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PHYSICOCHEMICAL PARAMETERS OF AMAZON MELIPONA HONEY

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Stingless bees produce a honey that is different from the Apis honey in terms of composition. There aren't enough data to establish quality control parameters for this product, mainly due to lack of research results. The aim of this work is to evaluate some physicochemical parameters that can be used for the characterization and for the quality control of the Meliponinae honey. Four different samples were collected in the Amazon region of Brazil in 2004 (*Melipona compressipes manaoense* bee and *Melipona seminigra merribae* bee). Honey analyses were performed as described by the official methods. The mean results were: moisture (30.13%), pH (3.65), acidity (24.57 mEq/kg), water activity (0.75), fructose (31.91%), glucose (29.30%) and sucrose (0.19%). These results reinforce the need for a specific regulation for stingless bee honey. This will only be feasible when enough data is available to establish upper and lower limits for the physicochemical parameters used for quality control.

Keywords: stingless bees; Amazon Melipona honey; quality control.

INTRODUCTION

Two types of honey are produced and commercialized in Brazil: the traditional *Apis melifera* honey and that produced by the stingless bees. Stingless bee honey is completely different from that produced by the bees of the genus *Apis*[1,2]. Although the former product reaches a higher price in the market compared with the traditional honey, there is a few information, both in the national and international literature, about its physicochemical composition. The increasing stingless bee honey production and the perspective of a broader market to natural and organic products indicate the need to establish quality parameters to protect the consumer against honey adulteration[3]. Amazon region has a huge potential for production and exportation of stingless bee honey, which is increasing due to initiatives towards sustainable development of the rain forest. There is an international effort for the standardization of the quality parameters of this honey, which compels researchers from South America to study the physico-chemical parameters of this product[2].

The aim of this research is to determine some physicochemical parameters that can be used for the characterization and for the quality control of the Amazon Melipona honey.

EXPERIMENTAL

Material

Four samples of Melipona honey were collected in the Amazon region of Brazil, two from *Melipona compressipes manaoense* bee (Jupará honey) and two from *Melipona seminigra merribae* bee (Jandaíra honey). The samples were collected in September, 2004 at Manacapuru and Itacoatiara villages, in Amazonas state, north Brazil.

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Methods

Moisture determination

Moisture analysis was performed with an infra-red equipment (MA45 Sartorios)[4].

pH

pH determination was made using a regular pHmeter (Micronal)[5].

Free acidity

Free acidity was made by direct titation using NaOH 0,05N[6].

Water activity

Water activity was made directly using Aqualab® apparatus.

Main sugars (glucose, fructose and sucrose) by HPLC

Analysis of glucose, fructose and sucrose were performed by HPLC with a Refractive Index (RI) detector based on the procedure described by Bogdanov *et al.*[7]. The column, Shim-Pack CLC-NH_2 (6.0 x 150 mm), 5 μm was eluted by use of isocratic system with acetonitrile (pump A) and water (pump B) (80:20, v/v), previously filtered through a 0.45 μm filter. The separation was performed at a flow rate of 1.3 mL/min, with the column and detector temperature set at 30 ºC. Quantification was achieved by external calibration method and the calibration curves ranged from 50 to 500 μg/mL for glucose, fructose and sucrose.

RESULTS AND DISCUSSION

The moisture content of the analyzed samples varied from 24.80 to 30.50% (Table 1), which are higher than those found for *Apis* honey. Similar results were obtained by Sousa *et al.*[1] (mean of 29.49%), who studied honey from *Melipona asilvai* collected in Bahia, Brazil and Sousa *et al.*[8], who studied honey from "Jupará" (25.3 to 34.6%),

