Food Quality and Preference 34 (2014) 37–44

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Trained sensory panellists' response to product alcohol content in the projective mapping task: Observations on alcohol content, product complexity and prior knowledge

Leanie Louw [a,b], Sulette Oelofse [b], Tormod Naes [c,d], Marius Lambrechts [a,b], Pierre van Rensburg [a,b], Hélène Nieuwoudt [a,*]

[a] Institute for Wine Biotechnology, Department of Viticulture and Oenology, Stellenbosch University, Private Bag X1, 7602 Matieland, Stellenbosch, South Africa
[b] Distell Ltd, PO Box 184, Stellenbosch 7599, South Africa
[c] Nofima Mat, Oslovegen 1, 1430 Ås, Norway
[d] Department of Food Science, University of Copenhagen, Faculty of Science, Denmark

ARTICLE INFO

Article history:
Received 17 September 2013
Received in revised form 29 November 2013
Accepted 21 December 2013
Available online 3 January 2014

Keywords:
Sensory evaluation
Projective mapping
Panellist performance
Relative Performance Indicator
Alcohol content
Product complexity

ABSTRACT

Projective mapping has been validated as a practical tool for the rapid sensory profiling of brandy products, although repeatability concerns necessitate repeated measurements in larger sample sets. The reason for poor repeatability could be linked to the complexity of the product type, as well as the physical and possibly psychological factors associated with its high alcohol content. To date no information has been published that tested the effect of these specific factors on panellist performance in projective mapping tasks. This study tested the effect of sample complexity and alcohol content on sensory panel repeatability and accuracy in projective mapping, using six types of commercial alcoholic beverages. In a second objective, the study also tested the effect of prior knowledge of alcohol content of a given product set on panellist performance in projective mapping. The results showed that complexity had the biggest impact on panel performance, while alcohol content had a secondary but decisive influence, largely due to its chemosensory fatiguing nature. Knowledge of the product alcohol content appeared to affect individuals differently, and also had an effect on the terminology used by the panellists to describe the products. The study also introduces the Relative Performance Indicator (RPI) as a new panel performance monitoring tool for projective mapping.

1. Introduction

Brandy is a complex grape-based distilled beverage with an alcohol content of at least 36% ABV (alcohol by volume), as specified by EU regulations (European Union., 2008). Many different styles and types of brandy are produced across the globe. Well-known and protected styles include French cognac, Spanish Brandy de Jerez, Portuguese Lourinhã brandy, Chilean Pisco and South African potstill brandies (Robinson, 1999). Sensory evaluation of these products is important to ensure quality products that meet consumer demands.

Projective mapping, also known as Napping®, (Pagès, 2005; Risvik, McEwan, Colwill, Rogers, & Lyon, 1994) is a rapid sensory profiling method designed to obtain a holistic overview of the sensory differentiation between products in a given sample set, without the time- and cost impact of conventional sensory profiling methods such as quantitative descriptive analysis (QDA™) (Stone, Sidel, Oliver, Woolsey, & Singleton, 1974). When it comes to alcoholic beverages, projective mapping has only been applied to wine (Hopfer & Heymann, 2013; Pagès, 2005; Perrin & Pagès, 2009; Perrin et al., 2008; Ross, Weller, & Alldredge, 2012; Torri et al., 2013). The wines tested included white wines from the Loire valley as well as red wines from France, Italy and the USA. Although the alcohol contents were not specified, the expected range for these wine styles is 11–15% ABV. One of these studies reported a maximum alcohol content of 15.3% ABV (Hopfer & Heymann, 2013; chemical analyses reported in related study in Hopfer, Ebeler, & Heymann, 2012). Spirit beverages, such as brandy, are typically diluted to 20–23% ABV before sensory evaluation (Louw & Lambrechts, 2012). Our earlier work was the first study on rapid sensory profiling of spirit beverages and projective mapping was validated as a suitable method for brandy evaluation (Louw et al., 2013). The results showed good accuracy and repeatability

Abbreviations: RPI, relative performance indicator; PPI, people performance indicator.

* Corresponding author. Tel.: +27 21 808 2748; fax: +27 21 808 3771.
E-mail address: hhn@sun.ac.za (H. Nieuwoudt).

0950-3293/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.foodqual.2013.12.010

for a small set of six brandies per evaluation. However, in comparison, when a larger set of ten brandies per session was evaluated, the repeatability of the method decreased, and repeated measurements were recommended to improve the quality of the results (Louw et al., 2013).

Considering the nature of brandy, we speculated in our earlier work that the decrease in panel performance could be due to sensory fatigue caused by the samples. Different types of fatigue relevant to sensory evaluation have been identified (Sauvageot, 1990). Those relevant to brandy evaluation include sensory and mental fatigue that may be induced by the inherent product properties and possibly psychological fatigue that may be induced by panellists' expectations of the product type and what the evaluation thereof, would involve. For high alcohol beverages, panellists may for example expect the product to elicit a stronger burning sensation than a low alcohol beverage or that it may cause them to tire more easily.

