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EFFECTS OF TRONA TREATMENT ON THE FEEDING VALUE OF JACKBEAN (*Canavalia - ensiformis*) FOR BROILER BIRDS

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ABSTRACT

35 - day feeding trial was conducted to evaluate the effects of trona on the nutritive value of jackbean. One batch of jackbean was soaked for 48 hours in trona solution (3% of the weight of jackbean) prior to cooking for 30 minutes, dried and ground into meal. The second batch was cooked directly in the presence of trona (3% of the weight of jackbean) for 30 minutes, then dried and ground into meal. Jackbean meals so prepared were then used to formulate broiler finisher diets at 0%, 20%, 25%, and 30% levels, respectively. Two hundred and eighty (280), 21-day old broiler chicks were divided into 7 groups and each group randomly assigned to the 7 treatment diets in a completely randomised design (CRD). Each group was further sub-divided into four replicates. Feed and water were provided ad-libitum. The results of this trial suggest that jackbean meals so prepared significantly ($P < 0.05$) depressed performance of broiler finishers at all levels tested. When compared with the control, mortality was similar in all cases.

Key words: *Trona treatment, Jackbean feeding value, Broiler birds*

INTRODUCTION

Trona locally called Akanwu in Southern Nigeria is hydrated, basic sodium carbonate containing Na_2CO_3. $NaHCO_3$, $2H_2O$ with some impurities. It is white/grey/yellowish material with a virteous, glistering lustre. Commercially, it is the source of sodium compounds and used in medicine and as a tenderizer (El-Tabey - Shehata, 1992; Ankrah and Dovio, 1978).

Jackbean (*canavalia ensiformis)* is a high yielding tropical legume. The crude protein content of the ripe seed ranges from 28% - 32% on dry basis and the protein has relatively good amino acid profile (Udedibie, 1990; Esonu, 1996; Udedibie and Carlini, 1998). Unfortunately, the use of raw jackbean as a protein source for non-ruminants is limited by its content of anti-nutritional factors (Udedibie *et al*, 1994). Earlier studies at our station have shown that heat treatment alone, addition of ferrous sulphate and ensilage in urea, could only improve the nutritive value of jackbean to the extent of 10% dietary level for broiler birds (Imo, 1988; Udedibie and Nkwocha, 1990).

Although Udedibie and Carlini (1998) recently developed a "Crack and Cook" processing method of jackbean, there is still need to explore other ways of detoxifying the beans. Soaking prior to cooking or cooking directly jackbean with Trona has not been tried but it is thought likely that this method can improve the nutritive value of the beans as with other legumes so as to be incorporated at 20% dietary level or above.

MATERIALS AND METHODS

A sample (1gm) of Trona (Akanwu) was dissolved in 2N-HCl and made up to 100ml. So-

dium, potassium and calcium were measured on the "EEL" flame spectrophotometer. For iron, the solution was reduced with ascorbic acid, and reacted with dipyridyl. The intensity of the colour of the solution was measured in a 10mm (id) curette at 500μm using an ultra violet/visible sp 500 spectrophotometer. Magnesium content was measured according to analytical methods (Elmer, 1973). Phosphorus was measured by the vanadomolybdate colorimeteric method (Pearson, 1970) at 470μm on the ultra violet/visible sp 500 spectrophotometer (Table 1).

and ground into meal.

Sample of the two batches of jackbean so prepared were subjected to chemical analysis (AOAC, 1980) to determine the effects of these processing methods on the nutrient content (Table 2).

The jackbean meals so prepared were then used to formulate broiler finisher diets at 0%, 20%, 25% and 30% levels respectively (Table 3).

Two hundred and eighty (280), 21-day old broiler chicks of Ross breed were divided into 7

Table 1: Chemical Constituents of Trona

Description of Trona	Moisture (%)	Na^+ (%)	K^+ (%)	Ca (%)	Mg (%)	Fe (%)	P as P_2O_4 (%)
Rocky	26.5	22.6	0.4	0.3	0.03	0.09	0.69

The jackbeans were produced at Vom in Plateau state of Nigeria. The beans were divided into two batches. One batch was sub-merged in water and cooked for 30 minutes with Trona (3% of the weight of jackbeans), sun dried and milled.

groups of 40 and each randomly assigned to the 7 treatment diets in a completely randomised design (CRD). Each group was further sub-divided into four replicates of 10 birds and each replicate kept in a compartment measuring 6m x 8m. Feed and

Table 2: Proximate Cchemical analysis of raw and processed jackbean

	Raw	Cooked	Soaked & cooked
Crude protein	28.46	28.25	26.18
Crude fibre	7.81	6.60	6.45
Ether extract	3.06	1.73	1.76
Total Ash	3.71	6.33	11.10
NFE	56.96	50.58	47.55
Gross energy (kcal/g)	4.70	3.182	3.038

Values expressed on 100% dry matter basis.

The second batch was soaked in Trona solution (3% of the weight of the jackbeans dissolved in 30 litres of water) and allowed to stand for 48 hours, prior to cooking for 30 minutes. Period of cooking was taken as starting from the point of boiling. Subjective measurement by pressing the bean between two fingers until it ruptured, was taken as the cooking time. After cooking, the water was discarded, the beans sun dried

water were provided *ad libitum* and other routine poultry management practices maintained over the trial period of 35 days. Feed intake was recorded daily and the birds weighed weekly after the initial body weight was taken. Data collected were subjected to analysis of variance (Snedecor and Cochran, 1978). When analysis of variance indicated significant effects, means were compared as outlined by Obi (1990).

