



**Issue 15: June, 2022:** 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 bell peppers

The composition and health benefits of green, yellow and red bell peppers (*Capsicum annuum*) was featured in PlantFoods-ucd, Issue 10, 2021. This was a desk study as laboratory facilities were not available due to the Covid-19 pandemic. However, this was upgraded in 2021/2022 in a laboratory trial where the composition, glucose control potential, and antioxidant status of alcohol insoluble solids (AIS) from green, yellow and red bell peppers was tested. For brevity/convenience, green, yellow and red bell peppers are referred to as G, Y and R in this article. AIS are the fraction of finely blended (pureed) fruit or vegetables (250g lots) insoluble in boiling 80% aqueous ethanol (PlantFoods-ucd, Issues 4 & 6). AIS powders are cell wall materials and as such are largely dietary fibre with some protein, minerals, insoluble carbohydrate and small amounts of other compounds. The current trial was prompted by previous UCD studies which showed that AIS from selected fruit, vegetables, mushrooms and algae had a positive effect on the growth of rat BRIN BD11 pancreatic  $\beta$ -cell lines and stimulated them to produce significant amounts of insulin (PlantFoods-ucd, Issues 4 & 6). 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 in a clinical trial (Mayne *et al.*, 1982). The current work on AIS separated from bell peppers was conducted by **Gemma Walsh** (4<sup>th</sup> year food science research project) in cooperation with Dr Heleena Moni Bottu and Professors Lorraine Brennan, Niamh Harbourne and Ronan Gormley of the UCD Institute of Food and Health, University College Dublin.

### Procedure

GYR peppers were purchased in a Dublin retail store on five occasions (test dates) at 10-12 day intervals. Each sample was tested for moisture, protein and carbohydrate contents by the routine procedures used in the food science laboratory in UCD Science Centre South (AOAC, 2000). AIS were separated and washed as described previously (SeaHealth-ucd, Issue 4) and were dried to constant weight (oven/100°C), and stored in plastic containers until required for follow-on tests. Insulin secretion potential of the AIS materials was tested using BRIN BD11 rat pancreatic  $\beta$ -cell lines (procedure of Drummond *et al.*, 2018). Control solutions of 16.7mM glucose and 16.7mM glucose+10mM alanine (well-known insulin stimulator) were used. The antioxidant status of the AIS samples of replicate 5 was quantified using DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay by the procedure of Sonklin *et al.* (2018).

### Composition (means - over the 5 test dates)

The dry matter (DM) content of raw GYR bell peppers was 5.41, 6.32 and 7.29% respectively. As expected, R peppers had the highest DM being the most mature of the three types. The yields of AIS were 2.06, 1.97 and 2.12% (GYR) and were lower than

the DMs of the raw peppers as soluble materials were washed out in the aqueous ethanol. Other compositional values for AIS in the order GYR were moisture (5.46, 5.23, 6.01%), carbohydrate (73.5, 76.8, 74.5%) and protein (16.3, 13.2, 15.0%). Fat and ash contents were not measured for logistic reasons but were estimated at 0.75 (fat) and 4% (ash) for all samples. AIS compositional differences were marginal for samples from the 5 test dates. AIS (G & Y) was off-white in colour whereas R AIS was a light pink.

### Insulin secretion

Insulin secretion tests were conducted on GYR AIS from test dates 1 and 3 with BRIN BD11 rat pancreatic  $\beta$ -cell lines. The results are expressed relative to the 16.7mM glucose+10mM alanine control which had an insulin secretion of 24.5ng/mg protein. Ratios >1 indicate better insulin secretion and <1 lower secretion than the control. Y AIS was best with ratios of 1.51 (test date 1) and 1.24 (test date 3) followed by R AIS 1.24 (test date 1) and 1.08 (test date 3). G AIS gave ratios lower than unity i.e. 0.90 (test date 1) and 0.70 (test date 3) and so was inferior in insulin secretion by the pancreatic cell lines to the control. The results suggest that Y and R AIS may have potential for aiding control of Type-2 diabetes. However, further studies are needed to examine the effects *in-vivo*.

### Antioxidant potential of AIS

The antioxidant potential of GYR AIS (1mg/ml) was very low relative to the ascorbic acid standard (1mg/ml) which had a free radical scavenging value of 85%. The results are expressed relative to the control. All ratios were far below unity showing that GYR AIS had little antioxidant potential i.e. ratios ranged 0.01-0.11. Deepa *et al.* (2007) showed that raw GYR peppers have good antioxidant properties. However, most of the coloured antioxidant compounds were extracted into the aqueous ethanol during AIS separation in the current study.

### Conclusions

AIS from yellow and red bell peppers may have potential for aiding glucose control through stimulation of insulin secretion in BRIN BD11 pancreatic  $\beta$ -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*. Green, yellow and red bell pepper AIS had very low antioxidant potential.

### Acknowledgements

Thanks to Dr Selene Pedrós-Garrido for her assistance with many parts of the project.

### References

- \*AOAC. 2000. Official methods of analysis of AOAC. *International 17th Edition*; Gaithersburg, MD, USA Association of Analytical Communities.
- \*Deepa, N.N. & 3 co-authors. 2007. Antioxidant constituents in some sweet pepper (*Capsicum annuum L.*) genotypes during maturity. *Lebensmittel-Wissenschaft und-Technologie*, 40(1), 121-129.
- \*Drummond, E. & 15 co-authors. 2018. Casein hydrolysate with glycaemic control properties: Evidence from cells, animal models & humans. *J. Agriculture & Food Chemistry*, 66, 4352-4363.
- \*Mayne, P.D. & 5 co-authors. 1982. The effect of apple fibre on diabetic control & plasma lipids. *Irish Journal of Medical Science*, 151, 36-41.
- \*Sonklin, C., Laohakunjit, N. & Kerdchoechuen, O. 2018. Assessment of antioxidant properties of membrane ultrafiltration peptides from mungbean meal protein hydrolysates. *PeerJ* 6:e5337 <https://doi.org/10.7717/peerj.5337>

See previous 14 issues of PlantFoods-ucd at: <https://www.ucd.ie/foodandhealth/more/plantfoodsucd/>

More information from [ronan.gormley@ucd.ie](mailto:ronan.gormley@ucd.ie)

**DISCLAIMER:** While every care has been taken in ensuring the accuracy of the material presented, no liability as to its use or interpretation is accepted by the authors or by UCD.

