Metabolomic changes in mango fruit peel associated with chilling injury tolerance induced by quarantine hot water treatment

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Abstract

The application of a quarantine hot water treatment (HWT) induces chilling injury (CI) tolerance in mango fruit, but little is known about the mechanisms involved in this tolerance. The aim of this study was to identify metabolomic changes associated with HWT-induced CI tolerance in 'Keitt' mango fruit. Mature green fruit treated with hot water (HWT; 46.1 °C, 75-90 min) and non-treated (control) were stored for 20 d at 5 °C and ripened for 7 d at 21 °C. The incidence of chilling injury symptoms was registered as CI index. Methanol extracts of fruit peels were used for comparative metabolomics analyses by UPLC-DAD-MS and GC-MS. Total phenolics (TP) were analyzed by the Folin-Ciocalteu assay and the antioxidant activity (AA) was measured by ABTS, DPPH, and FRAP methods. HWT provided CI tolerance to mango fruit as evidenced by a low incidence of symptoms. Fifty-two and 14 metabolites were identified by UPLC-DAD-MS and GC-MS, respectively. These metabolites were classified as galloylquinic acids, gallic acid esters, gallotannins, gallic acid derivatives, benzophenone derivatives, xanthones, flavonoids, organic acids, sugars, fatty acids, and other metabolites (myo-inositol). The HWT before cold storage increased the abundance of galloylquinic acids, gallic acid esters, gallotannins, quercetin 3-*O*-rhamnoside, and myo-inositol; and it decreased the levels of mangiferin, ribose, malic acid, and palmitic acid. After cold storage and ripening, HWT fruit maintained higher levels of galloylquinic acids, gallic acid esters, gallotannins, quercetin 3-*O*-rhamnoside, mangiferin, myo-inositol, linolenic acid, and sugars than those in control fruit. HWT fruit also had higher values of TP and AA by the three methods. Control fruit had higher levels of citric acid, malic acid, palmitic acid, and ribose, as well as lower unsaturated/saturated fatty acid ratio. The HWT-induced CI tolerance in mango fruit appears to be associated with an increased content of antioxidants and osmoprotectant metabolites and a higher ratio of unsaturated/saturated fatty acids.