UV-B radiation hormesis in broccoli florets: Glucosinolates and hydroxy-cinnamates are enhanced by UV-B in florets during storage

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Postharvest Biology and Technology, Volume 168, October 2020, 111278

Abstract

Abiotic stresses are oxidative in nature and cause generation of reactive oxygen species (ROS) in plant bodies. Severe stresses can be harmful to the plant tissue, whereas sub-acute or lower doses of stresses could enhance or induce protective mechanisms, a biological phenomenon known as *hormesis*. The objective of this work was to examine the effect of hormetic as well as high doses of UV-B on the quality along with glucosinolate and hydroxy-cinnamate contents in broccoli florets during storage. An UV-B dose of 1.5 kJ m^{-2} was found to be hormetic from the color retention response. Color development, weight loss and respiration rate were monitored during 21 d of storage at 4 °C. The gene expression of dihomomethionine N-hydroxylase (*CYP79F1*), tryptophan N-hydroxylase 2 (*CYP79B3*), phenylalanine N-hydroxylase (*CYP79A2*), phenylalanine ammonia-lyase (*PAL*), chalcone synthase (*CH*) and flavanone 3-hydroxylase (*F3H1*) in the treated broccoli was also evaluated. The antioxidant capacity and the profiles of glucosinolates and hydroxy-cinnamates were determined for up to 14 d in broccoli florets stored at 4 °C by LC–MS. The hormetic dose of UV-B was effective in delaying the yellowing of broccoli florets. The initial respiration rate of the florets treated with the hormetic and a high dose (7.2 kJ m^{-2}) was significantly high. The antioxidant capacity of florets was higher in UV-B treated florets relative to the control. The titers of indole-type glucosinolates and hydroxycinnamates in broccoli were significantly ($p < 0.05$) higher with both doses of UV-B compared to the non-exposed florets. UV-B appears to exhibit balanced effects with respect to quality preservation and enhancement of phyto-compounds in broccoli florets. Results showed a good correlation between gene expression of *CYP79B3*, and the titers of indole glucosinolates in the treated broccoli florets, suggesting that the target of UV-B is likely to be the branch pathway of indole glucosinolates.