Review Article

Anthocyanins and anthocyanin-rich extracts: role in diabetes and eye function

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Anthocyanins are the largest group of water-soluble pigments in the plant kingdom, known collectively as flavonoids. More than 8000 flavonoids, and 500 anthocyanin structures had been reported by the year 2000 and more are continually being isolated. Anthocyanins are believed to display an array of beneficial actions on human health and well-being. Due to our increasing understanding and awareness of the potential beneficial human health effects, research on anthocyanins has recently intensified. During the past two decades an increasing number of studies have investigated the diverse protective effects elicited by polyphenolics present in various fruits and vegetables. These effects include antioxidant, anti-allergic, anti-inflammatory, anti-viral, anti-proliferative, anti-mutagenic, anti-microbial, anti-carcinogenic, protection from cardiovascular damage and allergy, microcirculation improvement, peripheral capillary fragility prevention, diabetes prevention, and vision improvement. Other physiological effects are continually being investigated. The aim of the present article is to summarise the known anti-diabetic and eye function properties of anthocyanins to help in our understanding of their functional mechanism.

Key Words: anthocyanins, anthocyanin-rich extracts, disease prevention, diabetes, eye function

Introduction

Anthocyanins (Greek *anthos*, flower and Greek *kyanose*, blue) used originally to describe the blue pigment of the cornflower *Centaurea cyanus*, are an important group of water-soluble plant pigments. They belong to the most common class of phenolic compounds, known collectively as flavonoids with more than 8000 flavonoid and 500 anthocyanin structures reported by the year 2000.[1] Anthocyanins are widespread in food plants, occurring in 27 families. The worldwide annual consumption has been estimated as 10 000 tonnes from black grapes alone. During the past two decades an increasing number of studies have investigated the diverse protective effects elicited by polyphenolics present in various fruits and vegetables. These effects include antioxidant, anti-allergic, anti-inflammatory, anti-viral, anti-proliferative, anti-mutagenic, anti-microbial, anti-carcinogenic, protection from cardiovascular damage and allergy, microcirculation improvement, peripheral capillary fragility prevention, diabetes prevention, and vision improvement.[2-13] Polyphenolic research has recently intensified because of this increasing understanding and awareness of the potential beneficial human health effects. There are some review articles on the general biochemical, cellular and medicinal properties of anthocyanins, [9,14-18] but no detailed review of their role in diabetes and eye function has yet been published. The aim of the present article is to summarise the known anti-diabetic and eye function properties of anthocyanins to help in our understanding of their functional mechanism.

Chemical structure and distribution

Anthocyanins are water-soluble glycosides of polyhydroxyl and polymethoxyl derivatives of 2-phenylbenzopyrylium or flavylium salts. The six anthocyanidins commonly found in plants are classified according to the number and position of hydroxyl groups on the flavan nucleus, and are named cyanidin (cy), delphinidin (dp), malvidin (mv), peonidin (pn), pelargonidin (pg) and petunidin (pt). The differences between individual anthocyanins come from the number and the position of hydroxyl groups; the degree of methylation of these hydroxyl groups; the nature, number and location of sugars attached to the molecule; and aliphatic or aromatic acids attached to the sugars in the molecule.[14] Glycosylation confers increased structural stability and water solubility to the parent anthocyanidin.[19] Acylation of the sugar residues with cinnamic (*p*-coumaric, caffeic, ferulic) or aliphatic (acetic, malonic, succinic) acids[14] further improves anthocyanin stability. Generally, di-, tri-, or polyacylated anthocyanins have increased stability over simple and monoacylated anthocyanins.[20]

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