Postharvest handling induces changes in fruit DNA methylation status and is associated with alterations in fruit quality in tomato (*Solanum lycopersicum* L.)

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Abstract

Postharvest handling of tomato (*Solanum lycopersicum* L.), specifically low-temperature storage and early harvest, are used to extend shelf life but often reduce fruit quality. Recent work suggests that DNA methylation dynamics influences fruit ripening through the demethylase *SlDML2* gene. However, the influence of postharvest handling on DNA methylation in relation to fruit quality is unclear. This work aimed to clarify these issues by analyzing DNA methylation using methyl-sensitive amplification polymorphism (MSAP), semi-quantitative transcriptional analysis of marker genes for fruit quality (*RIN*; *RIPENING INHIBITOR*) and DNA methylation (*SlDML2*; *Solanum lycopersicum* L. *DNA demethylase 2*), and, fruit biochemical quality biomarkers. Multivariate analysis of these data suggested that fruit DNA methylation state was associated with different postharvest handling techniques. Chilled postharvest fruit were distinct in their DNA methylation state and quality characteristics, which implied that these three phenomena i.e., chilling, methylation, and quality are highly connected. In addition, different postharvest handling methods modulated *SlDML2* transcript levels but had little effect on the level of *RIN* transcripts in fruit that reached the Turning stage after early harvest, and cold storage. Although not a comprehensive global assessment, these data collectively helped to advance our interpretation of tomato fruit ripening. In conclusion, our findings revealed that postharvest-induced variation in fruit quality is in relation to DNA methylation. Long-term this work will help better connect physiological changes in tomato fruit to events happening at the molecular level.