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Comparative performance of young growing rabbits fed diets containing cracked and cooked jackbean and jackbean soaked in water prior to cooking

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Abstract

Studies were conducted to determine the effects of dietary inclusion of cracked and cooked jackbean (CACJB) and jackbean that was soaked in water for 72 hours prior to cooking (SACJB) on the performance of young growing rabbits. Five experimental diets were made such that diet 1 (control) contained no jackbean while diets 2 and 3 contained CACJB at 20% and 30% levels, respectively; diets 4 and 5 contained SACJB also at 20% and 30% levels, respectively. Each diet was fed to a group of 5 rabbits individually housed for 8 weeks. Feed intakes of the control group and groups on CACJB diets were significantly ($P<0.05$) smaller than those of the groups on SACJB diets. The groups on 20% and 30% SACJB diets also recorded significantly ($P<0.05$) higher growth rate than the groups on the control and CACJB diets. The feed/gain ratios of the groups followed similar pattern. The weights of the hearts, livers and lungs were not affected by the treatments ($P>0.05$). There were also no significant differences ($P>0.05$) in dressing percentage of the groups. Thigh muscles of the groups on SACJB diets contained more fat and less protein relative to the other three groups.

Key words: Cracked and cooked jackbeans, soaked and cooked jackbeans, rabbits.

Introduction

Raw unprocessed jackbean (*Canavalia ensiformis*) contains about 60% carbohydrates, 30% crude protein and 3% lipids (Udedibie, 1990) and is relatively high in the essential amino acid, lysine (Leon *et al*, 1989; Rajaram and Janardhanam, 1992). But as with a number of other tropical legumes, it contains toxic substances, mostly protease inhibitors and lectins (concanavalia A & B), which limit its use as human food or animal feed (D'Mello and Walker, 1991; Udedibie *et al*, 1994; Nakatsu *et al*, 1996). As a result, it cannot be tolerated beyond 5% in poultry and rabbit diets (Udedibie and Nkwocha, 1990).

Heat treatments have, however, been reported to improve its nutritive value to the extent of 20% dietary inclusion for broilers (Udedibie *et al*, 2002) and for rabbits (Essien, 1995; Odey, 1995). Recent studies by Carlini and Udedibie (1997) and Udedibie and Carlini (1998) have shown that soaking the seeds in water for 72 hours before cooking for an hour or cracking the seeds into pieces before cooking for an hour can completely eliminate protease inhibitors and lectins from the
seeds. The efficacy of these processing methods *in vivo* has, however, not been tested.

The study herein reported was therefore designed to determine the performance of young growing rabbits fed diets containing cracked and cooked jackbeans on one hand and jackbeans that were soaked in water for 72 hours and cooked for an hour, on the other.

Materials and Methods

Source and processing of jackbeans

The jackbeans used for the study were produced at the sub-station of National Root Crops Research Institute (NRCRI) at Vom, Plateau State, Nigeria. The other feed ingredients were purchased from local markets and livestock feed stores at Owerri, Imo State, Nigeria.

Jackbeans (20kg) were submerged in water and left for 72 hours in the open. Thereafter they were rinsed with tap water and boiled for an hour. The cooked seeds were sun-dried and then milled to produce soaked and cooked jackbean meal (SACJB). Another batch of jackbeans was broken into pieces (one seed to 3-6 pieces) using adjusted grinding machine. The broken seeds were then cooked for an hour, sun-dried and then milled to produce cracked and cooked jackbean meal (CACJB). Both SACJB and CACJB as well as raw unprocessed jackbean meal were analyzed for proximate composition, using standard methods (AOAC, 1995).

Experimental Diets

Five experimental diets were made such that diet 1 (the control) contained no jackbean meal; diets 2 and 3 contained 20% and 30% CACJB, respectively, while diets 4 and 5 contained 20% and 30% SACJB, respectively. Ingredient composition of the experimental diets is shown in table 1.

Experimental Animals

A total of 25 weaner rabbits (Dutch breed) were used. Based on sex and weight, they were divided into 5 groups of 5 rabbits each. Each rabbit of a group was regarded as a replicate and kept in a cage. The groups were randomly assigned to the five experimental diets. Feed and water were supplied *ad libitum*. Feeding was done once daily and carried out between 8.00 a.m. and 10.00 a.m. The trial lasted 8 weeks.

