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Sensory evaluation of commercial samples of orange flavor refreshment powder

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ABSTRACT
Powdered soft drinks are low-cost products, being used by more than 54% of Brazilian homes and, generally, consumed after dilution in water. The objective of this word was to carry out a sensory evaluation of orange flavor refreshment powder to analyze the attributes of appearance, aroma, flavor, texture, overall impression, purchase intention, ideal sweet taste and ideal orange flavor, as well as the intention to purchase of samples. To perform the procedure, six commercial samples of orange-flavored refreshment powder from different commercial brands were used by 120 consumers. The results obtained showed that sample D, followed by sample E, indicated greater acceptability for the attributes evaluated, greater frequency of responses for positive intention to purchase. Sample F followed by sample C was the one with the lowest acceptability and highest frequency of negative intention to purchase. Samples E and D were closer to the ideal for sweet taste and orange flavor, respectively.

Keywords: Buy intention, Ideal test, Internal preference map.

1 INTRODUCTION

The powders for the preparation of soft drinks, are already part of the day-to-day of the Brazilian consumer, due to its ease of preparation, its yield and low cost when compared to ready drinks, such as soft drinks and box juices, making it more affordable economically, especially to low-income families (Inmetro, 1999). According to the legislation on beverages, the powder for

refreshment orange flavor must contain at least thirty percent by volume of natural juice (Brasil, 2009). In the period from February to March 2004, approximately 299 million liters of powder were consumed for refreshment, with the orange flavor being the most sought after in purchases for families (Caleguer et al., 2006).

Solid preparations for refreshment have an annual per capita consumption of 16 liters and are used in more than 54% of Brazilian households. According to a survey of eating habits conducted in Brazil, powders for refreshment are considered items of the basic basket and constitute an economic alternative to ready juices and soft drinks. (Silva et al, 2005)

The Brazilian Association of Technical Standards (ABNT, 1993) defines Sensory Analysis as the scientific discipline used to analyze, measure and interpret reactions of the characteristics of food and materials as they are perceived by the senses of sight, smell, taste, touch and hearing (Teixeira, 2009). In this analysis, affective tests that deal directly with the consumer's opinion about a product were performed, through the evaluation of preference and acceptability, analyzing parameters such as intention to purchase the product, sweet taste and orange taste (Dutcosky, 2011; Yang, Lee, 2019).

The acceptance test reports the willingness that the consumer has to acquire the product tested, it can vary according to the culture of each one and standard of living. The set of some factors, such as price, directly influences the acceptance or not of the product by consumers (Teixeira, 2009). The purchase intention is influenced by the price, convenience, marketing and sensory characteristics of the sample, generating from these factors a certain purchase decision (Walter et al. 2010).

The preference map shows graphically, the differences in acceptance obtained from the sample in question, allowing the identification of the preferences of each consumer with the sample, as well as the identification of the same. In the present work we have an internal preference map, in which the analysis of acceptance and preference data obtained from the affective tests is performed (Behrens; Silva; Wakeling, 1999).

The objective of this work was to evaluate the sweet taste and the orange flavor by the ideal test, purchase intention and acceptability test of different attributes for commercial samples of powder for refreshment, orange flavor.

2 MATERIAL AND METHODS

Six brands of powder for orange refreshment were evaluated, acquired in supermarkets in the city of Sumaré - SP and Itapira - SP, whose respective list of ingredients is described in table 1.

