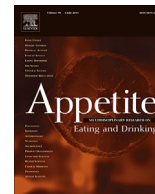




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Variety in snack servings as determinant for acceptance in school children

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ABSTRACT

Variety within a meal is known to increase intake. However, intake of certain food items (e.g. vegetables) in children is consistently below recommendations, and increasing the consumption of such food would lead to health benefits. This study investigated how different levels of food variety influence children's acceptance. A total of 132 children, aged from 9 to 11 years, were exposed to vegetables, fruits and nut snacks during mid-morning break at school. Two different sets of stimuli were used in a within subject design: Classical Variety (CV), i.e. serving of different foods and Perceived Variety (PV), i.e. serving of the same food in different shapes. For each set, three levels of variety in the servings were tested: low, medium, and high. Intake and liking were determined for each serving set. ANOVA results showed that intake of CV set decreased according to the level of variety, whereas results of PV set only showed an increase of liking with increasing levels of variety. Adding more variations of products appeared to be less successful on consumption despite changing the liking of the products, may be because consumption is more affected by acceptability and familiarity for the stimuli than by variety.

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1. Introduction

Children population surveys indicate the need to increase the intake of fruits and vegetables (Fox, Condon, Briefel, Reidy, & Deming, 2010). Indeed, in most countries daily consumption of fruits and vegetables is well below the recommendations of five portions a day (Lorson, Melgar-Quinonez, & Taylor, 2009; National Obesity Observatory (NOO), 2012; WHO, 2003). Moreover, recent studies on children's food preferences showed that vegetables are still the least liked food category, particularly among school-aged children and adolescents (Lanfer et al., 2011). Considering that the pattern of fruits and vegetables consumption persists into adulthood (Lien, Lytle, & Klepp, 2001), it is important to establish healthy habits from childhood.

On one hand, dietary variety is an important component of a healthy diet, but on the other hand it may also lead to a negative outcome. Variety within a meal is known to be one of the most

powerful ways to increase energy intake, with a larger amount of food being consumed in meals characterized by high variety. Earlier studies (Hollis & Henry, 2007; Rolls et al., 1981, 1982; Spiegel & Stellar, 1990) explained this behavior by the mechanism of sensory-specific satiety (SSS); when a variety of foods is available, there is the tendency to switch from one food to another because of the decrease in palatability in any one food after consumption. McCrory et al. (1999) and Norton, Anderson, & Hetherington, (2006) have shown that dietary variety is associated with increased energy intake and body fat in adults. Thus, offering a meal with high variety could potentially lead to overeating. Unfortunately, few studies have been addressed to children (Avena & Gold, 2011; Bucher, Siegrist, & van der Horst, 2014; Epstein, et al., 2009).

One of the first experiments conducted on food variety in children suggested that it influenced intake of low energy density foods as well as high energy density alternatives (Epstein et al., 2009). Temple, Giacomelli, Roemmich, & Epstein (2008) investigated the effects of a varied diet in children, and showed that offering a high variety of foods could increase energy intake, but the response was not related to energy density. This suggested that, also for low energy dense foods, such as fruits and vegetables,

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increasing the variety of foods offered may increase their consumption. Thus, variety may be used as an alternative approach for promoting intake of particular healthy products, such as fruits and vegetables.

Variety has rarely been used to encourage children's vegetables consumption. Roe, Meengs, Birch, and Rolls (2013) tested several familiar fruits and vegetables as snack with pre-school children, and successfully found that providing a variety of foods increased the likelihood that children would select some of them as well as the amount they actually chose and ate.

Most of the previously mentioned studies considered food variety as the variation of number of products but relatively little is known about what food variety actually means for children. It is likely that varying sensory properties such as taste, texture, size, shape, and color will influence perceived variety since such attributes have previously been demonstrated to affect SSS (Rolls, Rowe, & Rolls, 1982). In vegetables, shape is known to affect liking in children aged 9–12 years, who prefer to have their vegetables cut and presented in more complex serving styles (Olsen, Ritz, Kramer, & Møller, 2012; Zampollo, Kniffin, Wansink, & Shimizu, 2012). Olsen, Ritz (2012) also demonstrated that size did not matter when vegetables were cut, but when served as a whole or as chunks the ordinary size was preferred over the smaller size.

The present study investigated the effect of two different types of variety on fruits and vegetables snacks intake and acceptance in school children: *Classical Variety* (CV), i.e. serving of different foods and *Perceived Variety* (PV), i.e. serving of the same food in different shapes. The aim was to investigate if the CV and PV choice varieties influence acceptance and intake of snack servings in a similar way in Danish school-aged children.

