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Comparison of static and dynamic sensory product characterizations based on check-all-that-apply questions with consumers

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ABSTRACT

The aim of the present work was to compare static and dynamic sensory product characterizations based on check-all-that-apply (CATA) questions with consumers. Three studies involving a total of 310 consumers were carried out. In each study, a between-subjects experimental design was used to compare static sensory characterizations obtained using CATA questions with dynamic characterizations over a relatively short time period using temporal CATA (TCATA). Three different product categories were evaluated (orange juice, strawberry yogurt, and vanilla milk desserts) using 6–11 sensory terms. TCATA data were analysed as CATA considering fixed time periods throughout the evaluation. CATA and TCATA were compared in terms of frequency of use of the terms, sample discrimination, and sample and term configurations. Asking consumers to continuously select the attributes that applied to describe a product and to deselect those that no longer applied during the evaluation period did not substantially modify the average citation proportion of terms or the maximum citation proportion for individual terms for liquid and semi-solid products with a relatively fast oral preparatory phase. Although both methodologies provided similar information, additional insights on how similarities and differences among samples evolved during consumption were obtained with TCATA in the case of products that experience large temporal changes or attributes with strong time-dependency. CATA provided similar information as TCATA for sensory attributes that did not change substantially during the evaluation period. Results from the present work suggest that static and dynamic product sensory characterizations using CATA questions with consumers provide complementary information about consumer experiences with food products.

1. Introduction

Sensory characterization aims at providing a detailed description of the sensory characteristics of products (Lawless & Heymann, 2010). It is one of the most extensively used methods in sensory science, particularly in industrial settings, where it plays a central role in new product development and quality control (Varela & Ares, 2014). Although sensory characterization has been frequently applied with highly trained assessors, interest in consumer-based approaches has increased in the last decade, partly motivated by the need to integrate consumers' perceptions in the new product development process more fully (Ares, 2015; Varela & Ares, 2012).

Check-all-that-apply (CATA) questions is one of the most popular methods for consumer-based sensory characterization. This methodology consists of presenting consumers with a list of terms and asking them to select all the terms that describe a focal sample (Ares & Jaeger, 2015). CATA questions are regarded as easy to answer for consumers and have been reported to provide valid and reliable product sensory characterizations (Ares, Antúnez, et al., 2015; Ares et al., 2014; Jaeger et al., 2014). Despite their recent introduction in sensory and consumer science, CATA questions have already been applied for sensory characterization of a wide range of products of different complexity, including whole grain breads (Meyners, Castura, & Carr, 2013), yogurt (Tárrega, Marcano, & Fiszman, 2016), cooked ham (Henrique, Deliza, & Rosenthal, 2015), and insect-based foods (Tan, Verbaan, & Stieger, 2017).

CATA questions, as well as other traditional sensory characterization approaches such as descriptive analysis, consider the sensory characteristics of products as a static phenomenon (Cliff & Heymann, 1993; Dijksterhuis & Piggott, 2000). However, sensory perception is a

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Table 1
Details of the studies included in the research for comparing static and dynamic sensory characterizations obtained using check-all-that-apply (CATA) data.

Study	Product category	Number of consumers in the test and number of consumers who completed the static CATA task (between brackets)	Number of samples	Task duration (s)	Number of terms	List of terms
1	Orange juice	100 (50)	6	20	6	Sweet, acid, bitter, astringent, orange flavour, off-flavour
2	Strawberry yogurt	104 (52)	6	30	8	Creamy, greasy coating, sweet, strawberry flavour, sour, cream flavour, artificial flavour, off-flavour
3	Vanilla milk desserts	106 (52)	5	25	11	Thick, creamy, firm, liquid, smooth, sweet, barely sweet, very sweet, vanilla flavour, milk flavour, tasteless

dynamic phenomenon as the perceived sensory characteristics of products change during consumption (Lawless & Heymann, 2010). This may imply that if no specific instructions are provided to assessors, the sensory characteristics of products could be evaluated at different moments of the evaluation, adding to heterogeneity in the data (Sokolowsky & Fischer, 2012). For this reason, dynamic methodologies for sensory characterization are necessary to understand more fully the time course of sensory characteristics and, consequently, of consumer product experiences (Dijksterhuis & Piggott, 2000).

An extension of CATA questions to measure the dynamics of sensory perception, called temporal CATA (TCATA) has been introduced recently (Castura, Antúnez, Giménez, & Ares, 2016). In TCATA, assessors are presented with a list of terms and are asked to continuously select all attributes that describe the sensory characteristics of the focal product during the evaluation. They have to check all the sensory characteristics they perceive at each moment of the evaluation and to uncheck any selected attributes that are no longer applicable. This methodology has been shown to provide a detailed description of how the sensory characteristics of products change over time (Ares, Jaeger, et al., 2015). Although the temporal aspect of the evaluation does not seem to be largely demanding for consumers (Ares, Jaeger, et al., 2015; Ares et al., 2014), it can modify the cognitive strategies used by consumers to evaluate samples. Whether this could potentially reduce (or increase) consumer's ability to discriminate among samples with small differences is expected to depend on the specific product and sensory attributes being considered. However, no study has yet compared static and dynamic sensory product characterizations obtained with CATA and TCATA with consumers.

Comparison of static and dynamic sensory characterizations has mainly focused on trained assessors' data and have shown that they provide complementary information (Bruzzone, Ares, & Giménez, 2013; Devezeaux de Lavergne, van Delft, van de Velde, van Boekel, & Stieger, 2015; Labbe, Schlich, Pineau, Gilbert, & Martin, 2009; Ng et al., 2012; Sokolowsky & Fischer, 2012). Static methods provide a single assessment of the sensory characteristics of products, which could correspond to the perceived intensity at a single time point or to an integration of the intensity perceived throughout the evaluation. The exact criterion used by assessors in static methods is usually not well controlled nor captured precisely (Sokolowsky & Fischer, 2012). By contrast, temporal methods provide information about their evaluation over time (Labbe et al., 2009; Sokolowsky, Rosenberger, & Fischer, 2015). Neither static nor temporal methods have been demonstrated to be superior in their ability to discriminate among samples (Ng et al., 2012). In some cases, temporal methods have been reported to provide more discrimination among samples than static methods, such as descriptive analysis (Bruzzone et al., 2013; Meillon, Urbano, & Schlich, 2009), whereas in other situations the opposite trend has been found (Sokolowsky et al., 2015). The main differences between static and dynamic characterizations have been found for attributes that experience large changes during consumption (e.g. bitterness) or for complex sensory attributes that are evaluated throughout consumption (e.g. creaminess) (Bruzzone et al., 2013; Sokolowsky & Fischer, 2012).

In this context, the aim of the present work was to compare static and dynamic sensory product characterizations based on check-all-that-apply questions with consumers, specifically in liquid and semi-solid products with a relatively fast oral preparatory phase.

2. Materials and methods

The present work comprised three studies involving a total of 310 consumers. In each study, a between-subjects experimental design was used to compare static and dynamic sensory characterizations obtained using CATA questions. A between-subjects design was used to avoid familiarization with the samples and the methodologies, as well as any potential carry over effects between the methodologies. Each study involved a different product category: orange juice, strawberry yogurt,