Alcohol is a chemosensory irritant which may cause sensory fatigue through continuous stimulation of the trigeminal senses (Green, 1988; Prescott & Swain-Campbell, 2000). As projective mapping relies on holistic, comparative product evaluation, sensory analysts are more restricted in the measures that can be taken to compensate for fatigue induced by high alcohol content than in conventional profiling where samples are presented one at a time. However, the effect of alcohol content on panel performance, and subsequently data quality, has not specifically been explored in literature.

Product complexity also complicates sensory evaluation, by leading to mental fatigue amongst panellists and hence poor performance. It has been suggested that a less analytical sensory approach is more suitable to complex samples than intensity scaling, based on the argument that the overall odour perception of complex products cannot be accurately broken down into independent, measurable attributes (Lawless, 1999). This often results in a sensory lexicon that is limited to a few descriptors that can be accurately scaled, ignoring many other attributes that may be present but for which panel consensus regarding their definition and intensity could not be achieved (Lawless, 1999). An approach that could deal with this issue would be to allow panellists to indicate, instead of quantify, which terms are important to describe the product by providing them with an extensive list of descriptors relevant to the product category (Campo, Ballester, Langlois, Dacremont, & Valentin, 2010; Lelièvre, Chollet, Abdi, & Valentin, 2008), or allowing them to supply their own words to describe the product, as is done in the Napping® procedure (Perrin et al., 2008). Product complexity has been implicated to impact on the quality of projective mapping results (Nestrud & Lawless, 2010), although this observation was based on fruit and dairy studies. The complex volatile structure of brandy elicits a considerable number of sensory perceivable nuances (Jolly & Hattingh, 2001), which can complicate the projective mapping task by making it more difficult for the panellist to decide which attributes are the most important. To date, there is no information available on the effect of the complexity of alcoholic beverages on panel performance in projective mapping.

As mentioned previously, panellists' assessment of spirit beverages may be influenced by their expectations of the product and the task of evaluating it. Panellists' expectations from information received or inferred prior to product evaluation are some of the many cognitive factors that can influence the way that trained panellists perceive and evaluate products (Lawless & Heymann, 1999; Schifferstein, 1996). Panellists may expect to perceive certain attributes based on verbal cues given by the panel leader, or from non-verbal cues obtained from the product itself. Qualitative judgments made on product information such as nutritional information has shown to also affect quantitative product assessment (Schifferstein, 1996). Confidence in task competency has been linked to motivation and performance of trained sensory panellists (Lund, Jones, & Spanitz, 2009). It is possible that panellists may form expectations around task difficulty based on product type and information; panellists may associate high alcohol beverages with sensory fatigue, mild intoxication and/or increased task difficulty. However, there is no information on whether sensory panellists' performance in the evaluation of spirit products is affected by their knowledge of the products' alcohol content.

Projective mapping studies tend to report on panel performance by comparing panellists with each other, but very few report on the individual panellists' internal consistency. Some researchers have used the panellists' physical projective maps to determine their task competency, i.e., whether samples were placed in straight lines, or scattered across the entire sheet (Nestrud & Lawless, 2008; Pagès, 2005). RV coefficients between data from repeated sessions have been used to determine the repeatability of individuals (Kennedy, 2010). Panellist performance has been evaluated by their ability to position two duplicated samples close to each other on the projective mapping sheet. This is expressed as a ratio of the Euclidean distance between the two duplicate samples and the maximum inter-sample Euclidean distance in the sample set. This ratio has been referred to as the People Performance Index (PPI) (Hopfer & Heymann, 2013) and also as a $D_{r\%}$ ratio (Torri et al., 2013). The drawback of this ratio is that it provides information on the panellists' consistency in positioning only one sample. Procrustes Analysis of Variance (PANOVA) has been used to determine panel consistency by evaluating total consensus variance for overall consistency and product residuals to determine whether there were any specific products that the panellists disagreed on (Nestrud & Lawless, 2008). Although this approach provides information the panel's consistency for all samples, it does not provide a single interpretable measure.

In this study it was of interest to gain better understanding of the sensory, mental and psychological fatigue causing factors that influence panel performance in projective mapping of spirit beverages, and two separate research objectives were identified. The first was to investigate the effects of alcohol content and product complexity, using an experiment design to vary these two factors, on panellist performance in the projective mapping task. The aim of this experiment was to evaluate which of these product characteristics would be the most important risk factor in brandy evaluation. The second objective was to determine to what extent panellists' performance is affected by prior knowledge of the alcohol content of a given sample set. In other words, the objective was to gain insight into the cognitive impact of high alcohol content on panellist performance. With panellist performance being a key concern in this study, a new performance monitoring measure, will be introduced.

2. Methods and materials

2.1. Panellists

The panels that participated in this study consisted of women between the ages of 23 and 60 that are employed as trained sensory panellists at Distell Ltd, South Africa. They were screened for sensory acuity according to the guidelines in Stone and Sidel (1992). The screening test included threshold testing for basic tastes, aroma identification, memory recall for aromas, discrimination ability, intensity ranking and participation in a mock panel situation. The panel was experienced in conventional sensory profiling as well as projective mapping of various types of alcoholic beverages, including brandy. Nine women participated in the study that investigated the effect of product alcohol content and