Proximate, Antinutrient and Mineral Composition of Five Varieties (Improved and Local) of Cowpea, *Vigna unguiculata*, Commonly Consumed in Samaru Community, Zaria-Nigeria

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Abstract: In Nigeria, several improved varieties of cowpea have been developed, yet little effort has been made to ascertain their nutritional advantage over local varieties, hence the need for this research. In this work, five varieties of cowpea (which include two local and three improved varieties) consumed in Samaru community, Zaria-Nigeria were analyzed for their proximate composition, antinutrients and mineral contents. The results shows that IAR48 an improved variety has significantly higher (p<0.05) protein (26.61±0.48) compared to the other varieties (improved and local). Similarly, the crude fibre, gross energy and ash contents are significantly higher (p<0.05) in the improved varieties compared to the local varieties. The antinutrient contents of the improved varieties are generally lower significantly (p<0.05) when compared to the local varieties, although, phytate is an exception. The mineral content showed varying differences. Calcium and magnesium, however, are significantly higher in the improved varieties compared to the local varieties while potassium show no significant difference (p>0.05) between the five varieties. In conclusion, the result of this research suggests that the improved varieties are indeed better than the local varieties.

Key words: Antinutrient, cowpea, improved varieties, local varieties, mineral composition, proximate

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) is an annual plant that belongs to the pea family (fabaceae) (Singh *et al*., 2002). It is regarded as the most important crop in Africa (Doku and Karikari, 1970) and one of the most important legumes as well as a very important source of protein, carbohydrate and vitamins in the diets of many populations especially in developing countries (Phillips and McWatters, 1991). It remains one of the most important legumes in Nigeria, where avalanche of varieties are known. Due to its strategic significance in Nigeria and in the world at large, research on long-term genetic improvement are ongoing within national laboratories, institutes and universities in several West African countries, India, Brazil and the USA with the aim of generating varieties with better nutritional composition. In Nigeria, the International Institute of Tropical Agriculture (IITA), Ibadan and the Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria, Nigeria. Two out of the five varieties are local varieties namely: ‘Dan Borno’ (DB) and ‘Kannanado’ (Kd) while the remaining three are improved varieties which are; IT93K-452-1, IT95K-499s-35, IAR 48. Kannanado, IT93K-452-1 and IT95K-499-35, have white coat while ‘Dan borno’ and IAR 48 have brown coat. All chemicals used were of analytical grade, unless stated other-wise. The standards for minerals were procured from Merck, India. The research was carried out between April and October, 2011 at the Department of Biochemistry, Ahmadu Bello University, Zaria.

In Samaru, a community in Zaria metropolis, Kaduna State, Nigeria, several improved varieties of cowpea are available in the market, however, little effort has been made to ascertain their nutritional advantage over local varieties, hence the need for this research.

MATERIALS AND METHODS

Materials: The five varieties of cowpea used in this project were purchased at the Samaru market and identified at the Department of Agronomy and Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria, Nigeria. Two out of the five varieties are local varieties namely: ‘Dan Borno’ (DB) and ‘Kannanado’ (Kd) while the remaining three are improved varieties which are; IT93K-452-1, IT95K-499s-35, IAR 48. Kannanado, IT93K-452-1 and IT95K-499-35, have white coat while ‘Dan borno’ and IAR 48 have brown coat. All chemicals used were of analytical grade, unless stated other-wise. The standards for minerals were procured from Merck, India. The research was carried out between April and October, 2011 at the Department of Biochemistry, Ahmadu Bello University, Zaria.

Proximate analysis: The moisture content of the various varieties of cowpea was determined after drying at 105°C until a constant weight was attained (Induhara Swamy *et al*., 1971). The micro-Kjeldahl method was employed to determine the total nitrogen and the crude protein (N×5.95) (AOAC, 2000). Crude lipids were extracted with petroleum ether, using a Soxhlet apparatus and ash contents (gravimetric) were determined based on methods outlined in AOAC (2000). Total carbohydrate was calculated by the difference method (summing the values...

