

Sensory optimization of whole grape juice with added yam

ABSTRACT

Due to the possibility of adding yams to beverages, it is believed that the yam added to the whole grape juice will make it even more nutritious by raising the content of vitamins, minerals, and mainly antioxidant compounds, besides possibly obtaining a more creamy juice, i.e., with innovative technological characteristics. Therefore, the present study aimed to evaluate the effect of the addition of different yam concentrations on the sensory characteristics of whole grape juice. Juice formulations were evaluated through acceptance tests with 75 consumers. Two analyses were performed to evaluate the impact of the product health benefits information on the consumer acceptance. Based on the results of the sensory analysis, it can be concluded that it is possible to add up to 15% of yam in the whole grape juice without depreciating its sensory quality. This addition of yam to the juice can contribute favorably with the nutritional value of this beverage and hence with its sensory acceptance by the consumer. It was possible to observe that information and health concern by consumers contributed to increasing the product acceptability, however, the sensory properties are decisive to elaborate a new product.

KEYWORDS: grape juice; health information; yam; beverages.

Amanda Cristina Andrade

andradenut@gmail.com
<http://orcid.org/0000-0002-0166-1009>
Departamento de Nutrição, Universidade Federal de Lavras, Câmpus Lavras, Lavras, Minas Gerais, Brasil.

Jéssica Ferreira Rodrigues

jessica.rodrigues@ifmg.edu.br
<http://orcid.org/0000-0003-0113-4898>
Departamento de Ciências Agrárias, Instituto Federal de Minas Gerais, Câmpus Bambuí, Bambuí, Minas Gerais, Brasil.

João Paulo Lima de Oliveira

joaopaulolimanut@gmail.com
<http://orcid.org/0000-0002-9623-5474>
Departamento de Nutrição, Universidade Federal de Lavras, Câmpus Lavras, Lavras, Minas Gerais, Brasil.

Mariana Mirelle Pereira Natividade

mariana.mirelle@ufia.br
<http://orcid.org/0000-0001-6423-7486>
Departamento de Nutrição, Universidade Federal de Lavras, Câmpus Lavras, Lavras, Minas Gerais, Brasil.

Sabrina Carvalho Bastos

sabrinabastos@ufia.br
<http://orcid.org/0000-0002-3374-2743>
Departamento de Nutrição, Universidade Federal de Lavras, Câmpus Lavras, Lavras, Minas Gerais, Brasil.

INTRODUCTION

The population is now becoming more health conscious, but considering the current fast-paced life, people have been looking for practical, healthy foods, i.e., ready-to-eat or serve. This has led to the popularization of natural fruit juices as a healthier alternative in relation to other beverages and soft drinks with high sugar content (BHARDWAJ *et al.*, 2014).

Natural fruit juices are part of the daily diet of people of different age groups and provide a deep relationship with health due to its nutritional content, functional and therapeutic qualities. Its consumption is associated with the reduction of diseases such as cancer, neurodegenerative and cardiovascular diseases (BHARDWAJ *et al.*, 2014, ZHENG *et al.*, 2017).

Grape is one of the most consumed fruits worldwide due to its sensory properties, commercial availability and reasonable price, besides showing relatively high yield. In this sense, grapes are widely used to obtain several products, including grape juice (GRANATO *et al.*, 2016). Grape juice is one of the primary grape derivatives and can be defined as an unfermented and undiluted beverage, obtained from the edible part of the grape (*Vitis* spp.) through appropriate technological processes (BRASIL, 2018).

Grape juice has becoming relevant because it contains a high amount of bioactive compounds, mainly phenolics, such as anthocyanins, catechins, resveratrol, among others, which have antioxidant properties capable of providing health benefits, including prevention of cardiovascular diseases and cancer (NASSIRI-ASL; HOSSEINZADEH, 2016; HASAN; BAE, 2017),

Changes in eating habits, besides sensory preferences of consumers, have contributed to emerging a new trend related to beverages prepared with fruits and vegetables. The blend of fruits and vegetables can improve sensory properties such as aroma and flavor, besides adding higher nutritional value to beverages. Therefore, the food industries are seeking to develop new juices with vegetables, such as with added yam (BHARDWAJ; PANDEY, 2011).