We hypothesized to obtain a lower consumption of PV set compared to CV set, since in the first one only the appearance and remotely the texture were changed.

Eating habits and frequency of consumption of fruits and vegetables were also investigated, through a questionnaire completed by the children's parents.

2. Material and methods

2.1. Participants

One-hundred-fifty-three children from a public school in Copenhagen (Denmark) were enrolled in the study. Children were aged from 9 to 11 years, 63 (47.7%) were girls and 69 (52.3%) were boys. Participant characteristics are given in Table 1.

A total of seven classes were involved: four 3rd graders (9–10 years) and three 4th graders (10–11 years). One 3rd class was involved in a pilot study ($n = 18$) only, whereas all other children ($n = 132$) took part in the main experiment. Teachers and parents were thoroughly informed about the study and parents gave written consent and completed a short questionnaire on food allergy or whether their child followed a specific diet prior to study start. None of the children involved in the present experiment

followed specific diets. Children who suffered from allergies for the study products were not served these products in their servings. Children's participation in the study was voluntary and classes received mixed toys (value: 80 US dollars) as a small reward for their participation. The study complied with the Helsinki declaration, and after reviewing the study protocol, the Danish National Committee on Biomedical Research Ethics found that it did not require formal ethical approval.

2.2. Pilot study

A pilot study was carried out to select the stimuli for the main experimental study. Fifteen snack foods were tested for liking, familiarity, frequency of consumption, and preferred serving styles by one of the school classes. The presented fruits and vegetables were: pear, red apple, dried cranberry, almond, parsley root, beetroot, white cabbage, plum, green apple, red currant, hazelnut, parsnip, carrot, kohlrabi, and Brussels sprout. Products were selected on the basis of suitability as a snack food and conformed with recommendations for the New Nordic Diet (Mithril et al., 2013). All products, except cranberries and almonds, were organically produced, as well as complied with seasonal availability from the Danish suppliers. They were further selected on easiness to handle and divide in portions.

Testing took place in the classroom. Children were instructed how the questions were phrased and how to use the scales. This was practiced a couple of times in plenum. For each food, children were asked about familiarity (before tasting the food): "Do you know this food?" on a 3-point scale: "No, I've never seen it before", "Yes, I've seen it, but not tasted", and "Yes, and I've tasted it". Then children tasted the food and rated liking: "How much do you like this food?", on a 7-point hedonic facial scale (Laureati, Pagliarini, Gallina Toschi, & Monteleone, 2015) with the descriptors: "really bad", "very bad", "bad", "okay", "good", "very good", and "really good". Finally, children assessed their frequency of consumption: "How often do you eat this food?" and answered through a 5-point scale with the descriptors: "Never", "A few times a year", "A few times a month", "A few times a week", "Every day".

During tasting, children were offered a small piece/bunch (around 30 g) of each food one at a time in a mid-morning break. To minimize peer interaction and the effect of serving order, during assessments, two serving orders were used, so children sitting next to each other would not evaluate the same food at the same time. Half of the children received the foods in the order mentioned above, and the other half received the opposite order. Products were served with a small break between each serving. After each tasting, children took a sip of water for palate cleansing. Results are shown in Table 2. Familiarity is reported as the percentage of children answering "I know this vegetable and I've tasted it" (score 3), while frequency of consumption was measured as the sum of the percentage of children answering "A few times a week" and "Every day" (scores 4 and 5).

In order to choose stimuli shapes for the main study, after the tasting session, children rated their liking of pictures of green apple and carrot presented in four different serving styles: small chunks, slices, sticks, and triangles. The eight serving shapes were arranged with each vegetable in a similar position in identical plates. Children evaluated liking of each serving shape individually: "How much do you like this serving style?" and answered on the 7-point hedonic facial scale described above. Children were instructed not to influence their classmates with facial expression or comment about the food they tasted, and it was carefully emphasized that there were no right or wrong answers. Results showed that, for both green apple and carrot, children's liking increased significantly from simpler shape (small chunks) to more elaborated

Table 1
Participants' description.

Characteristics	Number or mean \pm SEM
Children	132
Gender distribution	69 boys, 63 girls
Age (years)	9.60 \pm 0.05
Class	59 3rd grade, 73 4th grade
BMI (kg/m ²)	17.2 \pm 0.2
BMI z-score ^a	0.39 \pm 0.08

^a The WHO 2007 data are used as reference population (De Onis et al., 2007).

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