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Proximate and Mineral Composition of Boiled *Carnavalia ensiformis* Seeds

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Abstract: The study examines the proximate and mineral composition of *Carnavalia ensiformis* seeds subjected to varying periods of boiling in water. There were four treatments, which comprised: 1 hr, 2 hrs, 3 hrs and 4 hrs water boiling. Each treatment was made up of three replicates. After the expiration of each boiling period, the water was discarded, sun-dried for 7 days and thereafter milled to pass through 1 mm sieve and subjected to laboratory analysis. The study revealed the following: Dry matter did not differ significantly, $P < 0.01$, across treatments. Crude protein recorded for the 4 hrs boiling had a higher value of 21%. Highest crude fibre was recorded for the 2 hrs boiling. Ether extract decreased in value up to the 3 hrs treatment time but later increased in seeds boiled for 4 hrs. Ash content decreased from 4% in the raw seeds to 2% after boiling for 2 hrs but later increased to 4% in seeds subjected to 4 hrs boiling. Magnesium level increased to 20% in seeds boiled for 3 hrs but zinc level decreased from 0.73% in the raw seeds to 0.42% in seeds subjected to 4 hrs of boiling. Iron content recorded a decrease at 3 hrs of boiling but boiling for 4 hrs recorded an increase while copper content recorded an increase in seeds boiled for 3 hrs. The results revealed that subjecting seeds of *Canavalia ensiformis* to 4 hrs boiling in water led to a release more nutrients in improve form.

Key words: Proximate, mineral composition, crude protein, ether extract, *canavalia ensiformis* seeds

INTRODUCTION

Feed constitutes a major production input to in livestock enterprise. Livestock operators are faced with the problem of inadequacy of feed resource because of the stiff competition between humans and livestock industries for the available feed resource. Ruminants are maintained economically on naturally occurring vegetations (pastures and browse plants), however, the naturally occurring vegetations are generally low in feed nutrients. Legume forage and seeds have been found to be able to furnish protein (Bressani *et al*., 1982), energy and mineral elements to livestock (Akanji *et al*., 2003). Jack-bean (*Carnavalia ensiformis*) is a tropical leguminous plant with high seed and herbage yields and there is no stiff competition between humans and livestock industries in its use. Jack-bean seeds and herbage are rich in protein and mineral elements such as Ca, Zn, P, Mg and Cu (Udedibie and Nkwocha, 1990), however, the seeds contain some anti-nutrients (Udedibie *et al*., 1996), which inhibit protein and energy utilization in poultry (Carlini and Udedibie, 1997). The higher protein content of Jack-bean seeds relative to its herbage (Bogdan, 1977) reveals potential of the seeds as valuable protein feed ingredient. Several studies have been conducted which examined effects of processing on nutritive value of Jack-bean seeds (Akanji *et al*., 2003; Udedibie *et al*., 2005), however, there were few studies on the effects of variations in boiling period. The main objective of the study was to examine the effects of variations in boiling period of *Carnavalia ensiformis* seeds in water on proximate and mineral composition.

MATERIALS AND METHODS

Experimental site, processing methods and sample preparation: The study was carried out at the Animal Production and Health Laboratory of the Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State. The raw *Carnavalia ensiformis* seeds used were harvested from the pasture plot of the Teaching and Research Farm, LAUTECH. Five hundred grams of cleaned Jack-bean seeds in three replicates were weighed for each treatment that comprised: Raw as control, 1 hr, 2 hrs, 3 hrs and 4 hrs of boiling at 100°C. After the expiration of the boiling time, the water was discarded and each replicate was sun-dried for 7 days and milled to pass through 1 mm sieve and stored separately in sealed containers pending laboratory analysis.

Laboratory analysis: The dry matter content of raw Jack-bean seeds was determined by weighing 500 g of the seeds in triplicate and placed in an oven at 60°C for 72 hrs followed by cooling in a desiccator and weighed. The nitrogen content of each processed samples was estimated using the Kjeldahl technique and the crude protein was estimated by multiplying the nitrogen content by a factor of 6.25. The ash content was determined by subjecting 2-4 g of each replicate to 600°C for 6 hrs while the lipid determination was carried out using Soxhlet apparatus. The crude fibre was determined as described by AOAC (1990). The mineral element (Magnesium, Copper, Iron and Zinc) contents

Table 1: Proximate and mineral elements composition of water boiled *Carnavalia ensiformis* seeds

