

Enhancement of the antioxidant capacity of ripe tomatoes by the application of a hot water treatment at the mature-green stage

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Abstract

Plants are constantly exposed to abiotic and biotic stresses, inducing the generation of reactive oxygen species (ROS). In response, the synthesis of antioxidants is upregulated to neutralize the deteriorating effects of ROS. We investigated whether promoting this response could enhance the nutritional and sensory quality of tomatoes. In preliminary experiments, mature green tomatoes were immersed in hot water (HW) at 50 °C for 5 min, 52 °C for 5 min, or 54 °C for 2.5 min (25 °C water for 5 min as control); subsequent experiments utilized 52 °C for 5 min. Following those treatments, we evaluated the changes in color, texture, soluble solids, titratable acidity, and the antioxidant system of the fruit during ripening at 20 °C and 85–90 % relative humidity. The HW treatment of 52 °C for 5 min promoted higher accumulation of carotenoids and lipophilic phenolics, resulting in greater color development and slightly higher antioxidant potential, but did not otherwise affect the composition of ripe fruit; the tomatoes ripened normally after HW immersion, with no firmness differences, but were darker red and less yellow-orange with higher antioxidant potential. Furthermore, we observed that the beneficial effects were more noticeable at early stages of ripening, even in varieties that did not exhibit major differences after reaching full ripeness. In this sense, we found that ‘Florida 47’ and ‘Security 28’ tomatoes have a limited response to HW treatment compared with ‘Soraya’ and especially ‘Tasti Lee’ tomatoes, indicating that there might be genetic constraints on the response in the former varieties. The beneficial effect of immersing the tomatoes in HW was proportional to the heat penetration profile inside the fruit; for example, the 52 °C for 5 min treatment increased the temperature up to 45 °C in the peripheral tissues 4 mm below the fruit surface where the content of carotenoids and

lipophilic phenolic compounds was mainly increased; whereas, the tissue temperature was 35 °C at the center of the tomato, where we did not observe any change in composition. In conclusion, the HW immersion used in this research promoted the synthesis of lipophilic antioxidants such as carotenoids in tomato fruit, enhancing red color development and antioxidant potential.