Table 1: The proximate composition of the five varieties (improved and local) of cowpea (%)

<table>
<thead>
<tr>
<th>Varieties*</th>
<th><em>CP</em></th>
<th>Lipid</th>
<th>CHO*</th>
<th>Moisture</th>
<th>Ash</th>
<th>CF*</th>
<th>GE*</th>
<th>NFE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>KD (local)</td>
<td>19.84±0.18a</td>
<td>3.46±0.05b</td>
<td>63.30±0.33a</td>
<td>7.99±0.16a</td>
<td>3.38±0.93a</td>
<td>2.02±0.27a</td>
<td>1.49±0.18a</td>
<td>61.28±0.59a</td>
</tr>
<tr>
<td>DB (local)</td>
<td>22.13±0.41b</td>
<td>3.77±0.32a</td>
<td>60.06±0.15a</td>
<td>9.10±0.41a</td>
<td>3.62±0.02a</td>
<td>1.33±0.09a</td>
<td>1.51±0.00a</td>
<td>58.72±1.13a</td>
</tr>
<tr>
<td>425-1 (improved)</td>
<td>22.61±0.60bc</td>
<td>4.48±0.05b</td>
<td>58.85±0.96c</td>
<td>7.83±0.19b</td>
<td>4.08±0.22c</td>
<td>2.42±0.13a</td>
<td>1.50±0.04a</td>
<td>56.63±0.10ab</td>
</tr>
<tr>
<td>499-35 (improved)</td>
<td>23.88±0.18c</td>
<td>4.45±0.12a</td>
<td>58.26±0.34a</td>
<td>6.80±0.22c</td>
<td>4.46±0.41b</td>
<td>2.17±0.17c</td>
<td>1.51±0.03a</td>
<td>56.09±0.46ab</td>
</tr>
<tr>
<td>IAR 48 (improved)</td>
<td>26.61±0.49d</td>
<td>3.99±0.47ab</td>
<td>56.24±0.51a</td>
<td>8.60±0.38b</td>
<td>3.84±0.02ab</td>
<td>1.38±0.12c</td>
<td>1.51±0.03a</td>
<td>54.85±0.39a</td>
</tr>
</tbody>
</table>

Values are expressed as mean±SEM (n = 3); Values with different superscripts down the column are significantly different from each other at p<0.05;

*GE: gross energy; NFE: nitrogen free extract; CF: crude fibre; CP: crude protein; CHO: carbohydrate; **DB: Dan borno; KD: Kannanado; 425-1: IT93K-452-1; 499-35: IT95K-499s-35

Table 2: The antinutritional composition of the five varieties (improved and local) of cowpea

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Phytate (mg/100 g)</th>
<th>HCN* (mg/kg)</th>
<th>Saponin (mg/100 g)</th>
<th>Tannin (mg/g)</th>
<th>Oxalate (mg/kg)</th>
<th>TIA* (mg/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KD (local)</td>
<td>5.33±0.33**</td>
<td>0.37±0.33</td>
<td>7.17±0.58</td>
<td>6.01±0.01</td>
<td>6.21±0.11</td>
<td>4.17±0.96**</td>
</tr>
<tr>
<td>DB (local)</td>
<td>4.00±1.00*</td>
<td>0.33±0.15</td>
<td>9.71±0.87</td>
<td>4.36±0.15</td>
<td>6.13±0.81</td>
<td>4.73±0.38*</td>
</tr>
<tr>
<td>425-1 (improved)</td>
<td>8.50±1.80</td>
<td>0.27±0.67</td>
<td>5.37±0.86</td>
<td>3.13±0.88</td>
<td>4.15±0.11</td>
<td>2.19±0.18*</td>
</tr>
<tr>
<td>499-35 (improved)</td>
<td>5.83±0.83</td>
<td>0.2±0.00</td>
<td>3.56±0.57</td>
<td>2.62±0.31</td>
<td>4.06±0.05</td>
<td>2.76±0.26*</td>
</tr>
<tr>
<td>IAR 48 (improved)</td>
<td>3.00±0.00</td>
<td>0.007±0.01</td>
<td>5.99±0.65</td>
<td>1.64±0.50</td>
<td>2.09±0.07</td>
<td>2.65±0.45*</td>
</tr>
</tbody>
</table>

