Elevated Gene Expression in Chalcone Synthase Enzyme Suggests an Increased Production of Flavonoids in Skin and Synchronized Red Cell Cultures of North American Native Grape Berries

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Abstract

Anthocyanins are antioxidants and are among the natural products synthesized via the flavonoid biosynthesis pathway. Anthocyanins have been recommended for dietary intake in the prevention of cardiovascular diseases, cancer, and age-related conditions such as Alzheimer's disease or dementia. With an increasingly aging population in many parts of the world, strategies for the commercial production of in vitro synchronized red cell cultures as natural antioxidants will be a significant contribution to human medicine. Red pigmented fruits such as grapes (Vitis sp.) are a major source of bioavailable anthocyanins and other polyphenols. Since the level of antioxidants varies among cultivars, this study is the first one that phytochemically and genetically characterizes native grape cultivars of North America to determine the optimal cultivar and berry cells for the production of anthocyanins as antioxidants. Using real-time PCR and bioinformatics approaches, we tested for the transcript expression of the chalcone synthase (CHS) gene, an enzyme involved in the flavonoid and anthocyanin biosynthesis pathway, in different parts of physiologically mature grape berries and in vitro synchronized red cells. A low level of expression was recorded in berry flesh, compared with an elevated expression in berry skins and in vitro synchronized red cells, suggesting increased production of flavonoids in skin and cell cultures. This preliminary study demonstrates the potential of functional genomics in natural products research as well as in systematic studies of North American native grapes, specifically in muscadine (Vitis rotundifolia).