Nutrient Composition and Anti-Nutritional Content of the White-Flesh Variety of Sweetpotato (*Ipomea batatas*)
Tuber Processed in Various Ways

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Nutrient Composition and Anti-Nutritional Content of the White-Flesh Variety of Sweetpotato (Ipomea batatas) Tuber Processed in Various Ways

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Abstract

In this study, the white–fleshed variety of sweetpotato was analyzed for proximate chemical composition and antinutritional content. Samples of fresh clean tubers were processed in four different ways; namely, unpeeled sundried, peeled sundried, unpeeled cooked sundried and peeled cooked sundried. Three samples each of the differently processed sweet potato meals were sent to the biochemistry laboratory for determination of proximate chemical composition and antinutritional content. Results showed that levels of crude protein, crude fibre, ether extract, ash and nitrogen free extract did not differ significantly between the sweet potato meals processed in various ways. Except for trypsin inhibitor activity, oxalate, phytate, saponin, tannin and haemagglutinin values did not differ significantly between the processed methods. Unexpectedly, values for trypsin inhibitor was significantly (p<0.05) higher (0.195mg/100g) in the peeled cooked sundried than in the peeled sundried (0.174mg/100g) sweet potato meal. However, since the levels of antinutritional factors are low and below the threshold for monogastrics, sweet potato from any of the processed methods can be included in diets for monogastric species.

Keywords: Nutrient, Anti-Nutritional, Composition, White-flesh Sweetpotato.
Introduction
Sweet potato belongs to the family convolvulaceae, Genus, *Ipomea,* section, *batatas* and belongs to the morning glory family. It is a tropical plant which needs warmth during day and night periods for optimum growth and yield. Neild (1992) reported that sweet potato (*Ipomea batatas*) requires a well-drained, loose soil to permit unimpeded root development and easy digging and that the optimum pH is in the range of 5.5 to 6.5. Sweet potato is a staple food in Nigeria, ranking fourth in production and importance after cassava, yam and cocoyam (Ikewelle et al., 2003). According to O’Hair (1990), the main differences between the white-fleshed and the familiar orange-fleshed sweet potatoes are that the white-fleshed types tend to have higher dry matter content with 25-40% starch and sugar content, are generally less sweet, are allowed to grow to a larger size, have variable root shape and have a skin colour that ranges from red to white. In addition, the white-fleshed types are usually propagated from stem tip cuttings usually from 30-40cm in length and that planting densities are about 30,000 plants per hectare with harvest beginning 4-6 months after planting. An important challenge in the production of sweet potatoes is the sweet potato weevil (*Cylas formicarius Fab*) in the roots, which can result in total crop loss if left uncontrolled (O’Hair, 1990). The cost of production of sweet potato seem much lower than cereal crops because of less need for weed control and the cuttings are much cheaper than cereal grains. Substances like phytates, oxalates, trypsin inhibitors, saponins, tannins and even haemagglutinins that inhibit digestive enzymes and cause disorders have been identified (Akinmutimi and Osuagwu, 2008). Therefore, there is need to pass the root through some form of processing that can improve their utilization by poultry.

The objective of this study is to investigate the effect of various processing methods on the nutrient composition and anti-nutritional content of sweet potato tubers.

Materials and Methods
The white-flesh sweet potato tuber used in this study was purchased from Bukuru market in Jos South Local Government Area of Plateau State and from a border market between Plateau and Kaduna States. The sweet potato tubers were cleaned of dirt and subjected to various processing methods as follows; Unpeeled sweet potato tubers were, sliced (3mm) and sun-dried for seven days during the harmattan to about 10% moisture, Peeled sweet potato tubers were sliced (3mm) and sun-dried for seven days during the harmattan, Unpeeled sweet potato tubers were sliced (3mm), cooked (20 minutes) and sun-dried for seven days during the harmattan and Peeled sweet potato tubers were cooked (20 minutes) sliced (3mm) and sun-dried for seven days during the harmattan. The cooking was done by pouring the sliced sweet potato root into boiling water and left boiling for 20 minutes. The variably processed sweet potato tuber meals were milled using a hammermill fitted with an 8mm sieve for incorporation into experimental diets.

