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Effect of boiling on biochemical composition of raw *Cassia Tora* seeds and its potential as feed ingredient in poultry feeds

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***Target audience:** animal nutritionists, livestock farmers, feed millers, livestock extension officers*

Abstract

Effect of the duration of boiling on the proximate, mineral and anti-nutritional factors of Cassia tora seeds was investigated. Boiling lasted for 30, 60 and 90 minutes, after which the seeds were dried in an oven at 60^{o}C for 24 hours, ground and analyzed. Results showed that raw seeds of C. tora contained 9.63% crude protein (CP) compared to 13.13%, 14.01% and 13.57% for 30, 60 and 90 minutes of boiling respectively. The dry matter was increased above 30 minutes of boiling. Fibre, ash, ether extract, nitrogen free extract and gross energy were reduced (P<0.05) by boiling. Boiling did not influence the mineral composition of the seeds. Generally boiling reduced the anti-nutritional factors. Boiling for 90 minutes compared to other durations led to 64.36%, 68.62%, 44.86% and 19.56% reductions in tannins, HCN, saponins and phytate respectively. In conclusion, raw Cassia tora seeds has potential for inclusion in poultry feeds and should be boiled at least for 30 minutes to reduce the anti-nutritional factors and improve its nutritive value especially the crude protein.

***Key words:** anti-nutritional factors, boiling, cassia tora, mineral, proximate.*

Description of Problem

Feeding constitutes an important part of poultry production and (1) observed that developing countries have feed deficits, made complex and complicated by competition among human, the industry and farm animals for the same food items as either food for man, feed for animals and raw materials for the industry. One of the ways of eliminating this problem of high feed cost is by looking for alternative feedstuffs, which have little or no dietary value for man and industry. Several conventional legume seeds such as sword bean, pigeon pea, mucuna species and *Cajanus cajan*, to mention just a few, have been studied and evaluated for inclusion in non-ruminant diets in Nigeria (2, 3, 4, 5, 6). There is however some unconventional legume seeds that are still under-utilized, which little are known about their chemical composition and nutritional values, like sickle pod (*Cassia tora)* seeds. There is therefore the need for continuous screening of such minor legume seeds for use as unconventional or alternative feed resources in monogastric diets. The seeds of sickle pod (*Cassia tora*) are one of such legume seeds, which seem to have good potential as alternative, cost-effective source of feed in monogastric diet, especially broilers. According to (7) broilers could utilize only 5% of the raw seed meal in their diet without deleterious effect. This, according to the authors was due to some anti-nutritional factors in the raw seeds, which must be detoxified before incorporation higher quantity in broiler diets. It is in view of this that the

research was conducted to determine the effect of the duration of on the proximate composition, mineral contents and anti-nutritional factors of *Cassia tora* seeds.

Materials and Methods

Experimental Site

The research was conducted at Department of Animal Science Laboratory, University of Nigeria Nsukka, Enugu State.

Processing of Test Ingredient

Mature dried pods of *Cassia tora* were obtained from Bauchi State, Nigeria and were dehulled to release the seeds. The seeds were processed according to the procedures of (8). Boiling lasted for 30, 60 and 90 minutes. In each case, water was heated to boil before the seeds were poured in and allowed to boil for the respective time durations. Thereafter, water was drained off, the boiled seeds dried in forced drought oven at 60^0C for 3 hours, ground and stored in air-tight container for chemical analyses. The raw and boiled seeds were analyzed for proximate composition using procedures described by (9). The gross energy was determined using adiabatic oxygen bomb calorimeter. Anti-nutritional factors common with other legume species investigated were tannins, phytate, saponins and hydrogen cyanide. Tannin and phytate in the seed samples was determined according to the method of (10). The method of (11) was used to determine the hydrocyanic acid and that of (12) for saponins in the samples. All data obtained were subjected to a one-way Analysis of Variance (ANOVA) according to (13) while differences between treatment means were separated using Duncan's Multiple Range Test using computer software IBM SPSS Statistic version 20.

