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# Providing choice and/or variety during a meal: Impact on vegetable liking and intake

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ABSTRACT

Out-of-home catering services frequently offer consumers the opportunity to choose their foods from among different proposals and/or provide consumers with a variety of food. The aim of the present study was to assess the impact of choice and/or variety on food liking and food intake. Fifty-nine normal-weight adults were recruited under the condition that they equally liked three vegetable recipes (green beans with butter, zucchinis with olive oil, spinach with cream). Volunteers participated in four sessions at lunch time. In the *no-choice/no-variety* condition, volunteers were served one dish randomly selected from among the three. In the *no-choice/variety* condition, volunteers were served all three dishes. In the *choice/no-variety* condition, participants chose one dish from among the three dishes. In the *choice/variety* condition, volunteers chose as many dishes as they desired from among the three dishes. Results showed that providing choice increased vegetable liking and vegetable intake, while offering a variety of vegetables only increased their liking. No synergy effect between choice and variety was observed on vegetable liking and vegetable intake (i.e. the effect in the *choice/variety* condition was not significantly higher than the effects in *no-choice/variety* and the *choice/no-variety* conditions).

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## 1. Introduction

Nowadays, out-of-home catering provides individuals some degree of freedom regarding food selection: it is common that people select their dishes from among several proposals (e.g. choice of one starter among several) and/or combine several alternatives for the same course (e.g. selecting two side dishes for the main course). Consequently, people often face a choice situation (e.g. making a decision about the food to be consumed) and/or a variety situation (e.g. being exposed to multiple foods). However, both choice and variety have been demonstrated to influence food liking and food intake.

Food choice is defined as providing the opportunity for an individual to select the food he or she wants to consume (Parizel et al., 2016). Several authors have observed a positive effect of providing food choice on food liking and/or food intake in adults (King, Meiselman, & Henriques, 2008; King, Meiselman, Hottenstein, Work, & Cronk, 2007; King, Weber, Meiselman, & Lv, 2004), children (Altintzoglou et al., 2015; de Wild, de Graaf, Boshuizen, & Jager, 2015; Rohlfs Domínguez et al., 2013; Zeinstra, Koelen, Kok, van der Laan, & de Graaf, 2010) and elderly individuals (Kremer, Derks, Nijenhuis, Boer, & Gorselink, 2012; Nijs, Graaf, Kok, & Staveren, 2006). For instance, Altintzoglou et al. (2015) observed a positive effect of choice on fish liking when children (11–12 years old) chose the fish they wanted to taste from among two alternatives, compared to a no-choice situation in which children were assigned one of the two fishes. Rohlfs Domínguez et al. (2013) observed a 120% increase in vegetable intake when children (Spanish, 4–6 years old) were allowed to choose the vegetable they wanted to consume for their school lunch from among two alternatives, compared to a no-choice situation. Recently, we observed that providing choice led to an increase in both food liking and food intake when French adults were allowed to choose the dessert they wanted to consume from among three alternatives, compared to a situation in which they were randomly assigned one of the three (Parizel et al., 2016). Several authors have demonstrated that choice has a powerful motivating

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effect: people are more likely to engage in an activity, and to succeed and enjoy it, if they had chosen it (Patall, Cooper, & Robinson, 2008). According to the self-determination theory, people are naturally inclined to interact with the environment in a way that promotes three psychological needs: the need for competence (i.e. feeling effective), for autonomy (i.e. feeling of being the perceived origin of a behavior) and for relatedness (i.e. feeling connected to others) (Deci & Ryan, 2002). Social contexts that fulfil these needs will thus enhance intrinsic motivation, namely the desire to carry out an activity for self-gratification (as opposed to extrinsic motivation, related to the desire to carry out an activity for external rewards). Providing choice is one way to enhance a person's experience of competence and autonomy (Langer, 1975; Ryan & Deci, 2000). Consequently, the self-determination theory holds that choice should result in positive intrinsic motivation, which in turn leads to higher performance and satisfaction (Patall et al., 2008). When applied to the subject of food, one can expect that providing the opportunity for an individual to choose the food he or she wants to consume would elicit an increased motivation to eat, as well as greater food enjoyment.