Data collection and analysis

The rabbits were weighed at the beginning of the experiment to obtain their initial body weights and weekly thereafter. Feed intake was recorded every morning as the difference between the quantity of feed offered and the left-over on the following day. At the end of the feeding trial, the rabbits were slaughtered and their internal organs (livers, hearts and lungs) removed, physically examined and weighed. Proximate analysis was also conducted on their thigh muscles to determine the effect of the diets mainly on the protein, carbohydrate and fat contents of the muscles.

Data collected were subjected to analysis of variance as outlined by Snedecor and Cochran (1978). When the analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

Table 1. Ingredient composition of the experimental diets (%)

Ingredients	Control	20% CACJB	30% CACJB	20%SACJB	30% SACJB
Maize	55.00	40.00	32.50	40.00	32.50
Soybean meal	11.00	6.00	3.50	6.00	3.50
Jackbean meal	-	20.00	30.00	20.00	30.00
Palm kernel cake	9.00	9.00	9.00	9.00	9.00
Wheat offal	15.00	15.00	15.00	15.00	15.00
Local fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.50	3.50	3.50	3.50	3.50
Blood meal	2.00	2.00	2.00	2.00	2.00
Common salt	0.25	9.25	9.25	0.25	0.25
Trace mineral/vit. Premix*	0.25	0.25	0.25	0.25	0.25
Chemical Composition (calculated)					
Crude protein, %	18.54	18.69	18.18	18.69	18.18
Crude fibre, %	3.52	4.21	4.52	4.21	4.52
Ether extract, %	5.43	4.65	4.10	4.65	4.10
Total ash, %	2.42	2.94	3.12	2.94	3.12
ME (Kcal/kg)	2.84	2.79	2.79	2.79	2.74

*To provide the following per kg feed: Vit. A, 200,000iu; vit D, 400,000 iu; vit E, 800g; vit k, 0.40g; vit B_1, 0.32g; vit. B_2, 0.96g; vit. B_6, 0.56g; vit B_{12}, 4.0mg; calcium panthothenate, 1.6g; folic acid, 0.16; biotin, 8.0mg; choline, 48.0g; zinc, 6.4g; manganese, 32.0g; iron, 8.0g; copper, 0.32g; iodine, 0.239; cobalt, 36.0mg; vit C, 25.0g.

Results and Discussion

Proximate composition of test materials

Data on the proximate composition of the test materials (CACJB and SACJB) are presented in table 2. The crude protein contents of raw and the processed jackbeans agreed with the values earlier reported (Udedibie and Nwaiwu, 1988; Esonu, 1996; Udedibie *et al,* 2002). The lower crude protein values recorded for CACJB and SACJB was an indication that some nitrogenous compounds were solubilized and removed in the course of the cooking. The higher crude fibre contents of the 3 materials were believed to be due to the thick testa of the seeds.

Performance of the experimental animals

Data on the performance of the experimental groups are shown in table 3. The groups on SACJB diets recorded significantly ($P<0.05$) higher feed intake than the control group and the 2 groups on CACJB diets. There were, however, no significant ($P<0.05$) differences between the control group and the 2 groups on CACJB diets. The feed intake of all the groups agreed with the established feed intake of rabbits of that age and size (Sicwaten and Stahl, 1982).

The growth rates of the 2 groups on SACJB diets were also significantly ($P<0.05$) higher than those of the control and the CACJB groups. The feed

Table 2. Proximate composition of raw and processed jackbean*

Components	Raw JB	CACJB	SACJB
Dry matter, %	91.12	87.35	88.22
Crude protein, % of DM	33.86	26.44	25.94
Crude fibre, " "	11.21	13.05	12.36
Ether extract, " "	2.86	3.14	3.08
Total ash, " "	3.17	4.01	3.09
Nitrogen free extract, % of DM	48.90	53.36	55.53

*Expressed on 100% dry matter basis.

