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Creation of a food taste database using an in-home "taste" profile method

Christophe Martin *, Michel Visalli, Christine Lange, Pascal Schlich, Sylvie Issanchou

CNRS, UMR6265 Centre des Sciences du Goût et de l'Alimentation, F-21000 Dijon, France
INRA, UMR1324 Centre des Sciences du Goût et de l'Alimentation, F-21000 Dijon, France
Université de Bourgogne, UMR Centre des Sciences du Goût et de l'Alimentation, F-21000 Dijon, France

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ABSTRACT

The purpose of this study was to create a food 'taste' database using an innovative in-home profile method. The five basic tastes and fat sensation were studied. The proposed method consisted in an intensive training in laboratory (55 h, 5 months) immediately followed by an in-home measurements phase (8 months) during which 12 trained panelists had to evaluate the five tastes and fat sensation of the foods they typically consumed. The rating scales were inspired by scales used in the Spectrum™ method. During the in-home measurement phase, ratings were reported thanks to a web-based tool and each month the panelists returned to the laboratory for a 2-h retraining session.

The results showed that the proposed method could lead to results of good quality compared to those obtained in laboratory. Over the in-home measurements period, 590 foods were described (average number of evaluations by food: 8.7). Six major classes of foods were identified on the basis of tastes and fat sensation perceptions enabling a "sensory" classification of foods to be proposed. The food contributors of high intensities were also highlighted, contributing to have an overview on the sensory sapid world we face in our diet. Linking this sensory database with other types of data on food opens new perspectives in nutrition and epidemiology.

1. Introduction

Many food composition databases exist. Indeed, more than 35,000 European, North American foods and foods from other countries are now LanguaL™ indexed. But, to the best of our knowledge, no database provides information on the taste intensity perceived in foods. Building a database indicating the perceived intensity of the tastes for the foods which are commonly consumed in different countries would be greatly useful for public policy makers as well as for food industries. First, it is well-known that sensory characteristic, and in particular taste properties, are key drivers of food acceptability. Second, it is also known that some tastes, such as sweet and fat, could act as an early signal of calories and nutrients. A food taste database would provide an overview of the sensory landscape of diets, foods, foods within food groups and it would allow major food items or food groups, which are high-intensity vectors, to be determined. It would also allow studying to what extent usual food groups based on culinary or nutritional are homogeneous from a sensory point of view. Combined with nutritional composition tables and food processing information, a food taste database could provide elements of understanding about relationship between food composition and processing characteristics (type of tastants, type of matrix, level of processing, etc.), and perceived taste intensity. A first attempt was made by Viskaal-van Dongen and collaborators on 50 foods in order to correlate taste intensities and composition in macronutrients (Viskaal-van Dongen, van den Berg, Vink, Kok, & de Graaf, 2012). A food taste database would also make possible the calculation of indices reflecting our exposure to tastes, in the same way as intakes for different nutrients are calculated. Identifying patterns of exposure to different tastes, or to foods with particular tastes in target populations (children, adults, elderly) could provide an additional factor, helping to understand the origin of food preferences and of excessive eating behaviours such as too sweet, too salty, or too fatty diets.

The difficulty of producing such database lies mostly in the large number of food items available and by variations induced by several factors probably modifying the taste profile of food items, such as trademarks, product origins, degrees of maturity, and transformations made at home (recipes, cooking methods

* Corresponding author at: Centre des Sciences du Goût et de l'Alimentation, Centre de Recherches INRA, BP86510, 21065 Dijon Cedex, France. Tel.: +33 3 80 69 30 75; fax: +33 3 80 69 32 27.
E-mail address: Christophe.martin@dijon.inra.fr (C. Martin).

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and seasoning). An in-home sensory evaluation of food prepared by the panelists themselves would enable to collect taste profiles for a great number of foods regularly consumed in real conditions and to have an overview of the taste variability of our diet.

The purpose of this study was to create a food taste database using an innovative in-home profile method and to have an overview on the sensory sapid world we face in our diet. The intensity of salty, sweet, acid and bitter tastes were scored using universal scales proposed within the Spectrum™ method (Muñoz & Civille, 1992) and newly developed scales for umami taste and fattiness.

Fat sensation was added to the studied stimuli for two main reasons. Firstly, although this multimodal sensation is mainly based on characteristics of texture, odour, and appearance (Gaillard, Passilly-Degrace, & Besnard, 2008), it is possible that it relies in part on the detection of free fatty acids in the oral cavity, according to the same type of physiological mechanisms involved in the perception of basic tastes even if this issue is still being debated (Mattes, 2009). Secondly, a potential application of this study would be to correlate sensory and nutritional data for different foods and/or to correlate sensory exposure to socio-demographic data. Thus, it is important to take into account the fat sensation because of its role as an indicator of the fat content of foods and its role in the attractiveness of high-fat foods.

