Processing enhanced the nutritional contents of Enterolobium cyclocarpum seeds

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Abstract

An experiment was carried out to determine the effects of different methods of processing on the nutritional and anti-nutritional contents of Enterolobium cyclocarpum seeds. The seeds were harvested and processed into four different treatments: T1 (raw), T2 (boiled), T3 (Soaked), and T4 (roasted). The seeds were later ground in hammer mill and taken to laboratory to determine crude protein (CP), crude fiber (CF), ether extract (EE), ash, nitrogen free extract (NFE). Mineral contents such as calcium (Ca), phosphorus (P), magnesium (Mg), and sodium (Na) were also analysed. Some anti-nutritional factors such as saponnin, tannins, oxalate and phytate were also determined. Data obtained were subjected to analysis of variance. It was observed that crude protein of the treated seeds were significantly higher than the raw. T2 recorded the highest (36.31%) followed by T3 (34.52%) and T4 (33.24%) while the lowest was observed in T1 (19.33%), Ether extract followed the same trend. Crude fiber ranged from 15.92% in T1 - 2.42% in T2. Results obtained for calcium (8.90–6.00%), magnesium (5.45-4.85%), sodium (2.38-1.69%) and phosphorus (2.85-1.36%) were significantly higher in Tlamong the treatments. Oxalates (0.19-0.11%), phytates (0.33-0.19%), tannin (0.05-0.02%), and saponnin (0.41-0.33%) were observed to be significantly lower in the processed seeds than the raw. It can be concluded boiling had significant increase in protein content and decrease in crude fiber content of the seeds.

Keywords: Enterolobium cyclocarpum seeds, nutrients, anti-nutrients and mineral contents.

Introduction

The prohibitive cost of concentrate diets for ruminants in the tropics during the dry season necessitates continuous search for less expensive and high nutritive feedstuffs. Unconventional protein sources from browse trees, legumes and seeds of trees were reported to be sustainable for ruminants in the tropics. Enterolobium cyclocarpum is a mimosaceous legume tree, found in the deciduous lowlands forest (Janzen, 1981). The legume is easily established and fast growing to maturity over a period of time than most common leguminous trees in Nigeria. In a preliminary study, Ezenwa (1998) recommended the legume to be suitable for use in intensive feed garden in southwestern Nigeria, being fast and

luxurious in growth. Enterolobium cvclocarpum has large, thickened, contorted, indehiscent pods which resemble an ear in form. The pods contain sugary dry pulp which is highly palatable and nutritious. Pods fall from the tree gradually at the end of the dry season for over a period of two months, thus spreading the availability of pods for livestock. According to Janzen (1981), its fruits are avidly eaten by free- ranging horses, suggesting its utilization for livestock. Browse plants and their seeds are available in the off season but most of them are less beneficial to livestock as they contain antinutritional factors. Anti-nutritional factors are organic compounds which when present in a diet, may adversely affect the health and growth of animal by interfering

with normal feed utilization and preventing the absorption of nutrients from the diet. Hence the need for processing in order to make them suitable for livestock feed. The study was aimed to determine the effects of different methods of processing on the nutritional contents of *Enterolobium cyclocarpum* seeds.

Materials and methods

Enterolobium cyclocarpum pods were harvested at Moor –plantation environment Ibadan, and the seeds were removed from the pods manually. The seeds were divided into four treatments: T1 (raw), T2 (boiled) 1kg of the seeds was poured into boiling water for 40 minutes, drained and sundried for 3 days. In theT3 (soaked), 1kg of the seed was soaked in 2 liters of water for 24 hours, drained and sundried for 3 days. For T4 (roasted), 1kg of the seed was roasted in dry frying pan on a hot plate at $60^{\circ c}$ for 45 minutes. All the treated seeds were separately ground in hammer mill for consequent analysis.

Chemical analysis

Known weight of each sample was oven dried at 65°C to a constant weight for dry matter determination (DM). Proximate analysis; crude protein, crude fibre, ether extract and ash were analysed according to the standard methods of (AOAC, 1995). Quantitative determination of tannins, saponnins, oxalates, and phytates were also carried out in triplicates, using the method of AOAC (1995). After ashing of samples in a muffle furnace at 550°C, mineral analyses of calcium and potassium were determined using Atomic Absorption Spectrophotometer while sodium was read in flame photometer and phosphorus was read in flame spectrophotometer.

Statiscal analysis

All the data obtained were subjected to analysis of variance (ANOVA) using SAS, (1998), Means were compared using Duncan (1955) option of same software.

Results and discussions

Table 1 shows the proximate composition of raw and processed *Enterolobium cyclocarpum* seeds. The crude protein ranged from 36.31 - 29.33%, processing increased the CP contents while crude fiber was reduced, the CF values ranged from 15.39-2.42%, T1 recorded the highest while the least was observed in T2. Etherextracts follows the same trend, it ranged from 5.66-2.20% the highest was observed in T1 while the lowest was observed in T2.

