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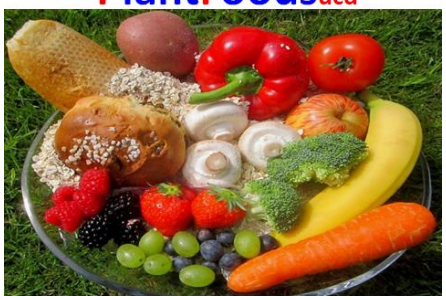

Issue 6: May, 2020: This e-bulletin is aimed at health professionals, consumers, growers, farmers, packers, processors, distributors, retailers, and others in the plant foods area.

Glucose control potential of AIS from vegetables and algae

A UCD study in 2019 showed that alcohol-insoluble-solids (AIS) from fruit and mushrooms had a positive effect on the growth of rat BRIN BD11 pancreatic β-cell lines and stimulated them to produce significant amounts of insulin (see PlantFoods-ucd, Issue 4). This could have potential for aiding control of Type-2 diabetes especially as apple AIS was shown to have a positive effect on Type-2 diabetes control (Mayne *et al*., 1982). The work continued in 2020 with AIS separated from vegetables and algae, and was conducted by Mary Sexton (4th year food science research project) in cooperation with Dr Heleena Moni Bottu, Professor Lorraine Brennan and Professor Ronan Gormley of the UCD Institute of Food and Health, University College Dublin.

Alcohol-insoluble-solids (AIS)

AIS are the fraction of finely blended (pureed) fruit, vegetables or algae (250g lots) insoluble in boiling 80% aqueous ethanol (see PlantFoods-ucd, Issue 4). AIS powders are largely dietary fibre with some protein, minerals, insoluble carbohydrate and small amounts of other compounds. Seven fresh vegetable samples were purchased from local stores and green strawberries (supplied by a local grower) were also tested as a comparison with ripe strawberries tested in 2019. Percentage yield of AIS from the different vegetable samples was broccoli (6.1), cauliflower (5.5), turnips (5.3), carrots (5.1), green beans (5.1), onions (3.4) and celery (1.8). AIS yield from strawberries was 3.6% (green) and 2.1% (ripe). This difference was due to the much higher sugar content in fresh red strawberries compared to fresh green strawberries; this sugar is removed in the 80% aqueous ethanol. Ranges for the carbohydrate, protein and ash contents of the vegetable AIS samples were 56-80, 6-29 and 5-11% respectively. The brown algae tested were *Alaria esculenta* and *Ascophyllum nodosum* and are referred to as *Alaria* and *Ascophyllum* for brevity. These samples were supplied as commercially dried (residual moisture content 12-13%) and gave an AIS yield of 64.8 and 70.4% respectively. Back calculation to a fresh weight basis gave AIS yield values of 9.6 and 10.8%. These AIS values were still higher than those for the vegetables and may be due to algal constituents such as fucoidans and other polymeric compounds which are insoluble in 80% aqueous ethanol (Bermano *et al*., 2020). The most notable aspect of algal AIS composition was the high ash content of 26.4 (*Alaria*) and

23.1% (*Ascophyllum*). This was expected as algae have a high mineral content relative to vegetables.

Effect of AIS on rat pancreatic beta cell viability and insulin secretion

None of the AIS extracts exhibited toxic effects in the pancreatic beta cell line BRIN BD11 with no significant reduction in cell viability.

Insulin secretion potential of the AIS materials was tested using BRIN BD11 rat pancreatic β-cell lines (procedure of Drummond *et al*., 2018). The cells were incubated with 1ml of Kreb's Ringer Bicarbonate buffer followed by addition of 16.7mM glucose plus 1mg/mL of AIS material. Control solutions of 16.7mM glucose and 16.7mM glucose plus 10mM alanine (well-known insulin stimulator) were used and insulin secretion was determined (Rat Insulin ELISA kit). Broccoli, turnip and *Ascophyllum* AIS outperformed ($P<0.05$) both controls while cauliflower, celery and *Alaria* AIS outperformed the glucose control. Insulin secretion values (ng/mg protein in 20min) in descending order for AIS samples were: 61 (broccoli), 53 (turnip), 50 (*Ascophyllum*), 15 (cauliflower), 14 (celery & *Alaria*), 11 (green beans & carrots) and 10 (green strawberries & onions). Values for the alanine/glucose and glucose control solutions were 31 and 12 respectively.

Conclusions

(i) AIS from broccoli, turnips and *Ascophyllum* may have potential for aiding glucose control through stimulation of insulin secretion in BRIN BD11 pancreatic β-cell lines. This may also have potential for aiding control of Type-2 diabetes. However, further studies are needed to examine the effects *in-vivo.*

(ii) Research will continue in 2020/2021 on identifying the compounds in the various AIS samples responsible for insulin secretion in the cell lines. In addition, AIS separated from different flushes, strains and storage treatments of white mushrooms (*Agaricus bisporus*) will be tested as will spot samples of oyster (*Pleurotus ostreatus*) and shiitake (*Lentinula edodes*) mushrooms.

References

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The previous 5 issues of PlantFoods-ucd can be viewed at:
https://www.ucd.ie/foodandhealth/newsandevents/plantfoodsucd/

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