

**Qualidade sensorial de caldo de cana com adição de polpa de frutos do semiárido**  
**Sensorial quality of sugarcane juice with the addition of fruits pulp from the semi-arid**  
**Calidad sensorial del azúcar con la adición de pulpa de frutas del semiárido**

Recebido: 17/04/2020 | Revisado: 27/04/2020 | Aceito: 02/05/2020 | Publicado: 04/05/2020

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## Resumo

O caldo de cana *in natura* ou garapa é um dos derivados da cana-de-açúcar e é uma bebida saborosa e energética. A adição de frutas ácidas ao caldo de cana é bastante comum, conferindo ao produto um sabor refrescante e suavizando sua doçura. O presente trabalho teve por objetivo avaliar a qualidade sensorial de bebidas elaboradas por meio da mistura de caldo de cana e polpa de frutas, entre os alunos do ensino médio do IFNMG – Campus Salinas. As amostras foram preparadas para os sabores de maracujá-do-mato, tamarindo e cajá, adicionando polpa nas proporções de 5, 7,5 e 10 mL por 100 mL de caldo de cana, e um teste de ordenação da preferência foi aplicado a 30 provadores não treinados. Com base no resultado desse teste, foram preparadas amostras da bebida com a concentração de polpa preferida para cada sabor. O teste de aceitação foi então aplicado a 88 provadores do mesmo grupo de estudo. Para o teste de ordenação, esta análise demonstrou não existir diferença significativa ( $p \geq 0,05$ ) entre as amostras em nenhum dos três sabores e concentrações avaliados. No entanto, os maiores valores absolutos foram obtidos para as amostras de maracujá-do-mato e tamarindo a 5% de polpa e cajá a 7,5% de polpa. Em relação à aceitabilidade, não existiu diferença significativa ( $p \geq 0,05$ ) entre as amostras. Na avaliação da impressão global, as notas estiveram situadas entre “gostei regularmente” e “gostei muitíssimo”, o que denota uma ótima aceitação pelos produtos. Ainda, o sabor mais aceito foi o de cajá a 7,5%. A intenção de compra foi avaliada em “provavelmente” e “certamente compraria” e a maior intenção de compra foi, também, pela amostra de cajá a 7,5%. Sendo assim, este estudo contribui para uma maior valorização dos frutos regionais do semiárido e para agregação de valor ao caldo de cana.

**Palavras-chave:** Cana de açúcar; Bebida; Frutas ácidas.

## Abstract

*In natura* sugarcane juice or garapa is one of the derivatives of sugarcane and is a tasty and energetic drink. The addition of acid fruits to the sugarcane juice is quite common, giving the product a refreshing flavor and softening its sweetness. The present study aimed to evaluate the sensorial quality of beverages elaborated by mixing sugarcane juice and fruits pulp, among high school students at IFNMG – campus Salinas. The samples were prepared for the flavors of passion fruit, tamarind, and caja, adding pulp in the proportions of 5, 7.5 and 10 mL

per 100 mL of sugarcane juice, and a preference-ranking test was applied to 30 untrained panelists. Based on the result of this test, samples of the beverage with the preferred pulp concentration for each flavor were prepared. The acceptance test was applied to 88 panelists in the same study group. For the preference-ranking test, this analysis showed that there was no significant difference ( $p \geq 0.05$ ) between the samples in any of the three flavors and concentrations evaluated. However, the highest absolute values were obtained by the samples of passion fruit and tamarind at 5% of pulp and caja at 7.5% of pulp. Regarding the acceptance test, there was no significant difference ( $p \geq 0.05$ ) between samples. In the evaluation of the overall impression, the scores were between “like moderately” and “like extremely”, which shows a great acceptance for these products. Also, the most accepted flavor was caja at 7.5%. The purchase intention was evaluated as “probably buy” and “certainly buy” and the highest purchase intention was also for the sample of caja at 7.5%. Therefore, this study contributes to a greater appreciation of the fruits from the semi-arid and to adding value to the sugarcane juice.