Yam is a tuber with a good source of nutrients, being rich in vitamin C and thiamine, minerals (K, P, Ca, Mg, Fe and Cu), antioxidant fibers and compounds (phytosterols) (XU; CAI; TOYOKAWA, 2009; FERRARO *et al.*, 2016). Thereby, yam has potentially positive health effects and can increase the antioxidant capacity (AJIBOLA *et al.*, 2001), acting as cardioprotective, anti-inflammatory and lipid metabolism, reducing the triglycerides and improving the cholesterol profile (CHEN *et al.*, 2017; LIU *et al.*, 2016).

Besides providing potential health effects, the addition of yams may contribute with critical technological characteristics in product development due to its high starch content (LIU *et al.*, 2016). According to Pelegrini and Carrasqueira (2008), yam juice is a much-valued product. These same authors prepared a vitamin yam juice and another of pineapple, and found that yam juice was the most preferred after sensory analysis. Martins *et al.* (2011), also obtained good acceptability for a sports drink prepared from the concentrated juice of fruits and vegetables containing yams. This fact suggests that the addition of yams to beverages can improve sensory acceptability and contribute to the product's nutritional value.

Due to the possibility of adding yams to beverages, it is believed that the yam added to the whole grape juice will make it even more nutritious by raising the content of vitamins, minerals, and mainly antioxidant compounds, besides possibly obtaining a more creamy juice, i.e., with innovative technological characteristics. Therefore, the present study aimed to evaluate the effect of the addition of different yam concentrations on the sensory characteristics of whole grape juice.

MATERIALS AND METHODS

SAMPLES

Whole grape juice (Campino®) and yam (*Dioscorea* sp.) were used for the product processing. Raw materials were purchased in city of Lavras (Minas Gerais, Brazil) commerce derived from a single batch.

Juice formulations were determined by preliminary tests, being established ratios of 5%, 10%, 15%, 20% and 25% of yams. According to previous assays, a yam addition greater than 25% mischaracterized the whole grape juice concerning taste, color and texture and therefore levels above this were avoided.

Yam was washed in running water in order to remove the larger soils, sanitized in sodium hypochlorite (NaClO) solution at 200 ppm for 30 min and thereafter washed in running water; afterward, it was peeled, cut in cubes and ground in a blender (Walita®) together with whole grape juice (MARTINS *et al.*, 2011; RODRIGUES *et al.*, 2015), for approximately 4 min until complete yam dissolution. The prepared beverages were submitted to the physical and chemical analyses and were placed in the refrigerator for approximately 2 h for temperature balance. After this period, the sensory tests were performed.

SENSORY ANALYSES

Sensory analyses were performed at the Sensory Analysis Laboratory of the Federal University of Lavras with healthy individuals and without any restriction to the analyzed products. The study was performed according to the Research Ethics Committee on Human Beings of the Federal University of Lavras (CAAE: 34331414.6.0000.5148).

Juice formulations were evaluated through acceptance tests with 75 consumers through SensoMaker software (PINHEIRO; NUNES; VIETORIS, 2013). Two analyses were performed. In the first analysis, the consumers did not obtain any information about the product (ingredients, benefits, among others). However, in the second test, previously to sensory analysis, a pamphlet was shown to each tester informing the ingredients and benefits of whole grape juice with added yam, such as sugar-free, water, preservatives and colorings, and the presence of fibers, minerals and antioxidants, besides their potential health benefits (prevention of chronic diseases, such as cardiovascular disease, improvement of cholesterol profile, reduction of triglycerides and other diseases associated with oxidative stress).

Four attributes were evaluated: appearance, aroma, taste and overall impression. To this end, the tasters were instructed to taste the samples from left to the right and indicate how much they liked or disliked each one, using a

structured 9-point hedonic scale, which ranged from "1-dislike extremely" to "9-like extremely" (RODRIGUES *et al.*, 2015; MININ, 2010), and a structured five-point Likert scale, which ranged from 1 "certainly would not buy" to 5 "buy certainly" for the purchase intention.

In both sensory tests, whole grape juice samples (30 ml) with yam were served to the tasters. They were served in disposable white plastic cups, identified by three-digit numbers arranged in a balanced order, according to Wakeling and McFie (1995). Evaluations used white light. The tests were performed in individual cabins, at room temperature, with adequate lighting and without the interference of odors and noise (BOWLES; DEMIATE, 2006).

