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Comparison of partial and global projective mapping with consumers: A case study with satiating cheese pies

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ABSTRACT

In the present work the performance of global projective mapping and partial projective mapping based on texture and flavor for sensory characterization of a novel food category (satiating food product) was compared. Eight different fresh-cheese pie formulations were designed to obtain different sensory (principally texture) characteristics which could affect expected satiating perception. Three groups of consumers evaluated the samples using one of the following methodologies: global projective mapping (G-PM) (n = 47), partial projective mapping based on flavor (F-PM) (n = 53), and partial projective mapping based on texture (T-PM) (n = 61). In addition, the expected satiating capacity of each cheese pie sample was scored on a nine-point scale. Results showed that the vocabulary used by consumers for describing the sensory characteristics of samples did not largely differ between global and partial projective mapping tasks. However, T-PM and F-PM tasks provided more detailed information than G-PM in each specific modality. Results suggested that when consumers performed the global projective mapping task they mainly took into account flavor characteristics for evaluating global similarities and differences among samples. In addition, hedonic attributes were more frequently mentioned in G-PM. Fresh cheese, sugar, corn starch and egg were the basic ingredients that conferred the fresh-cheese pies their typical, characteristic flavor and texture. The addition of whey or soy proteins, wheat bran or glucomannan increased expected satiating capacity which could be related to changes in texture (harder, more compact) leading to longer orosensory exposure. The addition of glucomannan caused the largest changes in the sensory characteristics of the cheese pies which in turn would be related to a decrease in perceived flavor intensity. Studying the interplay between formulations, sensory characteristics, expected satiating capacity and consumer liking could largely contribute to the development of this novel food category.

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1. Introduction

Interest in consumer-based sensory characterization has largely increased in the last five years, partly motivated by the need to directly include consumer input in the new product development process (Valentin, Chollet, Lelièvre, & Abdi, 2012).

Several methodologies are available for gathering information about consumers' perception of the sensory characteristics of products, being holistic methodologies one of them (Varela & Ares, 2012). These methodologies are based on the evaluation of global similarities and differences among samples, enabling assessors to decide the sensory characteristics that are responsible for perceived similarity (Ares & Varela, 2014; Dehlholm, Brockhoff, Meinert, Aaslyng, & Bredie, 2012).

Projective mapping is one of the most popular holistic methods. It was introduced to food sensory evaluation by Risvik, McEwan, Colwill, Rogers, and Lyon (1994). In this methodology assessors are given a sheet of paper and a sample set. They are instructed to taste the samples and to place them on the sheet according to their similarities and differences, in such a way that samples that are perceived as similar should be located close to each other and samples perceived to be more different should be located further apart.

In a projective mapping task assessors should form an overall representation of the similarities and differences among samples by relying on a process of synthesis for analyzing and processing sensory information (Jaeger, Wakeling, & MacFie, 2000). This process of synthesis determines the relative importance of the perceived sensory characteristics for estimating the similarities and differences among samples.

Projective mapping can present some disadvantages when specific information about a sensory modality is needed for guiding new product development since assessors would not specifically focus on it. In order to overcome this point, Pfeiffer and Gilbert (2008) proposed the application of projective mapping by modality or partial projective mapping, in which assessors are asked to evaluate similarities and differences in a specific modality (as appearance, flavor, texture) as opposed to global similarities and differences. According to these authors partial projective mapping showed better discrimination than global projective mapping and a higher correlation with descriptive analysis.

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Dehlholm et al. (2012) performed this approach to evaluate the appearance, taste and mouthfeel of commercial samples of liver pâté. This sensory technique has also been used to compare the response of consumers when they just looked at the packaging (like in a supermarket) or tasted the sample (having or not the information from the packaging) (Carrillo, Varela, & Fiszman, 2012).

Food products with enhanced satiating capacity could be considered as a new category of food. Satiating products used as between-meal snacks can produce consumer satisfaction at a particular time, because of their filling effects, and encourage healthy dietary habits when used as a way to prevent weight gain (Tárrega, Martínez, Vélez-Ruiz, & Fiszman, 2014). There is a need for formulating healthier low-energy, low-fat products that are affordable, attractive, convenient and, importantly, as tasty and gratifying as those they are intended to replace (Halford & Harrold, 2012).

It has been observed that the sensory properties of this product category, particularly texture, play a role in expected satiating capacity (how filling a food is likely to be and to what extent it is likely to stave off hunger until the next meal) (Hogenkamp, Stafleu, Mars, Brunstrom, & de Graaf, 2011; Yeomans & Chambers, 2011). Since orosensory exposure is a fundamental step for elicitation of preabsorptive satiating-related signals the in-mouth sensory perception and characterization become an essential point in the development of satiating food. According to Yeomans, McCrickerd, Brunstrom, and Chambers (2014) there was stronger evidence of learned satiety when a drink's textural (viscosity) rather than flavor cues predicted nutrient content, perhaps because texture is a more consistent predictor of energy: low satiation/satiety response of beverages can be largely attributed to their shorter oral residence time than solid food (De Graaf, 2012).

