

THE NUTRIENT COMPOSITION OF SOME COWPEA VARIETIES

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ABSTRACT

Five varieties of cowpea (*Vigna unguiculata*) were analysed for their proximate composition, major mineral elements and carbohydrate fractions. Values for crude protein ranged from 25.80% to 28.95% while the ether extract, crude fibre, total ash and total carbohydrate had the following values: 1.83 - 2.37%, 3.06 - 4.48%, 5.80 - 7.10% and 50.46 - 55.76% respectively. The average values for phosphorus, calcium, magnesium, potassium and sodium were 0.400%, 0.019%, 0.345%, 1.280% and 0.046% respectively. Ethanol soluble sugars ranged between 4.78g/100g and 6.14/100g while starch contents varied between 32.97g/100g and 44.26g/100g. Raffinose and stachyose contents were 1.55 - 2.44g/100g and 3.33 - 4.35g/100g respectively.

Keywords: Nutrients, macro elements, oligosaccharides, cowpea varieties.

INTRODUCTION

Cowpea is an excellent source of protein and calorie (Del Rosario *et al.*, 1981). Adrian and Helias - Frangne (1964) found the protein content of cowpeas, *Dolichos* and Bambara groundnuts to be 23.00, 24.30 and 17.45% respectively. Furthermore, Amirshani and Tavakoli (1970) showed that the average protein content of cowpeas based on 47 varieties in three trials was 24.28% and the range was 21.45 - 26.25%. The International Institute of Tropical Agriculture, Ibadan (1972) among other workers, reported cowpea seeds to contain about 50% starch and 0.5 - 2.2% oil. However, Adrian and Helias - Frangne (1964) compared cowpea lipids with those of Bambara groundnuts and came out with the result that lipids in cowpeas are $\frac{1}{3}$ - $\frac{1}{2}$ those in Bambara groundnuts. Information

on the nutrient status of feedstuffs is undoubtedly useful. Grain legumes should not be left out in the search for this vital information especially that they are widely cultivated in the tropics.

Adequate information on the nutrient composition of any feedstuffs is a pre-requisite for its effective utilisation, hence, this study was designed to evaluate the proximate composition, carbohydrate content and mineral profile of raw cowpea varieties.

MATERIALS AND METHODS

Source and description of the cowpea varieties: The cowpea varieties used were supplied by the International Institute of Tropical Agriculture (IITA), Ibadan. In order to have enough fresh seeds for this study all the varieties were multiplied by growing them on IITA experimental plots.

The full description of these varieties is shown in Table 1.

TABLE 1. DESCRIPTION OF THE COWPEA VARIETIES

Variety	Coat Colour	Coat texture	Seed size (g/100 seeds)
TVU 3000	white	Rough	7.910
IT 84E - 1 - 108	Cream	Smooth	13.410
IT 82 D - 889	Red	Smooth	10.485
IT 81 D - 1137	white	Rough	15.070
IT 84 E - 124	Brown	Rough	10.125

Preparation of cowpea flour: Air - dried, raw cowpea seeds of the five varieties were milled and put in screw-capped bottles and then stored in a deep freezer prior to use.

Proximate and mineral analyses: Protein (Nx6.25) was determined according to the Micro Kjeldahl method of A.O.A.C. (1975) although the method was modified by using an auto-analyser (Technicon A.A.II) to determine

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the nitrogen content as outlined by the Technicon Instrument Corporation (1973). A.O.A.C. (1980) methods were employed for moisture, crude fibre, ether extract and total ash determination.

Mineral profile of cowpea flour was estimated by wet-ashing the samples as indicated in the A.O.A.C. (1975) method except that phosphorus was estimated by the automated procedure which utilises the reaction between phosphorus and molybdovanadate to form phosphomolybdovanadate complex. The complex was measured colorimetrically at 420nm using Technicon Autoanalyser AAII (Technicon Instrument Corporation, 1973). Calcium was determined by first treating the digest with 1% lanthanum solution before using the appropriate lamp.

Estimation of Carbohydrates: The total ethanol soluble sugars were determined by the modified anthrone method (Finley and Feller, 1973). The method is based on the extraction of sugars in 1g of finely ground (40 mesh size) cowpea seeds with 80% ethanol followed by destruction of reducing sugars with Fehling's solution, the use of which eliminates the need to evaporate to dryness.