Food variety is defined as providing an individual with foods that differ on at least one sensory characteristic (Raynor & Epstein, 2001). Again, several authors have observed a positive effect of providing food variety on food intake within a meal (McCrory, Burke, & Roberts, 2012; Meengs, Roe, & Rolls, 2012; Pliner, Polivy, Herman, & Zakalusny, 1980; Raynor & Epstein, 2001; Rolls, Rowe et al., 1981; Spiegel & Stellar, 1990). For instance, Meengs et al. (2012) observed that participants ate more vegetables when served three types of vegetables side by side (simultaneous variety) than when served only one type. Barbara J. Rolls, Rowe et al. (1981) showed that participants ate more when offered a variety of food in succession (sequential variety) (sandwiches with four different fillings; three different flavored-yoghurts) than when offered the same food throughout a meal. In their review of literature, McCrory et al. (2012) found an average increase of 22% in food intake (amount or energy) when providing food variety within a meal (the meta-analysis was based on 10 within-subject design studies assessing sequential and simultaneous variety). It has been argued that providing food variety may prevent the onset of specific-sensory satiation that refers to a drop in pleasantness of an eaten food aroused by its ingestion in contrast to other non-eaten foods. In fact, Rolls, Rolls, Rowe, and Sweeney (1981) observed that liking decreased more for an eaten food than a non-eaten food and that these changes in liking were highly correlated with subsequent food intake: participants ate more when they were served a different food (the “non-eaten food”) than when they were served the same food (the “eaten food”). However, in some studies, variety also increased food selection, even if participants did not consume the foods (Bucher, Siegrist, & van der Horst, 2014; Keenan, Brunstrom, & Ferriday, 2015; Wilkinson, Hinton, Fay, Rogers, & Brunstrom, 2013). Bucher et al. (2014) observed that children served themselves significantly more vegetables when presented with two vegetables than only one. Wilkinson et al. (2013) argued that variety may affect the cognitive representation of food quantities, which in turn may increase served portions. In fact, these authors showed that participants increased their anticipated pleasantness and selected a larger portion to eat when provided with a sequential variety of foods compared to a no-variety condition.

Literature then shows that providing food choice or providing food variety may increase meal enjoyment and food intake. Until the present moment, these two factors have been mainly investigated separately, while they may actually co-occur in real-life settings. In fact, in many out-of-home catering situations, individuals have the possibility to choose as many dishes as they desire from among different proposals for their meal. Consequently, the aim of the present study was to assess the impact of choice and/or variety on food liking and food intake during a lunch. Specifically, four conditions that may occur in real life were compared: (i) participants were served with one dish randomly selected from among three alternatives (*no-choice/no-variety* condition); (ii) participants chose one dish from among three alternatives (*choice/no-variety* condition); (iii) participants were served with the three dishes (*no-choice/variety* condition); and (iv) participants chose as many dishes as they desired from among three alternatives (*choice/variety* condition).

## 2. Materials and methods

### 2.1. The food products

Three green vegetable recipes were selected from 27 recipes by an on-line questionnaire carried out by 205 French adults (a separate group from the participants in the present study). For each recipe, these adults were asked to indicate if they had already tasted it and then to rate their liking according to a 10-point hedonic scale ranging from “I do not like it at all” (0) to “I like it very much” (10). They were also asked to indicate their frequency of consumption (“more than 5 times per year”; “between 1 and 5 times per year”; “less than one time per year”). The results allowed us to select recipes that are commonly eaten and similarly liked by French adults. These recipes consisted in green beans with butter (mean liking: $M = 7.4$, $SEM = 0.1$), zucchinis with olive oil (mean liking: $M = 7.7$, $SEM = 0.2$) and spinach with cream (mean liking: $M = 7.4$, $SEM = 0.2$).

The green beans (extra-fine frozen green beans, Thiriet®), the zucchinis (frozen zucchinis, Thiriet®) and the spinach (frozen spinach leaves, Thiriet®) were cooked in a pressure cooker at 1 bar for 90 s, 130 s and 85 s, respectively. Then, they were seasoned with butter (1.6 g per 100 g of cooked green beans), olive oil (3.4 g per 100 g of cooked zucchinis) or 30%-fat cream (7.9 g per 100 g of cooked spinach), respectively. The amount of fatty ingredient added in each dish was adjusted so that the difference in energy content did not exceed 20 kcal while still fitting typical French culinary habits. Lastly, all the vegetables were seasoned with salt (0.15/100 g) and pepper (0.035/100 g). The nutritional content of each dish is displayed on Table 1. The dishes were prepared 2 h before each meal and reheated in a microwave just before being served, the serving temperature being between 50 and 60 °C.

### 2.2. Participants

Fifty-nine healthy and normal weight volunteers were recruited from Dijon (France) and its surroundings between January and April 2015. The recruitment criteria were as follows: aged between 18 and 40 years old; having a normal and stable weight (BMI between 18.5 and 26 kg/m$^2$ and no weight variation greater than 3 kg during the last three months); scoring lower than 14 on the restraint scale and lower than 12 on the disinhibition scale of the Three Factor Eating Questionnaire (Stunkard & Messick, 1985) (Harden, Corfe, Richardson, Dettmar, & Paxman, 2009); not taking any drugs liable to have an impact on appetite (e.g. corticoids, antidepressants); not on a diet; non-smoker; not abusing alcohol; neither pregnant nor breastfeeding; not allergic to any ingredients proposed during the study and having already eaten the vegetable dishes before. Furthermore, candidates were asked to rate their liking for the three selected recipes (green beans with butter, zucchinis with olive oil, spinach with cream) on a 10-point hedonic scale in an on-line questionnaire. To be recruited, a candidate had to have similar liking scores for the recipes (i.e. the liking scores of the