

Camu-Camu (*Myrciaria dubia*) from the Amazon

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Received: 16 Jun 2021;

Received in revised form: 14 Jul 2021;

Accepted: 22 Jul 2021;

Available online: 29 Jul 2021

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Keywords— Antioxidant capacity, Fruits
of the Amazon, Vitamin C.

Abstract— Camu-camu (*Myrciaria dubia*) H.B.K.) Mc Vaugh fruits are promising sources of various bioactive compounds such as vitamin C. Camu-camu is a fruit native to the Amazon region and is considered the greatest natural source of vitamin C worldwide are also good sources of minerals. The objective of this study was to analyze pulp camu-camu throughout the Amazon region using the methodology Vitamin C content was measured by high-performance liquid chromatography (HPLC). Analyzes have shown that camu-camu powder had the highest content of antioxidants capacity, 51,567 $\mu\text{mol TE/g}$ and anthocyanins 9548 GAE mg/100g compared to açaí, blueberry, apple and orange pulp. In conclusion, camu-camu can be used to introduce bioactive compounds into food products and to delay or prevent many human diseases.

I. INTRODUCTION

Camu-camu (*Myrciaria dubia* (HBK) McVaugh), is an exotic tropical fruit native fruit of the Amazon region and it is one of the few Amazon fruits that have been explored for commercial purposes, has numerous different behaviors from other species known to date, concerning ecology, morphology, agronomy, physiology and nutrition, with great potential for future uses in agribusiness and agroforestry systems.

Ecologically, camu-camu develops very well in pH ranges between 4 and 7, regardless of soil types, that is, soils poor or not in nutrients. It normally grows in full sun, with very high luminous intensity, as it originates from the banks of rivers and lakes where there is direct sunlight and the reflection of light on water and/or on the white sand beach. In its natural habitat, it is normally influenced by floods and ebbs. During floods the plants are partially or totally covered, for a period of two to four months a year and another stress is the dry period coinciding with the ebb of the rivers.

Morphologically, there may be a very different architecture, depending on the population density of the area, with greater or lesser ramification, and light intensity

seems to be one of the variables that directly interferes in fruit production. During the seedling stage, there may be greater differentiation in terms of morphology in the arrangement of leaves, which are usually simple, paired and crossed leaves, with trifoliate leaves (< 5%) and less than 0.5% with only one single leaf, which disappear over time making the sheets simple and opposite. Agronomically, plants normally grow in poor and acidic soils (with a pH between 4 and 4.5), but fruit production can be compromised depending on the nutrient content present in the soil. In areas corrected with liming and gradual fertilization on dry land, production reaches two or more crops per year. Heavy fertilization is not recommended at once, due to the sensitivity of the plants or seedlings, but the practice of fertilization or gradual correction. Plants that are well adapted on terra firme, with balanced fertilization, can start production after two years and some plants can produce 22 kg of fruit/crop. Some genotypes with 3 500 mg/100 g of ascorbic acid pulp have already been selected from the INPA Germplasm Bank, which can be vegetatively multiplied and distributed to producers.

Table 1. Result of vitamin C content, obtained in different locations, in relation to the visual maturation of Camu-Camu fruit throughout the Amazon region.

Collection location Rio/Municipality/State	Vitamin C (mg/100g of pulp)	Ascorbic acid (%)	Maturation of the fruit
Rio Urubu, Bonfim-RR	6100 a	268,48	Red/Ripe
Rio Candéias, Porto Velho-RO	2304 b	507,33	Red/Ripe
Rio Pirara, Normandia-RR	2163 bc	1285,69	Once / mature
Rio Tocantins, Marabá-PA	2128 bcd	74,03	Red/Ripe
Faz. Yuricam, Rio Preto da Eva- AM	2065 bcd	155,99	Red/Ripe
Rio Jaru, Jaru-RR	1694 bcde	514,78	Red/Ripe
Rio Jari, Laranjal do Jari-AP	1653 cde	152,29	Red/Ripe
Rio Uatumã, São Sebastião do Uatumã-AM	1629 cde	203,93	Red/Ripe
Rio Negro, Manaus-AM	1563 cdef	55,17	Red/Ripe
Rio Urubu 2, Bonfim-RR	1555 cdef	124,46	once/green
Rio Negro, Barcelos-AM	1529 cdef	93,58	verymature
Rio Urubu, Bonfim-RR	1517 cdef	109,93	once/green
Rio Madeira, Porto Velho-RO	1499 cdef	402,49	once/green
Rio Branco, Amajari-RR	1494 cdef	303,72	once/green
Rio Arraia, Bonfim-RR	1466 def	134,47	once/green
Rio Urupá, Ji-Paraná-RO	1439 def	230,76	verymature
Rio Urubu, Bonfim-RR	1420 ef	274,35	once/green
Rio Javari, Benjamin Constant-AM	1390 ef	127,29	Once / mature
Rio Cavamá, Boa Vista-RR	1238 ef	197,72	Once / mature
Rio Aracá, Barcelos-AM	1234 ef	140,25	verymature
Rio Jamari, Ariquemes-RO	1189 ef	274,61	past fruit
Rio Machado, Ji-Paraná-RO	939 f	240,99	past fruit

Nutritionally, camu-camu is known as the most vitamin C-rich fruit known today (Yuyama *et al.*, 2002), ranging from 800 to 6100 mg/100 g of pulp (Table 1) throughout the Amazon region using the methodology Vitamin C content was measured by high-performance liquid chromatography (HPLC) following the methodology described by the Association of official agricultural chemists (AOAC, 2011). The ascorbic acid content is normally higher when the fruit is red in color, unlike acerola which is higher when the fruit is green in color. Another very curious fact is the stability of ascorbic acid from camu-camu to storage (it kept its content after three years). After making jelly and ice cream there is still about 450 to 710 mg of ascorbic acid/100g of product. Vitamin C is important for the pharmaceutical and cosmetic industries and recently another component is becoming

very important in the pharmaceutical and food area which is natural antioxidants, which can prevent some types of cancer. With all the nutritional constituent of Camu-camu, in particular as a source of stable ascorbic acid, flavonoids, phenolic compounds and anthocyanins, it is suggested to use it not only in the composition of daily food, as it contributes to health protection and reduction of risk of chronic non-communicable diseases, but also with potential in the domestic and foreign market. Analyzes have shown that camu-camu powder had the highest content of antioxidants 51,567 $\mu\text{mol TE/g}$ and anthocyanins 9548 GAE mg/100g compared to açai, blueberry, apple and orange pulp.

Therefore, the expectation for the development of the crop is high, although farmers who believe in the crop are very small.

II. CONCLUSION

Camu-camu fruits are excellent sources of different bioactive compounds, such as vitamin C and phenolic compounds. Camu-camu fruits show high antioxidant capacity as compared to other fruits. In conclusion, camu-camu fruits can be used to increase the amount of bioactive compounds in food products and to delay or prevent many human diseases.

ACKNOWLEDGEMENTS

We thank BFN/FAO (Biodiversity for Food Nutrition) and INPA (National Research Institute of Amazonia).

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