Title Metabolite content of harvested Micro-Tom tomato (*Solanum lycopersicum* L.) fruit is altered by chilling and protective heat-shock treatments as shown by GC–MS metabolic profiling

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Abstract

The primary aim of this study was to identify metabolites associated with chilling tolerance that was engendered by a heat-shock treatment of tomato fruit pericarp (*Solanum lycopersicum* L. cv. Micro-Tom). Harvested mature-green fruit were immersed in 20 or 40 °C water for 7 min ('Heat-Shock') and then stored at 2.5 °C for 0 or 14 d ('Chilled'). A reduction in chilling injury symptoms (i.e., slow or abnormal ripening, increased ion leakage, and increased respiration following chilling) was used to select this heat-shock treatment as optimal. Using GC–MS (Gas Chromatography–Mass Spectrometry) metabolite profiling, 363 analytes were detected in fruit pericarp of which 65 are identified metabolites. Principal Component Analysis of these data led to distinct groups among the samples based on their treatments; 'Chilled' and 'Chilled + Heat-Shocked' fruit were markedly different from each other, while the 'Non-Chilled Control' and 'Heat-Shocked' fruit were similar and grouped closer to the 'Chilled + Heat-Shocked' fruit. These results indicate that the heat treatment provided protection from chilling in part by altering levels of fruit metabolites. The levels of arabinose, fructose-6-phosphate, valine and shikimic acid appear to be associated with this heat-shock induced chilling tolerance since their levels were altered in the 'Chilled' samples ($p< 0.05$), relative to the control and the heat-shocked protected fruit. We also describe the metabolites we identified that could be further studied as being indicative of incipient chilling injury in mature-green tomato fruit.