OBTAINING AND CHEMICAL CHARACTERIZATION OF PLANT BASED MILK OF MUNGUBA (*Pachira aquatica*) AND ITS POTENTIAL APPLICATION IN THE DEVELOPMENT OF FERMENTED BEVERAGES

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Introduction

The *Pachira aquatica* Aubl. is a tree species belonging to the Malvaceae family, popularly known as munguba, false cocoa, or Maranhão chestnut, among other names [1]. In Brazil, this species is considered an Unconventional Food Plant (UFP), meaning that its food potential is underutilized industrially and culturally, limited to specific locations [2]. Concurrently, in recent years, the market for plant-based alternative milks has been growing. Some reasons for this growth include the population's interest in healthy eating and individuals seeking alternatives to milk consumption, whether due to lactose intolerance, hypersensitivities to dairy proteins, or vegan dietary habits. Consequently, various plant matrices are used to produce these beverages, and there is a growing interest in fermenting these plant-based milks [3, 4]. Thus, the oilseeds of the munguba tree can be a promising source for producing this class of beverages. As a UFP, its cultivation can encourage more diversified and ecological agriculture [5]. Therefore, the objective of this study is to present the chemical characteristics of munguba seeds and the plant-based milk produced from them.

Material and Methods

The fruits of *P. aquatica* were collected at Quinta da Boa Vista park, Rio de Janeiro, Brazil. They were left in the sun to open through dehiscence. The released seeds were vacuum-packed and stored at -20°C in a Consul freezer at the Food Biotechnology Laboratory, Faculty of Pharmacy, Federal Fluminense University. For the preparation of the plant-based milk, the following steps were followed: seed sanitation, peeling, blanching, and grinding in water at a ratio of 1:4 (seed/water, m/m) using a blender (Mondial Turbo, L-900 W) [2, 6]. Chemical assays were conducted on both the product and the plant matrix. The Folin-Ciocalteu method was used to quantify total phenolics [7]. Trolox equivalent antioxidant capacity (TEAC), Ferric Reducing Antioxidant Power (FRAP), and Oxygen Radical Absorbance Capacity (ORAC) methods were employed to assess antioxidant activity [8]. The HPLC-DAD method was utilized to analyze the phenolic compound profile [9]. Data processing for calculation and presentation of results involved descriptive statistics. Linear regression and determination coefficient were used for concentration calculations based on calibration curves, performed using Microsoft Excel 2019.

Results and Discussion

The results are presented in Table 1, on a wet basis. The phenolics present in higher amounts are 5-caffeoylquinic acid (5-CQA), protocatechuic acid, and gallic acid, respectively, in the seed. In the plant-based beverage, the primary quantified phenolic was catechin, followed by gallic acid and protocatechuic acid. And the presence of this and the other compounds contributes to the antioxidant activity exhibited by both the seed and the beverage.

Table 1. Phenolic Compounds and Antioxidant Activity of Munguba Seed and Plant-Based Milk (mean ± standard deviation)

Compound	Seed	Plant based milk
Total phenolic (µg GAE/g)	899.65 ± 4.86	188.16 ± 9.44
Quercetin (µg/g)	5.59 ± 0.76	-
Catechin (µg/g)	52.88 ± 2.67	13.39 ± 0.29
caffeic acid (µg/g)	77.15 ± 0.16	6.51 ± 0.30
p-coumaric acid (µg/g)	23.30 ± 0.86	3.48 ± 0.11
5-CQA (µg/g)	138.41 ± 2.03	5.77 ± 0.09
Ferulic acid (µg/g)	40.27 ± 0.71	3.26 ± 0.06
o-coumaric acid (µg/g)	-	-
sinapic acid (µg/g)	44.74 ± 0.61	3.27 ± 0.03
Gallic acid (µg/g)	90.33 ± 7.65	11.66 ± 0.03
4-hydroxybenzoic (µg/g) acid	33.93 ± 0.34	4.80 ± 0.036
Protocatechuic acid (µg/g)	95.41 ± 0.43	8.39 ± 0.091
Antioxidant Activity		
FRAP (µmol $FeSO_4$/mL)	43.34±1.17	6.59 ± 0.52
TEAC (µmol TE/mL)	6.02±0.42	0.76 ± 0.03
ORAC (µmol TE/mL)	15.84±0.45	2.23 ± 0.19

GAE = Gallic Acid Equivalent; TE = Trolox Equivalent; FeSO4 = Ferrous Sulphate.

Conclusion

The munguba seeds and the plant-based milk exhibited a variety of phenolics substances, along with antioxidant activity in the different essays, showcasing their potential to contribute to a healthy diet, particularly for the target audiences of interest. As a future perspective, secondary applications for this beverage will be explored, such as the production of a yogurt analogue through fermentation by lactic acid bacteria, following such an emerging trend.

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