



Bioactive Compounds, Volatiles Profile, and Antioxidant Property of Jabuticaba (*Myrciaria cauliflora*) Fruit Pulp-Based Fermented Beverages

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ABSTRACT

The present study aimed to develop an alcoholic product by fermentation of jabuticaba fruit pulp. The herbal beverage was prepared by inoculation with different strains of *S. cerevisiae* viz. ISC, USC, and BSC, varying the pulp removal method (manual and direct). The BSC strain has good reducing sugars (4 g/L), non-reducing sugars (1.14 g/L), total sugars (5.12 g/L), ash (2.56 g/L), pH (3.50), total soluble solids (17.30°B) and total acidity (200.67 meq/L). Thus, BSC strain obtained higher contents of total phenolics (431.70 mg gallic acid/L), total polyphenols (10.18 g taninn/L), and tannin (3.38 g taninn/L). The HPLC-DAD analysis showed that malic acid (0.69 mg/mL) was higher in USCM. The GC/MS analysis showed that ethanol (18.52%) was higher in the ISCM. The ISCD exhibited higher DPPH[•] scavenging activity (5.65 mg/g) than other strains. This study will be useful in designing an on-site unit for the production of functional drinks from Jabuticaba.

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Myrciaria cauliflora; pulp; polyphenols; antioxidants; beverages; *S. cerevisiae*

Introduction

The global herbal beverages market has witnessed significant growth over the years, driven by the increasing consumer preference for natural products and rising awareness regarding health and wellness. Herbal beverages including fruit by-products infused fermented beverages are the best drinks for consumption. This transformation from natural products into a fermented beverage has higher economic benefits. According to the report, fruit-infused drinks have the largest market share of 39.2% of the global market in 2023 and are expected to witness a CAGR (Compound Annual Growth Rate) of 6.9% during the forecast years of 2023–2033 (Market Research Survey, 2022).

Brazil has a rich cultural heritage and diverse culinary traditions that influence consumer preferences for fermented ingredients over other countries. In 2021, Brazil's exports of fermented beverages exceeded its imports



Hydroalcoholic extracts of *Psidium cattleianum* Afzel. ex Sabine for liqueur production: influence of different fruit harvesting points on phytochemical, volatile, and sensory profiles, antioxidant activity and physical characteristics

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Abstract

Araçá (*Psidium cattleianum* Afzel. ex Sabine) is a tasty Brazilian fruit that can be used in the production of alcoholic beverages, such as liqueur. This study aimed to determine the phenolic, volatile, and sensory profiles, antioxidant activity and physical characteristics of hydroalcoholic extracts of Araçá, red variety, from different harvest points (unripe, ripe and, senescent fruits). For the elaboration of the extracts, Cachaça (Brazilian spirit) was used. Fifteen phenolic compounds were identified and quantified, classified between phenolic acids and flavonoids, with emphasis on 3,4-DHB, chlorogenic acid, sinapic acid, catechin, epicatechin, isoquercetrin, and quercetin. The highest antioxidant activity was for hydroalcoholic extract of unripe fruits. In the hydroalcoholic extracts, 53 volatile compounds were identified, being them: alcohols, esters, terpenes, ketones, aldehydes, and others compounds. In cachaça, 20 compounds were detected, mostly esters. For taste, senescent fruit extract differed from unripe fruit extract. The physical characteristics of the hydroalcoholic extracts were consistent with the fruit harvesting points. Hydroalcoholic extracts showed similar aroma profiles compared to Cachaça. The liqueurs, produced with the hydroalcoholic extracts of Araçá, red variety, can be a promising alternative for obtaining beverages with important compounds for human health.

