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Full length Research Paper

Chemical composition and mineral element content of two cowpea (*Igna unguiculata* l. walp.) varieties as food supplement

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The effect of processing on the chemical composition and mineral element content of two local cultivars of cowpea (*Vigna unguiculata* L. Walp.) was studied. The processing method subjected to are dehulling and roasting respectively. Four samples were prepared: processed (dehulled and roasted) and raw unprocessed from both varieties. The crude protein content of the raw and the processed varieties ranged from 19.82%-19.32% kananado and Banjaram jambo: 17.42%-16.92% respectively, same pattern was recorded for crude fat 2.1%-1.85% and 1.05%-0.80% and crude fiber 3.68%-2.37% and 2.61%-1.29%; whereas percentage ash (1.93%, 3.92%) and moisture contents (5.55% and 6.90%) the decrease is not statistically significant. The % carbohydrate content, however, increased (66.92%-69.21% and 68.1%-71.05% respectively). The mineral element contents of the two varieties reduced (with few exceptions) after processing (e.g. Na in Kananado: 37mg/L-32mg/L and Mg in Banjaram jambo: 28.7mg/L-26.7mg/L).

Keywords: Cowpea, soaking, dehulling, roasting and food supplement.

INTRODUCTION

Cowpea, which originated in Africa, is a major grain legume grown by small scale farmers in the Northern and Southern parts of the country (Davis *et al*., 1991; Chinma *et al.,* 2008).

The crop is indigenous to Africa and is widely used in many cropping systems throughout Africa (Eaglesham *et al.,* 1981; Sellschop, 1962; Evans and Boulter, 1974).

Traditional grain legume crops play important roles in the diet of many people in Africa and Asia and are major sources of proteins, carbohydrates, vitamins and minerals (Singh 2003; Bressani, 1985; Nell *et al.,* 1992).

Cowpeas are widely used source of fine expensive proteins (Rivas-Vega *et al., 2006*). This protein is good but incomplete and, like other pulses, is improved when supplemented with other foods which contain different types of proteins (Davis *et al.,* 1991; Giami, 2005); and as blend with cereals prepared of measuring meal, (Modu et al 2004; 2005; 2010 and Laminu et al 2011).

In Nigeria, cowpea has important uses. The young and mature seeds are consumed boiled in soups, stews and is also taken as a pottage (Chinma *et al.,* 2008; Ravhuhali *et al.,* 2010).

The nutritional quality of raw cowpea is poor due to the presence of anti-nutritive factors such as trypsin inhibitors, flatulence – causing oligosaccharides which contain galactoside bonds; for example, stachyose [(α-D-Galactose)$_2$ – (α-D-Glucose)-(β -D- fructose)] verbacose [(Gal$_2$ – Glu – Fru)], and raffinose [(Gal – Fruc - Glu) (Piergiovanni and Della, 1994; Gupta, 1987)]. The beans also have low protein digestibility and are deficient in sulfur – containing amino acids (Methonine and Cysteine) (Davis *et al.,* 1991; Ehlers and Hall, 1997). This problem can, however, be overcome by adequate processing techniques such as dehulling and roasting. The protein and tannin content of cowpea is likely to be affected by variety and growth environment (Khattab and Arnfield, 2009; Ming – Cheng *et al.,* 1993). The cowpea varieties adapted to the northern and southern parts of the state have not been evaluated for their nutrient content as well

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Table 1. Chemical Composition of Raw and Processed Cowpea Cultivar (Kananado)

Sample (Cowpea)	%Moisture content	%Crude protein	%Fat	%Crude fibre	%Ash	% Carbohydrate
Raw cowpea;Kananado	$5.55^{a} \pm 0.10$	$19.82^{a} \pm 0.27$	$2.1^{a} \pm 0.02$	$3.68^{a} \pm 0.20$	$1.93^{a} \pm 0.14$	$66.92^{a} \pm 1.00$
Processed cowpea;kananado	$5.50^{a} \pm 0.06$	$19.32^{b} \pm 0.1$	$1.85^{b} \pm 0.02$	$2.37^{b} \pm 0.04$	$1.75^{a} \pm 0.07$	$69.21^{b} \pm 1.80$