Table 3: Performance of experimental animals

Parameters	Control	20% CACJB	30% CACJB	20% SACJB	30% SACJB	SEM
Initial body wt. (g)	762.60	760.3	760.2	761.0	761.6	0.533
Final body wt. (kg)	1.27[a]	1.25[a]	1.28[a]	1.35[b]	1.34[b]	0.025
Av. feed intake (g/d)	47.4[a]	48.5[a]	48.5[a]	50.1[b]	49.9[b]	0.41
Av. growth rate (g/d)	9.06[a]	8.74[a]	9.28[a]	10.51[b]	10.31[b]	0.05
Feed conversion ratio (g feed/g gain)	5.23[a]	5.52[a]	5.22[a]	4.7[b]	4.80[b]	0.02
Weight of Internal Organs (% of body wt.)						
Liver	3.19	3.17	3.12	3.01	3.15	0.015
Heart	0.46	0.41	0.40	0.41	0.43	0.010
Lungs	0.56	0.59	0.50	0.50	0.56	0.006
Dressing percentage	55.3	55.3	55.5	54.9	54.6	0.074
CP, Fat and Ash content of thigh muscles						
Crude protein, % of DM	72.25[a]	70.93[a]	67.13[ab]	65.27[b]	6.51[b]	2.09
Ash, % of DM	6.31	5.35	5.55	6.00	5.65	0.17
Fat, % of DM	9.32[a]	8.35[a]	10.10[a]	11.16[b]	11.55[b]	0.04

[ab] means within a row with different superscripts are significantly different ($P<0.05$)

conversion ratios of the 5 groups followed the same pattern.

The physical structures and the weights of the internal organs (livers, hearts and lungs) were not affected by the treatments (P>0.05). Similarly, the dressing percentage of the carcasses was not affected by the treatments (P>0.05). The crude protein contents of the thigh muscles of the SACJB groups were significantly (P>0.05) lower than those of the control and CACJB groups. Conversely, the thigh muscles of the control and CACJB groups recorded significantly (P<0.05) lower levels of fat than those of SACJB groups, an indication of possible high marbling effect of the SACJB diets. The ash contents of the groups were not affected by the treatments (P>0.05).

Discussion

The results of this trial have shown that soaking the jackbean in water for 72 hours before cooking for an hour was a better processing method than crack and cook (CAC) method in detoxification of jackbean. It demonstrated that moist heat treatment alone is not enough to release the full potentials of jackbean as a feedstuff. The results have also shown that in the absence of supplementary lysine and methionine (the two most limiting essential amino acids in non-ruminant diets), jackbean soaked in water for 72 hours before cooking for an hour seems to be a better protein supplement than soybean. Jackbean has been reported to be higher in lysine (5.73g/16gN) (Leon *et al.* 1989) as against soybean meal (2.72g/16nN) (Scott *et al.* 1982). This seems to have contributed in part to the superiority of the soaked and cooked jackbean meal over the control and CACJB diets. Similar result had earlier been observed with jackbeans soaked in urea for 6 days prior to cooking (Udedibie, 1990).

Jackbean has been reported to contain thermolabile inhibitory substances like protease inhibitors, and thermostable anti-nutritional factors such as canavanine and canaline (Rosenthal, 1972), canatoxin (a non-hemagglutinating toxic protein) (Carlinin and Guimaraes, 1981), and more importantly, concanavalin A (con A) which is a lectin (Hague, 1975; Jaffe, 1980). Lectins are known to affect nutrient utilization by different mechanisms, including binding to the glycoproteins and glycolipids of the digestive tract mucosa (Jaffe, 1980), inhibition of the activity of enzymes of the brush border of enterocytes (Rosenthal, 1972) and interfering with the adherence of enterobacteria to the intestinal wall (Jayne-Williams, 1973). It appeared that soaking the seeds in water for 72 hours before cooking was able to eliminate both the thermolabile and thermostable toxic and anti-nutritional substances from the seeds since canavanine which is thermostable has been reported to solubilize in water (Obizoba and Obiano, 1988).

Conclusion

The results of this trial have shown that the two methods of processing the jackbean, the efficacy of which was investigated, appeared to be good for rabbit production. However, soaking the beans in water for 72 hours before cooking for an hour gave a better result and is therefore preferable, even though it is more laborious.

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