Table 1. Physicochemical parameters of melipona honey*

Samples	1		2		3		4		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	General Mean
Moisture (%)	28.60	0.36	30.60	0.20	30.20	0.10	24.80	0.20	28.55
pH	3.41	0.020	4.03	0.020	3.52	0.020	4.06	0.04	3.75
Acidity (%)	20.63	0.30	27.82	0.27	25.25	0.15	27.13	0.11	25.21
Water activity	0.74	0.001	0.75	0.001	0.76	0.001	0.75	0.001	0.75
Glucose (%)	28.59	0.50	29.50	0.53	29.80	0.48	29.44	0.41	29.33
Fructose (%)	32.04	0.25	31.95	0.16	31.73	0.20	30.72	0.20	31.61
Sucrose (%)	0.21	0.03	0.18	0.02	0.18	0.02	0.08	0.03	0.16
Ratio Fructose/Glucose	1.12		1.10		1.06		1.04		

*Number of replicates for each sample = 3; samples 1 and 4 = Jupará honey; sample 2 and 3 = Jandaíra honey

"Jandaíra" (27.0%) and "Uruçu boca de ralo"(23.9%) also collected in Amazon, Brazil. The Brazilian regulation[9] determines that *Apis* honey moisture should be equal or inferior to 20%, highlighting its inadequacy for the quality control of stingless bee honey. Vilhena and Almeida-Muradian[10], Cano *et al*.[11], Barth *et al.*[12] and Marchini *et al*.[13] analyzed *Apis* honeys from Southeast of the São Paulo state, Brazil and obtained a rang of 15.2 to 22.4 for eucalyptus honey, 15.0 to 17.3 for citrus honey and 16.0 to 23.4 for multifloral honey.

Sousa *et al.*[1] quoted exactly the same mean value of pH (3.75) compared with our results. On the other hand, the acidity value obtained by these authors was higher (41.74%) than that found in this work (25.21%). Higher acidity value may be due to fermentation of sugars to alcohol by microorganisms and further oxidation to carboxylic acids[14-16]. Higher moisture content and high environment temperature are favorable to these reactions.

The acidity results obtained in this work are according with Brazilian legislation[9] for *Apis* honey (the maximun value is 50%).

The total sugar content varied from 60.24 to 61.71%, the reducing sugars content varied from 60.18 to 61.53%. Sousa *et al.*[1] determined the total sugars varying from 67.72 to 84.99% and the reducing sugars from 66.00 to 66.20%.

Sucrose content found in our work varied from 0.08 to 0.21%, while Souza found values ranging from 1.13 to 8.35%. These values are consistently higher than those found in this work, what may be due to the methodology, the maturity of the honey (enzyme action) or to the floral origin. There are no other data on glucose and fructose content in stigless honey bee in the literature obtained by HPLC. Souza *et al*.[8] reported total carbohydrates, obtained by the difference between 100 and the addition of protein, total fat dietary fiber, moisture and ashes.

The fructose/glicose ratio was slight higher than 1,0 for all analyzed samples (Table 1), following the same behavior of Apis honey, whose fructose content is higher than glucose[17,18]. Cano[19] analyzing Apis honey from Southeat of Brazil (São Paulo) obtained a range of 0.71 for eucalyptus honey and 0.75 for citrus honey.

Costa *et al.*[20] presented the following ratios fructose/glucose (F/G) for Apis honey:

Southeast region of Brazil:	Eucalyptus F/G = 1.14 – 1.77
	Multifloral F/G = 1.17
	Extra-floral F/G = 1.11 – 1.44
	Citrus F/G = 1.24 – 1.57
South region of Brazil:	Eucalyptus F/G = 1.06 – 1.40
	Multifloral F/G = 1.18 – 1.38
Northeast region of Brazil:	Multifloral F/G = 1.24 – 1.34
	Extra-floral F/G = 0.78 – 1.39
Midwest region of Brazil:	Eucalyptus F/G = 1.17 – 1.33
	Multifloral F/G = 1.20 – 1.31
	Extra-floral F/G = 1.27 – 1.32

According to Moreira and De Maria[21], honey samples from Apis which shows a F/G ratio smaller than one, may be adulterated due to a low frutose content, which probably represents an addition of some kind of syrup.

In the light of the present regulation, melipona honey would be always out of the appropriate range for moisture content. The high variability found between the published data on stingless bee honey physicochemical parameters indicates that the establishment of the quality criteria limits for this product depends on further research results.

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