STABILITY STUDY AND ANTIOXIDANT POTENTIAL OF COLD GINGER TEA WITH PASSION FRUIT PULP

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RESUMO – A elaboração de chás gelados de gengibre com frutas consiste em uma alternativa prática para acrescentar produtos mais saudáveis à população. Neste contexto, o presente trabalho objetivou a elaboração e estudo das principais características físico-químicas e de compostos bioativos de chá de gengibre adicionado de polpa de maracujá. Foi possível constatar que a formulação proposta da bebida condiz com uma alternativa interessante à alimentação, no que diz respeito à conservação de suas propriedades físico-químicas e bioativas ao longo de 90 dias de armazenamento, sendo destacada quantidade significativa de polifenóis totais no produto.

ABSTRACT – The formulation of cold tea with ginger and fruits consists of a practical alternative to add healthier products to the population. In this context, this study aimed the formulation and study of the main physicochemical characteristics and bioactive compounds of ginger tea with passion fruit pulp. It was found that the proposed drink formulation is an interesting alternative to feeding, regarding the conservation of its physicochemical and bioactive properties during 90 days of storage, specifically, a significant amount of total polyphenol in the product.

PALAVRAS-CHAVE: bioativos; polifenóis; suco de fruta; armazenamento.

KEYWORDS: bioactive; polyphenols, fruit juice; storage.

1. INTRODUCTION

Tea consumption in Brazil grew by 16% in volume, rising to three thousand tons between 2009 and 2011 (Euromonitor, 2012). This is a reflection of the different options we have in supermarkets. The product can be found in powder, bag, bulk, or ready to drink.
Ginger (Zingiber officinale Roscoe) is a spice, which has a widely marketed rhizome because of its food and industrial use, especially as raw material for the manufacture of beverages, perfumes and confectionery products such as breads, cakes, cookies and jellies (Beal, 2006).

In Brazil, the consumption of fruit juices has been growing rapidly in recent years. Consumption of fruits and vegetables is recommended by the World Health Organization (WHO) as priority in nutritional, food and agricultural policies (Jaime et al., 2009).

The yellow passion fruit (Passiflora edulis f. Flavicarpa Deg.), among the species of Passiflora genus, is one of the most cultivated in Brazil and highly appreciated by the intense aroma and taste of its juice (Sampaio et al., 2008). Passion fruit juice has high acidity levels and a strong flavor; it is rich in vitamins and has sedative properties (Cunha, 2013) while also presenting considerable levels of phenols and carotenoids.

The identification of bioactive compounds in plant species has been potentially exploited in recent years due the growing popularity of herbal medicines and changing perspective of consumers, who are seeking foods with bioactive characteristics that provide greater health and wellbeing (Nachbar, 2013).

The preparation of cold ginger teas with fruit juices, using raw materials that are abundant in Northeast Brazil, is a practical alternative that is rich in bioactive compounds to provide to the population. The objective, therefore, was the formulation and study of the main physicochemical characteristics and bioactive compounds in ginger tea with passion fruit pulp aiming to provide a product ready for consumption and with maximum functional activity preserved.

2. MATERIALS AND METHODS

The passion fruit and ginger powder used in the formulation were obtained in the local market in the city of Fortaleza. The preparation of the beverage and the development of the research were conducted at the Processing Laboratory of Fruit and Vegetables of the Department of Food Engineering, in Federal University of Ceará.

The fruits were washed and sanitized by immersion in sodium hypochlorite solution (200 ppm) for 5 minutes, then they were washed in water, drained and processed in a depulper (Walita).

The ginger tea was formulated with the addition of 5g of ginger powder in 1 liter of boiling water. The mixture was maintained by infusion over 5 minutes with subsequent filtration, and then cooled in room temperature.

The formulation used for the preparation of the beverage was based on the Identity and Quality Pattern (IQP) of passion fruit nectar, where the amount of water was replaced by the addition of the tea. The beverage consisted of 15% passion fruit pulp and 85% ginger tea. After preparation of the beverage, the total soluble solids content was adjusted to 11 ° Brix with the addition of commercial sucrose, using a refractometer (ATAGO PAL-3 brand), with a scale from 0 to 90 ° Brix according to Brazil (2005).