Table 1.1 Toxinate composition of processed Enterorobulan cyclocarpain seeds						
T1(raw)	T2 (boiled)	T3 (soaked)	T4 (roasted)			
92.13	91.63	91.85	92.07			
29.33	36.31	34.52	33.24			
15.39	2.42	3.00	9.26			
5.66	2.20	3.12	3.80			
4.35	3.50	3.85	3.79			
47.36	50.87	41.98	43.78			
	T1(raw) 92.13 29.33 15.39 5.66 4.35 47.36	$\begin{array}{c c} \hline \textbf{T1(raw)} & \textbf{T2 (boiled)} \\ \hline \textbf{71(raw)} & \textbf{72 (boiled)} \\ \hline \textbf{92.13} & \textbf{91.63} \\ \hline \textbf{29.33} & \textbf{36.31} \\ \hline \textbf{15.39} & \textbf{2.42} \\ \hline \textbf{5.66} & \textbf{2.20} \\ \hline \textbf{4.35} & \textbf{3.50} \\ \hline \textbf{47.36} & \textbf{50.87} \\ \hline \end{array}$	$\begin{array}{c c} \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $		

Table 1: Proximate composition of processed *Enterolobium cyclocarpum* seeds

Table 2 shows the mineral contents of the raw and the processed seeds. Processing reduced the level of mineral composition of the seeds. The range observed for Ca (8.90-6.00%), Mg (5.45-4.85%), Na (2.38-1.69%) and P (2.85-1.36%), T1 recorded

the highest and significantly higher than values obtained for T2, T3and T4 among the treatments. The values obtained for Ca, Mg, Na and P were within the range recommended for maintenance, lactating and non-lactating goats (NRC, 1981).

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Table 2: Mineral contents (%) of raw and processed <i>Enteroloolum cyclocarpum</i> seeds						
Parameter	T1(raw)	T2(boiled)	T3(soaked)	T4(roasted)	±SEM	
Calcium	8.90 ^a	6.90 ^b	6.00 ^{bc}	6.10 ^{bc}	2.90	
Magnesium	5.45 ^a	5.32 ^b	4.85 ^c	5.27 ^b	0.60	
Sodium	2.38 ^a	2.16 ^b	1.69 ^c	2.16 ^b	0.69	
Phosphorus	2.85 ^a	2.59 ^b	1.36 ^c	2.30 ^{bc}	1.49	
±SEM - standard error of mean, a.b.c means same superscripts on the same row are not significantly different P > 0.05						

Presented in Table 3 are the anti-nutritional factors of both the raw and processed seeds. It was observed that processing reduced the level of anti-nutritional contents of the seeds. Oxalates ranged from 0.19-0.11% showed no significant differences among T1, T2 and T3. The same trend was observes for phytates (0.33-0.19%), tannin (0.05-0.02%) and saponnin (0, 41-0.33%). The level of oxalates observed here is unlikely to pose toxicity problems, since it was below 2-5g recommended as the threshold (Oke, 1969). Oxalate affects Ca and Mg metabolism (Onwuka, 1983) but ruminants can consume considerable amounts of high oxalate plants without adverse effects due principally to microbial decomposition in the rumen.(Oke,1969).

The knowledge of the phytate level in feeds is necessary because high concentration can cause adverse effects on the digestibility of minerals (Nwokolo and Bragg, 1977). Phytate forms stable complexes with Cu^{2+,} Zn²⁺, Co²⁺, Mn²⁺, Fe²⁺ and Ca²⁺. Saponins reduce feed intake, and uptake of certain nutrients including glucose and cholesterol. From the levels obtained in this study it is not likely that the saponnin content of Enterolobium cyclocarpum seeds will affect its nutritional potentials to any significant extent. The level of tannin which adversely affect digestibility in sheep and cattle is between 2% and 5% (Diagayete and Huss; 1981). Goats are known to have threshold capacity of about 9% dietary tannin (Natis and Malachek, 1981).

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Parameters	T1(raw)	T2(boiled)	T3(soaked)	T4(roasted)	±SEM	
Oxalate	0.19 ^a	0.12	0.11	0.11	0.07	
Phytate	0.33 ^a	0.20	0.19	0.19	0.14	
Tannin	0.05 ^a	0.03	0.02	0.02	0.03	
Saponin	0.41 ^a	0.34	0.34	0.33	0.08	
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±SEM = standard error of mean, a,b,c means same superscripts on the same row are not significantly different P > 0.05

Conclusion

The study has shown that different processing methods increased availability of crude protein contents, reduced crude fiber, mineral and anti-nutritional contents of Enterolobium cyclocarpum seeds.

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