EFFECT OF AEROBIC FERMENTATION OF CASSAVA ON THE NUTRIENT COMPOSITION OF ITS PRODUCT

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ABSTRACT
Aerobic fermentation of cassava was carried out to determine the nutrient quality of the final product with a view to optimizing its use in poultry diets. Two varieties of cassava TMS 30572 and OTA were peeled, chipped and heaped for fermentation. Samples were taken at days 0, 3, 5 and 7 for determination of moisture, crude protein, crude fibre, ether extract and cyanide levels. Fermentation was carried out in both dry and wet seasons. Results showed that major changes in composition were in the moisture content which increased with corresponding decreases in dry matter content with increasing period of fermentation for both seasons studied. Protein content increased up to a period of 3 days after which it declined. A similar trend was observed in both wet and dry seasons. However, it was noted that a higher moisture content with a correspondingly lower dry matter content was reported for all samples in the wet season when compared to their counterparts in the dry season. Cyanide content was reduced with increasing period of fermentation in all samples irrespective of variety and season. Further studies are recommended to investigate the possibility of increasing protein content by fermentation.

KEY WORDS: Cassava, Aerobic fermentation, Nutrient Composition.

INTRODUCTION
Fermentation of cassava prior to preparation for human foods is a common and well established practice. The mode of fermentation could be either acid or air fermentation (Westby, 1994) Acid fermented products are more popular and could be prepared from grated roots or soaked roots. The air fermented products could either be by mould growth due to slow drying or by heaping the cassava and covering with leaves. Although several air fermented products are consumed in Africa the role of the microorganisms in these products need to be further understood. However, few microbial species bring about desirable changes in the final quality of the product while others may not contribute to the product and may even lower the quality of the food or may represent a health hazard. (Bokanga, 1994)

Studies have been conducted on the protein enrichment of cassava by fermentation techniques (Muindi and Hassene, 1987; Balagopalam and Padmaja, 1988) Suchmann (1994) obtained satisfactory growth rate by feeding fermented cassava meal to broiler chicken. In all these studies the enhanced protein content was due to inoculation. This was study was therefore conducted to determine the effect of chance inoculation of microbes during aerobic fermentation on the nutrient quality and cyanide content of cassava.

MATERIALS AND METHODS
Preparation of Samples
Cassava tubers approximately 12 months old of the varieties TMS 30572 and OTA were manually harvested early in the morning, washed gently, freed of soil particles and microorganisms. They were thereafter peeled and sliced into chips of approximately 1 cm thickness and each variety weighed into 4 samples units of 250 g each. They were surface dried for 1 - 2 hours in the open air to reduce...
the water content and allow chance inoculation
of microbes (Hahn 1992) The chips were then
heaped into their units, covered with leaves
and left to ferment in the open air units for 0,
3, 5, and 7 days respectively. Chips before
fermentation i.e 0 days served as the control.
At the end of the specified period, the
fermented mouldly chips were scraped of
biomass terminating the further activity and
oven dried for 24 - 48 hours at 70°C, cooled in
a desiccator and weighed. The dried chips were
milled and stored in nylon bags for further
analysis. The entire process was carried out in
the peak periods of the dry season (January)
and wet season (July) for both varieties.

Laboratory Analysis
Samples were analysed for proximate
composition (AOAC 1984.) Calculations
were also made as follows for gross energy
content by a regression equation (Weende
analysis) as described by Wisemann (1984)
GE = 5.72 CP +95.06E + 47.9CF + 41.7 NFE + Di

Hydrogen Cyanide Estimation
Hydrogen cyanide content was determined by
the TOA TOB METER IM - 55 with an
Ogwassaki cyanide ion-selection electrode
as described by Zitnak (1973) In standardizing
the instrument 25g of potassium cyanide salt
was dissolved in 1 litre of distilled water to
obtain 1000ppm stock solution. The electrode
is re-activated for about 30 minutes by dipping
inside 10ppm solution of potassium cyanide
solution. For measurements, 2g of the milled
sample was dissolved in 20mls of distilled
water inside a small beaker attached to the
instrument. Readings were taken when the
deflection of the needle was stable.

RESULTS AND DISCUSSION
Physical Appearance
During the fermentation the chips were sticky
within the first 24 hours and traces of fungi
mycelia became visible from day 2 with
release of fermenting odours. As fermentation
progressed dense biomass covered the chips,
while the chips themselves were soft, tender
and moist. Fluid released was coloured and
sweet smelling. On completion of drying the
chips were like baked biscuits. After milling it
was observed that the texture of the flour was
smoother and more powdery with increasing
fermentation period. The powder itself
changed from white to increasing shades of
brown. Essers and Nout (1989) similarly
observed darker coloured flours from
fermented cassava produced in Mozambique.
They also observed that darker flours (mold
fermented) contain lower amounts of cyanide
than lighter coloured flours, although the
mechanisms involved have not been
investigated.

Nutrient Composition
Table 1 gives the proximate composition of the
2 varieties of cassava fermented in the dry
season. Moisture contents in both varieties
showed progressive increases with
respective decreases in dry matter as the
period of fermentation increased. Several
microorganisms have been associated with
fermentation depending on the conditions
employed during these fermentation.

