

Effect of frozen storage on the quality of camu camu (*Myrciaria dubia* (H. B.K.) McVaugh,) pulp

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ABSTRACT

Camu camu is a small tree, from the Myrtaceae family, that is dispersed throughout the Amazon region, along the rivers and lakes, usually in dark water. In its natural habitat, the plant can remain submerged for 4-5 months. Camu is a fruit of high nutritional value, known for its high vitamin C content, ranging from 1315mg/100g to 5000 mg/100g. Studies indicate that camu camu has many antioxidants, among them, the phenolic compounds, with values around 1350 mg Gallic acid/100g. Freezing is one of the simplest and least time-consuming ways to preserve foods at home. The aim of this study was to evaluate the effect of freezing on the physico-chemical characteristics of the camu camu pulp stored during 15 months at -18°C. The results indicated that there was no significant difference between the quality of the initial camu camu pulp and after 15 months stored at 18°C.

Keywords: fruit pulp, ascorbic acid, antioxidant activity, exotic fruits.

INTRODUCTION

Camu camu (*Myrciaria dubia* (H. B.K.) McVaugh, Myrtaceae) is a low-growing shrub found throughout the Amazon rainforest [1]. Studies are being conducted to adapt the culture to the field, extending the harvest areas. These studies aim to increase production, yield and fruit quality. Furthermore, various processes are being adapted and refined to obtain processed products from camu-camu, for their export to regions where the fruit is not grown. The fruits are globe berries, the skin color varying from red to violet when mature and very resistant, which facilitates the transport. During the ripening process, the colour changes from green to hues, varying from red to purple. The camu camu fruit has a high economical potential as a natural source of vitamin C. Its pulp has the vitamin C content ranging from 1000 to 3000mg/100g [2], higher than the all citrus and acerola fruit, considered one of the main sources of vitamin C. Moreover, the recent interest of polyphenols in plants has focused on its great potential to benefit human health, with special reference to polyphenols in fruits and vegetables [3].

Camu camu is a very perishable fruit, which makes difficult its commercialization out from the producing regions [4]. The camu camu is usually not consumed as a fresh fruit because of its high acidity [5]. The pulp is well appreciated for preparing nectars, ice creams, jams and other processed products. Studies have been developed aiming at the industrial exploitation of camu camu, obtaining products easily stored and transported [6]. These researches can make the fruit viable for consumption far from the regions where it is cultivated.

After the depulping of the fruits, the pulp must be refrigerated or frozen as soon as possible, as it can be easily fermented at room temperature. The frozen pulp must be kept in freezer between - 20 ° and -18 ° C, protected against direct light.

The fruits have essential nutrients and a range of micronutrients such as minerals, fibers and vitamins, secondary metabolites and components of phenolic nature. The fruit consume has been associated to the lower incidence of coronary heart diseases and cancer. Fresh fruits and vegetables, when harvested, continue to undergo chemical changes which can cause spoilage and deterioration of the product. Freezing is a simple, quick way to preserve foods. Fruits freeze well and retain their distinct fruit flavor. Texture is usually softened somewhat by freezing, but serving partially frozen fruit with ice crystals will compensate for texture changes. Lighter colored fruits may require special treatment to retain color, texture and flavor. The processing of camu camu as frozen pulp is an alternative for its conservation, increasing its shelf life, while maintaining their nutritional characteristics [7]. Thus, the objective of this work was to evaluate the effect of freezing on the functional quality of the camu camu pulp.

MATERIALS & METHODS

Camu-camu fruits were obtained at the experimental fields of Embrapa Western Amazonia, located at Manaus - Amazonas state, north region of Brazil. The fruits were frozen and transported to Rio de Janeiro where they were extracted using a pulper machine with a 0.6 mm diameter sieve. The obtained pulp was homogenized and stored in plastic packing's of 0.5kg at -18°C for 15 months.

Samples were analyzed for total soluble solids content (Bellingham + Stanley Limited refractometer), acidity (titration with NaOH solution) and pH (Metrohm model 785 DMP Titrino), according to standard AOAC methods [8].

The total solids were measured gravimetrically by determining the dry weight in the vacuum oven.

Vitamin C was analyzed by oxide-reduction reaction using 2,6-dichlorophenol indophenol [8].

The antioxidant activity was determined applying an improved ABTS radical cation decolorization assay according to Re et al. [9] modified by Rufino et al. [10].

The spectrophotometric quantification of phenolic compounds was performed according to the modified methodology of George et al. [11], using Gallic acid as the standard. For the color reaction, it was used the Folin-Ciocalteu reagent and sodium carbonate at 7.5%.

All analysis was carried out in three repetitions. One-way ANOVA (performed in XLStat Pro 7.5) was used to determine whether the effect of storage time on camu camu pulp properties was significant. Differences at $p < 0.05$ were considered to be significant.

RESULTS & DISCUSSION

The results indicate that the main properties of camu camu pulp remained stable during storage at low temperature. The physico-chemical analyses of the camu-camu pulp are in the range of those found in the literature. Maeda et al. [12] evaluated the camu camu pulp at different stages. They found for the soluble solids content and pH values of 2.64 and 6.2° Brix, respectively. Barreto [13] determined the acidity ranging from 1.94 to 2.07 g citric acid /100g, from 2.87 to 2.90 for pH and 5.30 to 5.75°Brix to the soluble solids content.

It was observed that the vitamin C content remained quite high, as cited by Ferreira et al. [14], Rodrigues et al. [15] and Rufino et al. [10]. The different vitamin C content in the camu-camu is a function of its maturity stage. The vitamin C content found for the frozen camu camu pulp storage for 15 months was higher than many fruits known for their high content of this vitamin like acerola and citrus.

Regarding the phenolic concentration and antioxidant activity, the values were also within the expected range, indicating that the frozen camu camu pulp had a high level of phenolic compounds and antioxidant activity even after 15 months storage.

The results shown in Table 1 were analyzed by Tukey test. The results indicated that there was no significant difference between the quality of the initial camu camu pulp and after 15 months stored at 18°C-.

Table 1. Characterization of camu-camu pulp¹

	Camu-camu pulp	Camu-camu pulp storage for 15 months
pH	2.76±0,0	2.91±0,0
Soluble solids (Brix)	6.4±0,0	6.1±0,0
Acidity (g citric acid/100g)	2.10±0,0	2.10±0,6
Vitamin C (mg/100g)	1315.69±11,6	1355.75±26,57
Total phenolics (mg/100g)	1207.86±45,8	1241.38±20,66
Antioxidant activity (µmol/g)	100.49±1,51	103.73±8,65

¹ Mean ± Standard Deviation

CONCLUSION

It was observed that the vitamin C content in camu camu pulp remained quite high after storage under -18°C for 15 months.

Storage at -18° C retained the main functional characteristics of the camu camu pulp even after a period of 15 months, suggesting the efficiency of freezing on the preservation of the main physicochemical characteristics of this fruit.

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