**Keywords:** Sugarcane; Beverage; Acid fruits.

### **Resumen**

El jugo de caña in *natura* o garapa es uno de los derivados de la caña de azúcar y es una bebida sabrosa y enérgica. La adición de frutas ácidas al jugo de caña de azúcar es bastante común, lo que le da al producto un sabor refrescante y suaviza su dulzura. El presente estudio tuvo como objetivo evaluar la calidad sensorial de las bebidas hechas mediante la mezcla de jugo de caña de azúcar y pulpa de fruta, entre estudiantes de secundaria en IFNMG - Campus Salinas. Las muestras se prepararon para los sabores de maracuyá, tamarindo y cajá, agregando pulpa en las proporciones de 5, 7,5 y 10 mL por 100 ml de jugo de caña, y se aplicó una prueba de orden de preferencia a 30 catadores no entrenados. Según el resultado de esta prueba, se prepararon muestras de la bebida con la concentración de pulpa preferida para cada sabor. La prueba de aceptación se aplicó a 88 catadores en el mismo grupo de estudio. Para la prueba de ordenación, este análisis demostró que no había una diferencia significativa ( $p \geq 0.05$ ) entre las muestras en ninguno de los tres sabores y concentraciones evaluados. Sin embargo, los valores absolutos más altos se obtuvieron para las muestras de maracuyá y tamarindo con 5% de pulpa y cajá con 7,5% de pulpa. En cuanto a la aceptabilidad, no hubo diferencias significativas ( $p \geq 0.05$ ) entre las muestras. En la evaluación de la impresión global, las notas se colocaron entre "Me gustó regularmente" y "Me gustó mucho", lo que muestra una excelente aceptación por parte de los productos. Aún así, el sabor más aceptado

fue el 7.5% de cajá. La intención de compra se evaluó como "probablemente" y "ciertamente compraría" y la intención de compra más grande fue, también, por la muestra de cajá del 7,5%. Por lo tanto, este estudio contribuye a una mayor apreciación de las frutas regionales en la región semiárida y a agregar valor al jugo de caña de azúcar.

**Palabras clave:** Caña de azúcar; Bebida, Frutas ácidas.

## 1. Introduction

Sugarcane (*Saccharum officinarum*) is a cultivar exclusively grown in tropical and subtropical regions (Saxena; Makroo; Srivastava, 2016). According to the National Supply Company – Conab (2019), Brazil is the world's largest producer of this cultivar. In this context, the city of Salinas, located in the north of the state of Minas Gerais (MG), stands out for the cultivation of sugarcane, a product that reaches high levels of Brix (content of total soluble solids), influencing its sweetness and becoming a suitable raw material for the production of juices.

*In natura* sugarcane juice or garapa is a popular drink obtained from crushing sugarcane through mills and appreciated for its sweet taste and aroma. It is considered an energy drink, since it contains 40 Kcal per 100 mL, 18.2% of sucrose, as well as important contents of magnesium (12.5 mg/100 g<sup>-1</sup>), calcium (9.1 mg/100 g), and vitamin C (2.8 mg/100 g) (TACO, 2011). Also, it is a tasty drink that conserves the nutrients of the raw material and can also be added with ice and citrus fruits (Trompete et al., 2019).

The marketing of sugarcane juice is usually carried out on the streets by street vendors who do not have adequate hygienic-sanitary installations to process a safe drink from the point of view of public health (Trompete et al., 2019; Galvão et al., 2019).

The addition of citrus pulps aims to soften the sweetness of sugarcane juice, as well as to promote a refreshing flavor. Also, it is known that the addition of acids restricts microbial development, contributing to the microbiological stability of the product. Additionally, the presence of acids helps in the enzymatic stability of the drink by inhibiting the action of enzymes, due to the reduction of pH and the complexation of citric acid with copper present in the active site of the enzyme polyphenoloxidase, the main enzyme responsible for browning of sugarcane juice (Prati et al., 2005).

In this sense, fruits of passion fruit (*Passiflora cincinnata* Mast), tamarind (*Tamarindus indica*, L.), and caju (*Spondias mombin*), endemic to the Brazilian semi-arid and easily found

in Salinas-MG, can be used in formulations with the sugarcane juice, since they are citrus fruits. Also, they have characteristic flavors and, when used in small proportions, they give a pleasant aroma and refreshing flavor to the sugarcane juice.

