Food Research International 76 (2015) 269–276

Contents lists available at ScienceDirect

Food Research International

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

Influence of information, gender and emotional status for detecting small differences in the acceptance of a new healthy beverage

Diego Rocha Parra [a,b], Mara Galmarini [a,b], Jorge Chirife [a], María Clara Zamora [a,b,*]

[a] Facultad de Ciencias Agrarias, Pontificia Universidad Católica Argentina (UCA), R. Freire 183, Ciudad de Buenos Aires 1426AVC, Argentina
[b] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Ciudad de Buenos Aires, Argentina

ARTICLE INFO

Article history:
Received 8 September 2014
Accepted 15 December 2014
Available online 20 December 2014

Keywords:
Emotions
Health
Alcohol
Drink powder
Wine

ABSTRACT

Moderate wine consumption has been recommended as a health benefits practice, although alcohol content is sometimes the main factor for rejecting its consumption. This study focuses on the development of a fruit flavored powder beverage, having the same polyphenols of wine but without the alcohol content. The specific aim of the present work was to evaluate if the factors gender and information regarding health benefits could have some influence on consumer decisions while evaluating preference of samples with small formulation differences. In addition, emotional status and comments about likes and dislikes of the beverages were also investigated. For this purpose, one hundred and forty-four consumers (70 females and 74 males; aged 19 to 35 years old, M = 23.3, SD = 4.0) gave their degree of acceptance for four beverages. Each drink contained different levels of a powder concentrate of red wine (35 and 40 g/L) and sweetener (4 and 5 g/L). The participants estimated first by a 9-point category scale and, then by Visual Analogue Scales (VAS) the following attributes: acceptance, appearance, aroma, sweetness, flavor, acidity and astringency. Having two scales allowed the study to double check consumer evaluations. Results showed that the acceptance scores among formulations only showed significant differences with the 9-point category scale. The cross study presented the highest divergences by gender factor. Males gave similar or higher values when confirming the evaluation using the second scale. Conversely, females gave similar or lower values in the same conditions. Thus, the double scale strategy highlighted the differences of the target population. Even though information of health benefits did not increase the acceptance of the new beverage, it had a different impact between males and females. The emotions chosen by the consumers to describe their feelings about the new beverage helped to explain the acceptance data.

1. Introduction

The health benefits of phenolic compounds in red wine have been extensively verified. Red wine is a natural source of antioxidants, which may protect the body from oxidative disorders and reduce the risk of coronary heart disease (Renaud & de Lorgeril, 1992; Klatsky, 2009). However, wine consumption has some clear drawbacks in relation to alcohol ingestion such as alcohol related diseases affecting liver and other digestive organs. In addition, certain sectors of the population are prevented from consuming wine due to ethnic, social, or religious reasons (Midgley, 1971).

In previous works Sanchez, Baeza, Galmarini, Zamora and Chirife (2013), and Galmarini et al. (2013) have reported the freeze dried encapsulation of the red wine's dry extract in an amorphous carbohydrate matrix. Water and almost all alcohol from wine were removed during freeze drying leading to an amorphous glassy microstructure entrapping the wine phenolics as well as other components of the dry extract. The free flowing powder obtained after milling was arbitrarily named "wine powder" and was proposed to be added to other powdered drinks as a source of enrichment with wine phenolics.

This study focuses on the development of a powder beverage using this "wine powder" as the main ingredient keeping the same polyphenols of wine but without, the alcohol content. On the basis of these preliminary observations, the new beverage was formulated according to two factors, namely the amount of "wine powder" and the level of sweetener; moreover the formulations selected for the current study only had slight differences among these variables. Consequently, multiple methodologies were searched to enhance the detection of such small differences in the acceptance of this drink.