STATISTICAL ANALYSIS

Sensory results were evaluated through analysis of variance and Tukey test, and through internal preference mapping, using Sensomaker software (PINHEIRO; NUNES; VIETORIS, 2013).

RESULTS AND DISCUSSION

SENSORY ANALYSES

The results of acceptance tests (with and without information on the product benefits) were evaluated by three-way preference mapping (Figure 1).

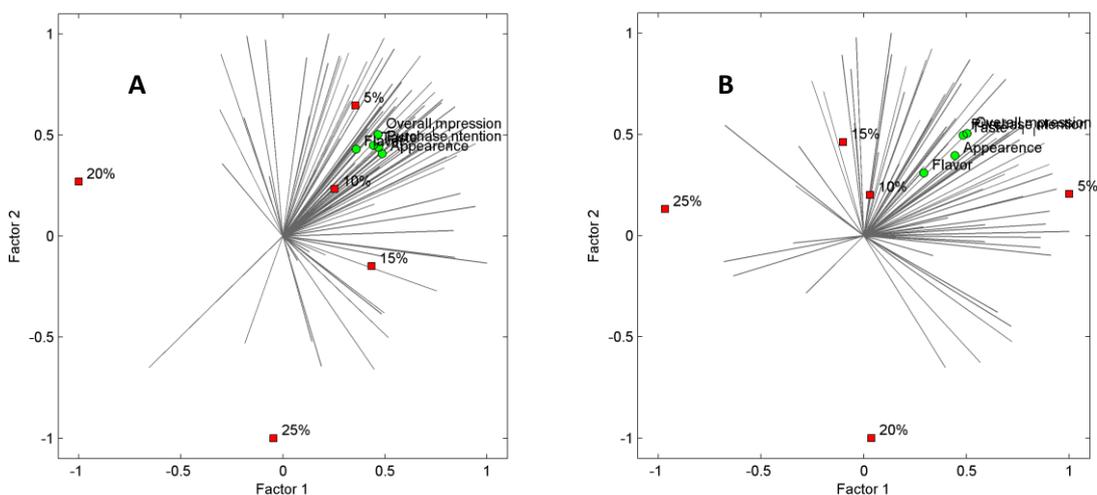


Figure 1. Three-way preference maps obtained for the formulations of grape juice with added yam evaluated without (A) and with prior information (B) regarding the evaluated product.

Based on the preference maps, it is observed that the tasters preferred the samples added with 5, 10 and 15% yam in both evaluations. Moreover, all the evaluated sensory properties (taste, aroma, appearance and overall impression), as well as the purchase intention, contributed to their greater acceptance. Considering this and considering that the properties that constitute the sensory

quality are integrated into the brain, as an overall impression quality (OLIVEIRA *et al.*, 2010; RODRIGUES *et al.*, 2014), this property was considered to evaluate the best concentrations of added yam, determined according to the preference of tasters.

The acceptance averages for the overall impression obtained among the samples within each of the evaluations and between the evaluations (with and without information on the product benefits are presented in (Table 1). The analysis of variance indicated that there was a significant difference ($p \leq 0.05$) among the samples in both evaluations and between the two evaluations.

Table 1. Acceptance averages for the overall impression obtained among the samples within each of the evaluations and between the evaluations (with and without information on the product benefits).

Samples	Overall impression mean	
	Evaluation without information about the product benefits	Evaluation with prior information about the product benefits
5% yam	7.07 ± 1.65 aA	7.32 ± 1.55 aA
10% yam	6.43 ± 1.85 bA	6.59 ± 1.50 bA
15% yam	6.40 ± 1.70 bA	6.85 ± 1.61 abA
20% yam	5.16 ± 2.10 cA	5.31 ± 1.78 cA
25% yam	4.84 ± 2.24 cA	5.81 ± 1.83 cB

NOTE: Equal lowercase letters on the same column indicate that the samples do not differ statistically by Tukey test; Equal capital letters on the same row indicate that the evaluations (with and without information on the product benefits) do not differ statistically among themselves by Tukey test.

In Table 1 is shown that in both evaluations (without and with prior information on the product benefits), the formulation of grape juice added with 5% yam obtained a sensory acceptance greater than the others, with scores between 7-like moderately and 8-like very much, followed by samples with 10 and 15% of yams that did not statistically differ among themselves and obtained scores between 6-like slightly and 7-like moderately, which also characterize good acceptance of these products. Juices with 20 and 25% of yam were the least preferred, with scores between 5-neither like nor dislike and 6-like slightly.

