The role of temperature in mediating postharvest polyamine homeostasis in tomato fruit

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Abstract

Polyamines are actively involved in diverse processes, including fruit ripening and stress responses. The aim of this study was to investigate the role of storage temperature on polyamine metabolism of tomato fruit, which were either harvested at the turning stage or left to mature on-plant. The applied temperatures (5, 10 and 25 °C) and storage duration (7 d) are regularly employed in real-world scenarios. The metabolic profile of polyamines (putrescine, spermidine and spermine), gene transcription of the enzymes mediating polyamine biosynthesis and catabolism, protein accumulation of the putrescine synthesis enzyme and the putrescine-produced H_2O_2 were evaluated. Putrescine was the major polyamine in all cases, and its content generally increased during ripening, as well as in chilled fruit (stored at 5 °C). Increases in arginine decarboxylase protein content and in arginine decarboxylase transcription of both attached fruit and detached ones stored at either 10 or 25 °C showed that putrescine accumulation was mainly driven via the arginine decarboxylase biosynthetic pathway. Interestingly, putrescine catabolism by copper-containing amine oxidase was favored in parallel with increases in arginine decarboxylase and ornithine decarboxylase transcripts in fruit stored at 5 °C. However, the arginine decarboxylase protein accumulation suggests that ornithine decarboxylase is mainly responsible for putrescine accumulation at 5 °C. This study indicates that storage temperature modifies the homeostasis of polyamines in tomato fruit, which in turn orchestrates ripening-associated physiological processes.