Table 1: Effect of boiling duration on proximate composition of *Cassia tora* seeds

	Boiling Duration (minutes)				
Parameters	**Raw**	**30**	**60**	**90**	**SEM**
Dry matter	88.50^{b}	88.00^{b}	91.50^{a}	90.00^{a}	0.51
Moisture content	11.50^{a}	12.00^{a}	8.50^{c}	10.00^{b}	0.51
Crude protein	9.63^{b}	13.13^{a}	14.01^{a}	13.57^{a}	0.65
Crude fibre	10.00^{a}	9.50^{b}	9.00^{b}	8.63^{c}	0.19
Ether extract	2.00^{a}	1.50^{b}	1.30^{bc}	1.40^{b}	0.10
Nitrogen free extract	73.37^{a}	68.37^{b}	69.99^{b}	69.43^{b}	0.70
Ash	5.00^{a}	4.00^{b}	4.00^{b}	4.00^{b}	0.16
Gross energy (Kcal/g)	3.594^{a}	3.013^{b}	3.018^{b}	3.055^{b}	0.09

^{a,b,c} Means with different superscripts in the same row are significantly different (P<0.05)

Table 2: Effect of boiling duration on anti-nutritional factors composition of *Cassia tora* seeds

	Boiling Duration (minutes)				
Parameters	**Raw**	**30**	**60**	**90**	**SEM**
Tannins (%)	0.087^{a}	0.044^{b}(49.42)	0.049^{b}(43.67)	0.031^{c}(64.36)	0.01
HCN (Mg/g)	0.883^{a}	0.356^{b}(59.68)	0.277^{c}(68.62)	0.344^{b}(61.04)	0.09
Saponins (Mg/g)	0.994^{a}	0.548^{c}(44.86)	0.769^{b}(22.63)	0.608^{c}(38.83)	0.65
Phytate (%)	0.046^{a}	0.039^{b}(15.21)	0.034^{b}(26.08)	0.037^{b}(19.56)	0.01

^{a,b,c} Means with different superscripts in the same row are significantly different (P<0.05)

N/B. Figures in parenthesis are % reduction as compared to values of raw seeds.

Results and Discussion

The effect of duration of boiling on the proximate composition of *Cassia tora* is shown in Table 1. From the result, boiling at 60 and 90 minutes significantly (P<0.05) increased dry matter content of *Cassia tora,* while the moisture content was reduced. The crude protein and crude fibre were significantly different (P<0.05) when *C. tora* seeds were subjected to various duration of boiling. The crude protein of the raw seeds was 9.63% while the crude protein of the boiled seeds for 30, 60 and 90 minutes were 13.13%, 14.01% and 13.57%, with no significant difference among the boiling durations. The increase in the CP of the boiled seeds could be that the decanted water contained testa of seeds, which softened and got detached during cooking and in the course of decanting water and drying, they were lost. This present result confirmed the result of (5) who observed higher CP of boiled seeds compared to raw seeds. The result of crude fibre (CF) showed significant difference (P<0.05) between the raw and those boiled for different durations. This could be as a result of loss of testa of the seeds in the course of cooking and decanting of water. The high percentage reduction in CF observed in boiled *Cassia tora* seeds agreed with (6), who reported 50% reduction of CF in sword bean when subjected to cooking. According to (5) and (14) reports, after 30 minutes boiling, CF of *M. cochinchinensis* seeds were significantly (P<0.05) reduced. The result of this present study agreed with (16), that cooking and autoclaving generally reduced CF of legumes. This present result however disagreed with (17) that crude fibre of lentils subjected to different cooking methods significantly increased by cooking treatments. Levels of ether extract in this study was significantly reduced (P<0.05) by different boiling durations compared to the raw seeds. This agreed with (5), who observed that dehulling effect of boiling of *M. cochinchinensis* must have pre-disposed the seeds to some kind of solubilization and leaching out of its fats and minerals. This is also supported by (17) who reported that cooking significantly decreased the non-protein nitrogen, ash and fat fractions of lentils seeds. These decreases, according to the author, could be attributed to their diffusion into cooking water. Boiling *C. tora* seeds resulted in significant (P<0.05) decrease in the nitrogen-free extract of the seeds, when compared with the raw, but did not differ significantly (P>0.05) across the boiling durations. It was also observed that boiling caused significant reductions (P>0.05) in ash and gross energy between raw seeds and those boiled for different durations. Furthermore, boiling *Cassia tora* seeds for 30, 60 and 90 minutes resulted in significant reductions (P<0.05) in anti-nutritional contents of the boiled seeds (Table 2). The 30 minutes boiling treatment did not have any reduction effect on phytate, compared with the 60 and 90 minutes. It was observed that 90 minutes of boiling *C. tora* seeds resulted in drastic reductions in tannins, HCN, saponins and phytate. The reduction of HCN, according to (16) can be attributed to its volatile nature and low melting point. The result of this study supported the report of (2) who reported significant reduction of anti-nutrients in jack bean by cooking for 60 minutes. This present result however, agreed with (2) that when cooking time was increased to 90 minutes, a higher degree of improvement in the nutritive value of jack bean was observed. This result also agreed with (5) that boiling seeds of *M. cochinchinensis* for 90 minutes gave the best result in terms of proximate composition and anti-nutritional factors. The author also reported that boiling the seeds achieved 45%, 21% and 48% reduction in trypsin inhibitor, tannin and cyanide levels over the raw seeds.

