EFFECT OF DIETARY RAW, COOKED AND TOASTED MUCUNA PRURIENS SEEDS (VELVET BEAN) ON THE PERFORMANCE OF FINISHER BROILERS.

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ABSTRACT

A 5-week feeding trial was conducted to determine the effect of dietary raw, cooked and toasted *Mucuna pruriens* seeds (velvet bean) on the performance of finisher broilers. Raw *Mucuna pruriens* seeds contained 30.3% crude protein. At 10% dietary level, raw and toasted *Mucuna pruriens* seed meals significantly ($P < 0.05$) depressed growth rate of broilers. At 20% dietary level, cooked *Mucuna pruriens* seed meal also significantly ($P < 0.05$) depressed growth rate of the birds. Feed intake was also significantly ($P < 0.05$) reduced at 20% and 10% dietary levels of cooked and toasted meals, respectively. The feed intake of the group on 10% raw Mucuna diet remained unexpectedly high.

Key Words: *Mucuna pruriens* seeds, broilers, feed intake, growth rate.

INTRODUCTION

Most developing tropical countries have depended on soybean meal and groundnut cake as the key conventional protein concentrates for feeding livestock. The heavy demand for those items has given rise to disproportionate increase in their prices, and consequently in the costs of livestock feeds. This, invariably, has escalated the prices of animal products out of reach of the common man. There is need, therefore, for identification and exploitation of other novel legumes which fortunately are in abundance in the region.

Mucuna pruriens (L) DC. Var. utilis (Wight) Burck, commonly known as velvet bean is a highly productive black-seeded tropical legume that is little known and utilized as human food or animal feed. In Nigeria, it is valuable only as green manure/cover crop.

The use of legume grains as human food or animal feed is limited by their relatively high concentrations of toxic and antinutritional factors (Liener, 1994). *M. pruriens* from India has been reported to contain trypsin inhibitors, phytates, cyanogenic glycosides, tannins and L-3,4 dehydroxyphenylalanine (L-DOPA) (Ravindran and Ravindran, 1988; Josephine and Janardhanan, 1992; Vijayakumari, 1994). Josephine and Janardhanan (1992), however, observed that except for L-DOPA, all the antinutritional factors detected in the seeds were heat-labile and hence could be eliminated by cooking. Recently Siddhuraju *et al;* (1996) reporting from the same laboratory observed that Indian *M. pruriens* has haemagglutinating activity (i.e, they contain lectins).

The concentrations of toxic and antinutritional factors in plants are known to be greatly influenced by climatic and ecological conditions. Recent studies by Udedibie and Carlini (1996, unpublished data) have shown marked differences between Canavalia seeds from Brazil and Nigeria in contents of toxic and antinutritional factors. The Nigerian *Mucuna pruriens* seeds have, however, attracted little attention as a possible source of protein and energy in livestock feeds. A preliminary study by Afolabi *et al.,* (1985) showed that even though the seeds were high in crude proteins, they were very toxic to broilers when fed in raw state. This paper reports the results of a study carried out to determine the effects of dietary inclusions of heat- treated *Mucuna pruriens* seeds on the performance of finisher broiler.

MATERIALS AND METHODS

The *Mucuna* seeds used for the study were collected from the wild at different locations in

TABLE 1: INGREDIENT, PROXIMATE AND ENERGY COMPOSITION OF THE EXPERIMENTAL DIETS

Ingredients (%)	Diet 1 (control)	10% RMSM	10% CMSM	20% CMSM	10% TMSM
Maize	55.00	50.00	50.00	45.00	50.00
Mucuna meal	-	10.00	10.00	20.00	10.00
Soybean meal	15.00	10.00	10.00	5.00	10.00
Premix*	30.00	30.00	30.00	30.00	30.00
Chemical composition					
Crude protein	18.64	18.53	19.53	18.25	18.55
Crude fibre	4.87	4.88	5.03	5.85	5.04
Ether extract	6.18	4.37	4.27	5.20	4.09
Calcium	1.31	1.27	1.30	1.33	1.32
Phosphorus	0.71	0.68	0.67	0.68	0.69
ME (Kcal/gm) (cal.)	3.10	3.04	3.06	3.13	3.07

*Contained 6.7% blood meal, 6.7% fishmeal, 23.3% palmkernel cake, 25% spent grains, 11.7% bone meal, 0.8% common salt and 0.8% vitamin/trace mineral premix. The vit/trace mineral premix was to provide the following per kg of diet: Vit A, 10, 000 iu; vit. D_3, 1500 iu; vit. E, 3 iu; vit. K, 2mg; ribofl., 3mg; panthothenic acid, 6mg; niacin, 15mg; cholinem 5mg; vit B_{12}, 0.08mg; folic acid, 4mg; Mn, 8mg; Zn, 0.5mg; iodine, 1.0mg; Co, 1.2mg; Cu, 10mg; Fe, 20mg.

Umudim in Ikeduru Local Government Area of Imo State in South-eastern Nigeria.

Seed Processing:

Raw seeds of *M. pruriens* were ground using 2mm screen. Part of the meal was stored as raw (raw *Mucuna* seed meal, RMSM). The other part was toasted to produce toasted *Mucuna* seed meal (TMSM). This involved spreading it thinly in a pan and placing the pan in the oven (120°C). It was stirred from time to time to maintain uniform heating. The heating (toasting) was considered adequate when the meal changed from whitish to light brown and became crispy to the touch. The process lasted for 20-25 minutes. Some seeds were cooked at 96°C for 60 minutes. The cooked seeds were then dried in the sun and ground as above (cooked *Mucuna* seed meal, CNSM). Samples of the three preparations (RMSM, TMSM and CMSM) were analysed for proximate composition (dry matter, crude proteins, crude fibre, ether extract, total ash and nitrogen-free extract) and gross energy according to AOAC (1995).