The oligosaccharides were estimated by extracting 10 g cowpea seed sample with 100ml 70% ethanol (V/V) and then agitating for 12 hours. The mixture was filtered and the residue washed with another 50ml 70% ethanol. The combined extracts were then concentrated using a rotary evaporator at 40°C, eluted and read at 490 nm (Akpapunam and Markakis, 1979).

RESULTS AND DISCUSSION

Proximate Composition: The percentage proximate composition of raw cowpeas is shown in Table 2. Crude protein data which varied significantly ($P < 0.05$) among the five varieties ranged between 25.80% in IT 81D - 1137 and 28.95% in IT 82 D - 889 with a mean of 27.86%. The different genetic origins of legumes and indeed cowpeas could have accounted for the varietal differences observed. Since proteins are required for growth, synthesis of enzymes and hormones,

and replacement of worn-out tissues in both animals and humans, the nutritional importance of legume grains cannot be over-emphasised.

The ether extract values ranged from 1.83% in IT 82D - 889 to 2.37% in IT 84E - 124 while the average value was 2.05%. The varietal means were significantly different ($P < 0.05$). The variation may be attributed to genetic variation and growing conditions. Crude fibre values ranged from 3.06% in IT 84E - 124 to 4.48% in TVU 3000 with a mean value of 3.92% while varietal means were significantly different ($P < 0.05$). The fairly high crude fibre content of legumes make them to have nutritional importance in that Eastwood (1974) reported the relationship between the absence of fibre in the diet and the incidence of a wide range of diseases in man, notably, colon diverticular, diabetes mellitus, obesity and coronary artery disease. This explains the practice of using high fibre source as energy diluents in the diets of pregnant or breeding farm animals. The ash contents of varieties studied varied between 5.80% in IT 82D - 889 and 7.10% in IT 84E - 1-108 with an average of 6.56%. Varietal means were different ($P < 0.001$).

Cowpea variety IT 82D - 889 had the lowest total carbohydrate content (50.46%) while TVU 3000 had the highest value (55.76%) and the average was 52.72%. Varietal means were significantly different ($P < 0.05$). Since the sum of the crude protein, ether extract, crude fibre and total ash subtracted from the dry matter content for each variety gave the total carbohydrate, varietal differences could be expected because each of these has been shown to be influenced by genetic variation.

The composition of the macro-elements of raw cowpea varieties is presented in Table 3. Among the major mineral elements (phosphorus, calcium, potassium and sodium), IT 81D - 1137 had the lowest P content (0.368%) while TVU 3000 had the highest P content (0.465%). The Ca content ranged from 0.017% in IT 84E - 1 - 108 to 0.022% in TVU 3000. The lowest value for Mg (0.293%) was obtained in IT 82D-889 while the highest value

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TABLE 2 : PROXIMATE COMPOSITION OF RAW COWPEA VARIETIES (%)

Cowpea Varieties	Moisture ¹	Dry Matter ¹	Crude Protein ¹	Ether Extract ¹	Crude Fibre	Total Ash	Total Carbohydrate ¹
TVU 3000	4.00c	96.00a	27.15 a	1.91 b	4.48a	6.70a	55.76a
IT 84E - 1-108	8.00a	92.00c	28.59a	2.02a	3.44b	7.10a	50.85b
IT 82D - 889	8.50a	91.50c	28.95a	1.83b	4.46a	5.80c	50.46b
IT 81D - 1137	6.00b	94.00b	25.80b	2.12a	4.14a	6.44ab	55.51a
IT 84 E - 124	8.00a	92.00c	28.82a	2.37a	3.06b	6.75a	51.01b
Mean	6.90 ±0.59	93.10 ±0.60	27.86 ±0.43	2.05 ±0.07	3.92 ±0.20	6.56 ±0.15	52.72 ±0.85

Values are means of triplicate determinations. 1. Values followed by different letters are significantly different (P < 0.05) 2. Values followed by different letters are significantly different (P < 0.001)

TABLE 3: MINERAL ELEMENTS (MACRO) IN RAW COWPEA VARIETIES(%)

Cowpea Varieties	Total Phosphorus	Calcium	Magnesium	Potassium	Sodium
TVU 3000	0.465 a	0.022 a	0.382 ab	1.439a	0.059a
IT 84E - 1-108	0.389 b	0.017b	0.351 b	2.228b	0.037b
IT 82D - 889	0.402 b	0.020a	0.293 c	1.279b	0.058 a
IT 81D - 1137	0.368 c	0.020a	0.299c	1.215 b	0.038 b
IT 84E - 124	0.378 b	0.018b	0.402 a	1.241 b	0.038 b
Mean	0.400 ±0.012	0.019 ±0.001	0.345 ±0.015	1.280 ±0.029	0.046 ±0.004