Passion fruit is commonly found in the Caatinga and Cerrado biomes of Brazil and occurs abundantly in the semi-arid regions of northeastern of Goiás, Bahia, and Minas Gerais (Jesus; Faleiro, 2016), being easily found in Salinas. It is a dark green-skinned fruit and its pulp has an acid pH (Imig, 2013).

Tamarind has a significant content of vitamins C, E, and B complex, as well as of calcium, iron, phosphorus, potassium, manganese, and dietary fiber (Urszula et al., 2014). Its pulp has a high acidity index (1.4 to 3.4%), being used in the production of juices (Almeida et al., 2019).

Caja or cajarana is a fruit that has good characteristics for industrialization, due to the typical flavor and aroma, and can be used *in natura* and in processed form. Its pulp is also used in the production of slightly acid drinks, jellies, frozen pulp, among others (Damiani, 2011).

In this context, this study aimed to evaluate the sensorial quality of sugarcane juice added with fruit pulps, as well as to promote the valorization of native fruits from the semi-arid region, using them in association with sugarcane juice.

## 2. Material and Methods

We made a lab experiment, as oriented by Pereira et al. (2018) that occurs under controlled conditions. The experiment was carried out in the Sensorial Analysis Laboratory of the Federal Institute of Northern Minas Gerais – campus Salinas (IFNMG).

Sugarcane juice was extracted from IAC 72.454 sugarcane variety grown at IFNMG and the fruit pulps were purchased from a local producer. Initially, the stalks were scraped and sanitized with a 50 ppm sodium hypochlorite solution for 15 minutes and the sugarcane juice extracted in an electric mill, previously sanitized with 200 ppm sodium hypochlorite solution for 15 minutes.

Immediately after extraction, the sugarcane juice was standardized to 19 °Brix and used in the preparation of the samples. Two liters of sample were prepared for the flavors of passion fruit (*Passiflora cincinnata*), tamarind (*Tamarindus indica*), and caja (*Spondias mombin*) in the proportions of 5, 7.5, and 10 mL of pulp per 100 mL of sugarcane juice, resulting in three different concentrations of the beverage for each type of fruit. In the

sequence, the preparations were filtered, the pH standardized, pasteurized (75 °C for 15 s), and hot filled in glass bottles previously sanitized.

Sensorial analysis was approved by the Research Ethics Committee under number 52919115.4.0000.5141 and performed in two stages. First, a preference-ranking test was applied to 30 untrained panelists. For each flavor, the three preparations were evaluated and organized in ascending order using an unstructured scale (1 – least preferred to 3 – most preferred).

In disposable cups encoded with three-digit numbers, 50 mL of beverage of each flavor and concentration were served in individual booths, with red lighting. Results were treated by statistical analysis to verify significant differences between samples, using the Newell and MacFarlane table at the level of 5% of significance using the Excel software version 2010.

With the result of the preference-ranking test previously applied, 4 liters of sample were prepared for the flavors of passion fruit and tamarind, in the concentration of 5 mL of pulp per 100 mL of sugarcane juice, and of caja, in the concentration of 7.5 mL of pulp per 100 mL of sugarcane juice.