Texture characteristics can be overlooked by consumers when they evaluate some product categories (Szczesniak, 2002). Therefore, global projective mapping could potentially miss to identify similarities and differences in this specific sensory modality, which could be highly relevant for the development of satiating foods. For this reason, having a consumer insight into the texture features of new designed satiating food products through partial projective mapping would be highly convenient.

The aim of the present work was to compare the performance of global projective mapping and partial projective mapping based on texture and flavor for sensory characterization of novel satiating fresh-cheese pies with different texture characteristics. In addition, the correlation between the expected satiating capacity scores and the sensory characteristics of the samples was analyzed.

2. Materials and methods

2.1. Samples

Fresh-cheese pie is a refrigerated dairy dessert that is basically made of fresh cheese, eggs, sugar, milk, and starch. It differs from American cheesecake in not having a crust and having a soft, spongy, moist, and gel-like texture which can be cut with a knife. Fresh cheese is made from pasteurized non-cultured cows' milk and is characterized by a creamy, firm texture with a mild milky flavor. Eight different fresh-cheese formulations were designed (Table 1) to obtain different sensory textures which could affect expected satiating capacity perception. None of the formulation changes distorted the nature of the sample pies.

Three samples were formulated by removing one of the minor ingredients from the basic recipe (B): no egg (B-E), no corn starch (B-CS), or no sugar (B-S) to obtain different textures. In sample B-S a high-intensity sweetener was added to compensate sweetness changes. Considering that high protein content is related to higher satiating capacity, two samples were formulated by adding a higher level of protein: soy protein (B + SP) and whey protein (B + WP). The last two samples were formulated by adding fiber ingredients which could add satiating capacity by different mechanisms: wheat bran (B + WB), or konjac glucomannan (B + K).

2.1.1. Ingredients

The ingredients used in the formulation of the eight fresh-cheese pies were: full-fat fresh cheese (starter-free, pasteurized, protein content = 10.9 g/100 g, moisture = 72 g/100 g and fat = 14 g/100 g as declared by the supplier, Hacendado, Spain), pasteurized liquid whole egg (Ovocity, Valencia, Spain), sucrose (Acor, Valladolid, Spain), maize starch (Maizena®, Barcelona, Spain), skimmed milk powder (Central Lechera Asturiana, Siero, Spain), whey protein isolate (WPI, Best Protein®, 90 g/100 g protein content, Barcelona, Spain), wheat bran (Harinera Castellana, Valladolid, Spain) and konjac glucomannan (Trades S.A., Barcelona, Spain).

2.1.2. Sample preparation

2.1.2.1. Batter preparation. The basic recipe batter was prepared in a mixer (Kenwood Major Classic, UK), at top speed (580 rpm). Firstly, the cheese was whisked for 1 min, and then the egg and sugar were added separately and mixed in for 1 min more after each addition. The milk powder was dissolved in water and the starch dispersed in it. These were added to the mixture, which was beaten for a further 1 min. Lastly, any other ingredient (if any) was added and the final mixture was beaten for 16 min. A total of 20 min processing was used for all formulations.

2.1.2.2. Baking. The batter was poured into a heat-resistant silicone mold for five rounded pies (7 cm in diameter and 3.5 cm in height), and baked for 25 min at 180 °C in an electric oven (De Dietrich, Basingstoke, UK), preheated for 15 min. The oven, the tray and the tray position in the oven were identical in each case. The pies were left to cool at room

Table 1
Formulation of cheese pie samples.

Ingredient	Ingredient in each sample[a] (g/100 g)							
	B	B-E	B-S	B-CS	B + SP	B + WP	B + WB	B + K
Fresh cheese	55.00	68.75	61.11	57.89	52.80	52.80	53.90	56.59
Whole egg	20.00	–	22.22	21.05	19.20	19.20	19.60	20.58
Sugar	10.00	12.50	–	10.53	9.60	9.60	9.80	10.29
Skimmed milk	10.00	12.50	10.28	10.53	9.60	9.60	9.80	10.29
Corn starch	5.00	6.25	5.56	–	4.80	4.80	4.90	–
Whey protein	–	–	–	–	–	4.00	–	–
Soy protein	–	–	–	–	4.00	–	–	–
Wheat bran	–	–	–	–	–	–	2.00	–
Glucomannan	–	–	–	–	–	–	–	2.25
Sweetener	–	–	0.83	–	–	–	–	–
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[a] B: basic formulation; B-E: B without whole egg; B-S: B without sugar; B-CS: B without corn starch; B + SP: B with soy protein added; B + WP: B with whey protein added; B + WB: B with wheat bran added; B + K: B with konjac glucomannan added.

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