Chemical changes during jabuticaba (*Myrciaria cauliflora*) fruit development and ripening

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Abstract

Jabuticaba fruits showed significant chemical changes in sugars, organic acids and phenolic compounds during ripening.

Introdução

Jabuticaba (*Myrciaria cauliflora* (Mart.) O. Berg) is a Brazilian tree with edible grape like fruits, which are consumed fresh or used to prepare jams, liqueurs and wines. The decoction of the skins is used as a treatment for hemoptysis, cough, bronchitis, asthma, diarrhea and dysentery[1]. The aim of this study was to identify the chemical changes in phenolics, sugars and organic acids during jabuticaba's development.

Resultados e Discussão

Jabuticaba fruit was analyzed at four developmental stages for citric acid, malic acid, fructose, glucose and sucrose by ^{1}H NMR, and anthocyanins, ellagitannins and phenolic acids by HPLC/DAD. Data collected was analyzed firstly by hierarchical cluster analyses, which divided samples into three main groups according to fruit stages, (S1, S2+S3, S4). Canonical redundancy analysis (RDA) was used to assess the way developmental stages influences fruit's chemical constituents.

Figure 1 shows RDA ordination results of fruit's stages data set [12 samples × 12 chemical variables × 3 stages]. The correlations between chemicals and stages were higher for the first two canonical axes (0.9851 and 0.9213) with 93.1 % of cumulative variance in the first factorial plane. A statistical test with an unrestricted Monte Carlo permutation (9999 permutations) found significant Fischer's *F*-ratio for the eigenvalues of RDA axes 1 (*F*-value = 65.8; $p < 0.001$) and 2 ($F = 6.8$; $p < 0.004$). Trace statistics (*i.e.* the sum of all canonical eigenvalues) were highly significant (traces = 0.946; *F*-values = 61.0; $p < 0.001$), giving signs that patterns in the RDA plane did not arise by chance. These results suggest a strong and significant association between organic acids/phenolics/sugars contents and developmental stages. RDA1 revealed a time-course dependent separation between the variables; sugars and anthocyanins with high positive loadings represent the full ripe stage (S4), whereas organic acids and ellagitannins are characteristic of the green stage (S1). On RDA2, the variables with high positive values were ellagic acid and fructose, contrasting with negative loadings of elagitannins and cyanidin-3-glycoside.

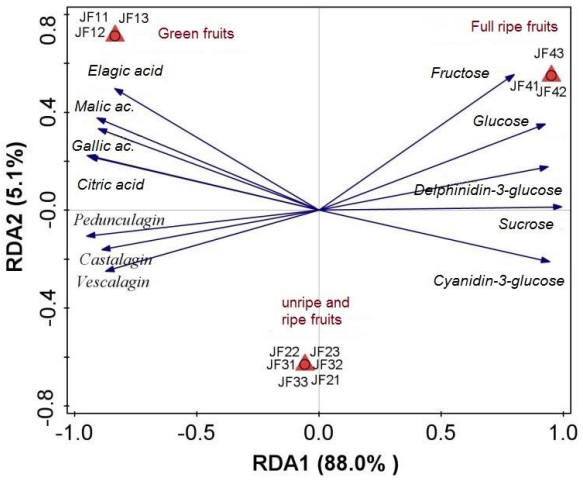

Figura 1. RDA ordination of the first two axes showing the distribution of jabuticaba samples.

Citric and malic acids significantly decreased (27.8-14.2 g/100 g and 4.4-1.0 g/100 g), whereas sucrose increased about twentyfold until the full ripe stage (1.2-22.7 g/100 g). Phenolic compounds changed significantly in their contents during jabuticaba's maturation. Anthocyanin levels underwent a sharp increase reaching 10.8 mg/10 g of cyaniding-3-glucoside at complete maturation. Gallic and ellagic acids showed significant differences in their levels between green to ripe stages (2.2-0.6 and 4.4-1.5 mg/10 g. The ellagitannins pedunculagin, vescalagin and castalagin had significant reductions from ripe to full ripe stages (23.4-4.3; 27.3-8.5; 26.9-15.5 mg/10 g). This reduction is common for several fruits and could be due to complexation between tannins and soluble pectin produced during fruit maturation or tannin polymerization and complexation with cell walls.

Conclusões

Results demonstrated that the optimum harvest time, for technological purposes, coincides with the highest anthocyanins accumulation associated to the lowest ellagitannins and acids contents.

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[1]Wu, S-B.; Long, C.; Kennelly, E. *J. Food Res. Int.* **2013**, *54*, 148.