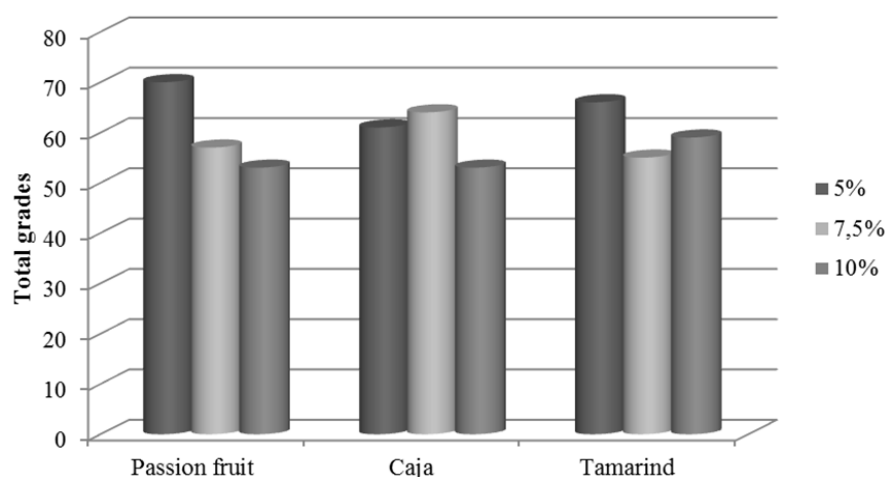
These samples were subjected to the acceptance test, applied to 88 untrained panelists, and evaluated the attributes of aroma, flavor, texture, color, appearance, and overall impression using a 9-point structured hedonic scale (1 – dislike extremely to 9 – like extremely).

The purchase intention of these samples was also evaluated using a 5-point structured hedonic scale (1 – certainly would not buy to 5 – certainly would buy). Data obtained were analyzed using analysis of variance (ANOVA) and the means compared by the Tukey test at  $p \leq 0.05$ , using Excel software version 2010.

### **3. Results and discussion**

According to the preference-ranking test, no significant difference ( $p \geq 0.05$ ) was observed between the preparations in any of the three flavors evaluated. However, the highest absolute values were obtained by the samples with 5% of passion fruit pulp, 7.5% of caja pulp, and 5% of tamarind pulp, as shown in Figure 1.

**Figure 1.** Histogram of preference-ranking of sugarcane juice with different concentrations of fruits pulp from the semi-arid.



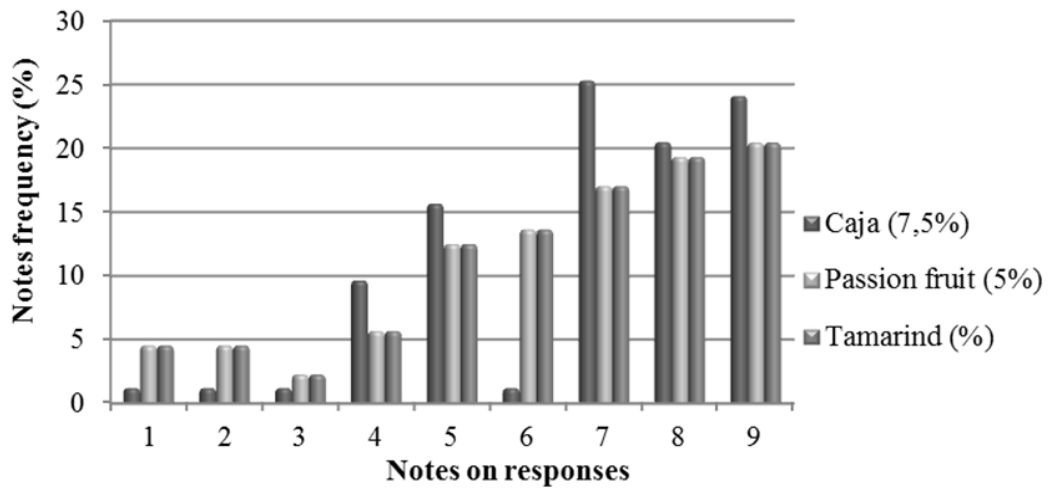
Source: Research data.

The preference for the beverages with lower concentration (5%) of passion fruit and tamarind pulps is possibly associated to their markable acid flavor. In contrast, for caja, the preferred sample was with 7.5% of pulp, probably due to its lower acidity content.

The mean values attributed by the panelists in relation to the overall impression of the preferred samples of sugarcane juice with passion fruit (5% of pulp), caja (7.5% of pulp), and tamarind (5% of pulp) are located on the hedonic scale corresponding to 6.38; 6.84, and 6.45, respectively, indicating that there is no significant difference ( $p \geq 0.05$ ) by the Tukey test. According to Teixeira *et al.* (1987), it is necessary that the product obtain an acceptability index of at least 70%, which means, on a 9-point structured hedonic scale, scores higher than 6 in order to be considered sensorially accepted. Regarding the attributes of aroma, flavor, texture, color, and appearance, no significant difference ( $p \geq 0.05$ ) was detected for any of the samples.

