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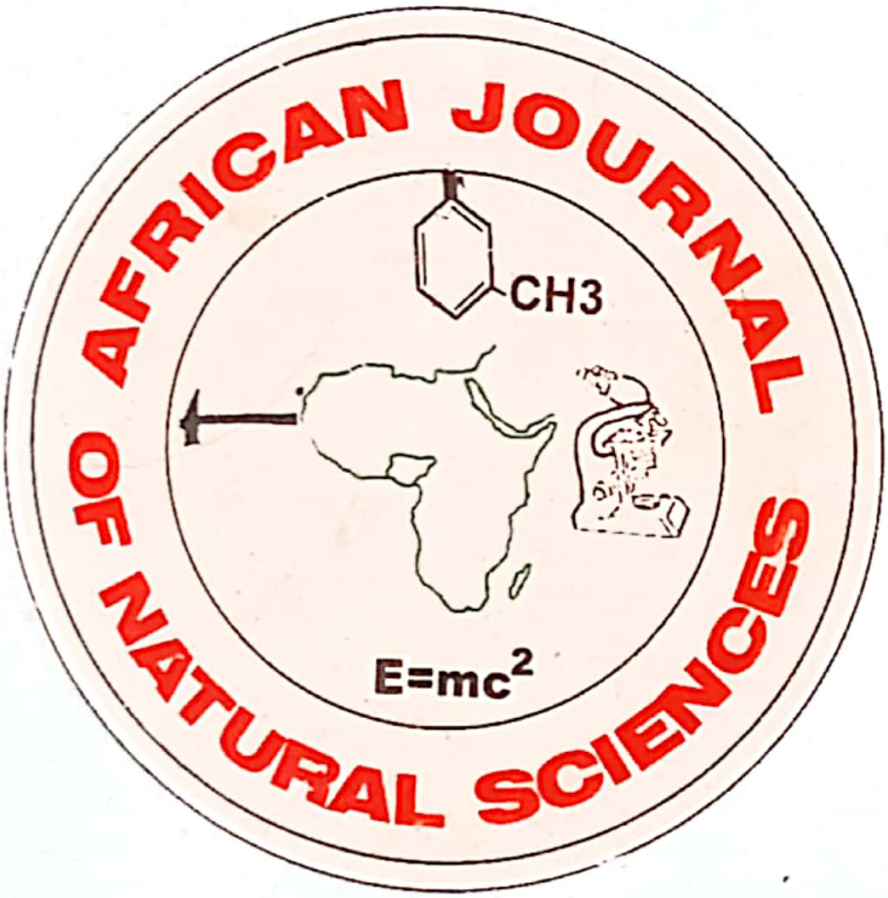

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SERUM METABOLITE CONCENTRATION AND SOME HAEMATOLOGICAL INDICES OF BROILERS FED DETOXIFIED JACKBEANS (*Canavalia ensiformis* (L.) (D.C). II

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Abstract

A study was carried out to examine the serum metabolite concentration and some haematological indices and internal organ weights of broilers fed detoxified jackbean meal (JBM), at inclusion levels of 0% 5% 10%, 15% and 20% in their diets. Dietary treatments did not significantly affect the levels of serum total protein, serum albumin, serum urea and serum uric acid concentrations of the broilers (P>0.05). There was no significant difference in the haemoglobin values of the broilers on different dietary treatments (P>0.05). The values of the packed cell volume of the broilers fed graded levels of JBM were also not significantly different (P>0.05). likewise, weight of internal organs were not significantly influenced by dietary treatments (P>0.05). Gross examination of internal organs of broilers showed no trace of lesion, haemorrhage nor necrosis among the dietary treatments. These results suggest the elimination of toxicity associated with jackbeans and thus proves the efficacy of the detoxification procedure employed.

Key words: Serum metabolites, haematological indices, detoxified jackbean.

INTRODUCTION

The use of legumes for livestock nutrition is impeded by the anti-nutritional substances in their raw seeds and foliage. Anti-nutritional factors are substances that are found in feedstuff which reduce their nutritional value and also affect the animals adversely in various ways. The deleterious effects of ingested raw legumes have been attributed to the presence of anti-nutritional factors. Thus, feeding chicken on diets containing raw legumes depressed growth (Ologhobo *et al,* 1993), inhibited amino acid absorption (Santidrian *et al,* 1988) induced pancreatic hypertrophy (Roebuck, 1986) and caused marked alterations in the normal activities of some hepatic and extrahepatic enzymes (Aletor and Fetuga, 1984).

In common with a number of other tropical legumes both the foliage and seeds of the jackbean plant contain anti-nutritional factors which affect its nutritional quality for monogastric animals.

The anti-nutritional constituents of *Canavalia ensiformis* have been reported to include trypsin inhibitors and concanavalin A which are heat-labile, and canavanine and canalin which are hydrosoluble (Weast, 1975, Liener, 1980).