One of these strategies was to use a second scale to double check consumer evaluations. A large number of studies have been conducted comparing the use of different scaling methods (Lawless & Heymann, 2010), because scaling data is often used to identify differences between products. Some methods, like category scales, line scales and magnitude estimation, can be applied to both intensity and hedonic (like–dislike) responses. For hedonic scaling, one might want the method to correspond to other behaviors such as choice or consumption (Lawless, Popper & Kroll, 2010). A related criterion is the ability of the scale to

* Corresponding author at: Facultad de Ciencias Agrarias, Pontificia Universidad Católica Argentina (UCA), R. Freire 183, Ciudad de Buenos Aires 1426AVC, Argentina. Tel.: +54 11 45522711x2721.
E-mail address: zamoramariacl@gmail.com (M.C. Zamora).

http://dx.doi.org/10.1016/j.foodres.2014.12.021
0963-9969/

identify or uncover consumer segments with different preferences (Villanueva & Da Silva, 2009).

In regards to consumer segments with different preferences, specific differences exist in the wine consumption behavior and sensory preferences between males and females. Generally speaking, females drink less wine than males but they do however consume a higher amount of white wine than their male counterparts. Moreover, women showed a preference for a sweeter wine style at a young age, and reported a strong preference for medium body style wines instead of light and full-bodied wines. From a sensory preference viewpoint, fruit tastes and aromas are by far the most important, especially among females (Bruwer, Saliba & Miller, 2011). Since these differences exist for wine, one of the objectives of the present study was to investigate if they might be transferred to the new wine-based beverage.

Concerning polyphenol-rich beverages, disclosing information about their health benefits could have a big impact on consumers' evaluations (Jaeger, Axten, Wohlers & Sun-Waterhouse, 2009). The strategy of providing health-related information can contribute to a more positive evaluation of some products, particularly in relation to purchase intention (Tuorila & Cardello, 2002; Casati et al., 2012). Therefore, in the current paper we analyzed the influence of health advantages on the new beverage's potential.

Consumer expectations for a new food or beverage may also be explored taking into account the emotions that these products generate. It is generally acknowledged that human eating choices are affected by and associated with emotions (Desmet & Schifferstein, 2008; Hanoch, Wood & Rice, 2007). Manzocco, Rumignani and Lagazio (2013) studied the emotional response to fruit salads with different visual quality levels by analyzing fruit browning, microbiological count, and overall visual acceptability. In the current paper, a preliminary approximation was made to correlate the acceptance level with the consumer's identification of their emotional status in relation to detecting small differences in acceptance.

The main objective of this work was to detect changes in acceptance among four different formulations of a new fruit flavored powder drink using a concentrate of red wine polyphenols ("wine powder") as one of its main ingredients. The hypothesis to be tested was whether health information, gender and scaling methods could contribute to a more discriminative evaluation of the beverage acceptance. Moreover, which sensory attributes contributed to consumer liking/disliking and the emotional status level evoked by consumers after tasting the beverage were also investigated. In addition, consumers' attitude for a novel product was evaluated by comments and emotional status, in regards to gender.

2. Materials and methods

2.1. Drink powder formulation

The "wine powder" which constituted the base of the healthy beverage was obtained by freeze drying the wine according to a method previously described by Sanchez, Baeza, Galmarini, Zamora and Chirife (2013) and Galmarini et al. (2013). The wine used was *Cabernet Sauvignon*, "Postales del Fin del Mundo" (*Bodega Fin del Mundo*) from a cold climate wine growing region (Neuquén province, Patagonia region, Argentina) with an original alcohol content of 13.7% in average and a pH of 3.8 (vintage 2013, aged in oak). Carbohydrates used as drying aids for encapsulation were a mixture of Maltodextrin (Dextrose Equivalent 10 (MD10) provided by Productos de Maíz, S.A., Argentina) and Arabic gum (provided by Gelfix, Argentina). A solution of wine + carbohydrate was freeze-dried at room temperature in a FIC Ll-I-E300-CRT freeze dryer (Rificor, Argentina). The powder so obtained had 3% moisture content and about 1400 mg polyphenols/100 g.