<p>| TABLE 1: PROXIMATE COMPOSITION OF CASSAVA FERMENTED IN THE DRY SEASON (DRY MATTER BASIS) |</p>
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>OTA VARIETY</th>
<th>TMS 30077</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 days</td>
<td>3 days</td>
</tr>
<tr>
<td>Moist</td>
<td>61.40</td>
<td>54.20</td>
</tr>
<tr>
<td>Dry Matter</td>
<td>38.60</td>
<td>45.80</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>2.27</td>
<td>2.63</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>2.34</td>
<td>2.37</td>
</tr>
<tr>
<td>Total Ash</td>
<td>1.04</td>
<td>1.05</td>
</tr>
<tr>
<td>Free Extract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE Calculated</td>
<td>41.64</td>
<td>41.52</td>
</tr>
</tbody>
</table>

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TABLE 2: PROXIMATE COMPOSITION OF CASSAVA FERMENTED IN THE WET SEASON (DRY MATTER BASIS)

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>OTA VARIETY</th>
<th>TMS 30572</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days 5 Days 10 Days 15 Days</td>
<td>Days 5 Days 10 Days 15 Days</td>
</tr>
<tr>
<td>Water</td>
<td>63.00 63.80 65.00 71.00</td>
<td>80.20 83.00 67.20 96.00</td>
</tr>
<tr>
<td>Dry Matter</td>
<td>57.00 58.00 64.00 59.00</td>
<td>38.00 36.00 32.00 36.00</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>3.45 3.77 3.48 3.87</td>
<td>3.78 4.01 3.71 3.90</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>0.18 1.04 0.30 0.23</td>
<td>0.23 0.32 0.50 1.70</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>12.47 12.21 11.82 12.06</td>
<td>11.82 11.82 10.01 10.97</td>
</tr>
<tr>
<td>Total Ash</td>
<td>1.83 1.69 1.94 1.83</td>
<td>1.82 1.84 1.94 2.41</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>92.95 92.67 92.04 92.67</td>
<td>94.09 94.39 94.95 94.89</td>
</tr>
<tr>
<td>Free Extract</td>
<td>92.27 81.32 80.62 82.03</td>
<td>82.77 81.74 82.64 81.83</td>
</tr>
<tr>
<td>GE Kcal/kg Calculated</td>
<td>4242 4208 4228 4239</td>
<td>4245 4287 4241 4243</td>
</tr>
</tbody>
</table>

Crude protein contents in both varieties increased by day 3 of fermentation in both seasons, (Tables 1 and 2)

Increase in protein synthesis as a result of microbial fermentation has also been reported by Muindi and Hansen (1987) and Balagopalan and Padmaja (1988). However, on further fermentation to 5 and 7 days there was a decrease in protein content. The formation of additional metabolic by-products by day 3 may have inhibited fungal growth thus preventing further protein formation (Cochrane, 1958). Ether extract and crude fibre values were low throughout the fermentation period. The low crude fibre was due to the early stages of maturity of the tubers selected (~ 1 year in both varieties. The NFE values were lowest in both varieties at day 3 corresponding with the highest protein levels recorded. Noomhorn et al (1992) reported increased protein content during solid state fermentation of cassava. However, the calculated gross energy values for all samples were within a narrow range of 4144 - 4166 kcal/kg indicating that the gross energy contents of the cassava samples still remained relatively unchanged.

Table 2 shows the proximate composition of the fermented cassava in the wet season. An increase in moisture content was observed as fermentation period was prolonged with corresponding decreases in dry matter contents. The higher dry matter contents in the TMS30572 variety when compared to the OTS variety may be due to varietal differences. Gomez (1982) reported varying dry matter contents in different varieties of cassava samples.

As in the dry season, protein content once again recorded the highest value at day 3 and declined thereafter by days 5 and 7. Corresponding with the increased protein content at day 3 was a decrease in NFE value. The overall low NFE values in the wet season (81.32 - 82.94) when compared to those in the
dry season (92.67 - 94.68) is due to the higher crude fibre content in the wet season samples. Crude fibre increase is due to conversion of soluble sugars to cellulose and hemimellulose (McDonald et al. 1987). Ether extract values were low for all samples except at day 3 for both varieties and day 7 for TMS 30572 variety. The reason for this increase is unknown. Ash content was low in all samples while calculated. Gross Energy contents of the different samples ranged from 4220 - 4288 kcal/kg. The highest energy value at day 3 of fermentation was related the higher extract values at this stage.

The cyanide content of the cassava samples (Table 3) showed a lower cyanide content initially in the OTA variety when compared to the TMS 30572 variety. As fermentation progressed in all cases the cyanide content reduced with the lowest values recorded at day 7. Fermentation has been assumed to be a key process in cyanide elimination (Westby, 1994) and this has been supported by ability of microorganisms to hydrolyse linamarin (Okafor and Ejofor, 1986). The remarkable reduction in the levels of hydrogen cyanide, shows that the microorganisms are very effective in the detoxification of this compound during aerobic fermentation especially by the third day, after which, the level of a cyanide continues to decline. Bokanga (1994) noted that the major benefit of cassava fermentation is the detoxification of their final products. The exact role of these microorganisms is currently being further investigated at ARI (Westby, 1994).

From the above studies it is observed that fermentation does bring a change in nutrient composition of the cassava products. By day 3, there was a slight increase in protein content of the fermented cassava irrespective of the season. It is also obvious that the cyanide content of cassava is considerably reduced with progressive fermentation. The advantages of fermentation can thus be made use of in developing further studies to significantly increase the protein content of cassava with a view to using it satisfactorily in rations for poultry.

REFERENCES


AEROBIC FERMENTATION OF CASSAVA VS NUTRIENT CONTENT

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