Phenolic composition and antioxidant capacity of a novel variety of purple potato

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Introduction

There is a growing awareness of the potential health benefit of diets rich in fruits and vegetables and nutritional guidelines indicate that an increase in their consumption may reduce the risk of CVD and certain cancers (1). This effect has been ascribed in part to low molecular weight phenolic compounds which can act as antioxidants due to their extensive conjugated n-electron systems which allow ready donation of electrons or hydrogen atoms from their hydroxyl moieties to free radicals (2). Potatoes (Solanum tuberosum L) provide a rich and varied source of micronutrients in the human diet, >80% of the UK population consume potatoes on a weekly basis (3). A novel purple potato, Purple Majesty has been introduced to the UK market by Albert Bartlett. Anthocyanins are the most abundant phenolic present in purple potatoes and there is some evidence that they are able to elicit endothelium dependent vasorelaxation and may be protective against CVD (4).

The aims of this study were to investigate the antioxidant potential of purple potatoes compared with white potatoes, to establish the effect of domestic processing on phenolic composition and antioxidant capacity and to compare the findings with other vegetable sources to establish whether purple potatoes could provide a rich source of antioxidants in the human diet.

Methods

Cooked samples were prepared by boiling approximately 200g of potatoes in 1.7L of water for twenty minutes. The cooked potatoes were freeze dried for 72 hours. All assays were carried out in triplicate.

Three assays were used to determine the antioxidant potential of the potatoes.

i) The Folin and Ciocalteau (5) method was used to measure total phenolics.

ii) The Ferric reducing ability of plasma (FRAP) assay (6) was used to determine antioxidant capacity.

iii) The pH shift method (7) was used to measure the anthocyanin content.

Results

Table 1. Results for total phenolic content, antioxidant capacity and anthocyanin content of potato samples.

<table>
<thead>
<tr>
<th>Potato Samples</th>
<th>Concentration of total phenolics as mg GAE/100g Fresh weight</th>
<th>Antioxidant capacity as mM FeII/100g Fresh weight</th>
<th>Anthocyanin concentration as mg cyanidin-3-glucoside/Kg Fresh weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw White</td>
<td>38.7 ± 0.4</td>
<td>5.9 ± 0.1</td>
<td>7.8 ± 6.9</td>
</tr>
<tr>
<td>Cooked White</td>
<td>37.1 ± 1.5</td>
<td>6.1 ± 0.1</td>
<td>2.2 ± 3.9</td>
</tr>
<tr>
<td>Raw Purple</td>
<td>105.5 ± 4.0</td>
<td>21.7 ± 0.8</td>
<td>219.3 ± 3.9</td>
</tr>
<tr>
<td>Cooked Purple</td>
<td>61.5 ± 1.6</td>
<td>18.8 ± 1.0</td>
<td>141.4 ± 19.6</td>
</tr>
</tbody>
</table>

The cooked Purple Majesty potatoes contained highly significantly more total phenolics than raw white potatoes, 105.5 compared to 38.7 GAE/100g. (P <0.001).

Cooked Purple Majesty potatoes remained highly significantly richer in phenolics than cooked white potatoes, 61.5 compared to 37 GAE/100g (P<0.001).

Figure 1. Total phenolics mg GAE/100g fresh weight

Figure 2. Antioxidant capacity mM FeII produced/100g fresh weight

Cooked Purple Majesty potatoes contained a significantly higher antioxidant capacity than raw white potatoes, 21.7 compared to 5.9 mM Fe II/100g. (P<0.001).

Cooked Purple Majesty potatoes had a significantly higher antioxidant capacity following cooking than white cooked potatoes, 18.8 compared to 6.1 mM Fe II/100g (P<0.005).

Figure 3. Total anthocyanins mg cyanidin-3-glucoside equivalents/Kg

Raw Purple Majesty potatoes had a significantly higher antioxidant capacity than raw white potatoes, 219.3 compared to 7.8 mg cyanidin-3-glucoside/kg (P<0.001).

Conclusion

Purple Majesty potatoes contained higher overall levels of total phenolics and anthocyanins and had a greater antioxidant capacity compared with white potatoes.

Domestic processing significantly reduced the total phenolic content of Purple Majesty potatoes (P<0.005) but did not significantly influence anthocyanins or the overall antioxidant capacity.

Cooked Purple Majesty potatoes contain significantly higher antioxidant capacities than cooked white potatoes (P<0.0001). With >80% of the UK population consuming potatoes weekly (8), Purple Majesty potatoes could therefore provide a rich source of antioxidants in the UK diet and they compare favourably to other ‘purple vegetables’ for example in this study, Purple Majesty potatoes contained 105.5 mg GAE/100g Fresh Weight compared to Red cabbage, 439 mg GAE/100g Fresh Weight (9).

References