Values are means of triplicate determinations. Values followed by different letters are significantly different (P < 0.001)

Table 4: CARBOHYDRATE CONTENTS OF RAW COWPEA VARIETIES (g.100g DM)

Cowpea Varieties	Ethanol Soluble Sugars	Starch	Raffinose	Stachyose	Total Oligosaccharides
TVU 3000	6.14a	34.21c	1.55c	3.34b	4.89c
IT 84E - 1-108	5.82 a	44.26a	2.33 a	3.88 b	6.21 a
IT 82D - 889	4.92 b	36.52b	1.85b	3.33 b	5.18b
IT 81 D - 1137	5.40ab	38.92 b	2.44 a	4.35a	6.79a
IT 84 E - 124	4.78c	32.97c	1.76b	3.71b	5.47b
Mean	5.41 ±0.18	37.38 ±1.42	1.99 ±0.12	3.72 ±0.13	5.71 ±0.25

Values are means of triplicate determinations. Values followed by different letters are significantly different (P < 0.01).

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of 0.402% was recorded in IT 84E - 124. The lowest values recorded for K and Na were 1.215% and 0.037% exhibited by IT 81D - 1137 and IT 84 E -1-108 respectively. The highest values of 1.439% and 0.059 were shown by TVU 3000 for both mineral elements. This study reveals that cowpea seeds contained high levels of potassium and very low level of calcium. These wide variations within species may depend on such factors as variety, climate, cultural methods and the mineral contents of the soil as suggested by Aykroyd and Doughty (1982). When cowpeas are consumed in adequate amounts, they could provide sufficient potassium to meet the needs of an individual. One of the beneficial effects of a legume or cowpea diet, is reported to be the substitution of potassium for sodium (Schuphan, 1969). This therefore recommends the incorporation of cowpea into the diets of hypertensive patients since cowpeas are low in sodium. Calcium is known to be required for bone and teeth mineralisation. If adequate quantities of cowpea seeds are not consumed, conditions associated with calcium deficiency may precipitate. Because cowpeas are particularly low in calcium, Del Rosario *et al.* (1981) suggested a daily intake by adults of about 50 g cowpea foods to supply daily Ca requirement.

Carbohydrate contents of raw cowpea seeds of different cultivars expressed in g/100 g DM are shown in Table 4. Cowpea variety IT 84E - 124 had the lowest value of ethanol soluble sugars while TVU 3000 had the highest value with 4.78 and 6.14g/100g DM respectively. Values for starch ranged from 32.97g/100g DM in IT 84E - 124 to 44.26g/100g DM in IT 84E - 1-108. TVU 3000 had the lowest raffinose content of 1.55g/100g and IT 81D - 1137 recorded the highest value of 2.44g/100g. As for stachyose, IT 82 D - 889 had the lowest value of 3.33 g/100g and the highest value of 4.35g/100g was recorded in IT 81D - 1137. Since oligosaccharides contain galactopyranose residues in alpha (1-6) linkages, they are indigestible and have been shown to be partly responsible for the flatulence which can result from the digestion of legume seeds by

simple-stomached farm animals and man (Bressani *et al.* 1985 and Oke, 1987). This implies that TVU 3000 with the lowest value of total oligosaccharides will have its carbohydrates well utilised by monogastric animals when compared with other varieties.

CONCLUSION

The outcome of this investigation has greatly elucidated the nutrient composition of cowpeas revealing their potentials as good sources of protein, carbohydrates and macro elements except calcium. Therefore, if cowpea is to be fed to monogastric animals, the diet must be supplemented with a calcium salt. Furthermore, a though soybean which is not widely accept grown in Nigeria has been extensively fed to livestock especially monogastric animals in developed countries as a source of high quality protein, cowpea can equally be fed to monogastric animals, more so as it is widely cultivated in the country. This will undoubtedly lead to increased cowpea production with a view to preventing the problem of competition between man and livestock that may ensue due to increased demand. It should be noted, however, that feeding of cowpea to monogastric animals as herein opined will be an innovation as there is dearth of information in this direction.

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