

QUERY THIS: ANTHOCYANINS

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What are anthocyanins?

Anthocyanins are commonly consumed plant pigments found naturally in many fruit, vegetables, grains and flowers. They are responsible for the bright red, blue and purple colours. They are a subfamily of flavonoids comprising a basic structural 2-phenylchromenylium aglycone skeleton (or flavylium cation) called an anthocyanidin. They are further classified based on substitution with hydroxyl and methoxyl groups, which determines the colour, with the most abundantly found in nature being the red cyanidin, followed by the blue delphinidin then purple malvidin. When glycosylated with sugars (glucose, galactose, arabinose etc), they are anthocyanins. Their colour is most pronounced in acidic environments (low pH).

BerriQi® predominantly contains cyanidin-3-O-sophoroside, cyanidin-3-O-glucoside and cyanidin-3-O-(2-glucosylrutinoside) from Boysenberries. The apple juice component of BerriQi® does not contain anthocyanins.

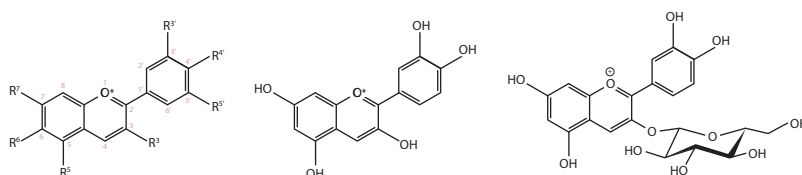


Figure 1: Anthocyanins. Left shows generic structure of anthocyanidins, the aglycone (sugar-less) anthocyanin. Middle shows cyanidin. Right shows the cyanidin-3-O-glucoside from BerriQi®.

What do plants use anthocyanins for?

Plants mainly use anthocyanins to absorb and protect them from UV, as antioxidants to reduce oxidative stress, as colours to attract animals for seed distribution, and as antimicrobial compounds to protect from fungal, bacterial or viral infections.

New Zealand fruit and vegetable anthocyanin production

New Zealand has twice the UV levels of equivalent latitudes in the Northern Hemisphere. Reducing fruit and vegetable exposure to UV has been shown to reduce anthocyanin production. The highest recorded average total sunlight hours in New Zealand are in the Nelson region, where New Zealand Boysenberries are grown. This combines to suggest that the anthocyanin levels of the Boysenberries in **BerriQi®** are amongst the highest in the world.

What health benefits does consuming anthocyanins have?

Anthocyanins are antioxidant and anti-inflammatory. They prevent oxidative stress in humans and other animals that consume them, and mitigate inflammatory conditions such as those found in cardiovascular disease, obesity, type 2 diabetes, and otherwise prevent against inappropriate inflammation, such as asthma or pollution effects in the respiratory system.

Antioxidant activity

Anthocyanins are highly active antioxidants, with particularly high scavenging ability versus the superoxide radical. Anthocyanin-induced proteins upregulate antioxidant response element pathways. This protects cells against oxidative stress.

Preventing respiratory and skin inflammation

Anthocyanins reduce the innate proinflammatory pathways which respond to allergens in the lung to reduce immune cell infiltration, reduce mucus overproduction and promote class-switching of macrophages to the anti-inflammatory M2 type which repair damaged tissue. The same underlying immune mechanisms operate in skin, so the anthocyanins are also likely to repair atopic dermatitis-like conditions.

Reducing systemic inflammation

Anthocyanins are associated with downregulation of the inflammatory events controlled by the transcription factor NFκB via mitogen-activated protein kinase (MAPK) pathways.

Reducing obesity-related chronic inflammation

Obesity is an ongoing low level chronic inflammatory condition. MAPK-based reduction in NFκB-induced inflammatory pathways. In addition, anthocyanins activate AMP-activated protein kinase (AMPK) which regulates energy homeostasis pathways, resulting in lower cholesterol levels, decreased fatty acid synthesis and lower triglyceride concentrations.

Reducing cardiovascular disease-related conditions

Anthocyanin associations with lowered inflammation, cholesterol and triglyceride concentrations means that these cardiovascular disease risk markers are improved.

Mitigating type 2 diabetes

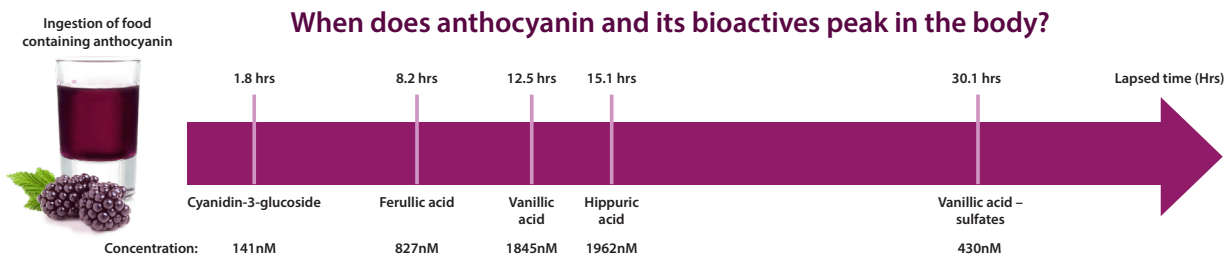
Anthocyanin associations with lowered inflammation, cholesterol and triglyceride concentrations, as well as associations with upregulated glucose transport and improved insulin sensitivity mitigates the effects of type 2 diabetes.

Modifying interactions with gut microbiota

Anthocyanins downregulation of the inflammatory pathways controlled by NFκB results in improved gut barrier function and decreased permeability from bacterial inflammatory stimulators like LPS.

Bioavailability and metabolism

Anthocyanins become quickly bioavailable. They are not commonly detected in blood, plasma, urine or faeces because are easily degraded at biological pHs to a wide range of metabolites with different pharmacokinetic elimination profiles. Tracer studies with stable isotopically labelled ($[^{13}C_5]$ cyanidin-3-O-glucoside as the parent anthocyanin showed it and its Phase II conjugates were detected in blood serum and urine peaking at 2 h and in faeces by 6-24 h.



Recommended daily intake

A recommended daily intake value does not yet exist. Our recommended bioactive daily dose of BerriQi (with a patented formulation of Boysenberries and apples) contains 10.7 mg total anthocyanins per 7.4g concentrate.

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