2. Materials and methods

The in-home taste profile method experimented in this study consisted in an intensive training in laboratory, and an in-home measurements phase during which the panelists had to evaluate the tastes and fat sensation of the foods they typically consumed. A general description of the in-home "taste" profile method is presented in Fig. 1.

2.1. Panelists

Thirty-two subjects with previous experience in sensory profiling were invited to participate in a selection session. The selection criteria were based on the ability of the subjects to identify the five basic tastes, to classify simple sapid solutions according to the intensity of the perceived tastes, to use a linear scale, to concentrate in performing a complex task (Bourdon T.I.B. test, Swets & Zeitlinger BV, Calisse, The Netherlands), and finally, to assess the intensity of the five tastes in three different foods. On the basis of their results, 16 candidates were selected. Over the 13 months of experimentation, four panelists stopped the study for personal reasons. The 12 remaining panelists (seven women and five men) completed the entire study. The age of the 12 panelists was between 28 and 67 years (mean age = 46 years).

2.2. Experimental conditions

The laboratory sessions took place in the tasting rooms of the Chemosens platform (INRA Dijon), where assessments were conducted in individual booths equipped with FIZZ® software (Biosystèmes, Couternon, France). The room temperature was controlled (21 ± 1 °C), and the samples were evaluated in daylight and in the white light of the rooms and booths. The "in-home" measurements were performed in a completely free environment. The panelists could make the assessments in their homes or during a catered meal, at a friend's house, or in restaurants. The panelists all signed an informed consent form and were compensated for their participation (15 € per hour for training in the laboratory and 40 € per month for scoring at home).

2.3. Training in laboratory

The panelists were trained during 55 h in 5 months. Given the "multi-product" mission of the panel, special attention was paid to the variety of food used during training. Indeed, over 180 different foods were evaluated. Several commercial foods were modified by adding food grade sapid substances (caffeine, sucrose, monosodium glutamate, citric acid, sodium chloride, differents fats) in order to modify the taste intensity and to obtain series of samples varying mainly by the intensity of one taste (e.g. mashed potatoes more or less salty sweet or bitter, fruits compotes more or less sweet or bitter, soft cheese more or less sweet, sour, bitter or fat, etc.). Items from all food groups, including mixed dishes, were presented. Some foods were selected because of the particularly high intensity of one of their sensations, others for the simultaneous occurrence of several sensations at a high level. Panelists learned to assess the tastes and fat sensation, regardless of the level of

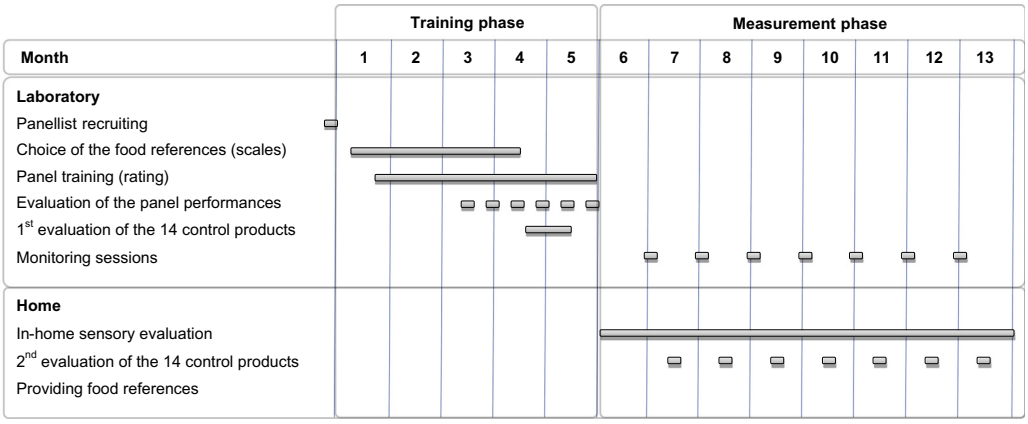

Fig. 1. General description of the in-home "taste" profile method. Twelve panelists with previous experience in sensory profiling were recruited through a 1-h selection session. Five months (55 h) were dedicated to the development of the rating scales (choice of the food references) and to the training in the use of these scales. The panelists' performances (discriminatory power, agreement within the group, and repeatability) were assessed approximately every four sessions in the second half of the training. A set of 14 foods (control products) was evaluated first in laboratory, at the end of the training phase, and then at home at different times of the in-home measurement phase (from the 2nd to 8th month). The comparison of the results obtained in both conditions gave an idea of the quality of the in-home measurements. The in-home measurements phase lasted 8 months during which the panelists had to characterise the taste and fat sensation profile of the food they typically consumed and to regularly report their ratings thanks to a web-based tool. During the measuring phase, each month, the panelists returned to the laboratory for a 2-h monitoring session. These sessions allowed taking stock of the situation and retraining the panelists with the sapid reference solutions of the Spectrum™ scales and enabled to provide the panelists with food references for the upcoming month.