Objectives

This study was conducted to develop an effective and economical method of detoxifying jackbean, thereby improving the nutritive value of this tropical legume grain for animal feeding and also to determine the physiological effect of dietary jackbean on broilers.

MATERIALS AND METHODS

Detoxification of raw jackbean and preparation of jackbean meal

Raw dry seeds of jackbean were treated using the following procedure. Two percent (2% w/v) wood ash solution was prepared by dissolving 2kg of wood ash in 100 litres of tap water, giving a ratio of 1:50 w/v. One hundred kilograms (100kg) of jackbean seeds were then soaked in 300 litres of wood ash solution for 48 hours, at ambient temperature, with stirring for 1-2 minutes every 12 hours. The ratio of jackbeans to wood ash solution was 1:3 (w/v). The wood ash solution used in the soaking of jackbeans was discarded and the jackbeans were rinsed with fresh tap water. Cooking of these beans in a fresh 2% (w/v) wood ash solution was done for 90 minutes. The solution used in cooking the beans was drained off. The jackbeans were rinsed again with fresh tap water, sundried and ground using a hammer mill. The jackbean meal was then used in the preparation of the experimental diets.

Experimental design and formulation of diet

One hundred day-old Ross broiler chicks of Anak 2000 strain were used in the experiment. Day old chicks were weighed and randomly allocated to five dietary treatments. Each treatment consisted of 20 birds which were sub-divided into two replicates of ten birds per replicate. The completely randomized design (CRD) was used for the experiment. The five treatments consisted of detoxified jackbean meal incorporated at 0% 5% 10% 15% and 20% levels of inclusion in broilers diets. The feeding trial lasted for 9 weeks.

At the end of the experiment, six birds were sacrificed from each of the five treatment group, making a total of thirty birds that were sacrificed for gross examination of the internal organs and for the determination of blood parameters. The internal organs were weighed singly with the use of an electronic balance. The heart, liver, lungs, pancreas, gizzard, spleen and intestine were weighed and expressed as a percentage of body weight. Gross examinations of these internal organs for macroscopic lesions, necrosis and haemorrhage were made.

Determination of serum metabolite concentration and haematological measurements

At 63 of age, blood samples were taken from the wing veins of three birds chosen at random from each replicate pen, making a total of six birds from each treatment group, for the determination of serum metabolites and some haematological measurements.

Serum metabolite concentration

Blood was collected in test tubes without Ethylene diamine tetra-acetic dipotassium (EDTA) salt for serum metabolite analyses. The concentration of serum total protein was determined using the procedures outlined by Wootton (1964), serum albumin (Doumas and Biggs, 1972), serum urea (Fawacett and Scott, 1966) and serum uric acid (Searcy, 1969) were also determined.

Haematological measurements

Blood was collected in test tubes containing EDTA salt for haematological determinations. Haematological parameters, namely, haemoglobin (Hb) and packed cell volume (PCV) were determined using the procedures outlined by Dacie and Lewis (1977).

Statistical analysis

All the data obtained were subjected to the analysis of variance (Steel and Torrie, 1980).

RESULTS

Internal organ weights

The weights of the internal organs expressed as a percentage of body weight are shown in Table 1. There were no significant differences (P>0.05) in the weight of internal organs of broilers expressed as a percentage of body weight. The organs measured were gizzard, liver, heart, pancreas, lungs, spleen and intestine. There was also no trend in the values obtained as result of the graded levels of the JBM.

Table 1: Effect of jackbean meal (JBM) on relative weight* of internal organs of broilers

Internal organs	0% JMB	5% JMB	10% JMB	15% JMB	20% JMB	SEM
Gizzard	1.89	1.84	1.92	1.93	1.57	±0.14
Liver	1.97	1.84	1.93	1.74	2.00	±0.11
Heart	0.44	0.36	0.52	0.35	0.46	±0.10
Pancreas	0.26	0.22	0.28	0.19.	0.27	±0.02
Lungs	0.67	0.55	0.56	0.51	0.61	±0.04
Spleen	0.14	0.10	0.16	0.12	0.15	±0.02
Intestine	3.50	3.52	3.44	3.59	3.41	±0.14

*Weight of organs are expressed as percentages of body weight of birds.

Gross examination of internal organs

Gross examination of the internal organs of the broilers including the gizzard, liver, heart, pancreas, lungs, spleen and intestine, showed no trace of macroscopic lesions, necrosis nor haemorrhage among the dietary treatments.

Serum metabolites concentration

The concentrations of serum metabolites of broilers fed varying levels of JBM are shown in Table 2. Dietary treatments did not significantly influence the levels of serum total protein, serum albumin, serum urea and serum uric acid concentrations of the broilers (P>0.05). There was also no trend in the values obtained from these metabolites.

