Bioavailability and bioeffiacy of soft fruit antioxidants

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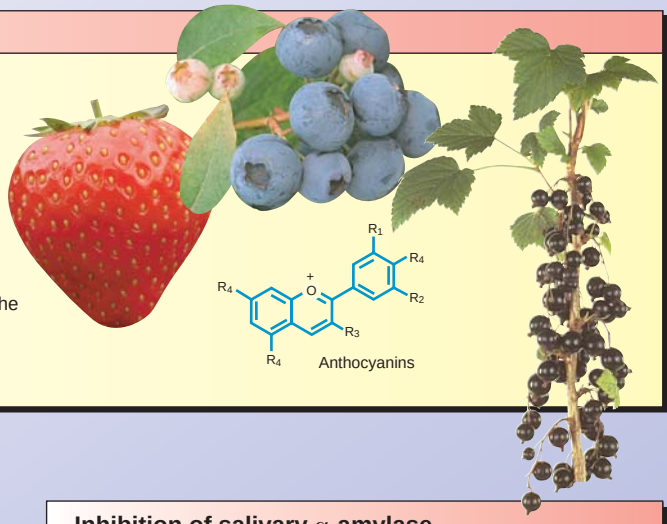
Introduction

A diet rich in fruits and vegetables is associated with a reduced risk of cancer and cardiovascular disease. This protective effect has been attributed to the activity of antioxidants in preventing oxidative damage to biomolecules caused by free radicals generated during aerobic metabolism (1). Soft fruits are a particularly palatable and rich source of dietary antioxidants and berry intake has been correlated with reductions in cardiovascular disease (2).

This study has reports on the bioavailability of antioxidant compounds from blackcurrants and the bioeffectiveness of soft fruits in inhibiting α-amylase, the crucial enzyme of starch digestion.



Results

Bioavailability

The bioavailability of blackcurrant antioxidants was assessed using a model system that mimicked the digestive processes of the human gastrointestinal tract (Fig. 1). The phenolic antioxidants, including the anthocyanins, were remarkably stable under stomach conditions (Fig. 2). However, phenols and, in particular, the anthocyanins were less stable under intestinal conditions. Only 3% of anthocyanins was recovered in the fraction that represents serum bioavailability (i.e. in the dialysis membrane), compared to ~ 10 % of phenols. Around 7 % of anthocyanins were recovered in the fraction outside of the dialysis membrane, which represents compounds that remain within the intestine, compared to ~ 40% of phenols.

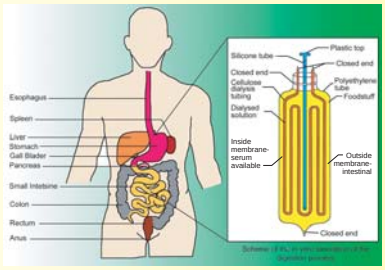


Fig 1

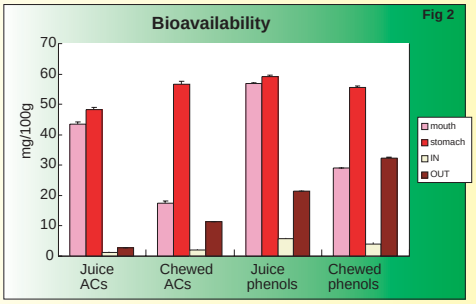


Fig 2

Blackcurrants that had been prepared in a "chewed" manner gave a different bioavailability pattern. As expected, less anthocyanins and phenolics were released during "chewing" than juicing but similar levels of anthocyanins/phenolics were recovered in the stomach (Fig. 2). Moreover, more anthocyanins were recovered in the serum and intestinal samples and more phenols were recovered in the intestinal sample from chewed berries than juice.

Inhibition of salivary α-amylase

Extracts from blackcurrants, blueberries and strawberries enriched in phenolic antioxidants inhibited α-amylase under conditions commonly found in saliva (Fig. 3). Strawberry was the most effective giving a K_i (amount that gives 50 % inhibition) of 150 µg phenols/assay, which is in the same range as green tea extracts. Strawberries differ from blackcurrants and blueberries in their high content of soluble ellagic and gallic acid derivatives, which are the building blocks of tannins (Fig. 4). Removal of tannins using gelatin caused a significant reduction in the inhibition of α-amylase.

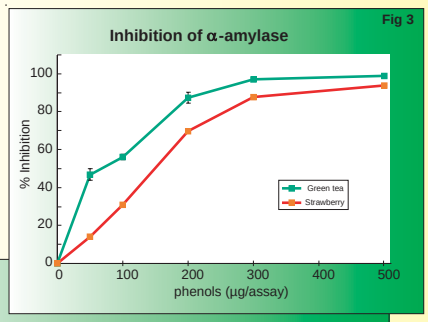


Fig 3

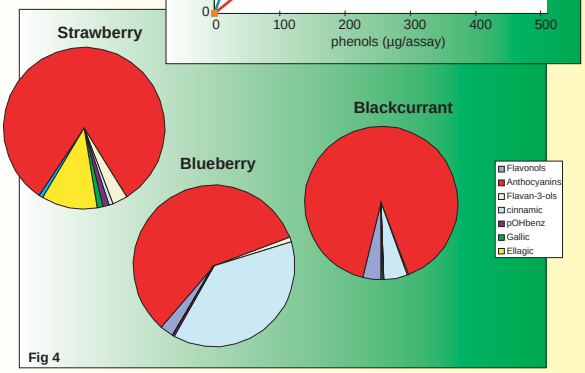


Fig 4

Conclusions

The form in which the blackcurrants are ingested influenced the bioavailability of phenolic antioxidants in a model system. Berries may act as slow release vehicles for the antioxidants preventing their degradation and increasing their bioavailability in the serum and small intestine where they can assert their bio-effects.

Green teas are known to inhibit salivary α-amylase and reduce the oral concentration of fermentable sugars after eating starchy foods (3). The inhibition of α-amylase by strawberry (and other soft fruit) extracts may provide a more palatable means of protecting against dental caries, especially in young children. In addition, similar inhibition of pancreatic α-amylase by soft fruit extracts may provide a means of controlling post-meal blood glucose levels in patients with non-insulin dependent diabetes mellitus (NIDDM) without recourse to artificial α-amylase inhibitors (4).

References

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