The maximum amount of wine powder to be used in a liter of reconstituted beverage was 35–40 g. This was determined by making a compromise between the total powder content in commercial powder beverages and the concentration of phenols. It was expected to obtain, per serving, the same amount of polyphenols as in a glass of red wine.

Preliminary studies – performed with 40 consumers – were made to adjust the level of powder, raspberry aroma (Symrise, Argentina), thickener (Guar gum, Gelfix, Argentina) and a commercial diet sweetener (cyclamate 5700 mg/100 g; saccharin 2000 mg/100 g) in the formulations of the drink powder. The critical points observed by the consumers in these formulations were the degree of sweetness and, the powder content which was perceived as differences in viscosity. Therefore, a 2^k full factorial design with two factors, wine powder level and commercial sweetener level was applied. The formulations selected for the present work were the following four combinations (for 1 L of reconstituted drink powder): 35 g of wine powder + 4 g of commercial sweetener (the sample hereon called 35-4), 40 g of wine powder + 4 g of commercial sweetener (hereon 40-4); 35 g of wine powder + 5 g of commercial sweetener (35-5) and 40 g of wine powder + 5 g of commercial sweetener (40-5). All the formulations had the same concentration of raspberry aroma and thickener.

2.2. Quantitative descriptive analysis

The sensory profiling of the four samples was generated by the quantitative descriptive analysis (QDA) according to methodology proposed by Stone and Sidel (2004). This technique has been adopted to analyze several food products, and its principles and steps are well established (Morais, Cruz, Faria & Bolini, 2014; Cadena et al., 2013).

The sensory panel consisted of 10 female assessors (20–22-years old), students of Facultad de Ciencias Agrarias, Pontificia Universidad Católica Argentina. All assessors were experienced in sensory analysis. They were trained in descriptive wine flavors (8 h). During training period, judges performed the following tasks: (1) taste and odor identification using standard solutions (Table 1); (2) matching of aromas; (3) attribute generation of the four wine powder samples with the aid of standards and (4) use of unstructured scales. A total of 12 descriptive terms were defined by consensus among the assessors.

Table 1
Attribute definitions and reference standards used for descriptive sensory analysis of the wine powder beverage.

Attribute	Definition and reference standard
Acidity	Taste sensation stimulated by acids contained in citric fruits such as lemon. Citric acid 0.15% (w/vol.)
Sweetness	Taste sensation stimulated by sugars such as sucrose and other substances such as saccharin. Sucrose 5%
Bitterness	Taste sensation associated with caffeine in a water solution. Caffeine 0.15%.
Astringency	A combination of shrinking, puckering, drying, and roughening sensations in the mouth caused by substances such as phenolic compounds contained in infusions including tea, mate and wine. Tea bag soaked in hot water for 1 h.
Body/viscosity	Thickness, consistency or density in the mouth for example the sensation produced by a light cream. Guar gum 0.25%.
Alcohol (odor)	Odor associated with ethanol (Ethanol 1% in water, Soria, Bs. As., Argentina)
Raspberry (odor)	Aroma associated with fresh raspberry (Symrise, Argentina; 0.02% in water)
Yeast (odor)	The aroma of yeast in bakery products. Filter paper soaked in essence of Firmenich, Argentina, placed in a sealed glass flask.
Berry fruits (odor)	Aromatic characteristics of a mixture of fresh berries. Filter paper soaked in essence of Firmenich, Argentina placed in a sealed glass flask
Strawberry (odor)	The aroma of strawberry fresh fruit. Filter paper soaked in essence of Firmenich, Argentina placed in a sealed glass flask
Fermented (odor)	The aroma of fermented beverages. Filter paper soaked in essence of Firmenich, Argentina placed in a sealed glass flask
Astringent aftertaste	Astringency sensation that remains in the mouth after the beverage has been swallowed.