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School food options to increase vegetable consumption

Edito

Increasing children's fruit and vegetables intake is a significant goal of paediatricians, nutritionists, and public health experts. However this goal is not easy to reach, due to a strong obesogenic environment in which children are submerged even at home and at school.

Children are bombarded by junk food advertising, through their parents' "life rush" driving the use of pre-packed foods even at family meals, and by often flavourless school meals prepared with technical difficulties. Despite this depressing picture, research to improve children's F&V intake is happening in different settings especially in school cafeterias. The following three papers present explorations of different strategies to improve children's F&V intake.

Redden *et al.* have used a simple tool: presenting vegetables like carrots and broccoli first and at a distance from the other meal courses at the school cafeteria. The action seemed to have positive results and increased consumption seemed almost entirely driven by many students eating vegetables from cups before entering the cafeteria line to have lunch.

The paper written by Van Kleef *et al.* examined portion size and unit size effects to increase vegetable consumption among primary school children aged 8-13 years in The Netherlands. Their findings suggest that children's vegetables intake can be increased by serving larger portions in smaller-sized pieces.

The third paper (Cohen JF *et al.*) reports the effects of a double intervention in the school cafeteria: improving palatability and changing the food-choice-architecture. The results showed that improving foods palatability is the best tool to increase F&V intakes in short (3 months) and long terms (7 months). Providing vegetables at the beginning of the lunch line, as well as displaying them in attractive containers significantly increased vegetable selection, but not overall consumption.

What can we deduce from these studies? We need to:

- Improve vegetables taste, if we want children to enjoy eating them, and return to the healthy, tasty recipes of the Mediterranean Diet,
- Eliminate the availability of junk food from the places dedicated to children's education,
- Promote the strong cooperation of the school system as well as positive political support,
- Dismiss short term interventions as they fail to yield valuable results and could even be harmful, wasting much needed resources.

Finally, for interventions to be successful, they must be long lasting, perhaps life-long, to help "make healthier choices easier".

Margherita Caroli

Doctor in human nutrition science, Azienda Sanitaria Locale Brindisi, ITALY

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Acknowledgement to
250 contributors since 2006

September 2008: P. James; NI. Tak; J. Ogden; K. Chapman (Parental role in children's diet)
October 2008: B. Rolls; H. Schröder; KE. Leahy; MC. de Oliveira, R. Sichiari (F&V and energy density)
November 2008: H. Lagstrom; SF. Olsen; L. Chatzi; J. Aaltonen (The importance of F&V consumption during pregnancy)
December 2008: S. Khokhar; T. Dubowitz; AM. Renzaho; C. Méjan, B. Maire (F&V consumption among migrants)
January 2009: M. Bonnefoy; TN. Akbaraly; L. Ferrucci; F. Lauretani (Carotenoids: elderly healthy diet marker)

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How to increase vegetable intake among children?

Joseph P. Redden

Department of Marketing, University of Minnesota, Minneapolis, Minnesota, USA

It is well-known that having a healthy diet is essential to reduce the risk of suffering from many diseases like cancers, obesity, heart disease, etc.¹⁻⁴ An overall healthy diet requires:

- limits on certain foods such as those high in calories, fat, sugar, or salt
- increasing the intake of healthy foods such as vegetables

Unfortunately, only 13% of the American population and less than 5% of children (9-13 years old) eat the daily recommended amount of vegetables⁵.

Deciding what to eat often involves choosing among different possibilities. In this context, vegetables are typically much less attractive than tastier food on the same shelf, plate, or menu. This relative disadvantage poses a significant barrier to vegetable consumption: think about how hard it is to make a child eat carrots instead of candies when both are readily available.

Getting children to eat carrots and broccoli

We propose a simple solution to boost vegetable consumption: present vegetables first and far from all the other courses.

This study was carried out in the cafeteria of an elementary school with approximately 800 students (5-11 years old). Children gathered in groups and went to the school's cafeteria. After lining up, each child chose what they would eat for lunch. The results were convincing as the consumption of carrots and broccoli increased when they were presented in isolation and before the other foods.

How the order of serving foods has a positive impact on vegetable intake

Nothing changed on the control day; students chose and ate their lunch like every other day under "normal" conditions.

On the Vegetable-First day (3 months later), the same menu was presented to the students. Importantly, we also placed a small paper cup that contained two raw mini carrots (the same as those available from the line) on the table in front of each student upon arrival. Students could eat these carrots as they waited to enter the line, but they were never explicitly instructed or encouraged to eat them.

At the end of each lunch the mean amount of carrots eaten per student was calculated. We considered the amount of carrots eaten from served-first cups and from the serving line.

There was an increase in their carrots consumption by over 430% in the Vegetable-First day versus the control day (2.39g to 12.67g) – cf Table 1. This increase was almost entirely driven by many students eating carrots from the cups before entering the line.

