Proceedings of the Nutrition Society (2025), **84 (OCE1)**, E123 doi:10.1017/S0029665125001338

The 48th Annual Scientific Meeting of the Nutrition Society of Australia, 3-6 December 2024

Investigating purple and red fruits in neuronal health: an in vitro study

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Nutrition represents a promising strategy for increasing antioxidants in the brain, with potential implications for mitigating illnesses with oxidative stress-related neuropathology(1). Emerging evidence indicates that bioactive compounds, including phenolics and betalains—responsible for the red, yellow, and purple hues in fruits—may decrease oxidative damage(2). Therefore, research into novel plant-based sources of phenolics and betalains with potential antioxidant properties is needed. This study aimed to examine the neuroprotective effects of key fruit extracts and to correlate effects with their phytochemical and antioxidant profile. Dragon fruit (DF), queen garnet plum (QGP) jaboticaba (JB), green apple (GA), blueberry (BlueB), blackberry (BlackB), watermelon (WM), and apricot (AP) extracts were analysed for their phenolic, flavonoid, anthocyanin and betalain concentrations, and antioxidant capacity (Oxygen Radical Absorbance Capacity (ORAC)). The neuroprotective efficacy of the fruits (10, 25, 50, 100 µg/mL) was then examined in-vitro using H_2O_2-induced oxidative stress in SH-SY5Y neuroblastoma-like cells. Cells were treated with the fruit extracts either prior to H_2O_2 administration (to examine protective effects), or after the H_2O_2 stressor (to determine treatment effects), with cell viability examined using MTT assays. Statistical analyses determined differences between fruits and the controls (healthy (untreated) and H_2O_2 controls) using one-way ANOVAs and post-hoc Tukey comparisons. Correlations were examined using Spearman's correlation tests. QGP and BlueB were significantly higher in phenolics and anthocyanins ($p < 0.01$), QGP highest in flavonoids ($p < 0.01$), and DF was highest in betalains ($p < 0.001$) and ORAC ($p < 0.01$), compared to the remaining fruits. Pre-treatment with DF and JB prevented H_2O_2-induced loss in cell viability, retaining control-like levels ($p > 0.05$ vs healthy controls). GA pre-treatment also exhibited significant neuroprotective effects ($p < 0.01$ vs H_2O_2 alone) but could not restore control levels ($p < 0.01$ vs healthy controls). The ability of DF, JB and GA to treat existing damage to cell viability induced by H_2O_2 was then examined; however, the extracts were ineffective as a treatment ($p > 0.001$ vs H_2O_2 alone and healthy controls). Interestingly, there were moderate correlations between cell viability and both ORAC ($r^2 = 0.680$, $p < 0.001$) and betalain concentration ($r^2 = 0.446$, $p < 0.05$). This study revealed novel sources of bioactive compounds, including characterisation of betalain concentrations, in these fruits. The results demonstrate an ability of DF and JB to prevent oxidative stress in neuronal-like cells, but not treat damage after it has occurred. This finding agrees with the evidence that implementing a healthy diet rich in bioactive compounds, such as betalains and phenolics, may support brain health(1). The data also support a link between increased betalains, antioxidant capacity and neuroprotection; however, further research into the mechanisms underpinning the beneficial protective effects of DF and JB are required.

References

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