In a similar study, Rodrigues *et al.*, (2015), found that the increased yam concentration in passion fruit juice reduced its acceptance; thus, it was possible to add up to 10% of yam in passion fruit juice without worsening the overall impression. However, the samples most accepted by consumers contained the highest sugar concentrations (6 to 8%), showing that the sweet taste contributed to improving the beverage acceptance.

Therefore, it was verified that the consumers more accepted the whole grape juice with added yam, is possible to add 5% more of yam concerning the passion fruit juice in the study of Rodrigues *et al.* (2015) without changing the overall impression. Another observed point was that the whole grape juice used in the

present study does not show added sugar as passion fruit juice did. Nevertheless, a greater acceptance was obtained, demonstrating that the juice flavor can influence the amount of added yam.

Yam is food with high nutritional value, rich in nutrients, fiber, antioxidant compounds, and starch, favoring its addition in several beverages to improve both the sensory properties as nutritional aspects (XU *et al.*, 2009; FERRARO *et al.*, 2016). Thus, the beverage acceptance could be promoted by reporting its benefits to the consumers.

Regarding the effect of information on the product's sensory acceptance, it is observed that the knowledge about the benefits of the yam addition to whole grape juice positively influenced its acceptance when added at a higher concentration of yam. This was observed for formulation E, with 25% of yam, which obtained a statistically average score (between 5-neither like nor dislike and 6-like slightly) higher to that obtained in sensory analysis without prior information (score between 4-dislike slightly and 5-neither like nor dislike) of the product, taking this formulation to the acceptance region.

According to Fernqvist and Ekelund (2014), information on health benefits in products can be an influential factor in consumers' choice and sensory perception. In the research performed by Minim (2010), health information increased the acceptance of exotic fruit juices. In the case of Carrilho *et al.* (2012), the information did not positively influence the sensory characteristics of cookies. Therefore, health information may affect acceptance or not, but the result depends mainly on the product sensory properties. Thereby, the flavor greatly influences the consumer choice.

Therefore, it was possible to observe that information and health concern by consumers contributed to increasing the product acceptability; however, the sensory properties are decisive to elaborate a new product. Taking into consideration the hedonic values obtained in the two sections, the addition of 15% of yam was the best concentration.

CONCLUSIONS

Based on the results of the sensory analysis, it can be concluded that it is possible to add up to 15% of yam in the whole grape juice without depreciating its sensory quality. This addition of yam to the juice can contribute favorably with the nutritional value of this beverage and hence with its sensory acceptance by the consumer.

Otimização sensorial de suco de uva integral com adição de inhame

RESUMO

Devido à possibilidade de adicionar inhame às bebidas, acredita-se que o inhame adicionado ao suco de uva integral o torne ainda mais nutritivo, aumentando o conteúdo de vitaminas, minerais e principalmente compostos antioxidantes, além de obter um suco mais cremoso, isto é, com características tecnológicas inovadoras. Portanto, o presente estudo teve como objetivo avaliar o efeito da adição de diferentes concentrações de inhame nas características sensoriais do suco de uva integral. As formulações de suco foram avaliadas através de testes de aceitação com 75 consumidores. Duas análises foram realizadas para avaliar o impacto das informações de benefícios de saúde do produto na aceitação do consumidor. Com base nos resultados da análise sensorial, pode-se concluir que é possível adicionar até 15% de inhame em todo o suco de uva sem depreciar sua qualidade sensorial. Esta adição de inhame ao suco pode contribuir favoravelmente com o valor nutricional dessa bebida e, portanto, com sua aceitação sensorial pelo consumidor. Foi possível observar que as informações e preocupações com a saúde dos consumidores contribuíram para aumentar a aceitabilidade do produto, no entanto, as propriedades sensoriais são decisivas para a elaboração de um novo produto.

PALAVRAS-CHAVE: suco de uva; informação de saúde; inhame; bebidas.

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Correspondência:

João Paulo Lima de Oliveira

Departamento de Nutrição, Universidade Federal de Lavras, Câmpus Lavras, Lavras, Minas Gerais, Brasil.

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