Table 1 - List of ingredients in the respective samples

Brand	Ingredients List
The	Sugar, maltodextrin, dehydrated orange juice, vitamin C, vitamin D, citric acid acidulant, sweeteners: aspartame (27 mg/100 ml), sodium cyclamate (21 mg/100 ml), acesulfame potassium (4.4 mg/100 ml), sodium saccharin (1.6 mg/100 ml), antihumectants: tricalcium phosphate and silicon dioxide, acidity regulator sodium citrate, thickeners: guar gum and xanthan gum, Flavoring, dyes: titanium dioxide, tartrazine and twilight yellow FCF and sparkling chilaia extract. (*) addition of vitamin D and antihumectant silicon dioxide
B	Sugar, dehydrated orange pulp, ascorbic acid (vitamin C), citric acid acidulant, acidity regulator sodium citrate, sweeteners: aspartame, sodium cyclamate, acesulfame potassium and saccharin sodium, thickeners: xanthan gum and guar gum, flavouring, antihumectant silicon dioxide, inorganic colour titanium dioxide and artificial colours: twilight yellow FCF and tartrazine
C	Maltodextrin, dehydrated orange juice*, citric acid acidulant, acidity regulator sodium citrate, antihumectant tricalcium phosphate, flavouring flavouring identical to natural orange, artificial sweeteners (per 100 ml: aspartame: 34.9 mg, acesulfame potassium: 3.9 mg), stabilisers sodium carboxymethylcellulose and xanthan gum, inorganic dye titanium dioxide and artificial colours twilight yellow fcf and tartrazine. *(provides no significant amount of sugar)
D	Sugar, maltodextrin, dehydrated orange juice, vitamin C (ascorbic acid), citric acid acidulant, tricalcium phosphate antihumectant, artificial sweeteners (per 100 ml: aspartame: 33.2 mg, acesulfame potassium: 14.2 mg, advantame: 0.01 mg), flavouring identical to natural orange, xanthan gum stabiliser, inorganic titanium dioxide dye, acidity regulator sodium citrate and artificial colours twilight yellow fcf and tartrazine
And	Sugar, dehydrated orange pulp, vitamin C (ascorbic acid), acidulants (citric acid and malic acid), acidity regulators (sodium citrate and fumaric acid), artificial sweeteners (aspartame (27 mg per 100 ml), acesulfame potassium (8.65 mg per 100 ml) and neotame (0.39 mg per 100 ml)), flavouring, antihumectants (tricalcium phosphate and silicon dioxide), inorganic dye (titanium dioxide), thickeners (carboxymethylcellulose sodium and xanthan gum) and artificial dyes (tartrazine yellow and twilight yellow).
F	Sugar, dehydrated orange juice (1%) and maltodextrin. Contains: citric acid acidulant, tricalcium phosphate antihumectant, flavouring (flavouring identical to the natural orange), acidity regulator sodium citrate, stabilisers xanthan gum and carboxymethylcellulose, antioxidant ascorbic acid, inorganic colour titanium dioxide, artificial sweeteners (sodium cyclamate 30,0 mg/100ml, sodium saccharin 10,0 mg/100 ml, aspartame 5,0 mg/100 ml and acesulfame 2,0 mg/100 ml) and artificial colours: tartrazine yellow and twilight yellow

The samples were valid and were prepared according to the label's guidance, and kept refrigerated (6±2°C) until the moment of analysis.

The sensory analyses were carried out at the Federal Institute of Education, Sciences and Technologies of the South of Minas Gerais - Campus Inconfidentes, containing the presence of 120 consumers, 90 women and 30 men, aged 14 to 50 years, and the disclosure for the tests was made through social networks and verbally. The analysis was carried out in individual booths with white light where each consumer received the test sheets for evaluation of the orange flavor refreshments and a glass with water to clean the palate between the evaluation of the samples.

The samples were offered to consumers in disposable plastic cups with a capacity of 50 mL, containing 25 mL of each of the samples, and coded with random three-digit codes. The samples were served to consumers through presentation in balanced complete blocks (MACFIE et al., 1988).

The six brands were evaluated by the test: acceptance, purchase intention, ideal sweet taste and ideal orange flavor. In the acceptance test, the appearance, aroma, taste, texture and overall impression were evaluated, in which a structured nine-point hedonic scale was used, in which "I liked extremely" and "I disliked extremely" was anchored in the extremes (STONE; SIDEL, 2010). To assess purchase intention, a five-point scale ranging from "would certainly buy" to "certainly would not buy" (MEILGAARD et al., 1999). To assess the sweet taste and the ideal orange flavor, a nine-point scale ranging from "extremely sweeter than ideal" to "extremely less sweet than ideal" and from "extremely larger than ideal orange flavor" to "extremely less than ideal orange flavor" was used, respectively (MEILGAARD et al., 1999).

The results of the attributes evaluated in the acceptance test and in the ideal test were evaluated by Analysis of Variance (ANOVA) and Tukey test at 5% probability using Sensomaker Software developed by Pinheiro et al. (2013), which was also used for the construction of the internal preference map, with the use of the results for global printing of the six commercial brands of powder for orange flavor refreshment evaluated. The frequency distributions of the purchase intention results were represented by a histogram generated by the Excel software.

3 RESULTS AND DISCUSSION

Table 1 shows the averages of the scores that were assigned by consumers for the attributes evaluated in the acceptance test of the powder samples for orange flavor refreshment.