Table 1 : Amount of carrots taken and consumed per student eating lunch in Cafeteria study

	Grams Eaten from served-first cups M (SE)	Number of students taking carrots from line (% of total)	Grams Eaten from Line M (SE)	Total Grams Eaten M (SE)
Control Day n=680	-	80 (11.8)	2.39 (0.36)	2.39 (0.36)
Intervention Day n=755	10.14 (0.38)	70 (9.3)	2.52 (0.37)	12.67 (0.57)

The same methodology has also been used in the same elementary school on approximately 500 students. This time the vegetable used was broccoli and it was distributed while students stood in the register line (again with no encouragement to eat them). This experiment included an initial control day, repeated vegetables first interventions on three days, and a follow-up control day eight weeks later.

The long-term effects of the intervention

Results confirmed that serving a vegetable before other foods and in isolation increased its consumption in an elementary school cafeteria. They suggest that our intervention could be effective across a wide range of vegetables and this procedure should be fairly easy to implement in almost any school cafeteria.

Furthermore, we examined the long-term effects of our intervention. In particular, we proved that the effectiveness of our intervention was the same, even with repeated exposures. This indicates that novelty was not the main explanation for our effects. We also noticed that our intervention had few lingering effects once removed.

Easy ideas to increase the consumption of vegetables

Future work should test our simple intervention across a range of settings, considering the high effectiveness and its relatively low implementation cost. This should include cafeterias with a range of mealtime procedures so that our intervention can apply as widely as possible. Although the logistics of serving vegetables first may be particularly challenging to commercial food service establishments, we firmly believe that eating vegetables first in isolation can prove useful to children, dieters, parents, school officials, and public policy makers. Parents, for example, might increase vegetable consumption by simply serving vegetables as an appetizer before serving the rest of the meal. Future research could also test whether our intervention encourages the development of healthier eating habits.

Based on: Redden JP, Mann T, Vickers Z, Mykerezzi E, Reicks M, Elsbernd S (2015) Serving First in Isolation Increases Vegetable Intake among Elementary Schoolchildren. *PLoS ONE* 10(4): e0121283. doi:10.1371/journal.pone.0121283

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Encouraging vegetable intake among children

Ellen Van Kleef

Wageningen University, Marketing and Consumer Behaviour Group, THE NETHERLANDS

The portion size you get served strongly determines how much you eat

More children are becoming overweight worldwide. For example, in the Netherlands, about one out of eight children in the age-group of 0-9 years is overweight. Being overweight is not only caused by not getting enough exercise on a daily basis, but also an important reason is that we have gotten used to eating bigger portion sizes of particularly energy-dense food. Numerous studies have shown it again and again: larger portion sizes, serving devices and packages lead people to eat more, often without them realizing it. In the last decades, the portion sizes of many, often relatively unhealthy foods increased. An example is the family bottle size Coca-Cola that was introduced in the Netherlands in 1954 which contained 0.75 litres. Now a family bottle size contains double this volume or even 2 litres. This portion size phenomenon can also be observed in slices of cheese, potato chips and chocolate bars. Consumers traditionally want 'value for money' and food companies and restaurants have appealed to these wants by providing larger portion sizes over the years. Unfortunately, as human beings, we are not good at recognizing feelings of fullness in the stomach and determining appropriate portion sizes accordingly. More than 90% of what people serve themselves is eaten. Research has also shown that people usually do not compensate for the increased intake by eating less later on in the day. As a result, scientists agree that this so-called 'portion size effect' is a large driver of the overweight problem globally.

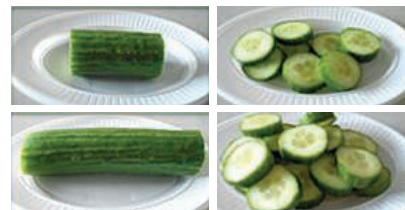
Using the portion size effect 'for the good'

But what if we use this 'portion size effect' to encourage children to eat more vegetables? Vegetables contain vitamins, fibre and are naturally 'light', but most children, like many adults, do not eat enough of them. The question is: do children unknowingly eat more when served more or do they stop eating? These questions were, in short, the reason for the 'cucumber study' in which 255 children of two primary schools in the Netherlands participated. The study was conducted by Ilse Bruggers, Emely de Vet and Ellen van Kleef of Wageningen University.



Getting children to eat more snack vegetables

In this study, we investigated whether portion size could be exploited to entice children to eat more snack vegetables. Cucumber was chosen as a generally familiar and well-liked vegetable among children. We expected consumption in children to increase when portions are doubled. We served children (aged 8-13) cucumber during the morning break and presented the study to them as a taste test. Each class got the cucumber in a different way. In some classes, each child got two third of one cucumber and in other classes they were only served one third of a cucumber. We also varied the size of the pieces of cucumber; some were given small slices and others an unsliced piece. Children ate as much or as little as they wanted and filled in a questionnaire. Leftover cucumber was weighted afterwards to calculate the grams of cucumber eaten. All children participated enthusiastically in the study. 'It was delicious and fun to do! Can you come back with strawberries next time?' a 9-year-old girl wrote on the questionnaire.



