



Sensory analysis and observational study in an experimental restaurant: Pilot study



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ARTICLE INFO

Keywords:

Liking
Preference
Food choice
Observation
Self-reported measures
Natural meal situation

ABSTRACT

Food businesses test their products to predict their success in the future market. Intrusive methods, such as self-reported evaluations in laboratory settings, are used to assess the appreciation for those products. However, the data collected in such conditions is not always predictive of consumers behaviour. This research reports the evaluations of two kinds of bread by restaurant consumers ($n = 107$) before and after the meal, using self-reported assessments of liking and preference in a ‘one-shot’ test conducted in controlled conditions. Additionally, respondents’ choices and intake of the same products in an ad libitum setting during the meal was recorded. For the ‘one-shot’ evaluation, there was no difference in liking scores between products, while the preference test showed a tendency towards bread with a higher fibre content (whole wheat bread) (49% versus 36% for white bread, $p = 0.072$). The non-intrusive method of behaviour recording demonstrated a higher tendency for the consumption of the white bread (“baguette”) (60 versus 47 participants, $p = 0.076$). The preference test indicated a significant stated preference for whole wheat bread before than after the meal (49% before versus 34% after, $p = 0.026$). This result illustrates the challenge of predicting preferences and behaviours. Self-reported preferences in questionnaires may be subject to hypothetical biases, particularly when healthy products are involved, and they may fluctuate in time. The link between appreciation and real choice behaviours may also vary with the setting. The results bring some insight to food professionals regarding the value of controlled self-reported evaluations, compared to controlled observation to predict market success of a product.

Introduction

Sensory preferences, liking and choice behaviours all reveal information about product appreciation. Sensory preferences refer to the hierarchy of appreciation of products, while liking indicates the immediate qualitative or quantitative, affective (hedonic) evaluation of food. Choice behaviours correspond to the action of choosing a product among others (Baumeister et al., 2011). The determinants of preferences, liking and choice behaviours are numerous. Besides taste (Mela, 2001), the determinants include, for example, the eating situation, the appropriateness of consumption, the habits and the frequency of consumption (Cardello and Schutz, 1996; Meiselman, 2007). Food research used in food development relies on two types of measurements: (i) self-reported assessments of liking (through the rating of products on a hedonic scale) or of preference (self-reported sensory preference between two products) (Bolhuis et al., 2011; Porcherot and Issanchou, 1998), and (ii) eating behaviour observation (through the recording of choice of a product and its consumption). While the first

category of variables are stated, observational measurements make it possible to consider the conscious and unconscious parts of eating behaviours, such as the choices and the amount of food consumed (Furst et al., 1996; Wansink and Sobal, 2007). These studies are usually conducted under laboratory conditions (‘one-shot’ laboratory test), where environmental factors, sample selection and product characteristics are fully standardised and controlled (Depledge, 2009). Official standards have been developed to homogenise such practices for the measure of liking (e.g., UNE-EN ISO 8589:2010). However, it has been shown that the eating situation influences the outcome of food product evaluations, leading to question the ability of thoroughly controlled, and thus unnatural, experimental situations to produce externally valid data (Meiselman, 2007; Boutrolle (2005)) observed higher scores to products tested at home than products tested in a central location test. Other studies also corroborate the influence of consumption location on self-reported measures of food acceptance (Edwards, Meiselman, Edwards, and Lesher, 2003; King, Meiselman, Hottenstein, Work, and Cronk, 2007; Petit, and Sieffermann, 2007) and on observed food or

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drink choice (Sester et al., 2013).

Although liking, stated preference, and choices, are generally correlated in laboratory studies (although not always highly so), their relative benefits and respective uses for product development are unclear. The amounts of food consumed during laboratory tests are usually different from natural settings. It is a valuable element to consider because the amount of food ingested is a major parameter of food appreciation (Brug et al., 2008). Satiety is the feeling of fullness that persists after eating, and affects the period between eating occasions, and thus, its daily number (Benelam, 2009). Satiety comprises at least two elements, namely, nutritional satiety and cognitive satiety. The former is mediated by the metabolic consequences of ingestion. The cognitive satiety is usually described as sensory-specific satiety (SSS) and has been observed in different situations (Johnson and Vickers, 1992; Rolls et al., 1981). It corresponds to a temporary decline in the pleasure derived from consuming a certain food compared to other unconsumed food. The SSS has been found in different repeated exposures to certain tastes (Guinard and Brun, 1998; Havermans et al., 2009), aromas (Fernandez et al., 2013) and textures (Guinard and Brun, 1998). Satiety effects could play a role in the perception of food products. First, differences in the liking of the same product could appear, according to the amount of product consumed, because of satiety effects, as well as boredom or irritation of the respondent (Köster et al., 2003). Additionally, food intake could be elicited or inhibited by the psycho-physiological states of hunger and satiety, respectively (Bellisle, 2005). Yet to our knowledge, this consideration is rarely integrated in the methodological approaches to food appreciation evaluation.