	Raw	1 hr Boiling	2 hrs Boiling	3 hrs Boiling	4 hrs Boiling	S.E.D.	P-values
Proximate							
Dry Matter	88.00^{a}	92.00^{b}	92.00^{b}	92.00^{b}	92.00^{b}	0.312	0.01
Crude Protein	21.00^{a}	20.13^{a}	21.88^{b}	21.00^{c}	21.88^{b}	0.082	0.01
Crude Fibre	12.00^{a}	12.00^{a}	12.00^{a}	10.00^{b}	10.00^{b}	0.193	0.01
Ether Extract	6.00^{a}	4.00^{b}	4.00^{b}	4.00^{b}	6.00^{a}	0.213	0.01
Ash Content	4.00^{a}	4.00^{a}	2.00^{b}	2.00^{b}	4.00^{a}	0.132	0.01
NFE	57.00^{c}	59.87^{b}	60.12^{b}	63.00^{a}	58.12^{c}	0.210	0.01
Mineral Elements							
Mg	14.68^{a}	20.94^{b}	21.78^{c}	20.64^{d}	16.02^{e}	0.012	0.01
Zn	0.73^{a}	0.44^{b}	0.44^{b}	0.47^{b}	0.42^{b}	0.017	0.01
Fe	7.31^{a}	3.58^{b}	3.34^{c}	2.79^{d}	5.21^{e}	0.015	0.01
Cu	0.83^{a}	2.11^{b}	2.24^{c}	2.58^{d}	2.00^{e}	0.012	0.01

were determined by wet ashing 2 g each replicate with a mixture of nitric acid, perchloric acid and sulphuric acid (10: 4: 1) as described by AOAC (1990).

Statistical analysis: The data were subjected to one way analysis of variance (ANOVA) using the Minitab Software Statistical Package (Minitab, 1998). Treatment means were compared using the standard error of the difference between means (S.E.D.) for significance ($p < 0.05$).

RESULTS AND DISCUSSION

Proximate: The % DM was not significantly different across treatments but higher than the value recorded for the control (88%). The % DM values in this study were within the range values (86%-96%) reported by Sridha and Seena (2006). However, the % DM of the raw and treated seeds in this study were lower and higher than the 91.12% and 87-88%, respectively, reported by Udedibie *et al*. (2005). The variations probably were due to differences in cultivars used or differences in soil status of site of cultivation. Crude protein values differed across treatment; 1 hr boiling recorded the least value (20.13%) and the value was lower than 26.5% recorded by Essien and Udedibie (2007) for 1 hr boiled seeds. The lower value recorded for seeds boiled for 1 hr and higher values recorded for prolonged boiling seem to indicate that 1 hr boiling and prolong period of boiling reduced and increased CP content of seeds, respectively. This agrees with the report of a previous study, that prolong boiling of Jack-bean seeds improves nutritive value and was ascribed to the destruction of anti-nutrients contained in the seeds (Akanji *et al., 2003*). The 4.70%-11.4% range of CF content for raw Jack-bean seeds reported by Sridhar and Seena (2006) was lower than the value obtained in this study. The differences between studies, probably was due to differences in cultivars or soil status between experimental sites. The CF content of raw Jack-bean seeds subjected to 2 hrs boiling was higher (12%) than the seeds boiled for 3 and 4 hrs (12% vs 10%). The trend was similar to observation of Essien and Udedibie (2007) they recorded a decrease in CF content of Jack-bean seeds form 6.94% to 6.24% after boiling for 2 hrs. The reduction in CF contents suggests a reduction in seeds' testa due to exposure of the seeds to hot water. Crude protein and CF are inversely related; the prolonged boiling of Jack-bean seeds weakens the seed coat (testa) and enhances the release of CP. The %EE decreased from 6% in raw seeds to 4% after 3 hrs of boiling but increased in seeds subjected to 4 hrs boiling. The trend in % EE was not consistent with the report of Essien and Udedibie (2007) that reported no significant difference after boiling for 2 hrs. Ash content was 2% after 2 hrs of boiling compared to 4% recorded for the raw seeds. However, the % Ash in seeds subjected to prolong period of boiling longer period of boiling was found to be 4%.

Mineral elements: Magnesium content of the raw seeds increased from 14%-20% after 3 hrs of boiling but decreased to 16% after 4 hrs boiling. Sridhar and Seena (2006) reported between 5%-23% in the raw seeds of *Canavalia ensiformis*. Zinc content reduced from 0.73% in the raw seeds to 0.42% after 4 hrs of boiling. Iron content also reduced from 7.31% to a level of 2.79% after 3 hrs boiling but later increased to 5.21% after 4 hours. Copper however had an increase form 0.83% to 2.58% after 3 hours of boiling the seeds. Sridhar and Seena (2006) reported between 0.11%-0.98%, 0.33%-1.00% and below 9.33% for the raw seeds of *Canavalia ensiformis* for zinc, copper and iron respectively. The trends obtained in this study for the proximate and mineral composition of Jack-bean seeds subjected to varying periods of boiling in water agree with the reports of other workers (Esonu *et al*., 1996; Udedibie *et al*., 1996; Udedibie *et al*., 2005).

Conclusion: In conclusion, boiling as a method of processing was to found to improve the nutritive value of Jack-bean seeds.

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