify for a free school lunch and eat the school lunch regularly.

The simultaneous presentation of all food components currently used in US school lunches only guarantees that the students receive servings of two fruits and/or vegetables. Although the regulations dictate that different types of vegetables are served over the course of a week (Nutrition Standards, 2012) that does not guarantee that the students are taking a variety of vegetables. In fact, it does not guarantee that the students are taking any vegetables. Most importantly, even if the students do select vegetables at lunch it does not guarantee that the vegetables are consumed. Consuming vegetables, not simply putting them on your plate, has a positive impact on health. It also reduces plate waste which is an area of both economic and environmental concern (Buzby & Guthrie, 2002).

While this study did demonstrate a large negative effect of serving the fruit at the same time as the vegetable on vegetable consumption, ideally half of the subjects in the present study should have received the meal containing the fruit as a dessert course prior to the meal with all components served simultaneously, and half should have received the two types of meals in the reverse order. Luckily, the coursed meal was served before the meal with all components served simultaneously. Had the meals been served in the opposite direction one might have been concerned that the increase in kale consumption was due to exposure. However, the fact that a large decrease in kale consumption occurred on the second presentation makes an even stronger case for the negative effect of the fruit being served at the same time as the vegetable on vegetable consumption. Nevertheless, future research might

**Table 1**  
Percentage of children consuming “none”, “some”, or “all/seconds” of the kale salad when fruit/dessert served with or after the rest of the meal.

Consumption categories	Fruit/dessert after meal (%)	Fruit/dessert with meal (%)
None	0	40
Some	45	40
All/seconds	55	20

want to investigate this effect using a between-subjects design or counterbalancing order of presentation of meal type.

Further research on the effect of presenting the fruit as a “dessert” course in a school meal should be extended to other populations and types of lunches. It is also important that the effect of having a separate dessert course on the consumption of all foods in the meal and overall energy intake at the meal be studied. Previous research investigating the effect of an initial vegetable course found an increase in total vegetable consumption in the meal but no increase in overall energy intake (Spill, Birch, Roe, & Rolls, 2010). In addition, more research should be conducted to determine the mechanism at work in the effect demonstrated in this study.

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