## Short-term high CO<sub>2</sub> treatment reduces water loss and decay by modulating defense proteins and organic osmolytes in Cardinal table grape after cold storage and shelf-life

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## Abstract

Shelf-life quality was improved when Cardinal table grapes (Vitis vinifera L.) were pretreated with 20 kPa of  $CO_2$  for three days at the beginning of a long-term cold storage. This pretreatment was effective in avoiding postharvest losses of cv. Cardinal grapes in terms of water loss, oxidative damage and disease prevention. To elucidate those physiological and biochemical factors involved in preserving the postharvest shelf-life quality of table grapes, we studied the expression pattern of defense proteins such as pathogenesis-related proteins (PRs) and dehydrins, as well as the profile of protective osmolytes. The efficacy of a short-term high CO<sub>2</sub> pretreatment in reducing fungal disease could be mediated by the increase in the low molecular mass chitinase isoform of 16 kDa, which is up-regulated in the skin of CO<sub>2</sub>-treated grapes in parallel with the shelf-life fungal decay control. In addition, the increasing accumulation of a 22 kDa dehydrin isoform and the endogenous levels of organic osmolytes proline and glycine betaine in fruit stored at 20 °C (mainly in CO<sub>2</sub>-treated fruit) revealed that these protective biomolecules might play a more effective role in maintaining the structural and cellular homeostasis of table grapes after the shelf-life period, helping to reduce water loss and membrane oxidative damage (malondialdehyde accumulation) associated with the senescence-related disorders of postharvest table grapes.