Offering larger vegetable portions, preferably in smaller pieces

On average, children ate 115 grams of cucumber. Interestingly, children ate 54% more cucumber when served a large portion compared to a smaller portion. As such, intake of cucumber increased with 49 grams to about 139 grams, which represents about two-thirds of the recommended daily intake of vegetables in the Netherlands of 150 to 200 grams. Pre-slicing the cucumber did not influence how much children ate. Smaller sizes were, however, considered to be more convenient to eat.

The present study has some implications for the development of nutritional advice and interventions to encourage consumption of fruit and vegetables. The key message is to offer larger portions, preferably cut in smaller pieces. For example, presenting children with larger bowls of cucumber, carrots or other raw vegetables and fruit could encourage greater consumption. In this way, children will eat more without verbal encouragement or 'pushing' them to eat.

Based on: Van Kleef, E., Bruggers, I., and De Vet, E. (2015). Encouraging vegetable intake as a snack among children: The influence of portion and unit size. *Public Health Nutrition*, 18(5), 2736-2741.

Effects of choice architecture and chef-enhanced meals on the selection and consumption of healthier school foods

Juliana Cohen

Department of Health Sciences, Merrimack College, North Andover, USA
Department of Nutrition, Harvard T.H. Chan School of Public Health, Harvard University, Boston, USA

School meals can make important contributions to the diets of children, and interventions that improve the selection and consumption of vegetables can have important health implications^{1,2}. Some research suggests that improving palatability should be prioritized to increase selection and consumption of vegetables³, while other studies suggest that just modifying the food environment to “nudge” students towards the healthier vegetables (*i.e.* “choice architecture” techniques) may be sufficient^{4,5}. For example, a study by Wansink and colleagues found that giving vegetables attractive names, such as x-ray vision carrots, can lead to increases in children’s vegetable selection after only one exposure⁶. However, it was unclear if the effectiveness of choice-architecture techniques diminishes over time or if there would be a benefit to combining both a chef-based approach to improve palatability with choice architecture.

Chef-Based Approach and Choice Architecture to promote F&V

Research was conducted to evaluate the short-term (3 months) and long-term (7 months) exposure to a professional chef and extended daily exposure (4 months) to choice architecture on school vegetable selection and consumption using data from the Modifying Eating and Lifestyles at School (MEALS) study. The MEALS study was a randomized control trial in two urban, low-income school districts in Massachusetts among students in grades 3-8. Selection and consumption were measured at three time points to assess baseline levels, after schools were randomized to a professional chef or control status, and then again after schools were randomized to receive a professional chef alone, choice architecture alone, both the chef and choice architecture combined, or control status.

Increased vegetable consumption in the chef intervention schools

The schools that received a professional chef received both training in culinary skills and culturally appropriate recipes that were cost effective and incorporated fresh or frozen produce, prepared with seasonings without added salt or sugar (recipes can be found at <http://www.projectbread.org/reusable-components/accordions/download-files/school-food-cookbook.pdf>).

When examining the short-term impact of the chef-based, more palatable meals, there was a significant increase in vegetable selection in the chef intervention schools compared with the control schools. However, because students had only limited exposure to the new vegetables, overall vegetable consumption did not change. With long-term exposure to the more palatable,

chef-inspired meals, again vegetable selection was significantly greater in the chef intervention schools compared with the control schools. Additionally, vegetable consumption increased by about 30 percent in the chef intervention schools; students consumed roughly 60 percent of their vegetable dish in the chef intervention schools compared with less than 30 percent consumed in the control schools. This translated to students consuming an additional 0.15 cups of vegetables per day or 0.75 cups of vegetables per week.

Choice Architecture increase vegetable selection but not their consumption

The choice architecture techniques used in the schools included providing vegetables at the beginning of the lunch line, as well as displaying them in attractive containers and offering options at the cash registers (Figure 1). Additionally, visual images and posters promoting vegetables were prominently displayed.



Figure 1.
Example of choice architecture techniques used in schools for vegetables (and fruits)

When examining the impact of extended daily exposure to choice architecture, vegetable selection significantly increased in the choice architecture intervention schools compared with the control schools. However, overall consumption of vegetables did not change, and students in the schools with choice architecture techniques discarded approximately 80 percent of their vegetable dishes. Interestingly, when examining the schools that had both the chef-enhanced food and the choice architecture techniques, there was no additional benefit for vegetable consumption beyond the impact of the chef intervention alone.

Improving palatability should be prioritized to increase F&V consumption

Both improved palatability and choice architecture techniques provide benefits, especially to increase the selection of vegetable consumption in schools. This may help provide children with repeated exposure to new vegetables, which can increase the likelihood that children will consume them. However, improving the taste of vegetables appears to be a more effective long-term solution to increasing vegetable consumption in schools.

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