Another element that requires consideration is the consistency of responses over time, because the basis of behaviour may be different in the first versus subsequent choices, due to exposure effects. The expected quality of a product and the possibility of not choosing could drive the first choice, while the following choices are mainly based on the sensory experience, among many other factors (Arvola et al., 1999), including the intrinsic need for variety (Lähteenmäki and Van Trijp, 1995; Ratner et al., 1999). In addition, an increase of acceptability for unfamiliar food has been found, due to an increase of exposure times (Rozin and Fallon, 1986; Rozin and Schiller, 1980; Wardle et al., 2003).

Recently, living laboratory approaches have been proposed in order to conduct hedonic measurements in realistic, but controlled eating contexts (Giboreau, 2017). Such a methodological approach increases the ecological validity of measures, but requires an adaptation of the techniques of laboratory sensory analysis to less standardized experimental conditions (Allirot et al., 2014; King et al., 2004). Regardless of the practical drawbacks of those methods (such as the cost, the quantity of products required and the duration of the study), they provide useful insight into the determinants of product appreciation and eating behaviours and take into account the context-dependence of food selection and intake behaviours. Behavioural measurements could be implemented, although the conventional, self-reported measurement could also be used in realistic contexts.

We present a pilot experiment, which aims to describe preferences for bread measured in a 'one-shot' test and during a meal. We examine different types of indicators (self-reported and behavioural). The specific objectives of the work are to check the consistency between hedonic scores in a 'one-shot' test (before a meal), behaviours during a meal and hedonic scores after a meal. More precisely, we examine the following questions:

a) Do the liking scores and self-reported preference for bread measured in a 'one-shot' test display the same tendencies for liking and preference measured after a meal experience?

b) Do liking scores and self-reported preference for bread measured in a 'one-shot' test agree with the tendency in the observed behaviours during a real meal situation?

Table 1
Number of subjects and demographic characteristics (age and gender).

Participants age	n	Gender (%)	
		Men	Women
20–39 years	45	62.2	37.8
40–59 years	35	31.4	68.6
60 + years	27	48.1	51.9
Total	107	48.6	51.4

Methods

Participants and sessions

Participants

The participants were naturally occurring customers (n = 107), who booked the table by themselves for a lunch at the Experimental Restaurant (Ecully, France) (Giboreau and Fleury, 2009) and paid 20 euros for a meal. Before starting the investigation participants were made aware of their participation in a study, whose objectives were not revealed. A consent form for participation and video recording in the dining room was signed. Additional characteristics, including gender and age, are reported in Table 1. Participants were adults, aged between 20 and 85 years (average, 45 ± 16 years). The most common motivation to eat out was to share a meal with friends (52%) or relatives (23%).

Sessions

A total of 8 sessions were conducted to study all subjects at midday or in the evening. The study took place in the Experimental Restaurant [Le Restaurant (Ecully, France), certified Living Lab by ENoLL (2011)].

The restaurant serves gourmet style meals, with a menu fixed in advance. There was a wide variety of dishes served during the test period, allowing to reduce potential biases due to the type of meals. Meals were all composed of an "amuse bouche", a starter, a main course and a sweet dessert. The customers did not make a choice among the dishes. More precisely, each consumer received her or his dish, randomly selected from the day's fixed list of available dishes.

Products

White bread (WB) and whole wheat bread (WWB) were supplied daily by the same bakery. WB was made by following the traditional French recipe, using 1000 g wheat flour (T65, GMS Meunerie, France), 600 g water, 4.2 g yeast, 4.2 g bread improver and 15 g salt (NaCl). The dough was divided to obtain 200 ± 10 g sticks after baking, with a diameter of around 6 ± 1 cm. WWB was prepared according to the recipe of GMS Meunerie (France), the supplier of flour used for "Pain complet". The dough was made with 1000 g whole wheat flour, 700 g water and 25 g salt and divided to obtain final sticks of 200 ± 10 g after baking with a diameter of approximately 6 ± 1 cm. Both breads were cut into 1.2–1.6-cm-thick bread slices.

Experimental design

Protocol

The protocol design consisted of three phases. The first phase comprised a taste test and a questionnaire before the meal (BEFORE). The second phase (DURING) consisted of an observation of participants during the meal, where consumers were not aware of the measurement (the choice between breads). In the third phase (AFTER), a second questionnaire-based data collection was conducted at the end of the meal.

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