Sodium benzoate was used as a preservative in the proportion of 0.1g / 100g, value allowed by RDC No. 8 of March 6, 2013 (Brazil, 2013), in order to inhibit or delay nutritional losses due to microbiological, enzymatic or chemical changes, which the product is exposed to during storage.

The beverage was subjected to heat treatment at 90 ° C for 60 seconds, hot bottled in glass bottles (250 ml), previously sterilized, and then sealed with plastic screw caps. Then, the bottles were cooled in chlorinated water and stored under refrigeration (8 ° C) until being analyzed at 30-day intervals for a total of 90 days of storage.

The pH was determined by direct reading on the potentiometer (WTW brand), model 330i / SET, according to AOAC (1995).
The titratable acidity was determined by titration and expressed in mg of citric acid / 100 ml of the sample, according to the methodology described by Brazil (2005).

The content of total and reducing sugars was determined by the Miller method (1959). The results were expressed in grams per 100 mL of sample.

The color analysis was performed according to CIE (1986), the luminosity (L) coordinate a * (red / green) and b * coordinate (yellow / blue) parameters were analyzed.

The total carotenoids were obtained by the method described by Higby (1962) and the results were expressed in mg / 100mL.

The yellow flavonoids were determined by the method of Francis (1982) and quantified in mg / 100mL.

For the quantification of the polyphenols, the extracts were obtained according to the methodology described by Rotili et al. (2013), which consists in mixing 2 ml of the sample and 6 mL of 80% ethanol homogenized in vortex for 30 seconds and dispersed in ULTRA-TURRAX for 1 minute. Then, they were centrifuged at 2000 rpm for 10 minutes, filtered and stored at -18 ° C until the time of analysis.

The total polyphenols were determined by the method described by Singleton, Orthofer and Lamuela (1999), the results expressed in mg GAE / 100mL of the sample.

Analyses were performed in three replicates and the data were submitted to analysis of variance (ANOVA) followed by Tukey test at a significance level of 5% using the statistical program ASSISTAT 7.7beta version (Silva, 2014).

### 3. RESULTS AND DISCUSSION

Values statistically treated by Tukey test with 95% confidence, related to the physicochemical characteristics of ginger tea with passion fruit pulp and stored for 90 days under refrigeration, are described in Tables 1 and 2.

Table 1 - Physicochemical characteristics of ginger tea added with passion fruit pulp and stored under refrigeration for 90 days.

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>TA (g de citric acid/100g)</th>
<th>pH</th>
<th>TS (g/100g)</th>
<th>RS (g/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.38a</td>
<td>3.31c</td>
<td>55.17a</td>
<td>0.83b</td>
</tr>
<tr>
<td>30</td>
<td>0.38a</td>
<td>3.46a</td>
<td>49.06a</td>
<td>0.92a</td>
</tr>
<tr>
<td>60</td>
<td>0.33b</td>
<td>3.47a</td>
<td>42.11b</td>
<td>1.68a</td>
</tr>
<tr>
<td>90</td>
<td>0.32b</td>
<td>3.37b</td>
<td>29.80b</td>
<td>1.42ab</td>
</tr>
</tbody>
</table>

*Means followed by different lowercase letters indicate significant differences (P <0.05) between the storage time. TA: Titratable acidity; TS: Total sugars; RS: Reducing sugars.

The pH of the ginger tea with passion fruit pulp remained below 4.0, being a tea with acidic characteristics. This value is desirable, since below this pH, there is no growth of spoilage microorganisms (Forsythe, 2002). These results are close to those found by Da Silva et al. (2008), who developed a study adding passion fruit juice in coconut water, it showed levels ranging from 3.40 to 3.60.
The titratable acidity showed similar behavior, which remained constant for 60 days. The tea results are in accordance with those established by the Identity and Quality Pattern (IQP) of passion fruit nectar, which has a minimum value of 0.25% citric acid.

At the end of the storage time, the beverage obtained a decrease in its total sugar values, differing in 5% of probability in relation to the storage time. The values ranged from 55.45 g / 100 g to 42.11 g / 100 g. Although the reduction of these values, in the 60th day, the total sugar content is still considered high due to the starch present in ginger and the amount of sucrose added to the beverage. Reducing sugars values showed an increase during the storage period. There was a significant difference between them.