Table 1 – Mean values* of the attributes of the acceptance test of the powder samples for orange flavor refreshment

Samples	Appearance	Aroma	Flavor	Texture	Global Printing
Sample A	6,90 ^{b} ± 1,63	6,78 ^{a,b} ± 1,76	6,87 ^{a} ± 2,04	6,93 ^{a} ± 1,94	6,64 ^{a} ± 1,97
Sample B	4,35 ^{c} ± 2,17	5,26 ^{c} ± 1,87	5,08 ^{b} ± 2,39	5,57 ^{b} ± 1,97	5,08 ^{b} ± 2,11
Sample C	6,77 ^{b} ± 2,08	5,22 ^{c} ± 2,20	4,21 ^{c} ± 2,46	5,39 ^{b} ± 2,15	4,82 ^{b} ± 2,27
Sample D	7,68 ^{a} ± 1,79	7,23 ^{a} ± 1,62	7,02 ^{a} ± 1,86	7,08 ^{a} ± 1,52	6,99 ^{a} ± 1,69
Sample E	7,12 ^{a,b} ± 1,67	6,42 ^{b} ± 1,76	6,49 ^{a} ± 1,97	6,64 ^{a} ± 1,69	6,51 ^{a} ± 1,80
Sample F	6,68 ^{b} ± 1,78	5,33 ^{c} ± 1,75	4,24 ^{c} ± 1,93	5.00 ^{b} ± 2.14	4.87 ^{b} ± 1.97

*means followed by the same letter, in the same column, do not differ from each other at $p > 0.05$ by the Tukey Test.

According to the data presented in Table 1, sample D was the most accepted for the attribute appearance, not differing ($p>0.05$) from sample E, while the least accepted sample for this attribute was sample B. As for the attribute aroma, the highest acceptability was presented by sample D, which did not differ statistically ($p>0.05$) from sample A, and samples C, B and F were the least accepted for this attribute.

Regarding the flavor attribute, samples A, D and E presented higher mean scores while samples

C and F were the least accepted. Samples A, D and E were the most accepted for the texture and global impression attributes, while samples B, C and F were the least accepted. In a study conducted by Tan et al. (2020) they indicated that the orange-flavored powdered soft drinks evaluated obtained averages for the different attributes evaluated, which were between the terms "slightly" and "I liked it a lot".

Table 2 shows the mean values and standard deviation for the ideal test for the sweet flavor and the ideal orange flavor

Table 2- Mean values* of the ideal test attributes for sweet taste and orange flavor of the powder samples for orange flavor refreshment

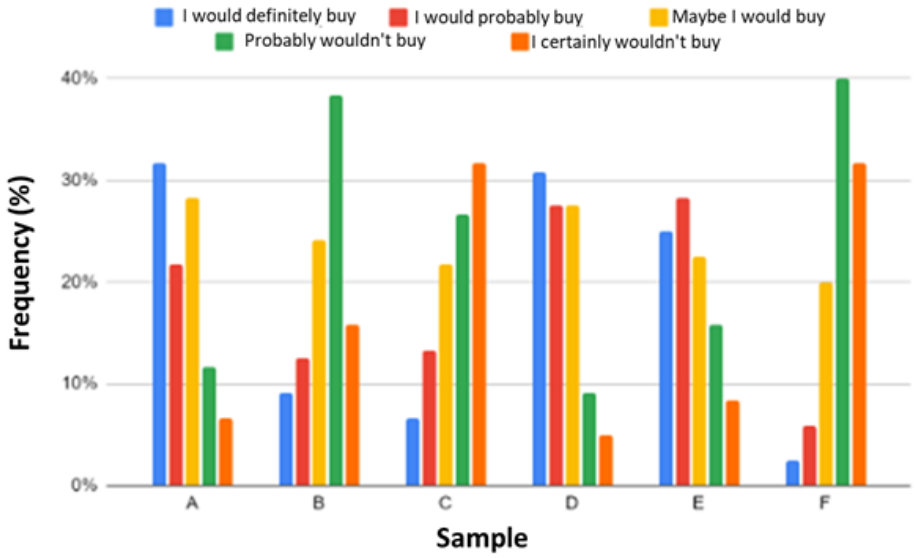
Samples	Sweet taste	Orange flavor
Sample A	0.37 ^{a,b} ± 1.50	-0.18 ^{to} ± 1.48
Sample B	0.34 ^{a,b} ± 2.21	-0.87 ^{b} ± 2.19
Sample C	-1,60 ^{c} ± 1,73	-1,60 ^{c} ± 1,88
Sample D	0,84 ^{a} ± 1,57	-0,10a ± 1,53
Sample E	0,00 ^{b} ± 1,60	-0,41^{a,b} ± 1,69
Sample F	-1.16^{c} ± 1.96	-2.06c ± 1.64

*means followed by the same letter in the same column do not differ at p > 0.05 by the Tukey Test

For the sweet taste attribute, sample E presented a mean equivalent to the ideal of the scale used, not differing statistically from samples A and B while samples C and F were further away from the ideal point of the scale for sweetness. For the orange flavor attribute, the sample that came closest, in average terms, to what was considered ideal by the test scale was sample D, not differing statistically from sample A and E, while sample C was more distant from the ideality for the orange flavor.

