Food Quality and Preference 44 (2015) 62–69

Contents lists available at ScienceDirect

Food Quality and Preference

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

How many assessors are necessary for the Optimized Descriptive Profile when associated with training?

Andréa Alves Simiqueli [a,*], Valéria Paula Rodrigues Minim [a], Rita de Cássia dos Santos Navarro da Silva [a], Alexandre Navarro da Silva [b], Luis Antonio Minim [a]

[a] Departamento de Tecnologia de Alimentos, Universidade Federal de Viçosa (UFV), 36570-000 Viçosa, Minas Gerais, Brazil
[b] Departamento de Engenharia de Produção e Mecânica, Universidade Federal de Viçosa (UFV), 36570-000 Viçosa, Minas Gerais, Brazil

ARTICLE INFO

Article history:
Received 18 November 2014
Received in revised form 30 March 2015
Accepted 31 March 2015
Available online 4 April 2015

Keywords:
Training
Number of assessors
High precision and quality
Computer simulation

ABSTRACT

The number of assessors composing a descriptive analysis panel directly affects the costs for executing the sensory methodology. For the Optimized Descriptive Profile (ODP) method which uses semi-trained assessors, at least sixteen assessors are necessary to make up the panel, where the criteria magnitude of the experimental error estimate is most robust and demanding for determining the ideal number of assessors. Thus, the inclusion of training may result in reduced random variability in the data (experimental error), and therefore require fewer assessors to obtain reliable results. The present study therefore sought to evaluate the influence of training the panel to determine the ideal number of assessors for the ODP evaluation protocol. The study on determination of the number of assessors was conducted via a computer simulation, using the re-sampling with replacement technique from original data obtained by a panel of 26 trained assessors. A total of 10,000 subgroups were simulated for each number of assessors. The criteria for determining the number of assessors were: obtaining an experimental error less than or equal to the effect verified in the reference methodology (Conventional Profile); size of the effect of the interaction between the formulations and assessors less than or equal to the full panel; discrimination of samples similar to that obtained by the complete panel; and minimum loss of information in the sensory map. The discrimination criterion of the samples showed to be a more robust measure for determining the number of assessors required by the ODP technique when associated with training of the panel, with recommendation of at least eight assessors. Training of the panel had a great influence on data quality, providing a 50% reduction in the number of assessors required for the ODP.

1. Introduction

The number of assessors making up a descriptive analysis panel directly affects the costs of executing the sensory methodology. According to Heymann, Machado, Torri, and Robinson (2012), training a panel composed of few assessors requires less time, money and effort, but this can result in a "false economy" due to the possibility of obtaining "poor" data. Therefore, it is extremely important to determine the optimal number of assessors which allows for reducing the size of the panel, without loss of information on the sensory profile of foods.

Some researchers have proposed methods to determine the optimal number of assessors based on mathematical criteria for the traditional descriptive techniques. For example, re-sampling techniques with experimental data was used by King, Arents, and Moreau (1995), Pagès and Périnel (2003), Gacula and Rutenbeck (2006) and Heymann et al. (2012) and concept "sample size and power of analysis" was used by Silva, Minim, Silva, & Minim, 2014. Different from the concept "sample size and power of analysis", the re-sampling procedure allows for obtaining a large number of random subsets from a different number of assessors evaluating the original data. This would be difficult to achieve by repeating the experiments due to cost, time and resource limitations. Additionally, resampling approaches also allow for estimating the stability indices of the complete data set.

With regards to new descriptive sensory methods, calculating the number of judges has been little explored in literature. Some recent studies have been conducted for sorting task and check-all-that-apply (CATA) methods. Faye et al. (2006), Blancher, Clavier, Egoroff, Duineveld, and Parcon (2012) proposed a resampling approach for studying the stability of a sorting map.

* Corresponding author.
E-mail addresses: andrea.simiqueli@ufv.br (A.A. Simiqueli), vprm@ufv.br (V.P.R. Minim), rita.navarro@ufv.br (Rita de Cássia dos Santos Navarro da Silva), alexandre.navarro@ufv.br (A.N.d. Silva), lminim@ufv.br (L.A. Minim).

http://dx.doi.org/10.1016/j.foodqual.2015.03.019
0950-3293/© 2015 Published by Elsevier Ltd.

Blancher et al. (2012) simulated repeated experiments by sampling repeatedly from the population of interest. Ares, Tárrega, Izquierdo, and Jaeger (2014) evaluated the influence of the number of consumers on the stability of sensory spaces obtained from CATA questions using a resampling approach.

In most studies, the authors recommend different panel sizes when the tests are conducted with trained panelists or consumers. For example, for the Flash Profile method (Dairou & Sieffermann, 2002; Delarue & Sieffermann, 2004) the number of trained assessors ranges from 6 to 12 (Albert, Varela, Salvador, Hough, & Fiszman, 2011; Moussaoui & Varela, 2010) and untrained assessors from 20 to 40 (Lassoued, Delarue, Launay, & Michon, 2008; Moussaoui & Varela, 2010; Veinand, Godefroy, Adam, & Delarue, 2011). The Napping methodology (Pagès, 2005) considers a panel ranging from 9 to 15 trained panelists (Perrin et al., 2008; Risvik, McEwan, & Rodbotten, 1997) and from 15 to 50 for consumers (Albert et al., 2011; Ares, Deliza, Barreiro, Gimenéz, & Gámbaro, 2010; Nestrud & Lawless, 2008). The Free Sorting Task procedure (Cartier et al., 2006) recommends a panel containing 9–15 trained evaluators (Chollet & Valentin, 2001) and 20 to 50 consumers (Ares, Bruzzone, & Giménez, 2011; Cartier et al., 2006; Moussaoui & Varela, 2010). However, criteria for determining the number of assessors needed are not shown.