Values are expressed as mean±SEM (n = 3); Values with different superscripts down the column are significantly different from each other at p<0.05;

*TIA: trypsin inhibitor activity; HCN: hydrogen cyanide; **DB: Dan borno; KD: Kannanado; 425-1: IT93K-452-1; 499-35: IT95K-499s-35

RESULTS AND DISCUSSION

Proximate analysis: Proximate compositions of the five different varieties (local and improved) of cowpea are presented in Table 1. The crude protein for IAR 48 is significantly higher than other improved varieties and the local varieties. Generally, however, the improved varieties have significantly higher protein content compared to the local varieties. Due to the significantly high protein content for the improved varieties, they could be selected for formulating infant feeds. Likewise, due to the lower carbohydrate content, low fat and significantly higher crude fibre of the improved varieties, they would be desirable in making meals for diabetic patients. We also discovered the same trend with regards to lipid content, ash and to a great extent crude fibre. For the local varieties the findings does not agree with the findings of Mbah and Silas (2007).

However, the local varieties have significantly higher carbohydrate, Nitrogen Free Extract (NFE) and to a large extent moisture compared to the improved varieties. The result showed that there is no significant difference (p>0.05) in the gross energy of the five varieties of cowpea.

Antinutrient analysis: From the Table 2, we discovered that the antinutrient composition was found to be significantly higher (p<0.05) in local varieties of cowpea compared to the improved varieties except for the phytic acid, which is not significantly different (p>0.05) between the local and improved varieties. This suggests that the rate at which these antinutrients affect the availability of nutrients by chelating the nutrients and making them

of moisture, crude protein, ash and crude fat (ether extract) and subtracting the sum from 100 (McDonald et al., 1973). Gross energy was calculated based on the formula (Ekanayake et al., 1999):

Gross energy (kJ per 100 g dry matter) = (crude protein × 16.7) + (crude lipid × 37.7) + (crude carbohydrates × 16.7)

Nitrogen Free Extract (NFE) was calculated by difference as: NFE = total carbohydrate-crude fiber

Mineral analysis: Potassium and sodium contents of samples were determined using flame photometer while the levels of calcium, magnesium, zinc and iron in the samples were determined by atomic absorption spectrophotometry (Perkin-Elmer, Analytis A700) after digestion with concentrated nitric acid (AOAC, 2000).

Antinutrient analysis: Alkaline Titration Method (AOAC, 1990) was used for hydrogen cyanide analysis while Reddy et al. (1982) method was used for phytate. Gravimetric method was used for saponin determination and the trypsin inhibitor analysis was done using spectrophotometric method as described by Armfild et al. (1985). For tannin analysis, the method of Allen et al. (1974) was used. Here, the optical density (absorbance) readings were taken at 760 nm wavelength. Oxalate determination was carried out based on the method of Muñoz Leyva et al. (1990). Here, the solution was prepared and read on the spectrophotometer at 440 nm.

Statistical analysis: The analysis was carried out in triplicates for all determinations and the results of the triplicate were expressed as mean±SEM. The SPSS 17.0 for windows Computer Software Package was used for the Analysis of Variance (ANOVA). Significance of the differences was defined as p<0.05 for ANOVA. The difference in mean was compared using the Duncan’s new Multiple Range test (Duncan, 1955).
unavailable for utilization in the system will be relatively reduced. Since the higher the level of antinutrient, the lower the bioavailability of the nutrient and minerals contained therein.

**Mineral analysis:** Data on the mineral composition of the five varieties of cowpea are presented in Table 3. There were significant differences (p<0.05) in the mineral composition of the local varieties when compared with the improved varieties, although it does not follow a trend. Zinc is significantly highest for IAR 48 while iron and calcium are highest in 499-35. The improved variety, 425-1 have significantly highest level of magnesium and potassium while DB (local variety) have the highest level of potassium. It is important to note, however, that generally an improved variety always have the highest level of the minerals analysed except for potassium. In addition, it was discovered that calcium and potassium are the most abundant mineral in cowpea.

**CONCLUSION**

From the foregoing, therefore, we concluded that indeed the improved varieties are relatively better than the local varieties, although more effort is needed to achieve a much better nutritional content for the improved varieties.

**REFERENCES**


