Impact of postharvest hot water, 1-MCP and $CaCl_2$ treatments on antioxidant enzymes and related genes during cold storage in sweet cherry (*Prunus avium* L.)

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Abstract

Superoxide dismutase (SOD), catalase (CAT), glutathione reductase (GR), ascorbate peroxidase (APX), glutathione peroxidase (GSH-POD) and dehydroascorbate reductase (DHAR) are the main enzymes in the antioxidant system and play an important role in the response to oxidant stress. To understand the role of the main enzymes players in sweet cherry (*Prunus avium*) fruit ripening in postharvest of hot water (45, 50 and 55 °C), 1-methylcyclopropene (1-MCP) (0.5, 1 and 5 μL L^{-1}) and $CaCl_2$ (1 and 2%) treatments, the antioxidant enzyme activities and the expressions of antioxidant genes were investigated in this study. *PaSOD*, *PaCAT*, *PaGR*, *PaAPX*, *PaGSH-POD* and *PaDHAR* genes in sweet cherry were determined from genome databases (Genbank) and expressions examined. The antioxidant enzyme activities and expression patterns were analyzed at four different storage timepoint (10, 15, 20 and 30 days) and in sweet cherry fruit treated with hot water, 1-MCP and $CaCl_2$. The activities of SOD, CAT, GR, APX and GSH-POD enzymes greatly increased in the control group at the day 15 and day 20, respectively, but were significantly decreased by hot water treatment (55 °C), 1-MCP (1 and 5 μL L^{-1}) and $CaCl_2$ (2%) treatments, which were positively correlated with the changes in the *PaSOD*, *PaCAT*, *PaGR*, *PaAPX* and *PaGSH-POD* gene expression levels. Activities and gene expression levels of GSH-POD and GR were inhibited by 1-MCP and $CaCl_2$ treatments during the 20-day storage period. The decrease in antioxidant enzyme activity during cold storage after all treatments period is due to the inhibition of reactive oxygen species synthesis, which maintains the cell integrity and stability. However, the antioxidant enzyme activities greatly decreased in the control group during 30 d storage and were significantly increased by hot water treatment, 1-MCP and $CaCl_2$ treatment. These results indicated that hot water (55 °C 60 s), 1-MCP (5 μL L^{-1}) and $CaCl_2$ (2%) treatments could useful role in extending the shelf life of fruit and improving fruit quality sweet cherry and the possible mechanisms were discussed.