The potential cancer preventative properties of sweetpotato anthocyanin-rich polyphenolic complex

ABSTRACT

Anthocyanins are a widespread source of naturally occurring colorants distributed in fruits, vegetables, and beverages such as red wine. Anthocyanin-rich foods and preparations have been reported to reduce the risk of life-style related diseases, including reducing the risk of coronary heart disease, preventing some chronic inflammatory diseases, protecting against cancer and slowing the ageing process. SL222 sweetpotato, a purple-fleshed cultivar, accumulates high levels of anthocyanins in the storage-root. This project examines the chemopreventative properties of the SL222 sweetpotato in the C57BL/6J-APC$^{MIN\ /+Apc}$ (APC^{MIN}) mouse, a genetic model of colorectal cancer, and the potential underlying mechanisms both in tissue culture and *in vivo*.

Anthocyanin rich-extract (ARE) was prepared from SL222 sweetpotato and incubated with the J774 murine macrophage cell line and HT29 and HCT116 human colon cancer cell lines in tissue culture. *In vivo,* APC^{MIN} and C57BL/6J wild-type mice (n=160) were divided into 4 feeding groups consuming diets incorporating 10% SL222 sweetpotato flesh, 10% SL222 sweetpotato skin or 0.12% ARE (diet contained anthocyanins at a concentration equivalent to the flesh-supplemented diet) or a control diet (AIN-76A) for 18 weeks. At 120 days of age, mice were anaesthetised and blood samples were collected, before mice were sacrificed and the intestines, spleens and livers harvested. The MTT assay was used to measure growth and viability in the cell lines. The intestine of APC^{MIN} mice was used for adenoma enumeration (i.e., number and size of adenomas). DNA-damage was assessed in the cell lines and blood samples using single cell gel electrophoresis (Comet assay). Changes in activation of nuclear factor-κB (NF-κB) were investigated in the cell lines and mouse spleens using Electromobility shift assays **(**EMSA). Expression of cyclooxygenase enzymes (COX1 and COX2) and inducible nitric oxide synthase (iNOS) was explored in cell lines and mouse livers using Western immuno-blot analysis. Finally, activity of xenobiotic metabolizing enzymes (XME), including cytochrome-P450 (CYP450) and glutathione-S-transferase (GST), was estimated in cell lines and mouse livers.

In tissue culture, ARE from SL222 purple sweetpotato enhanced the growth of the J774 cell line but reduced the growth of the HT29 and HCT116 cell lines. ARE exhibited strong antioxidant and radical scavenging properties, reducing DNA damage in the same cell lines. Moreover, ARE reduced LPS-induced activation of NFκB and suppressed the expression of COX2 and iNOS,

while it failed to alter COX1 expression. In addition, ARE suppressed CYP450 activity and induced the activity of GST in these cell lines.

In the animal model, SL222 sweetpotato supplemented-diets reduced the adenoma number in APC^{MIN} mice, exhibited significant protection against DNA-damage, suppressed NFκB activation and inhibited COX2 and iNOS enzymes expression, while COX1 enzyme expression was unaltered. Moreover, supplemented diets significantly modulated XME in both APC^{MIN} and wild-type mice.

In conclusion, the combined antioxidant properties preventing DNA damage, anti-inflammatory properties inhibiting the activation of NFκB and suppressing the expression of COX2 and iNOS, and the modulation XMEs by SL222 sweetpotato supplemented diets are likely to be contributing to the substantial reduction in the number and size of intestinal adenomas in APC^{MIN} mice consuming these diets. Since the APC^{MIN} mouse carries the same genetic mutation responsible for familial adenomatous polyposis (FAP) in humans and *APC* mutation is common in sporadic colorectal cancer, SL222 sweetpotato has potential chemopreventative properties against human colorectal cancer.