Application of ABA and GA_3 alleviated browning of litchi (*Litchi chinensis* Sonn.) via different strategies

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Abstract

Browning of harvested litchi causes fast quality losses that are closely associated with anthocyanin degradation. Abscisic acid (ABA) and gibberellins (GA) are antagonistic in regulating plant growth and development, but it is unclear whether and how they affect anthocyanin metabolism in harvested litchi fruit. Here, application of ABA and GA_3 to harvested litchi reduced browning and maintained higher anthocyanin content relative to the untreated control during storage at 20°C. Transcriptome profiling showed 2362 and 6304 differentially expressed genes (DEGs) were induced in response to ABA and GA_3 treatment, respectively, implying the metabolism pathways regulated by ABA and GA are quite different. The flavonoid and phenylpropanoid biosynthesis are two of the 30 most enriched KEGG pathways for ABA-treated fruit compared with the control, but not for GA_3-treated fruit. ABA upregulated key DEGs involved in phenylpropanoid biosynthesis and anthocyanin synthesis pathways, *phenylalanine ammonia-lyase (PAL), cinnamic acid 4-hydroxylase (C4H), chalcone synthase* (*CHS*) and *UDP-flavonoid glucosyl transferase* (*UFGT*), but GA_3 downregulated them. ABA upregulated DEGs related to anthocyanin degradation and transport, *laccase* (*LAC*), *peroxidase* (*POD*), and *glutathione S-transferase* (*GST*), whereas GA_3 downregulated them. Of the 29 different anthocyanin-related metabolites identified by LC–MS, ABA and GA_3 caused increase of four and two, respectively. Taken together, ABA alleviated browning mainly by promoting anthocyanin synthesis, whereas GA_3 inhibited anthocyanin degradation. These findings add to understanding of the roles of ABA and GA in regulating anthocyanin metabolism of plants in senescent stages and provides new approaches to pericarp browning prevention in litchi.