NUTRITIONAL EVALUATION OF FIVE WHITE COWPEA CULTIVARS

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ABSTRACT

The grains of five white cultivars of cowpea have been analysed for protein, fat, starch, in vitro digestibility, minerals and antinutritional factors. The crude protein, fat and starch content of five cultivars were in the range of 24.56-28.11, 1.59-2.95 and 42.99-48.69 per cent, respectively. Like other legumes, cowpea supplied a good amount of true protein (21.97-25.51%). In vitro protein digestibility varied from 74.85 to 78.6 per cent, whereas starch digestibility ranged from 20.73 to 23.80 mg maltose/g dry matter. Mineral profile of cowpea was found good. The grains had considerable level of inherent antinutrients including phytic acid, polyphenol and trypsin inhibitors.

INTRODUCTION

Food legumes constitute a cheap alternative sources of protein and calories, particularly for people who are unable to afford the high cost of dietary protein from animal sources. The search for novel, high quality but cheap sources of protein and energy has continued to be a major concern of government and bodies charged with the responsibility for food and nutrition in many parts of the developing world (Mohan and Janardhan, 1993).

At present, cowpeas are underutilized in India and being good source of energy, protein, vitamins, minerals and dietary fiber, it offers a great scope in meeting the nutritional requirement of population. Seeing the potentials of cowpea and its utility in human diet as well as a general lack of information on the chemical composition of Indian cowpea cultivars have necessitated the present systematic nutritional evaluation of cowpea.

MATERIAL AND METHODS

The seeds of five cultivars of cowpea [Vigna unguiculata (L) Walp] namely V 130, CS 39, GC 8962-1, Pusa phalguni and GC 3 were procured in a single lot from the forage section, Department of Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The seeds were cleaned of dust, cracked and broken seeds and other foreign materials. The raw seeds were ground to pass 0.5 mm sieve using sample mill.

Chemical analysis: Estimation of crude protein and fat was done by using AOAC (1990) methods. True protein was estimated by the method of Osborne and Voogt (1978). Starch from the sugar free pellet was extracted in 52% perchloric acid at room temperature (Clegg, 1956) and quantitative determination was carried out according to the colorimetric method of Yemm and Willis (1954). In vitro starch digestibility was assessed by employing pancreatic amylase and then measuring maltose liberated by using dinitrosalicylic acid reagent (Singh et al., 1982). In vitro digestibility of protein was carried out by the method of Akeson and Stahmann (1964) as modified by Singh and Jambunathan (1981). Calcium and iron were analysed by atomic absorption spectrophotometer (Lindsey and Norwell, 1969). Phosphorus content in the diacid HNO₃:HClO₄ :: 5:1 V/V digested extract was determined colorimetrically (Chen et al., 1956). The antinutritional factors such as phytic acid (Davies and Reid, 1979), polyphenols (Singh and Jambunathan, 1981) and trypsin inhibitor activity (Roy and Rao, 1971) were also quantified. All the analysis were done in triplicate.

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Statistical analysis: The data were subjected to analysis of variance (ANOVA) in completely randomized design to determine critical difference among cowpea cultivars.

RESULTS AND DISCUSSION

The nutrient and antinutrient contents of five cowpea cultivars are depicted in Table 1. Crude protein content was found to be in the range of 24.56 to 28.11 per cent. Fat content of cowpea cultivars ranged from 1.59 in cultivar CS39 to 2.95 per cent in V 130 (Table 1), whereas cultivars CS 39, GC 8962-1 and GC 3 had almost similar fat content. The results of protein and fat in the present study were consistent with those mentioned by previous workers (Longe, 1980, Farinu and Ingrao, 1991). Like other legumes, cowpea also supplied a good amount of true protein (21.97-25.52%). All cultivars differed significantly from each other in true protein content. Starch in cowpea cultivars ranged from 42.99 (GC 3) to 48.69 g/100 g (V 130). The findings of present study are in agreement with earlier reports, (Ene-Obong and Carnoval, 1992).

The in vitro Starch digestibility in V 130, CS 39, GC 8962-1, Pusa phalguni and GC 3 was found to be 23.80, 22.46, 23.13, 20.73 and 21.03mg maltose/g respectively. Values reported in the present study were found to be similar to that reported earlier (Chavan et al., 1989). However, El-Faki et al. (1984) reported slightly higher values (25 mg maltose/g) for starch digestibility. Protein digestibility ranged from 74.85 per cent in GC 3 to 78.60 per cent in V 130. The results of the present study are consistent with that of earlier workers (El-Faki et al., 1984; Ene-Obong, 1995). However Ros and Collin (1992) reported slightly lower value.