Three samples from each type of processed tuber meals were subjected to Laboratory analysis at the Biochemistry laboratory of the University of Jos and the Nutrition Laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria for determination of proximate chemical composition as described by AOAC (2000). Crude protein was as described by Pearson (1986). Anti-nutritional content was by methods described by authors; phytate was determined as described by Kirk et al. (1991), trypsin inhibitors and oxalate were determined as described by Onwuka (2005), saponins and tannins was determined as described by Harbone (1980) while haemagglutinin was determined as described by Buttle et al. (2001).

Results and Discussion
The CP, E.E, Ash, CF and NFE content of sweet potato tuber meal were slightly different from that reported by Oyenuga (1968), Cornelio (1988) and Manfredini et al. (1990) and this may be attributed to differences in varieties, geographical areas, soil nutrient conditions under which the plant was grown. The crude protein (CP) levels of between 5.45 and 6.08% compared favourably with the level (5.40%) reported by Oyenuga. (1968) and 5.54% reported by Aina and Fanimo (1997) but was higher than 4.40% reported by Noblet et al. (1990) and 4.90% reported by Cornelio (1988). Ash content ranged from 4.99 to 5.42% and is lower than the 7.6% reported by Cornelio (1988) and 7.33% by Aina and Fanimo (1997). However, the range of ash reported in the present work is higher than the 3.2% reported by Oyenuga (1968) and 3.4% reported by Manfredini et al. (1990). Crude fibre content of 5.13 – 6.43% reported in the present work is a little higher than the 3.20% reported by Manfredini et al. (1990) and 3.00% reported by Devendra (1992). Values for ether extract content of the sweet potato in this study which was between 4.68 and 6.43% is higher than earlier report (2.31%) by Aina and Fanimo (1997) and 0.80% by Manfredini et al. (1990). NFE range of 72.04 to 74.35% in the present work is lower than the 81.00 reported by Aina and Fanimo (1997) and 90.6 (Oyenuga, 1968) and 87.60% (Manfredini et al., 1990).

These variations in the nutrient content of sweet potato reported in this study and by these authors may be due to the different processing methods used. The trypsin inhibitor activity as analyzed in the sweet potato processed in various ways ranged from 0.195 to 0.174mg/100g and was much lower than the 2.2-3.5mg/g reported by Panigrahi et al. (1996) for the Bosbok variety and 5.4-5.2mg/g for the Carmel variety of sweet potato root meal. Akinmutimi and Osuagwu (2008) however, did not identify any trypsin inhibitors from the sweet potato used in their studies showing that some varieties hardly contain trypsin inhibitor activity. The saponin content of the white-fleshed sweet potato used in the present work ranged from 0.051 to 0.022mg/100g which was much lower than the level of saponin (0.67%) reported by Akinmutimi and Osuagwu (2008) and may be due to differences in varieties used. The levels of tannin, oxalate and phytate analyzed in the sweet potato in this study ranged 0.08 - 0.07%, 3.00 - 2.36% and 0.43-0.37% respectively. They reported that the sweet potato used in their study contained 0.22% tannin, 0.74% phytate which appear higher than the levels reported in this study. However, the level of oxalate (3.00-2.36%) reported in this study is a little higher than the 1.08% reported in their study and these variations can be linked to varietal differences and the processing method employed. Levels of haemagglutinins in sweet potato ranged...
from 0.074 to 0.065 mg/100g but lower than the range of value (3.50 – 11.30 Hu/mg) of haemagglutinin in breadfruit reported by Oladunjoye et al. (2010). However, it should be observed that unexpectedly, levels of tannin, saponin and trypsin inhibitors in the peeled and cooked appear higher than in the uncooked sweet potato root.