All of these methods only take into account the level of sensory acuity of the panel to recommend the optimal number of evaluators. Therefore, even without a prior study to accurately determine the number of assessors, the authors affirm that training may be an alternative to improve the quality of results in terms of accuracy and consistency, therefore it would require fewer assessors to obtain reliable data (Ares et al., 2011; Lelièvre, Chollet, Abdi, & Valentin, 2008; Moussaoui & Varela, 2010).

Renowned researchers in the field of sensory science have affirmed that a panel of trained assessors is more demanding and consistent in their assessment than untrained assessors. Furthermore, increased training of the descriptive sensory panel allows for obtaining more detailed, accurate, reproducible and stable results over time (Cardello et al., 1982; Clapperton & Piggott, 1979; Perón & Allen, 1988; Solomon, 1990; Wolters & Allchurch, 1994; Guerrero, Gou, & Arnau, 1997; Chambers, Allison, & Chambers, 2004; Labbe, Rytz, & Hugi, 2004; Lelièvre et al., 2008; Moussaoui & Varela, 2010; Ares et al., 2011).

According to Labbe et al. (2004), when evaluating the effect of training on sensory characterization of soluble coffee, it was concluded that training results in various advantages to the panel. For example, it allows for greater familiarization with the descriptive terms, increases the confidence of the assessors evaluating the samples and consequently improved the discrimination ability of both the panel as a whole (global) and the assessors individually. Rey-salgueiro, Gosálbez-García, Pérez-Lamela, Simal-Gándara, and Falqué-López (2013) evaluated the sensory characteristics of mineral water and concluded that training improved the ability of assessors to distinguish the sensory attributes. This fact showed that the proposed training was effective to develop and improve their sensory skills, and consequently reduce variability in the evaluations.

On the another hand, the Optimized Descriptive Profile (ODP) methodology, proposed by Silva et al. (2012), seeks to meet the current demand for rapid methods and at the same time provide quantitative information on the sensory attributes present in foods. In this methodology, it is proposed that semi-trained assessors evaluate samples according to the attribute-by-attribute protocol (Ishii, Chang, & O''Mahony, 2007), where all the samples are analyzed simultaneously for only one attribute at a time. Additionally, in the ODP the reference materials are presented together with the samples at the time of evaluation, thus facilitating the allocation of attribute intensity on the unstructured scale.

In the works performed with the ODP (Silva, Minim, Silva, Peternelli, & Minim, 2014; Silva et al., 2012, 2013), the authors confirmed that the methodology allowed for acquiring the sensory profile of foods with a high degree of similarity to the profile obtained by evaluation with trained panelists, using the Conventional Profile methodology. However, a great variability was observed in the responses of semi-trained assessors considering the different evaluation repetitions (measured by random variance – mean square error), suggesting poor precision of the results.

For the Optimized Descriptive Profile (ODP) technique, considering semi-trained assessors, a study to determine the optimal number of assessors was performed (Silva, Minim, Silva, Peternelli, et al., 2014) which was conducted via computer simulation using the experimental data re-sampling technique. In this study the need for at least sixteen assessors to compose the panel was verified. The authors found that the criterion which required the greatest number of assessors was the criterion of the estimated experimental error, which should be less than the value found for the reference method (Conventional Profile). According to the authors, because this descriptive technique requires a low level of training of the panel, the assessment of this criterion is extremely important because a higher residual random variation can normally be observed. This highlights the importance of a new study to determine the number of assessors when this technique (ODP) is associated with training of the panel of assessors.

In this sense, the objective of the present study was to evaluate the influence of panel training in determining the number of assessors for the ODP assessment methodology, without loss in quality of the sensory profile of foods.

2. Materials and methods

Study of the effect of training on the number of assessors needed to compose the panel of assessors was conducted by computer simulation, specifically using the data re-sampling technique from a full panel containing 26 assessors, as performed by Silva, Minim, Silva, Peternelli, et al. (2014).

2.1. Stimuli

Chocolates produced from different mixtures of milk, bittersweet and bitter chocolate (Table 1) were used as food matrices for sensory characterization. The test formulations were defined by preliminary triangular tests, in which the samples presented a small magnitude of difference ($p < 0.10$) in the sensory characterizations, showing proportion of distinguishers (Pd) less than 0.29 in the guessing model, equivalent to d0 equal to 1.6 in the Thurstonian model. Probability of Type II error was established at 0.10. Each test chocolate unit was approximately 30 mm in diameter and 20 mm in height.

Table 1
Compositions of the chocolates in relation to the type and quantity of chocolate used in processing.

Formulations*	Type and quantity (g) of chocolate		
	Milk	Semisweet	Bittersweet
F1	9.6	2.4	–
F2	9.6	–	2.4
F3	–	12.0	–
F4	6.0	–	6.0

* Each unit contains 12 g of chocolate.