

# TWO-STAGE COOKING AS A METHOD OF IMPROVING THE NUTRITIVE VALUE OF JACKBEAN (*Canavalia ensiformis*) FOR BROILERS

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## ABSTRACT

A 4 - week feeding trial was conducted to determine the effect of 2 - stage cooking on the nutritive value of jackbean (*Canavalia ensiformis*) for broilers. Two-stage cooking is one of the practices employed in the villages for preparing toxic foodstuffs for human consumption. Jackbeans were cooked for 40 minutes at the end of which the cooking water was thrown out. Fresh water was added and the cooking continued thereafter for another 40 minutes. The two-stage cooked jackbeans were then dried, ground and included in broiler finisher diet at 0,10,15 and 20% levels, respectively, and each diet fed to 30 broiler chickens for 4 weeks. There were no significant ( $P < 0.05$ ) differences in feed intake, growth rate and feed conversion ration among the four experimental groups.

Keywords: Jackbean, 2-stage cooking, Nutritive value, broilers.

## INTRODUCTION

Jackbean (*Canavalia ensiformis*) has been identified as an indigenous legume which has shown promise as energy and protein source for livestock production in view of its high seed yield and protein content. Jackbean seed yields of 2.5 - 3.0 t/ha have been reported in Zimbabwe (Addison, 1957), Dominican Republic (Pound *et al.*, 1982), Veneuela (MOra and Para, 1980), Mexico (Herrera, 1991) and in Northern Nigeria (Okonkwo and Udedibie, 1991). These yields are comparable to that of soybean grown under temperate conditions. The white seeds are relatively large, about 2 - 3 cm in diameter, 5 times the size of soybean and contains up to 30% crude protein.

Jackbean, however, contains toxic substances which limit its use as feed

ingredient for non-ruminants to only 5% dietary level (D'Mello *et al.*, 1995; Udedibie and Madubuike, 1988; Udedibie and Nwaiwu 1988; Wyss and Bickel, 1988). The best known of these substances is Concanavalin A (Con A), a lectin (Hague, 1975; Jaffe, 1980), which has been reported to have negative effects on nutrient digestion and absorption (Liener, 1986; Sandholm *et al.*, 1976). Earlier attempts at improving its nutritive value so as to render it valuable as a protein and energy supplement for poultry have demonstrated that heat treatment alone could not significantly destroy the anti-nutritional factors in it (Udedibie and Nwaiwu, 1988; Udedible and Madubuike, 1988; Udedibie and Nkocha, 1990). Treatment with urea followed by heating has now been established as one effective method of detoxifying it (Montilla *et al.*, 1981; Udedibie and Nkwocha, 1990; Udedibie *et al.*, 1994).

Two-stage cooking is a practice commonly employed locally for preparing certain poisonous foodstuffs for human consumption. It involves changing the cooking water half way during the cooking and continuing the cooking thereafter with fresh water. The trial herein reported was therefore designed to test its efficacy as a method of improving the nutritive value of the jackbean for broilers.

## MATERIALS AND METHODS

The jackbeans used for study were produced at the substation of National Root Crops Research Institute (NRCRI), Vom, Plateau State. The jackbeans were cooked in 2 stages. First, the Jackbeans were sub-merged in water and cooked for 40 minutes. Period of cooking was taken as starting from the point of boiling. At the end of the 40 minutes, the water was thrown out. Fresh water was added and the cooking continued for another 40 minutes during which

TABLE 1: INGREDIENT COMPOSITION OF THE EXPERIMENTAL DIETS

Ingredients (%)	0.0	Dietary Levels of Jackbean (%)		20.0
		10.0	15.0	
Maize	55.0	50.0	45.0	40.0
Jackbean meal	-	10.0	15.0	20.0
Soybean meal	15.0	12.5	12.5	12.5
Groundnut Cake	5.0	4.0	4.0	4.0
Palm kernel cake	6.5	5.0	5.0	5.0
Premix*	18.5	18.5	18.5	18.5
<b>Chemical Composition (% of DM)</b>				
Crude Protein	19.2	19.4	19.8	20.1
Crude fibre	5.6	5.6	5.7	5.8
Ether Extract	5.3	5.2	5.2	5.1
Calcium	1.4	1.3	1.3	1.2
Phosphorus	0.8	0.8	0.7	0.7
ME (Kcal/g)	2.8	2.8	2.8	2.8

Composition: Wheat offal, 60.0%; blood meal, 22.0%; bone meal 16%, Common salt, 1.5%; Vitamin/trade mineral premix, 1.5%

the beans became fairly soft. The beans were then dried over-night in the oven at 70 °C and milled. Samples of raw and the cooked jackbean meals were subjected to chemical analysis (AOAC, 1980) to determine the effect of the processing method on the nutrients contents, using 3 replicates per sample.

The processed jackbean meal was then used to formulate broiler finisher diets at 0, 10, 15 and 20 percent dietary levels, respectively (Table 1), which were fed to the broilers for 28 days.