Conclusion and Recommendations
Sweet potato performs well in several places in Nigeria especially the northern region of this Country. The white–flesh variety used in this study contains nutrients that compare favourably with those grown elsewhere. Therefore, increased production of sweet potato should be encouraged and intensified.

References
Dominguez, P.L. (1990) Sistema da alimentacion porcina con desperdicios procesados y otros subproductos agroindustriales. *Taller Regional sobre Utilizacion de los recursos alimentarios en la produccion porcina en America Latina y el Caribe* FAO-Instituto de Investigaciones Porcinas, Habana, Cuba
Neild, R.C. (1992). Extension horticulture culturists. Published by cooperative extension Institute of Agriculture and Natural Resources. University of Nebraska, Lincoln. Maitu: pub@unl.edu? Subject-comments from G75
### Tables

**Table 1:** Effect of method of processing on proximate composition of sweet potato tuber meal (%)

<table>
<thead>
<tr>
<th>Method of Processing</th>
<th>UP</th>
<th>P</th>
<th>UPC</th>
<th>PC</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>94.37</td>
<td>94.42</td>
<td>95.48</td>
<td>95.50</td>
<td>±0.55N.S</td>
</tr>
<tr>
<td>Crude protein</td>
<td>5.72</td>
<td>6.08</td>
<td>5.61</td>
<td>5.45</td>
<td>±0.43N.S</td>
</tr>
<tr>
<td>Fat</td>
<td>5.26</td>
<td>4.68</td>
<td>5.90</td>
<td>6.43</td>
<td>±1.29NS</td>
</tr>
<tr>
<td>Ash</td>
<td>5.42</td>
<td>5.08</td>
<td>5.33</td>
<td>4.99</td>
<td>±0.35NS</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>5.93</td>
<td>5.13</td>
<td>6.12</td>
<td>6.43</td>
<td>±0.94NS</td>
</tr>
<tr>
<td>Nitrogen free extract</td>
<td>72.04</td>
<td>73.45</td>
<td>72.52</td>
<td>72.20</td>
<td>±1.07NS</td>
</tr>
</tbody>
</table>

UP: Unpeeled; P: Peeled; UPC: Unpeeled cooked; PC: Peeled cooked. N.S: not significant (p > 0.05). SEM: standard error of mean.

**Table 2:** Anti nutritional analysis of sweet potato tuber meal processed in various ways.

<table>
<thead>
<tr>
<th>Method of Processing</th>
<th>UP</th>
<th>P</th>
<th>UPC</th>
<th>PC</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytate (%)</td>
<td>0.37</td>
<td>0.35</td>
<td>0.43</td>
<td>0.34</td>
<td>±0.08NS</td>
</tr>
<tr>
<td>Oxalate (%)</td>
<td>3.00</td>
<td>2.36</td>
<td>1.73</td>
<td>2.46</td>
<td>±0.90NS</td>
</tr>
<tr>
<td>Tannin (%)</td>
<td>0.091</td>
<td>0.065</td>
<td>0.078</td>
<td>0.069</td>
<td>±0.02NS</td>
</tr>
<tr>
<td>Trypsin inhibitor</td>
<td>0.184&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.174&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.181&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.195&lt;sup&gt;b&lt;/sup&gt;</td>
<td>±0.01*</td>
</tr>
<tr>
<td>(mg/100g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemagglutinin</td>
<td>0.067</td>
<td>0.065</td>
<td>0.074</td>
<td>0.073</td>
<td>±0.008NS</td>
</tr>
<tr>
<td>(mg/100g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saponin</td>
<td>0.023</td>
<td>0.022</td>
<td>0.047</td>
<td>0.051</td>
<td>±0.03NS</td>
</tr>
<tr>
<td>(mg/100g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UP: Unpeeled; P: Peeled; UPC: Unpeeled cooked; PC: Peeled cooked. N.S: not significant (p > 0.05). SEM: standard error of mean. *: significant, <sup>a</sup>, <sup>b</sup> means with common superscripts within rows are not significant.