The Figure 1 represents the frequency of responses to purchase intent in the different samples of orange powdered soft drinks.

Figure 1 - Frequency distribution of purchase intention responses of powder samples for orange flavor refreshment.



According to the results obtained, sample D presented higher positive purchase intentions when observing the response frequencies for "Would certainly buy" and "Probably would buy", totaling 57.5%. The indecision in the purchase intention represented by the term "maybe I would buy" obtained a higher frequency of responses for sample A (28%). The notes with the highest negative purchase intention represented by the terms "certainly would not buy" and "probably would not buy" were presented by sample F, which totaled 71%. According to a study conducted by Tan et al. (2020), the sensory characteristics of powders for soft drinks such as taste, appearance and aroma are essential in the purchase decision of consumers.

The internal preference map allows you to clearly and objectively visualize the acceptance of a given sample of powdered soft drink in relation to the overall impression of consumers. Figure 2 shows the internal preference map of the commercial brands of orange flavor powder evaluated in this work.

Figure 2 - Internal preference map for orange beverage powder samples

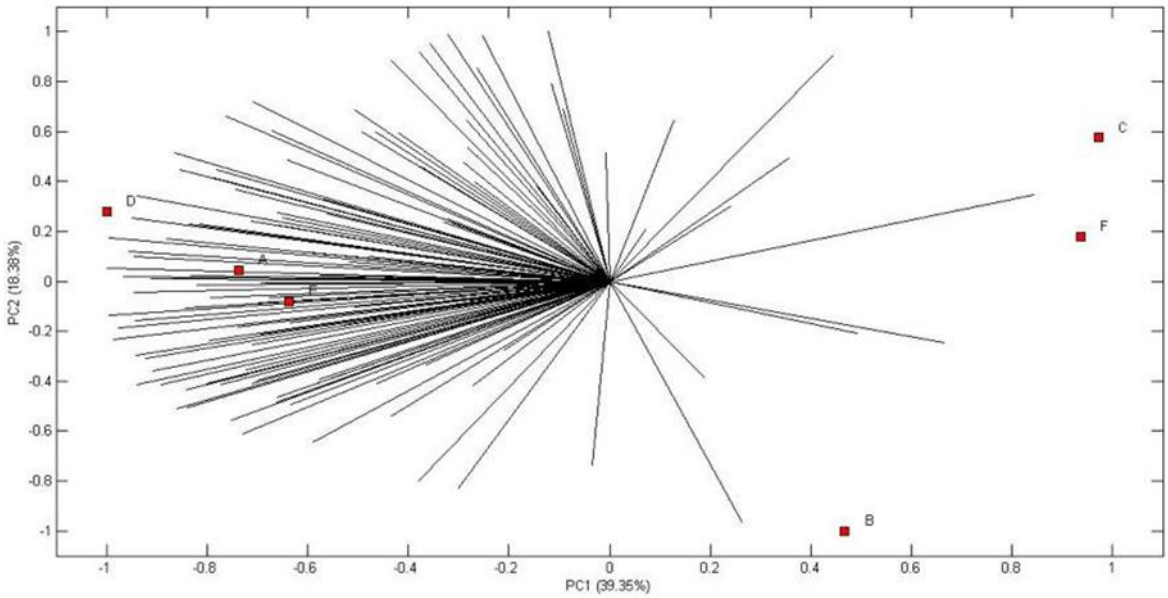


Figure 2 shows the internal preference map where each vector corresponds to a tester evaluating the response to the global impression attribute and each point represents a sample, considering the individual evaluations of each of the 120 consumers. From the interpretation of the map, it can be observed the direction of most of the vectors for samples A, D and E that represent the greatest preference of consumers for these samples. It is also observed the lowest amount of vectors directed to samples B, C and F. When evaluating soft drink powder of different commercial brands Caleguer et al. (2006) found that the samples closest to consumers in the internal preference map were those that presented higher pH and higher content of fruit pulp.

4 CONCLUSION

It can be observed that sample D presented greater acceptability for the attributes evaluated. Regarding the ideal test, sample E presented ideal sweetness while sample D presented orange flavor closer to ideal. For purchase intention, sample D had higher positive purchase intent while sample F had higher negative purchase intention. Samples A, D and E were closer to consumers in the internal preference map.

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