Keywords Araçá · Hydroalcoholic extracts · Phenolic and Aromatic · Sensory profile · Physical characteristics, Alcoholic beverages

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Nitric oxide reapplication during controlled atmosphere storage impacts on oxidative stress and volatiles production in 'Cripps Pink' apples

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ABSTRACT

The aim of this study was to evaluate the effect of different concentrations of nitric oxide (NO) reapplied during controlled atmosphere (CA) storage on oxidative stress defense mechanisms and on profile of volatile compounds of 'Cripps Pink' apples. Fruit were treated with NO at 0, 1, 2, 5, or 10 $\mu\text{L L}^{-1}$ every seven days during CA storage (0.8 kPa of O₂, <0.5 kPa of CO₂, at temperature of $1.5 \pm 0.2^\circ\text{C}$, and $94 \pm 2\%$ RH). Fruit were evaluated after 8 months of CA storage, followed by seven days of shelf life. In general, linear and quadratic models adjusted to quantitative levels of NO showed increased contents of total phenolic compounds (in the pulp and peel tissues), increased activity of catalase, reduced activity of lipoxygenase, reduced content of H₂O₂, reduced lipid peroxidation and ethylene production in the fruit with the increase of NO concentrations. NO treatment had no effect in the total antioxidant activity and in the activity of the enzymes superoxide dismutase and peroxidase in the fruit. The increase of NO concentrations reduced the volatile compounds butyl acetate, hexyl acetate, 2-methylbutyl acetate, ethyl butanoate, 2-methylbutanoate, and 1-butanol in the pulp of the fruit. The results show that weekly application of NO at $\sim 6 \mu\text{L L}^{-1}$ during CA storage of 'Cripps Pink' apples improved the mechanisms to protect the fruit from oxidative stress, but it might impair the production of the main esters associated with aroma.

1. Introduction

'Cripps Pink' apple fruit has increased its commercial relevance worldwide, mainly due to the differentiated organoleptic characteristics, late maturation, high productivity, and the possibility of commercialization as Pink Lady®. However, fruit harvesting is concentrated in a short period of the year, and there is a lack of adequate storage facilities to prolong the period of fruit supply and to maintain the quality demanded by consumers (Klein et al., 2020). Commercially, 'Cripps Pink' apples are stored under controlled atmosphere (CA), which allows the reduction of metabolism and enables the extension of supply in the off-season (Mditshwa et al., 2018; Klein et al., 2020).

Even under CA storage, undesirable changes in the appearance, aroma, and taste of fruit may occur (Fernandes et al., 2021). These changes result in reduced quality and consumer acceptance. Among the main causes of depreciation in fruit quality are physiological disorders resulting from oxidative stress (Thewes et al., 2017; Fernandes et al.,

2021; Thewes et al., 2022). In addition, loss of crunchiness and juiciness, a decrease in the development of aroma and reduced taste are recurrent problems reported for fruit stored in CA (Lara et al., 2003; Thewes et al., 2017; Ludwig et al., 2022). In an attempt to reduce these drawbacks, technologies complementary to CA have been developed in recent decades. The application of nitric oxide (NO) has emerged as a promising strategy to improve fruit conservation (Pols et al., 2022). NO is a gaseous molecule produced naturally by living cells (Mukherjee, 2019), involved in the signaling of several physiological processes, including delayed ripening and senescence of fruit (Buet et al., 2021; Li et al., 2022). NO delays fruit ripening mainly by its ability to restrict the activity of enzymes responsible for ethylene biosynthesis (Palma et al., 2019; Pols et al., 2022). In addition, NO treatment reduced the incidence of mealiness, internal browning, chilling injury and decay, and increased the activity of antioxidant enzymes in climacteric fruit stored in CA (Gularte et al., 2022; Coser et al., 2023). However, NO application might affect the activity of enzymes responsible for the biosynthesis of

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RESEARCH ARTICLE

Vinegars from fruits of *Myrciaria cauliflora* (Mart.) O.Berg and *Myrciaria jaboticaba* (Vell.) Berg: Phytochemical, volatile, and sensory profiles, antioxidant activity, and chemical characteristics

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Abstract

Background: Jaboticaba is a tasty Brazilian fruit that can be used in vinegar production. This study aimed to determine the phenolic, volatile, and sensory profiles; antioxidant activity; and chemical characteristics of vinegars produced with fruits, with and without the peel, of *Myrciaria cauliflora* (Mart.) O.Berg and *Myrciaria jaboticaba* (Vell.) Berg.