Values are means of three determinations ± the respective standard deviations.
Values on the same column vertically with different superscripts are significantly different ($p<0.05$).

as anti-nutrient status. Hence, this study was conducted to determine the chemical composition; mineral element contents and anti-nutrient status of two local cowpea cultivars. The aim of the work is to determine the effect of processing on the proximate, mineral element and anti-nutrient status compositions of the local cowpea cultivars.

MATERIALS AND METHODS

The two local cowpea varieties (local Hausa names; Banjaram jambo and Kananado cultivated in both Northern/Southern parts of Borno State, Nigeria) were bought from Monday market, Maiduguri, Borno state.

Experimental Processing Methods

About 1kg of each variety was cleaned (husks and defective seeds removed) and soaked in pure water in a clean ratio of 1:2 in a plastic container. After about 5 minutes, the samples were transferred to a clean mortar and dehuled using a pestle. The pericarps/skins were removed by serious washing in water. The dehuled seeds were dried under sun for about 24 hours. The dry dehuled seeds were then roasted and milled/ground using a clean commercial milling/grinding machine (the initial portions that emerged were discarded to avoid contamination). The dry powders were then sieved and packed in air-tight plastic containers.

Chemical Analysis

The proximate compositions were determined using AOAC (2004) methods.

Mineral/Elemental Analysis

The mineral element contents of the sample were determined using atomic absorption spectrometry (AAS: model; analyst 400) – as described by Victor (2000).

RESULTS

All determinations were made in triplicates and the data obtained were subjected to statistical analysis (students t-test) using the software instat 3 (2000).

Chemical Composition (Kananado)

The Chemical composition of the unprocessed and processed local cowpea cultivar (Kananado) is presented in table above.

From the above results, the crude protein, crude fat and crude fibre contents decreased ($p<0.05$) after processing. However, there was no statistically significant decrease in the moisture and ash contents. The percentage carbohydrate slightly increased after processing.

Chemicl Composition (Banjaram Jambo)

The Chemical compositions of the unprocessed (raw) and processed Banjaram jambo (local cowpea cultivar) are presented in table 2 below.

From table 2 above, the moisture and ash contents of the samples did *not* statistically reduce ($p>0.05$) after processing. However, the crude protein, crude fibre, and crude fat decreased ($p<0.05$) after processing. The % Carbohydrate increased after processing.

Table 2. Chemical Composition of Unprocessed and Processed Local Cowpea Cultivars (Banjaram Jambo)

Sample	%Moisture content	%Crude protein	%Fat	%Crude fibre	%Ash	%Carbohydrate
Raw cowpea; Banjaram	6.90[a] ±1.00	17.42[a] ± .20	1.05[a] ±0.01	2.61[a] ±0.20	3.92[a] ± 0.13	68.1[a] ± 2.01
Processed cowpea; Banjaram	6.20[a] ±0.08	16.92[b] ±0.10	0.8 b ±0.01	1.29[b] ± .04	3.74[a] ± 0.06	71.05[b] ± 2.52

Values are means of three determinations ± the respective standard deviations.
Values on the same column vertically with different superscripts are significantly different ($p<0.05$).

Table 3. Mineral Composition of Raw and Processed Local Cowpea Cultivar (Kananado) (mg/L)

Sample (Kananado)	Na	K	Mg	Ca	P	Zn	Fe
Raw cowpea; Kananado	37[a] ±2.00	554[a] ± 3.00	10[a] ± 0.80	54.43[a] ± 0.12	45[a] ± 1.00	5.72[a] ±1.00	6.0[a] ± 0.17
Processed cowpea; kananado	32[b] ± 1.00	550[a] ± 2.00	6.88[b] ± 0.10	54.13[a] ± 0.20	42[b] ± 1.00	4.71[a] ± 0.10	5.55[b] ± 0.05

Values are means of three determinations ± the respective standard deviations.
Values on the same column with different superscripts are significantly different ($p<0.05$).