Table 2: Serum metabolites levels of broilers fed graded levels of jackbean meal (JBM)

Serum metabolites	Dietary Level of Jackbean meal (jbm) 0% JMB	5% JMB	10% JMB	15% JMB	20%J MB	SEM
Serum total protein (g/100ml)	3.65	4.10	3.55	4.05	3.30	±0.05
Serum albumin (g/100ml)	3.30	2.80	3.20	3.40	3.95	±0.22
Serum urea (mg/100ml)	3.50	3.20	3.80	3.60	3.40	±0.19
Serum uric (mg/100mg)	1.80	1.55	2.10	1.80	1.45	±0.14

Haematological measurements

Effect of graded levels of jackbean meal on haemoglobin (Hb) and packed cell volume (PCV) is presented in Table 3. There was no significant difference in the Hb values of the broilers on different dietary treatments (P>0.05). The values of the packed cell volume of the broilers fed graded levels of JBM were also not significantly different (P>0.05).

Table 3: Effect of graded levels of jackbean meals (JBM) on Haemogloblin and Packed Cell Volume of broilers.

Haematological parameters	Dietary Level of Jackbean meal (jbm) 0% JMB	5% JMB	10% JMB	15% JMB	20% JMB	SEM
Haemoglobin (Hb) (g/dl)	8.75	9.00	9.35	10.55	9.30	±0.74
Packed cell volume (pcv) (%)	37.15	22.65	17.40	31.15	29.15	±3.48

DISCUSSION

Internal organ weights (as a percentage of body weight)

Weight of the internal organs (gizzard, liver, heart, pancreas, lungs, spleen and intestine) of broilers on different dietary treatments were not significantly different (P>0.05)

Gross examination of internal organs

Gross examination for macrospic lesions, necrosis and hemorrhage made on the gizzard, liver, heart, pancreas, lungs, spleen and intestine showed no trace of lesions, necrosis nor haemorrhage in any of the internal organs examined for all different dietary treatments. Kessler *et al.* (1990) reported that the absence of lesions on the small intestine suggests the elimination of lectins (haemagglutinins) during cooking of jackbeans. The susceptibility of anti-nutritional factors to thermal inactivation was apparent from the absence of lesions in birds fed jackbean meal at varying inclusion levels. It is therefore conceivable that a complete inactivation of residual toxic effects was achieved and thus proving the efficacy of the method employed in detoxifying jackbeans.

Serum metabolite concentrations

There were no significant difference in the concentrations of serum total protein, serum albumin, serum urea and serum uric acid of birds on different dietary treatments (P>0.05).

The non-significant (P>0.05) effects of diets on these metabolites suggest a lack of alteration in protein metabolism, since the control treatment was not significantly (P>0.05) different from the other dietary treatments in these parameters. It thus reflects the protein quality of jackbean meal and the success in detoxifying its anti-nutritive constituents. It seems that there is a direct relationship between the quality of dietary protein as it relates to the formation of serum proteins bordering on efficient protein utilization. The unaltered serum total protein levels obtained in the study suggest unimpaired hepatic protein synthesis. Hoffenberg *et al.* (1966) reported that albumin synthesis is not related to the amount of calories, but as soon as protein intake increases, the rate of synthesis increases immediately, whereas, the catabolic rate remains the same for a long period. Normal serum urea obtained in the present study shows the elimination of canavanine. This is because arginase has the ability to catalyse the degradation of canavanine into canaline and urea (D'Mello, 1989), which may likely be the reason for elevated urea concentration in the serum of birds fed raw jackbeans. Serum uric acid is used as an index of muscular dystrophy or muscular breakdown in the body. A poor diet will result in muscular dystrophy as a result of poor utilization by the body.

Haematological measurements

The non-significant (P>0.05) effect of the dietary treatments on the haemoglobin values and packed cell volume clearly demonstrates the inactivation of haemagglutinating activity of concanavalin A in jackbean meal. This observation suggest normal blood formation in all birds, irrespective of the dietary treatment.

Haemagglutinins have the ability to agglutinate the erythrocytes, and since the main constituent of the erythrocytes is haemoglobin, the agglutination of the erythrocytes by the haemagglutinins will result in reduction in the haemoglobin and packed cell volume levels.

CONCLUSION

On the basis of these findings, it is recommended that detoxified JBM can be included at up to 20% level in the rations of broilers without significant adverse effects on internal organ weights, serum metabolites and haematological parameters of birds.

Ellis and Belmar (1985) reported that jackbean has a high potential as a protein replacer, but that the toxicity conferred by the thermolabile and non-thermolabile severely restrict its use in monogastric nutrition.

It is abundantly clear from the results presented in this study that considerable success was achieved in detoxifying jackbean. These findings indicate that canavanine, trypsin inhibitor and haemagglutinins must have been adequately inactivated by the method of detoxification employed in this experiment.

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