In Figure 2, the overall impression of the preferred samples of sugarcane juice with passion fruit (5% of pulp), caja (7.5% of pulp), and tamarind (5% of pulp) are shown. It was possible to infer that the scores were between “like moderately” and “like extremely”, which denotes an excellent acceptance of these products. Also, in relation to the three flavors evaluated, the best accepted was the beverage with 7.5% of caja pulp.

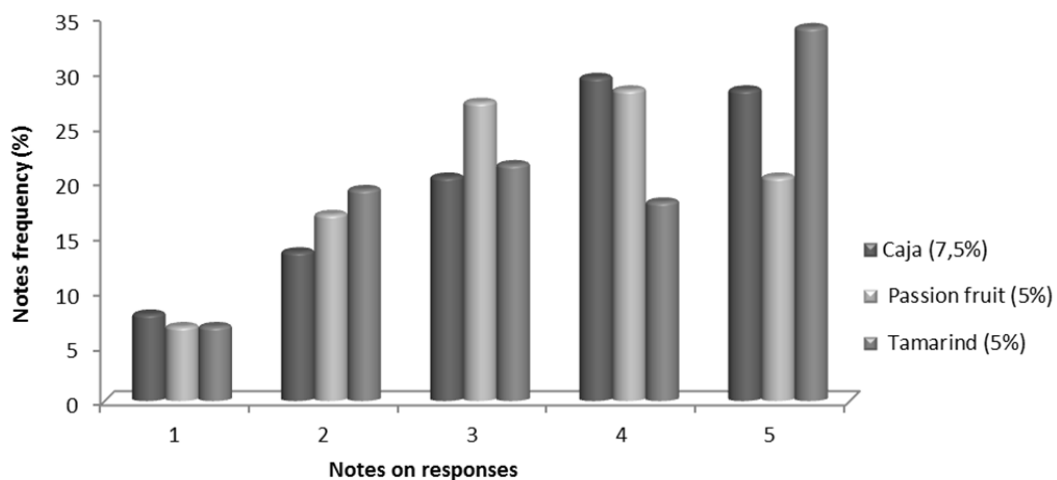
**Figure 2.** Histogram of overall impression of the preferred samples of sugarcane juice with fruits pulp from the semi-arid



Source: Research data.

Regarding the purchase intention, the scores attributed to the preferred beverages were between 4 and 5, which correspond to “probably buy” and “certainly buy”, respectively, as shown in Figure 3. It was also observed that the highest purchase intention was for sugarcane juice with 7.5% of caja pulp, followed by the beverages with 5% of tamarind and passion fruit pulps.

**Figure 3.** Histogram of purchase intention of the preferred samples of sugarcane juice with fruits pulp from the semi-arid



Source: Research data.



In contrast with the present study, Pratti et al. (2005) sensorially evaluated beverage samples of partially clarified-stabilized sugarcane juice with the addition of acid fruit juices (passion fruit, pineapple, and lemon) and observed that the beverage containing 5% of passion fruit juice was the preferred in the acceptance and purchase intention tests.

#### 4. Final Considerations

Samples of sugarcane juice with pulp of passion fruit, tamarind, and caja, at three different concentrations (5%, 7.5%, and 10%), were sensorially evaluated by the preference-ranking test. For each flavor, the best scores were observed for the samples of sugarcane juice with 5% of passion fruit pulp, 7.5% of caja pulp, and 5% of tamarind pulp.

Considering these three preferred beverages, 70% of acceptance was observed for all them and no significant difference was found between the samples for the attributes of aroma, flavor, texture, color, and appearance.

Also, the panelists showed positive purchase intention (probably buy and certainly buy) of the developed beverages and the sugarcane juice with 7.5% of cajá pulp showed the highest scores in the overall impression and in the purchase intention. Therefore, this study contributes to a greater appreciation of the fruits from the semi-arid and to adding value to the sugarcane juice.

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