Table 3: Ingredient composition of the experimental diets

Ingredients	Control	Cooked jackbean			Soaked/cooked jackbean		
	0%	20%	25%	30%	20%	25%	30%
Maize	55.0	41.0	38.0	35.0	41.0	38.0	35.0
Jackbean	0.0	20.0	25.0	30.0	20.0	25.0	30.0
Soyabean	15.0	9.0	7.0	5.0	9.0	7.0	5.0
Fish meal	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Blood meal	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Spent grain	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PKC	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Wheat offal	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Bone meal	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Vit/Tm premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Chemical Composition (%)							
Crude protein	20.72	21.80	21.88	21.80	21.10	21.12	21.33
Crude fibre	5.13	5.66	5.80	5.90	5.80	5.92	6.06
Ether extract	4.01	3.58	3.47	3.37	5.28	5.19	5.10
Calcium	1.41	1.46	1.41	1.42	1.43	1.41	1.41
Phosphorus	0.85	0.82	0.84	0.85	0.70	0.68	0.67
Lysine	1.0	1.92	1.11	1.08	1.09	1.91	1.91
Methionine	0.36	0.33	0.31	0.30	0.40	0.30	0.33
ME(kcal/kg)	2991.40	2972.6	2971.6	2970.5	2984.1	2901.4	2902.7

** To provide the following per kg feed: Vit A, 10.000iu; Vit D_3, 15000iu; Vit E, 5iu;Vit K, 2mg; riboflavin, 3mg, pantothenic acid, 5mg; nicotinic acid, 20mg; chlorine, 5mg; Vit B12, 0.88mg; folic acid, 4mg; Mn, 8mg; Zn, 0.5mg; Iodine, 1.0mg; iron, 20mg; Cu,, 10mg; Cobalt, 125mg; Manganese, 64mg; flavomycin, 100gm; Spiramycin, 5mg; 3-nitro, 50gm; DL-methionine, 50gm; Selenuim, 0.16gm; L-Lysine, 120gm; BHT; 5gm*

Table 4: Effects of Trona-treatment/cooking of jackbean on the performance of young chicks

	Control	Cooked Jackbean			Soaked/Cooked Jackbean			SEM
	0%	20%	25%	30%	20%	25%	30%	
Initial body weight (g)	315.0	312.0	315.0	315.0	315.0	313.0	315.0	0.53
Final body weight (g)	1095.0^a	775.0^b	670.0^b	600.0^b	815.0^b	654.5^b	607.05^b	18.12
Daily body weight gain (g)	22.29^a	13.23^b	10.14^b	8.14^b	14.28^b	9.76^b	8.34^b	0.95
Daily feed intake (g)	46.7^a	52.57^b	59.57^b	50.19^b	61.67^b	51.20^b	50.52^b	2.21
Feed conversion ratio (g feed/g.gain)	2.10^a	3.97^b	5.87^b	5.67^b	4.32^b	5.25^b	6.06^b	0.32
Mortality	1.0	1.0	1.0	1.0	1.0	2.0	0.0	-

ab means within a row with different superscript are significantly different ($P < 0.05$).

RESULTS AND DISCUSSION

The mineral composition of Trona is presented in Table 1 and the performance of the birds is shown in Table 4. The result showed that sodium was the predominant mineral present in Trona. There was nearly equal amount of calcium and potassium but magnesium and iron were found in trace quantities. The solution of 3% of the weight of jackbean of Trona was highly basic with a pH of 9.5, some carbonate and chloride were present.

There was significant ($P < 0.05$) differences in the performances of the group on the control (0%) diet compared with the groups on the processed jackbean meal in all the parameters measured - feed intake, body weight gain and feed conversion ratio. Processed jackbean meals at all levels tested significantly ($P < 0.05$) depressed performance of broiler birds. The higher feed intake recorded by the birds on processed jackbean meals over the control group, probably could be attributed to the solubility of nutrients as such the birds had to eat to meet their requirement. However, there was no corresponding body weight increase with the higher feed intake. This result agrees with the observations of Imo (1988); Esonu *et al* (1997).

The use of jackbean as livestock feed is encumbered by the presence of both thermolabile and thermostable anti-nutritional factors such as canavanine and canaline (Rosenthal, 1972), canatoxin, a non haemagglutinating toxic protein (Carlini and Guimaraes, 1981) and more importantly Con-canavalin A (Udedibie, 1990).

Soaking legumes in solution of trona prior to cooking or cooking directly with Trona reduced the cooking time and also exert other effects through the following mechanism: increasing protein solubility, breaking hydrogen bond between proteins and condensed tannins, removal of calcium binding proteins, phytin and mineral complexes, inducing porous micro structure that allow enzyme-substrate interaction and eases water and heat penetration (El-Tabey Shehata, 1992). Moreover, it is known that heat denatures proteins thereby destroying their biological activities. Although, the nature of leached out nitrogenous compounds arising from these processes was not determined, it is thought that a combination of soaking and cooking of jackbean in trona will improve the nutritive value of jackbean for broiler birds to the extent of 20% dietary levels. However, the poor performance of the birds on the processed jackbean meals suggests that trona at the level used was not effective in detoxifying the anti-nutritional factors in jackbean or improving the nutritive value of jackbean for broiler birds up to 20% dietary level.

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