Table 4. Mineral Composition of Raw and Processed Local Cowpea Cultivar (Banjaram Jambo) (mg/L)

Sample Code	Na	K	Mg	Ca	P	Zn	Fe
Raw cowpea; Banjaram	50[a] ±3.0	675[a] ±3.0	28.7[a] ±0.8	68[a] ±0.24	80.50[a] ±0.09	8.8[a] ±0.15	4.77[a] ±0.04
Processed cowpea; Banjaram	44[b] ±1.0	670[a] ±2.0	26.7[b] ±0.2	67.4[b] ±0.10	79.37[b] ±0.63	8.4[b] ±0.10	3.85[b] ±0.06

Values are means of three determinations ± the respective standard deviations.
Values on the same column with different superscripts are significantly different ($p<0.05$).

Mineral Element Content (Kananado)

The results are presented in table 3. The results were statistically analyzed.

From the table above, the levels of Na, Mg, P, and Fe, reduced ($p<0.05$) after processing. However, K, Ca, and Zn did *not* significantly reduce ($p>0.05$) after processing.

Mineral Element Content (Banajaram Jambo)

From the above results, it can be seen that the contents of Na, Mg, Ca, P, Zn and Fe decreased ($p<0.05$) after processing. However, the K level of the raw was *not* significantly different ($p >0.05$) from that of the processed sample.

DISCUSSION

The proximate compositions of the processed and unprocessed samples are shown in tables 1 and 2.

In table 1 (for kananado), the percentage moisture content did not show statistically significant decrease after processing though there was a slight change. The slight decrease in moisture might be due to the roasting process and can increase the shelf life of the processed sample (Giami, 2005). The ash content only showed a slight decrease after processing, however, the crude protein, fat content and crude fibre significantly decreased, after processing and the percentage carbohydrate, on the order hand, significantly increased ($p<0.05$). These agree with the earlier findings of Rivas – Vega *et al* (2006).

The chemical compositions of Banjaram jambo followed a similar pattern of alterations after processing.

The moisture content and ash contents slightly decreased after processing. The decrease in ash might be due to the volatilization of some metal/mineral elements (Bressani, 1985). The decrease in crude protein, percentage fat and crude fibre might be due to the loss of some parts (e.g. the plumules and hulls) of the seeds during the processing method (Rivas – Vega *et al.* and 2006, Modu *et al* 2011). This may suggest that the hull part of the seeds contribute to the fibre content. The increase in % carbohydrate shows that the carbohydrate contents (Davis *et al.,* 1991 and Modu *et al* 2004) were not significantly reduced in the course of processing (Rivas –Vega *et al.,* 2006 and Modu et al 2005).

The elemental contents of the processed and unprocessed local cowpea cultivars are presented in tables 3 and 4.

For kananado (table 3), there were significant decreases in the levels of Fe, P, Mg and Na. These might account for the slight decrease in the determined ash content (Rivas-Vega *et al.,* 2006).

However, changes in Ca, K and Zn levels were not statistically significant ($p <0.05$) after processing. These agree with the findings of Chinma *et al* (2008) and Rivas – Vega *et al* (2006).

With the exception of Na, the contents of all the remaining mineral elements determined statistically decreased ($p < 0.05$) after processing. This might be due to the fact that most of the mineral elements are located at the pericarp and the “eye” of the seeds (Giami, 2005).

CONCLUSION

From the forgoing it can be deduced that dehulling and roasting alter (mostly reduce) some of the proximate and mineral element contents of cowpea.

RECOMMENDATION

It is therefore recommended that processed (dehulled and roasted) cowpea be supplemented with other diets so as to improve its nutritional value.

It is also recommended that further studies be carried out on these two local varieties so as to determine other important parameters such as the activity/level of trypsin inhibitor.

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