Results: Fourteen phenolic compounds were identified and quantified, classified between phenolic acids and flavonoids, with emphasis on 3,4-dihydroxybenzoic acid, chlorogenic acid, and sinapic acid. The highest antioxidant activity was found in *M. jaboticaba* vinegar, made with unpeeled fruits. For volatile compounds, 21 esters, 7 alcohols, 5 terpenes, 1 ketone, and 1 vinylarene were identified. Sensory analysis showed similarities in terms of taste and differences in terms of odor between Jaboticaba vinegars and commercial vinegars. The mineral content demonstrates the nutritional potential of vinegars in terms of macro and micronutrients, with a predominance of potassium and calcium. Phenolic compounds, acetic acid, and esters were the main chemical groups identified. Vinegars, in general, showed differences concerning the presence and absence of peels.

Conclusion: Vinegars produced with different varieties of Jaboticabas can be a promising alternative for obtaining beverages with important compounds for human health, promoting local production, and adding value to regional products.

KEYWORDS

aromatic compounds, chemical characteristics, Jaboticaba, phenolic compounds, sensory profile, vinegar

INTRODUCTION

Jaboticaba is a small fruit native to Brazil, which has a sweet and slightly acidic pulp and high levels of sugars, organic acids, and terpenes. It is grown on a small scale, with production between August and

November. It has a spherical shape, with a thin (*Myrciaria cauliflora* (Mart.) O.Berg) or thick (*Myrciaria jaboticaba* (Vell.) Berg) peel, depending on the species, with a green to dark purple color, depending on the maturation stage.^{1–4} The dark purple peel is rich in phenolic acids, flavonols, ellagitannins, and anthocyanins such as cyanidin and delphinidin

Produção e qualidade de lúpulos cascade e chinook submetidos a diferentes umidades de solo

Production and quality of cascade and chinook hops subjected to different soil moisture

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RESUMO

O objetivo deste trabalho foi avaliar o efeito da umidade do solo sobre as características químicas, fisiológicas e de produção das cultivares de lúpulo Cascade e Chinook. O experimento foi conduzido com plantas das cultivares Cascade e Chinook de dois anos, cultivadas em vasos com Cambissolo Húmico mantidos em estufa, em Lages, Santa Catarina (safra 2022/2023). Avaliaram-se os tratamentos de umidade do solo mantida entre 90 a 100% da capacidade de campo (CC) durante todo o cultivo (97CC); umidade mantida entre 75 a 85% da CC durante todo o cultivo (83CC); umidade mantida entre 60 a 70% da CC durante todo o cultivo (69CC) e umidade mantida entre 75 a 85% da CC durante todo o cultivo, mas com corte da irrigação quatro dias antes da colheita dos cones (83CCpc). O delineamento foi inteiramente casualizado em esquema fatorial 4 x 2, com quatro repetições. A maior umidade do solo resultou em maior consumo de água por planta, mas os diferentes tratamentos não alteraram a produção de cones por planta, a duração do ciclo, taxa de crescimento da parte aérea e as respostas fisiológicas de transpiração, condutância estomática e fotossíntese líquida. Observou-se efeito de cultivar, com maior consumo de água por planta e maior produção de cones na cultivar Cascade.

Palavras-chave: Humulus Lupulus, fisiologia de plantas, déficit hídrico, umidade gravimétrica.

ABSTRACT

The objective of this work was to evaluate the effect of soil moisture on the chemical, physiological and production characteristics of Cascade and Chinook hop cultivars. The experiment was conducted with plants of the two-year-old Cascade and Chinook cultivars, grown in pots with Humic Cambisol kept in a greenhouse, in Lages, Santa Catarina (season 2022/2023). Soil moisture treatments maintained between 90 and 100% of field capacity (FC) throughout the cultivation period (97FC) were evaluated; humidity maintained between 75 and 85% of CC throughout the cultivation (83FC); humidity maintained between 60 and 70% of the CC throughout the cultivation (69FC) and humidity maintained between 75 and 85% of the CC throughout the cultivation, but with