Concurrent Session 1: Functional Foods I

The ability of kiwifruit to positively modulate key markers of gastrointestinal function

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Background – The consumption of kiwifruit is associated with a number of health benefits related to gastrointestinal function. These benefits are generally attributed to the high levels of vitamins, minerals, dietary fibre and bioactive phytochemicals present in kiwifruit. There is a need to investigate the biological activities of specific fractions of kiwifruit on markers of gastrointestinal health.
Objective – To further explore the potential of kiwifruit to influence specific aspects of gastrointestinal function, the edible portion and an aqueous extract from both ZESPRI™ GOLD (ZGO) and ZESPRI™ GREEN (ZGR) kiwifruit were assessed for their ability to influence the growth of both beneficial and pathogenic bacteria *in vitro*. In addition, the potential of kiwifruit to modulate the activity of ß-glucuronidase and ß-glucosidase was investigated.
Design – Aqueous solutions were prepared from the edible flesh and water-extracts of ZGO and ZGR kiwifruit. A series of *in vitro* experiments were conducted to evaluate both the antimicrobial and prebiotic properties, and intestinal bacterial enzyme activities of kiwifruit and kiwifruit extracts.
Outcomes – Solutions prepared from ZGO and ZGR kiwifruit showed high antimicrobial activities against both Gram-positive (*Staphylococcus aureus* and *Streptococcus mutans*) and Gram-negative (*Salmonella typhimurium* and *Escherichia coli*) pathogenic bacteria, with the water extracts exhibiting the greatest antimicrobial activity. The impact of the same solutions on the growth of three strains of lactic acid bacteria (*Lactobacillus rhamnosus, L. acidophilus* and *Bifidobacterium breve*) was evaluated in MRS medium *in vitro*. In general, lower concentrations (0.5 – 2.5 mg/ml) did not significantly affect the growth and viability of these bacteria, however an addition rate of 5 mg/ml resulted in a significant increase ($P< 0.05$-0.01) in the numbers of viable cells of these lactic acid bacteria. Kiwifruit, and in particular the water extract of ZGO kiwifruit demonstrated an ability to positively influence intestinal bacterial enzymes, by inhibiting ß-glucuronidase activity and promoting the activity of ß-glucosidase.
Conclusion – Both the edible flesh and particularly water extracts of ZGO and ZGR kiwifruit, exhibit antimicrobial and prebiotic activity when tested *in vitro*. Kiwifruits have also been shown to beneficially modulate the intestinal bacterial enzymes, ß-glucuronidase and ß-glucosidase, in a manner that is considered beneficial for gut health.

Synergistic interactions between different fruits for enhanced brain wellness

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Background – The health benefits of polyphenolic extracts or foods rich in polyphenols such as fruit are likely to be the result of distinct components interacting at different physiological sites or on diverse cellular pathways. It is most likely that multiple compounds (in a food or extract matrix) interact synergistically and/or additively to potentiate the bioactivity of major active ingredient (s). The benefit of a diet rich in fruits and vegetables is attributed to the complex mixture of phytochemicals present in these and other whole foods
Objective – We have focussed on the brain to develop *in vitro* assays that can detect synergies between phytochemical combinations that may promote 'brain wellness' benefits.
Design – A two cell system comprising human SH-SY5Y neuronal cells exposed to supernatants from THP-1 monocytes was used as a model for neuronal damage occurring as a result of inflammatory, metabolic or ageing processes. The ability of polyphenols and complex fruit extracts alone or in combination to protect the neuronal cells from cell death was determined over a 1-20 μM catechin equivalent dose range using flow cytometry. Results were expressed as EC_{50} values derived from the Cell Death Index (CDI) and the ratio between EC_{50} values of individual fruit extracts and combinations was used to calculate a Synergistic Index (SI).
Outcomes – Common phytochemicals were found to vary in their ability to protect the neuronal cells as did polyphenol rich extracts from blackcurrant and kiwifruit extracts. The EC_{50} values for quercetin, rutin, catechin, phloretin and phloridzin were 1.48, 1.76, 1.84, 2.39 and 7.20 (in μM), respectively. The EC50 values for blackcurrant and kiwifruit extracts were 4.86 and 3.31 (in μM catechin equivalent), respectively. The EC_{50} of combinations of blackcurrant and kiwifruit extracts were 1.12, which gives a Synergistic Index of 0.27 (SI<1 indicates synergistic interaction). Thus the blackcurrant and kiwifruit extracts were more protective together than both extracts alone or any of the other common phytochemicals tested.
Conclusions – The results demonstrate that the natural combination of phytochemicals in fruits may be responsible for their potent biological activities. Synergistic interaction between different fruit extracts can be detected and quantified and may allow the development of new types of functional foods based on synergistic interaction of fruit for brain health and other targeted health areas.