BrainHealthFood – Bioactive compounds from blackcurrant waste for brain health

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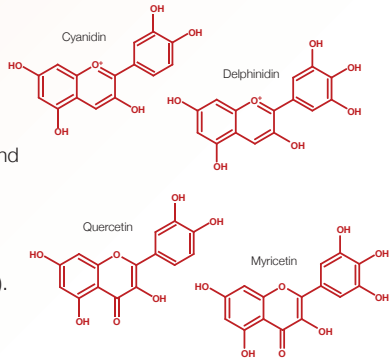
In neurological disorders such as Alzheimer's Disease (AD) there is neuronal cell loss in the hippocampus and cerebral cortex areas of the brain involved in memory and cognition. There is growing scientific evidence to suggest that oxidative stress plays a key role in AD, with the cytoplasm of neurons being the major site of oxidative damage (Ramassamy, 2006). Blackcurrant is a rich source of antioxidant polyphenolics, including anthocyanins, flavonols and proanthocyanidins. It has been shown that polyphenolic extracts from blackcurrant provide neuroprotection against oxidative stress-induced damage in human cell cultures (Ghosh *et al*, 2006).



Aims

The ultimate goal of the project is to develop dietary supplements and foods from blackcurrant waste (pomace) to reduce the risk of AD. The pomace is an attractive source because it is enriched in polyphenols but currently it is disposed of as waste. Our preliminary aims were to characterize and provide blackcurrant extracts and polyphenolic fractions to test for neuroprotective activity on human neuroblastoma cell lines and for amyloid beta protein formation and behaviour in a mouse model. The effect of different grinding and drying methods on the polyphenol content of pomace has been examined to optimise the processing of pomace.

Results

Figure 1 shows two blackcurrant extracts that are currently being assessed on Alzheimer models.
The liquid chromatography-mass spectrometry (LC-MS) profiles reveal that the ratio of anthocyanins to flavonols is different in the two extracts, with extract 2 containing relatively more flavonols

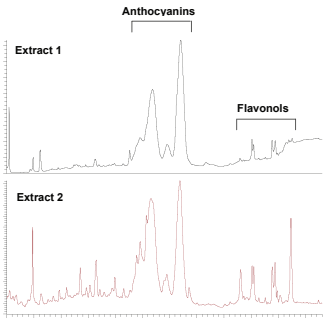
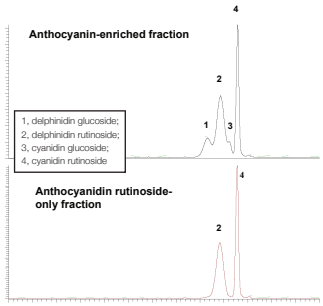


Figure 1. LC-MS traces of polyphenolics in blackcurrant extracts



An anthocyanin-enriched fraction was prepared using solid-phase extraction (SPE) and LC-MS revealed four major anthocyanins (Fig. 2). The anthocyanins were fractionated further to give only the rutinoside-containing anthocyanins.

Figure 2. LC-MS traces of anthocyanin fractions.

The anthocyanin-enriched fraction caused a reduction in reactive oxygen species (ROS) in neuroblastoma cell lines (Fig. 3).
We are also preparing black currant proanthocyanidin fractions for testing on cell lines.

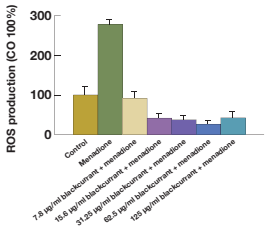
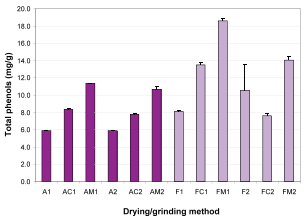


Figure 3. Effect of blackcurrant anthocyanin-enriched fraction on reactive oxygen species production in a neuroblastoma cell line.



Abbreviations:- A; air-dried; F, freeze-dried; C, ground with chopper; M, ground with cross hammer mill; no C or M; not ground; 1, moisture ~ 7%; 2,; moisture ~ 11-16%.

Different grinding and drying methods influenced the polyphenol content of pomace. Freeze-dried and hammer-milled pomace yielded the most polyphenols (Fig. 4)

Figure 4. Effect of grinding and drying method on total phenol content in pomace.

Future work

Testing of the effect of the different blackcurrant extracts and fractions on human neuroblastoma cell lines and their effect on amyloid beta protein formation and behaviour in a mouse model is continuing.

We will formulate a range of juices, dietary supplements and foods enriched in blackcurrant polyphenols for further testing.

References

Ghosh, D., McGhie, T., Zhang, J., Adam, A. and Skinner, M. 2006. Effects of anthocyanins and other phenolics of boysenberry and blackcurrant as inhibitors of oxidative stress and damage to cellular DNA in SH-SY5Y and HL 60 cells. *J. Sci. Food Agric.* **86**, 678-686.

Ramassamy, C. 2006. Emerging role of polyphenolic compounds in the treatment of neurodegenerative diseases: A review of their intracellular targets. *Eur. J. Pharmacol.* **545**, 51-64.

Acknowledgement

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