One hundred and twenty 3-week old broilers of Anak strain were divided into 4 groups of 30 birds each and the groups randomly assigned to the four experimental diets. Each group was further sub-divided into 2 replicates of 15 birds and each replicate kept in a 2m x 4m compartment. Feed and water were provided *ad libitum*. Feed intake was recorded daily and the birds were weighed weekly. Other management routines like vaccination against New castle disease at day old, prophylactic treatment against coccidiosis with Amprolium at 3-weeks of age and vaccination against Gumboro at 4 weeks were carried out. The data collected were subjected to Analysis of Variance (Snedecor and Cochran, 1967)

## RESULTS AND DISCUSSION

### Chemical Composition of 2-Stage Cooked Jackbean

The chemical composition of raw and 2-stage cooked jackbean meals is shown in Table 2. Jackbeans lost 14.4 and 17.5 percent of its crude protein and fibre contents respectively, in the course of the 2-stage cooking. Other nutrients were not significantly ( $P > 0.05$ ) affected by the processing method. This seems to agree with earlier observations at this station (Udedibie and Nwaiwu, 1988) which indicated that when cooked or autoclaved, some nitrogenous substances in jackbean are solubilized and removed. Extent of solubilization of nitrogenous substance in the jackbean appeared higher with 2-stage cooking as one hour cooking resulted in only 7% solubilization (Udedibie and Nwaiwu, 1988).

### Performance of Experimental Birds

Data on the performance of the experimental birds are summarized in Table 3. There were no significant ( $P > 0.05$ ) differences in the performance of the birds in all the measurements examined i.e growth rate, feed intake and feed conversion ratio. Only one bird died in the 10% jackbean group,

TWO-STAGE COOKED JACKBEANS FOR BROILERS

TABLE 2: ENERGY CONTENT AND CHEMICAL COMPOSITION OF RAW AND 2-STAGE COOKED JACKBEANS\* (% OF DM)

Constituents	Raw Jackbean	Cooked Jackbean	SEM
Crude Protein	28.46 <sup>a</sup>	24.37 <sup>b</sup>	1.22
Crude Fibre	7.81 <sup>a</sup>	6.44 <sup>b</sup>	0.26
Ether Extract	3.06	3.02	0.10
Total Ash	3.71	3.74	0.31
Calcium	0.14	0.12	0.002
Phosphorus	0.71	0.70	0.001
Gross Energy (Kcal/g)	4.70	4.61	0.17

\*All values expressed on 100% dry matter basis.

representing a mortality percent of 3.30%. The results of this trial contradicted earlier observation that heat treatment alone could not appreciably improve the nutritive value of jackbeans (Udedibie and Madubuike, 1988, Udedibie and Nkwocha, 1990; Udedibie *et al.*, 1994). Earlier studies at this station involving autoclaving, one hour straight cooking or toasting showed that those methods could improve the nutritive value of jackbean only to the extent of 10% dietary level of inclusion for poultry.

Jackbean contains toxic elements which limit its use as feed ingredient for non-ruminants. Jackbean has been reported to contain, in addition to thermolabile inhibitory substances, thermostable anti-nutritional factors such as Canavaliine and Canaliine (Rosantheil, 1972), Canatoxin (a haemagglutinin toxic protein (Carlini and Guimaraes, 1981) and more importantly Concanavaliin A (Con A) (Hague, 1975, Jaffe, 1980) which is a lectin. Lectins are reported to negatively affect nutrient utilization by

different mechanisms including binding to the glycoproteins and glycolipids of the digestive tract mucous (Hague, 1975; Jaffe, 1980), inhibition of the activity of enzymes of the brush border of enterocytes (Rosantheil, 1972) and interfering with the adherence of enterobacteria to the intestinal wall (Jayne - William, 1973). These anti-nutritional factors are nitrogen-containing compounds.

The mode of action of 2-stage cooking on these factors cannot totally and readily be explained. However, it is known that heat denatures proteins, thereby destroying their biological activities. This is mostly applicable to the thermolabile ones. Although the nature of the solubilized nitrogenous compounds arising from this process was not determined, it is likely that the thermostable factors in the jackbean formed a good proportion of the solubilized and removed nitrogenous compounds. This might have been partly responsible for the improvement in the nutritive value of the jackbean so processed. Whether extended period of cooking in the

TABLE 3: EFFECT OF 2 - STAGE COOKING ON THE NUTRITIVE VALUE OF THE JACKBEAN FOR BROILERS

Parameters	0%	Dietary levels of Jackbean			SEM
		10%	15%	20%	
Initial body wt (g)	409.5	402.6	410.2	410.6	3.96
Final body wt (g)	1093.5	1108.3	1091.5	1046.8	7.88
Feed Intake (g/day)	115.0	112.8	114.2	109.3	3.34
Growth rate (g/day)	24.4	25.2	22.9	22.8	1.08
Feed conversion Ratio (g feed/g gain)	4.71	4.48	4.99	4.79	0.33
Mortality (%)		3.30			

2-stage cooking process will result in further improvement on the nutritive value of the jackbean is not known. This will therefore form part of our focus in future investigations.

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