The reduction in anti-nutrients levels due to boiling in this study is based on the principle

that heat denatures protein and since some anti-nutritional factors found in raw legume seeds are protein substances, they tend to be denatured by heat. Some negative effects of anti-nutrients in feed are for instance, saponins confer a bitter taste on feed and also irritated the lining of the mouth, phytic acid lowers the bioavailability of minerals while tannins cause discoloration of the seeds as well as binds to proteins through hydrogen bonding and hydrophobic interactions thereby reducing their nutritional quality. This present study revealed non-significant differences (P>0.05) in the mineral content of seeds boiled for different time durations compared to the raw seeds (Table 3). This may be due to the leaching of these minerals in the decanted water after boiling. According to (17), microwave cooking caused slight losses in minerals, while boiling and autoclaving caused significant losses. By the report of (18) cooking caused great losses of K (30%), Cu (17%) and Fe (10%). Reports of (19) showed losses of 30% Cu and 23% Mg from mature cowpeas when cooked. Also, (20) reported that cooking caused considerable losses in soluble solids, especially vitamins and minerals. The result showed that apart from potassium and calcium, the values of other macro minerals were higher than 0.07% sodium, 0.27% for magnesium and phosphorus reported for boiled *M. sloanei* seed meal, 0.06% for sodium, 0.20% for magnesium and 0.22% for phosphorus for *M. sloanei* seeds boiled with sodium sespioxide locally called potash or 'akanwu' (21).

Table 3: Effect of boiling duration on mineral composition of *Cassia tora* seeds

	Boiling Duration (minutes)				
Parameters	**Raw**	**30**	**60**	**90**	**SEM**
Calcium	0.58	0.58	0.56	0.50	0.03
Magnesium	0.72	0.68	0.66	0.62	0.06
Sodium	0.50	0.33	0.38	0.41	0.04
Potassium	0.27	0.23	0.16	0.23	0.02
Phosphorus	0.60	0.57	0.55	0.59	0.01

Conclusion and Applications

1. The proximate composition of raw seeds of *Cassia tora* showed promising results.
2. Boiling by this result increased the crude protein and reduced the anti-nutritional factors that were tested.
3. The seeds have potentials as an alternative feed ingredient in poultry feeds.
4. *Cassia tora* seeds should be processed by boiling for at least 30 minutes to reduce the anti-nutritional factors and improve nutritive value especially the crude protein.

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