It is observed in Table 2 that the color of cold ginger tea with passion fruit did not differ significantly during 90 days of storage, taking into account the color coordinates L *, a * and b *, keeping its initial color until the end of this study.

Table 2 - Analysis of color of cold ginger tea added of passion fruit pulp stored under refrigeration for 90 days.

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>L</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>52,34a</td>
<td>5,29a</td>
<td>41,51a</td>
</tr>
<tr>
<td>30</td>
<td>51,22a</td>
<td>4,98a</td>
<td>39,23a</td>
</tr>
<tr>
<td>60</td>
<td>49,45a</td>
<td>4,76a</td>
<td>36,83a</td>
</tr>
<tr>
<td>90</td>
<td>52,17a</td>
<td>5,29a</td>
<td>45,03a</td>
</tr>
</tbody>
</table>

*Means followed by different lowercase letters indicate significant difference (P <0.05) between the storage time.

The positive value of b * parameter, which exceeds the red hue expressed by a * coordinate, also with positive values during storage, demonstrate the yellow hue in the color of the tea formulated with addition of passion fruit. This tone is derived from the passion fruit pulp, which has a high carotenoid content, influencing its intense color. The significant variations in the content of these bioactive compounds versus time as shown in Table 3, is probably due to enzymatic and non-enzymatic processes that occur naturally on the beverage (Da Silva et al., 2006). Enzymatic degradation can be avoided when the beverage passes through a bleaching treatment, which is responsible for the inactivation of most enzymes that cause degradation of compounds present in the beverage and other defects associated with prolonged storage time.

Table 3 - Analysis of bioactive compounds of cold ginger tea with passion fruit pulp stored under refrigeration for 90 days.

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>Total Carotenoids (mg/100g)</th>
<th>Yellow Flavonoids (mg/100g)</th>
<th>Total Polyphenols (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0,32a</td>
<td>1,04b</td>
<td>37,12a</td>
</tr>
<tr>
<td>30</td>
<td>0,23b</td>
<td>0,70b</td>
<td>28,84b</td>
</tr>
<tr>
<td>60</td>
<td>0,13c</td>
<td>1,10a</td>
<td>24,48b</td>
</tr>
<tr>
<td>90</td>
<td>0,06c</td>
<td>1,17a</td>
<td>26,35b</td>
</tr>
</tbody>
</table>

*Means followed by different lowercase letters indicate significant difference (P <0.05) between the storage time.

The flavonoids showed a decrease in value between day 30º and 60º, and it remained statistically constant until the end of storage. Flavonoids are antioxidants that are part of the
polyphenols group. They have the ability to scavenge free radicals and chelate metal ions, thereby protecting tissues of the harmful action of free radicals and lipid oxidation (Nachbar et al., 2013).

The total polyphenols present in the beverage differed significantly in 30 days and remained constant until the end of storage. The values of this compound are higher than those found by Kuskoski et al. (2006) which quantified the levels of total polyphenols in passion fruit pulp. Thereby, it is observed that the combined use of ginger and passion was favorable to increase the total polyphenols, contributing to the bioactive characteristics of the formulated beverage.

Most of the phenolic compounds in ginger are not classified as flavonoids. Teas are important sources of gallic acid (Beal, 2006), which is a type of phenolic acid. Therefore, the amounts of phenolic compounds present in the cold ginger tea added of passion fruit pulp are due to the presence of the root in the beverage. Total carotenoid content decreased significantly during the 90 days of storage. These compounds are present in large amount in passion fruit pulp, giving it the yellow color.

Among the substances of vegetable origin capable to act as antioxidants are minerals, vitamins, proteins (especially soy protein), carotenoid pigments and phenolic compounds, and others (Beal, 2006). The presence of these compounds in the studied product (carotenoid and phenolic compounds, in addition to minerals and vitamins in passion fruit), show that the formulated beverage has potential antioxidant capacity, and it can generate benefits to public health.

4. CONCLUSIONS

According to the analyses performed, the storage period used can be considered ideal for the studied beverage, by the end of 90 days a conservation of most bioactive compounds was observed. The results suggest that following the same standards of hygiene and quality to this beverage's formulation, the storage period can be extended for a longer time and maintain its functional properties.

5. REFERENCES


