Melatonin confers enhanced polyamine metabolism and cell tolerance in *Vitis vinifera* against oxidative damage: quantitative proteomic evidence

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Postharvest Biology and Technology, Volume 184, February 2022, 111756

Abstract

Melatonin (MLT) exhibited pleiotropic effects in multiple plant physiological processes; however, its role in the polyamine metabolism and quality performance of postharvest *Vitis vinifera* berry remain unknown. In the present study, MLT was applied to postharvest *Vitis vinifera* cv. Kyoho berry, which delayed berry abscission, berry rotten, and promoted cell tolerance to oxidative stress. Notably, the malondialdehyde content of berries was reduced to 40.8 % on the application of 200 μmol L^{-1} MLT. Furthermore, tandem mass tags (TMT)-based quantitative proteomic analysis identified 5,156 proteins from berry skin, among which 158 proteins showed quantitatively differences in response to MLT application. These differentially expressed proteins were mainly upregulated in the arginine and proline metabolism pathways, lysine degradation, and ascorbate and aldarate metabolism pathways. The abundance of proteins involved in polyamine metabolisms, including *N*-carbamoylputrescine amidase, spermidine synthase, and aldehyde dehydrogenases were also upregulated. Moreover, MLT application enhanced contents of arginine, proline, 4-aminobutanoic acid, and polyamines, which played an essential role in oxidative stress response. Further, the transcript level of key enzymes involved in polyamine metabolism, including *VvADC*, *VvODC*, *VvNAC*, *VvSPDS* and *VvCuAO* were up-regulated on MLT application. Overall, the role of MLT in regulating the polyamine metabolism and subsequently in cell tolerance against oxidative damage was scientifically established for the first time for *Vitis vinifera*. The empirical findings of this study may propose new insights on MLT application in postharvest berry physiology and provide theoretical regulation for the preservation of berries, perhaps other fruits.