Novel and successful free comments method for sensory characterization of chocolate ice cream: A comparative study between pivot profile and comment analysis

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ABSTRACT

Rapid sensory profiling methods have gained space in the sensory evaluation field. Techniques using direct analysis of the terms generated by consumers are considered easy to perform, without specific training requirements, thus improving knowledge about consumer perceptions on various products. This study aimed to determine the sensory profile of different commercial samples of chocolate ice cream, labeled as conventional and light or diet, using the "comment analysis" and "pivot profile" methods, based on consumers' perceptions. In the comment analysis task, consumers responded to 2 separate open questions describing the sensory attributes they liked or disliked in each sample. In the pivot profile method, samples were served in pairs (consisting of a coded sample and pivot), and consumers indicated the higher and lower intensity attributes in the target sample compared with the pivot. We observed that both methods were able to characterize the different chocolate ice cream samples using consumer perception, with high correlation results and configurational similarity (regression vector coefficient = 0.917) between them. However, it is worth emphasizing that comment analysis is performed intuitively by consumers, whereas the pivot profile method showed high analytical and discriminative power even using consumers, proving to be a promising technique for routine application when classical descriptive methods cannot be used.
Key words: ice cream, pivot profile, comment analysis, sensory characterization, consumer perception

INTRODUCTION

Ice cream is a milk-based food consumed worldwide, being a popular semi-solid dairy dessert well accepted among consumers of all ages (Cadena et al., 2012; Sun-Waterhouse et al., 2013). It is mainly formed by air bubbles, fat globules, and ice crystals dispersed in an aqueous phase of sugars, proteins, minerals, stabilizers, emulsifiers, colorings, and flavorings, besides containing artificial flavorings agents or extracts (Soukoulis and Tzia, 2010; da Silva et al., 2014).

Consumers are becoming increasingly aware of and looking for foods with health benefits. Joint efforts between the food industry and the academic sector have led to studies on changes in ice cream formulations (Cadena and Bolini, 2011). These strategies include fat replacement (Aykan et al., 2008), sucrose substitution (Ozdemir et al., 2015), addition of different types of fiber (Dervişoglu and Yazici, 2006), and use of probiotic cultures (Cruz et al., 2009; Ferraz et al., 2012).

Although technological changes in ice cream have multiple purposes, they must be carefully managed and investigated. Because of interactions among ingredients in a formulation, changes in the nature or amount of ingredients, such as fat or sugar, may result in undesirable changes in the ice cream, with negative effects on the sensory profile of the final product, especially with respect to aroma, flavor, and texture (Frøst et al., 2005).

Understanding how consumers perceive food products is an arduous and challenging task for both food industry and sensory researchers and should not be underestimated. This information is necessary for the development, marketing, and reformulation of existing products, and for establishing specifications for quality control programs (Meilgaard et al., 1999; Ares, 2015).

Quantitative descriptive analysis (**QDA**) stands out among classic methods of sensory characterization, and

it yields detailed, robust, consistent, and reproducible results through trained and selected assessors (Cruz et al., 2013). The disadvantage of using trained assessors in relation to consumers is evidenced by the different perceptions and descriptions of sensory attributes. Trained assessors often report attributes irrelevant to consumer perceptions (ten Kleij and Musters, 2003; Symoneaux et al., 2012). Furthermore, the use of a trained panel is costly and time consuming. For a small food company, the routine use of trained assessors can be cost prohibitive, and for large industries, the situation may be even more problematic due to the wide variety of products (Cruz et al., 2013).

Some studies have attempted to investigate and understand consumer perceptions through direct analysis of the mentioned words. These methods use the perception and spontaneous comments of consumers to differentiate and characterize products (Parente et al., 2011; Symoneaux et al., 2012). They exploit the generation of vocabulary and sensory descriptors, using free-listing tasks, open-ended questions, and word association with consequent textual analysis of the data (ten Kleij and Musters, 2003; Ares and Deliza, 2010; Lawrence et al., 2013).

Methods based on free comments are easy to perform, as they do not require specific training and can be applied to consumers (ten Kleij and Musters, 2003). The data collected are a rich source of information and should not be undervalued (ten Kleij and Musters, 2003). When analyzed properly, such data can provide results similar to those obtained through classic sensory characterization and can complement quantitative results (Symoneaux et al., 2012; Lawrence et al., 2013).

Open-ended questions with subsequent comment analysis of likes and dislikes have been successfully used in the sensory characterization of some foods (Galmarini et al., 2013). Consumers are asked to answer 2 open-ended questions indicating what they liked and disliked about each sample after giving their overall liking score. Comment analysis involves a frequency count of the sensory attributes used to characterize a product, generating a contingency table (Lawrence et al., 2013). The recent use of the chi-square test per cell has made it possible to increase the accuracy of data interpretation, and it has proven to be an interesting tool for sensory differentiation and, perhaps, an alternative to preference mapping (Symoneaux et al., 2012).

When free descriptions are used, as in open-ended questions, an association between an attribute and its intensity can occur, even when samples are presented in a monadic manner. In that case, data interpretation is a critical procedure and should be conducted carefully (ten Kleij and Musters 2003; Giboreau et al., 2009). Erroneous and unrepresentative results can be generated by considering all degrees of difference, besides decreasing refinement and statistical power. Pivot profile (**PP**) aimed to reduce this limitation was recently proposed by Thuillier et al. (2015), although its use is still limited.

Pivot profile is a descriptive method recently introduced that has been used in the characterization of Champagne varieties by experts. The PP task uses a comparative format between the target product and another product called the "pivot." The related responses assume the form of "less" or "more" intense than the pivot, minimizing variability within assessor responses, and the task-repeat dynamics provides a complete description of the set of products (Thuillier et al., 2015). In addition, the PP method allows the relative importance of the sensory descriptors of the products to be established and facilitates data analysis (Valentin et al., 2012). Other reference-based methods (e.g., polarized sensory positioning or polarized projective mapping) have a critical step regarding selection of an appropriate reference sample. Once the choice of a reference product occurs within the range of products to be evaluated, PP prevents it (Ares et al., 2015; de Saldamando et al., 2015; Fleming et al., 2015).

Pivot profile shows promise, but the implementation capacity (how it is used) is still little explored and underused, and information on the procedure remains scarce. Thus, there is a need to investigate the potential application of this new method in sensory characterization of food matrices using responses directly from consumers.

The objectives of this study were (1) to investigate the use of pivot profile in the sensory characterization of commercial conventional and light or diet chocolate ice cream samples; (2) to determine the descriptive profile of these products using comment analysis of likes and dislikes provided by consumers; and (3) to compare the effectiveness of both methods in the determination of a sensory profile based on consumer perceptions.

MATERIALS AND METHODS

Samples

Six commercial samples of chocolate ice cream—3 labeled as conventional (**IC1**, **IC2**, and **IC3**) and 3 labeled as light or diet (**ICL1**, **ICL2**, and **ICL3**)—were purchased from local supermarkets in the city of Campinas (São Paulo, Brazil). The specific ingredients