

UV-C hormesis in broccoli florets: Preservation, phyto-compounds and gene expression

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Postharvest Biology and Technology, Volume 157, November 2019, 110965

Abstract

The effect of pre-storage exposure to ultra-violet radiation (UV-C) on preservation of broccoli (*Brassica oleraceae* var. *Italica*) florets and glucosinolates, phenolic acids and their precursor amino acids as well the expression of genes related to the biosynthetic pathways of glucosinolates and phenolic compounds in broccoli stored at 4 °C and 90–95% HR was investigated. The UV-C dose of 1.2 kJ m⁻² was found to be hormetic in delaying the yellowing and in lowering the weight loss of broccoli florets during storage. The time-averages over the storage period of both ascorbic acid titer and ORAC (oxygen radical absorbance capacity) value of the tissue exposed to hormetic dose of 1.2 kJ m⁻² or a high dose of 3.0 kJ m⁻² were lower. The overexpression of genes (phenylalanine N-hydroxylase, tryptophan N-hydroxylase, dihomomethionine N-hydroxylase and flavonoid monooxygenase) in UV-C exposed broccoli, hours after exposure (0 d), and that of chalcone synthase and coumarate ligase was observed on day 0, 2 and 4. The titers of glucosinolate-precursor amino acids, methionine, tryptophan and phenylalanine in tissue were dose-dependent, where the doses of 1.2 and 3.0 kJ m⁻² UV-C caused a decrease in their concentrations compared to the control. Hormetic dose of UV-C significantly increased the concentration of total glucobrassicins and 4-hydroxyglucobrassicin. In addition, UV-C treated florets with the dose of 1.2 or 3.0 kJ m⁻² contained a higher level of hydroxycinnamic acids in broccoli compared to the control during the storage. The results suggest that the application of hormetic dose of UV-C can be beneficial in maintaining not only the quality of broccoli florets, but also in enhancing the phyto-compounds during the low-temperature storage.