Transcriptome analysis of starch and sucrose metabolism change in Gold Queen Hami melons under different storage temperatures

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Abstract

Temperature control is an effective method to maintain the postharvest quality of fruit and extend their shelf life. However, quality deterioration, or more specifically, faded sweetness, occurs in long-term cold-stored melons. This study aimed to characterize the transcriptomic profiles of Gold Queen Hami melon using RNA sequencing at different storage temperatures (21 °C, 3 °C, and 0.5 °C). The results indicated that storage temperature significantly affected the expression of numerous genes in the melon fruit, especially several key genes involved in the starch and sucrose metabolism pathway. The findings revealed that 23 genes presented opposite expression pattern between 3 °C and 21 °C, and 62 chilling-related candidate genes were obtained. Sweetness loss in Hami melons was enhanced at storage temperatures of 3 °C and 0.5 °C. Furthermore, storage at 3 °C was found to decelerate Hami melon softening, as the degradation of pectin and expression of polygalacturonase (PG) were reduced. Moreover, storage at 0.5 °C promoted starch degradation by regulating the expression of α-amylase (AMY) and β-amylase (BMY) genes, subsequently, the levels of soluble sugars increased, potentially preventing physiological or cellular damage from cold stress in the melon fruit. These results indicated that softening was delayed at 3 °C, but the sweetness of the Hami melon was negatively affected at the level of gene transcription, explaining the faded sweetness of cold-stored melon fruit.