Anthocyanins: "berry" much more than common plant pigments

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Anthocyanins are not only water-soluble polyphenols and plant pigments responsible for the bright colours of many fruits including berries and vegetables but may also play a significant role as health promoting food ingredients[1].

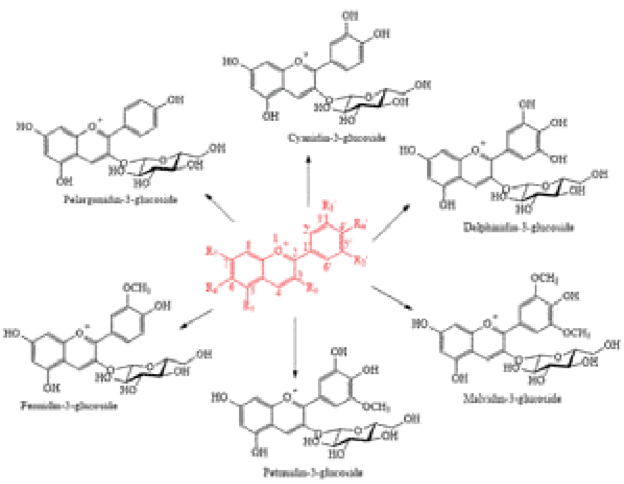

Figure 1. Molecular structures of the six most common anthocyanins in plant-based foods.

The evidence is promising from animal trials, but significant further clinical research with larger sample sizes is required to better understand the metabolism, bioavailability, health benefits and mechanism of action of anthocyanins and their role in human health. Clinical studies in humans are challenging due to the extensive inter-individual variation in the absorption of anthocyanins, difficulties with identifying and quantifying the extensive array of potential metabolites and a subsequent lack of evidence of optimum dosage and dose time effects. This has resulted in limited evidence to interpret the association between consumption of anthocyanin-rich foods and the incidence of cancer, cardiovascular, metabolic and other lifestyle-related diseases.

In the complex food matrix, the health benefits of anthocyanins may be derived from the anthocyanin itself, or in combination with other bioactive food components. Such synergistic or antagonistic effects remain unclear and warrant continued investigation. It is important to accurately characterise the molecular structure of anthocyanin compounds in studies to assist in hypothesis development. Utilising in vitro evidence to tailor the anthocyanin intervention to the health problem or process under investigation may also add clarity to understanding mechanisms of action.

Recent studies suggest a broader suite of outcome measures, or a focus on a different range of outcome measures, may enhance understanding of mechanisms of action of anthocyanins on cardiovascular and other health outcomes[2]. Current evidence suggests anthocyanin bioavailability is limited, but the evidence is also limited by the lack of reference standards, for example, for glucuronides or sulfates.

Over 700 anthocyanins have been found in nature[3] and a range of anthocyanin metabolites may be awaiting discovery, limited by current analytical methods. Ongoing refinement and development of analytical methods is important to help identify and quantify more of these compounds. Measures of bioaccessibility and bioavailability also require standardisation to facilitate development of research quantum that can be compared, contrasted and understood from a consistent analytical standpoint.

A novel area for future research involves examining the effect of anthocyanins on the human gut microbiome. Although the microbial composition of a "gold standard" or "ideal" human microbiome for health is not well defined, there are general ideas and patterns of microbial genera and species that have been linked to lifestyle issues, for example, metabolic syndrome and obesity. There is early evidence that anthocyanins can lead to healthier microbiota through a prebiotic effect[4,5].

Furthering understanding of the effect of well-defined anthocyanins on the gut microbiome may be far more beneficial than trying to pinpoint the mechanisms of action of anthocyanins on specific metabolic issues or health effects in isolation. Since the microbiome has widespread effects on a range of body systems, for example, cognition, mental health, CVD, neurological disease[4], influencing or improving the microbial communities of the gut could improve the health of several body systems simultaneously. It is critical to learn more about the effect of microbiota on anthocyanin metabolism, as the composition of bacteria may help or hinder the further catabolism and subsequent bioavailability of anthocyanins[5].

A stronger focus on how to measure anthocyanin absorption from the gut and a better identification and measurement of metabolites being absorbed will assist in advancing the field. This work should help in providing some dietary guidance for people in relation to the dose, format and timing of anthocyanin consumption and the types of foods to eat in combination with anthocyanins. For example, improving the gut microbiota profile may enhance its degradation activity to facilitate the release of more anthocyanins from plant cell walls.

Previous simulated digestion studies showed 60–70% of anthocyanins remain bound to the plant cell walls, reducing their bioaccessibility and bioavailability[6].

The mean anthocyanin intake in the Australian population has been estimated at 24.2 mg/day with berries as the primary source[7]. However, this could easily be increased with an extra "serve" of coloured berries. Dark strawberry cultivars, for example, can have a total anthocyanin content of up to 100 mg/100 g fresh fruit[8], which means that a 250 g punnet would deliver 250 mg of these bioactive plant pigments.

Since the current scientific evidence suggests anthocyanin-rich fruits and vegetables are "berry" good to eat for general health, it would be wise to choose a variety of these foods to include in the diet. On top of yoghurt, tossed through salads, in thirst-quenching smoothies, or simply on their own, including more red, purple and blue fruits and vegetables is a great idea to improve dietary intake of anthocyanins.

Bon appetit!

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