The content of calcium in V 130, CS 39, GC 8962-1, Pusa phalguni and GC 3 was found to be 88.33, 95.00, 91.66, 79.00, 77.33 mg/100 g, respectively (Table 1). Significant (P<0.05) variation was observed with regard to calcium content among cowpea cultivars. Aforesaid values confirm the earlier findings of Ene-Obong and Carnoval (1992), who reported a range of 71.8-101.0 mg/100g in different cowpea cultivars. On the other hand, lower values ranging from 15-24 mg/100g were reported by Fashakin and Ojo (1988), while very high value i.e. 827 mg/100g was reported by Mohan and Janardhan (1993). The wide variation observed in reported values may be due to difference in cultivars and agro-climatic conditions. Content of phosphorus was found to be maximum in CS 39 and minimum in GC 3. and values differed significantly and results were comparable to earlier reported values (Phillips and Mcwatters, 1991; Mohan and Janardhan, 1993). However, higher value (700 mg/100g) of phosphorus was reported by Akinyele (1989). Iron content ranged between 6.36 to 10.36 mg/100g. Maximum and minimum content of iron was observed in cultivars V 130 and GC 3, respectively. The present values are similar to that of Ene-Obong and Carnoval (1992), who also reported iron content of cowpea in the range of 4.91-8.18 mg/100g. Higher iron content of cowpea ranging from 10.02 to 22.51 (Fashakin and Ojo, 1988) and 32.7 mg/100g (Mohan and Janardhan, 1993) have been reported, while Farinu and Ingrao (1991) reported lower values varying from 3.71 to 5.73 mg/100g in different cowpea cultivars. This may be due to difference in varieties/cultivars and agro climatic condition.

The phytic acid content of five cultivars ranged from 836.00 to 924.66 mg/100g (Table 1). Cultivars V 130 contained minimum whereas CS 39 had maximum amount of phytic acid among cultivars. Significant (P<0.05) varietal differences were observed with regard to phytic acid among cultivars analyzed. Values reported in the present study resembles with those of Farinu and Ingaro (1991) and Ene-Obong (1995), who also
Table 1. Nutrient and antinutrient contents of five cultivars of cowpea on dry matter basis

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Cultivars</th>
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<tbody>
<tr>
<td></td>
<td>V 130</td>
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<tr>
<td>Crude protein (g/100g)</td>
<td>28.11±0.06</td>
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<tr>
<td>Fat (g/100g)</td>
<td>2.95±0.06</td>
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<tr>
<td>True protein (g/100g)</td>
<td>25.52±0.07</td>
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<tr>
<td>Starch (g/100g)</td>
<td>48.69±0.05</td>
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<td>In vitro protein digestibility (%)</td>
<td>78.60±0.27</td>
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<td>In vitro starch digestibility (mg maltose/g)</td>
<td>23.80±0.34</td>
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<tr>
<td>Calcium (mg/100g)</td>
<td>88.33±0.88</td>
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<tr>
<td>Phosphorus (mg/100g)</td>
<td>536.67±0.95</td>
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<tr>
<td>Iron (mg/100g)</td>
<td>10.36±0.16</td>
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<tr>
<td>Phytic acid (mg/100g)</td>
<td>836.00±2.30</td>
</tr>
<tr>
<td>Polyphenol (mg/100g)</td>
<td>517.22±1.41</td>
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<tr>
<td>Saponin (mg/100g)</td>
<td>1266.66±24.03</td>
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<tr>
<td>Trypsin inhibitor activity (TIU/g)</td>
<td>107.31±1.12</td>
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</tbody>
</table>

Values are mean±SE of three independent determinations;
Trypsin inhibitor units: One unit of trypsin was defined as the amount of enzyme, which produced one mg of TCA soluble component at 37°C for 20 min. at pH 7.0; One unit of inhibitory activity in that, which reduces the activity of trypsin by one unit under assay conditions.
reported phytic acid in range of 510-1027 and 840 to 992 mg/100g respectively in cowpea. On the other hand, lower range of (280-331 mg/100g) phytate content was reported among different varieties of cowpea by Ologhobo and Fetuga (1984). The reported difference may be due to the difference in variety of cowpea studied.

The polyphenolic content of the selected cultivars ranged from 434.54 to 601.10 mg/100g (Table 1). GC 3 cultivars had the highest polyphenolic content followed by V 130, GC 8962-1, CS 39 and Pusa Phalguni. The values of polyphenol obtained in the present study are in consistent with the observation, made by Oboghobo and Fetuga (1984). In contrast to the present findings, Ene-Obong (1995) reported that white cowpea had no detectable tannin content. Trypsin inhibitor activity of cowpea cultivars ranged from 107.31 to 137.44 TIU/g, highest being in GC 8962-1 and lowest being in V 130 (Table 1). All cultivars differed significantly for their trypsin inhibitor activity. In contrast to present study, Ologhobo and Fetuga (1984), reported higher values of trypsin inhibitor activity. The reason for this finding may be due to difference in varieties/cultivars, analytical techniques used and agro climatic condition.

On the basis of the above findings, it is concluded that cowpea cultivars investigated had superior chemical composition. Among cultivars, V 130 contained highest amount of protein, fat, true protein, starch, phosphorus, iron and lowest amount of phytic acid and trypsin inhibitor activity. In vitro digestibility of V 130 was also found superior. The adverse effect of most of the antinutritional factors detected in the present study, can be eliminated by household processing method (Oboghobo and Fetuga, 1984).

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REFERENCES