Experimental Diets:

Five experimental diets were formulated such that diet I (the control) contained no *Mucuna* seed meal. Diet 2 contained 10% RMSM; diet 3 contained 10% CMSM, diet 4 contained 20% CMSM while diet 5 contained 10% TMSM. Ingredient composition of the diets are shown in Table 1.

Experimental birds and Design:

One hundred and ten (110) young broiler chicks of Anak strain at week 4 of age were selected such that they weighed on the average 679±3.4g. They were divided into 5 groups of 22 birds each and each group randomly assigned to an experimental diet. Each group was further sub-divided into two replicates of 11 birds each and each replicate was kept in 2m x 4m compartment. The birds were weighed at the beginning of the experiment and weekly thereafter. Feed and water were offered *ad libitum*. Feed intake was determined by obtaining the differences between the quantity of feed offered and the quantity remaining in the morning of the

TABLE 2: PROXIMATE AND ENERGY COMPOSITION OF RAW, COOKED AND TOASTED *MUCUNA* SEED MEALS

Nutrients (% DM)	RSMS	CMSM	TMSM	SEM
Crude protein	30.33	28.72	32.29	0.23
Crude fibre	7.26	8.26	8.85	0.05
Ether extract	6.95[a]	6.00[a]	2.36[b]	0.03
Ash	5.73	4.69	6.44	0.03
Gross energy (Kcal/gm)	4.90	4.57	4.88	0.02

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

following day. The experiment was terminated when the birds were nine weeks of age.

At the end of the growth trial, two birds per replicate (i.e. 4 birds/treatment) were randomly selected, fasted for 18 hours, individually weighed, slaughtered and eviscerated. The weights of their livers, kidneys, hearts and gizzards were taken and expressed as percentages of the liveweights. Data generated were subjected to one-way analysis of variance (Steel and Torrieo, 1960) and significant differences between treatment means were determined using Fisher's Least Significant Difference (LSD) test (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

Proximate composition of the Mucuna seed meals:

The data on the proximate composition of the raw, cooked and toasted *Mucuna pruriens* seeds are presented in Table 2. The crude protein value of 30.3% for the raw seeds is in agreement with the values in literature. Raw *M. Pruriens* seeds from India have been reported to contain 31.4% crude protein (Siddhuraju *et al.,* 1996), and from Sri-Lanka, 24.0 - 31.3% (Ravindran and Ravindran, 1988). Cooking tended to reduce the crude protein content possibly due to solubilization of some nitrogenous compounds during cooking. The crude protein was slightly enhanced by toasting which in reverse order significantly affected the ether extract content, possibly due to burning off of lipid-related compounds.

Performance of experimental birds:

The data on the performance of the experimental birds are presented in Table 3.

Raw and toasted *Mucuna* seed meals significantly ($P < 0.05$) depressed growth rate of the broilers at 10% dietary level. CMSM significantly ($P < 0.05$) depressed growth rate of the birds only at 20% dietary level of inclusion. Although there was no statistical difference between the control group and the group on 10% CMSM, slight inferiority of the group on 10% CMSM to the control was observable. The groups on 20% CMSM and 10% TMSM had significantly ($P < 0.05$) lower feed intake. The abnormally high feed intake of the group on 10% RMSM was somehow difficult to explain. Recent studies by Siddhuraju *et al.* (1996), however, showed that raw *Mucuna pruriens* seeds contain amylase inhibitors. If that is the case, then birds taking raw Mucuna seed diet must have energy deficency problem. This could explain the unusually high feed intake of the birds on 10% RMSM diet since birds eat to meet their energy requirements. This also probably gave rise to significantly ($P < 0.05$) poor feed conversion ratio of the group. The results depicted toasting process as an inefficient method of detoxifying the seed as had earlier been observed with other seeds (Babar *et al.,* 1988; Bressani and Sosa, 1990; Udedibie *et al.,* 1994). The weights of the hearts were not affected by the treatments ($P > 0.05$) but the weights of the liver were significantly ($P < 0.05$) increased at 10% RMSM and 20% CMSM dietary inclusions, possibly as a result of high levels of toxic factors and the attempt by the liver to detoxify them. The weights of the gizzards were also significantly ($P < 0.05$) increased at dietary levels of 10% RMSM, 20% CMSM and 10% TMSM, respectively.

TABLE 3: MEAN VALUES FOR THE EFFECTS OF RAW, COOKED AND TOASTED *MUCUNA* SEED MEALS ON THE PERFORMANCE OF FINISHER BROILERS.

Parameters	Control	10% RMSM	10% CMSM	20% CMSM	10% TMSM	SEM
Initial body wt. (gm)	680.1	678.4	679.0	678.8	680.0	3.31
Final body wt. (kg)	2.30[a]	1.68[b]	1.98[a]	1.71[b]	1.77[b]	0.17
Growth rate (gm/d)	48.19[a]	30.46[b]	39.85[a]	31.82[b]	34.39[b]	3.26
Feed intake (gm/d)	88.95[a]	89.39[a]	82.13[a]	68.34[b]	73.64[b]	2.61
Feed/gain ratio	1.85[a]	2.96[b]	2.08[a]	2.16[a]	2.14[a]	0.03
Internal organs						
(% of body wt.)						
Heart	0.45	0.54	0.51	0.56	0.54	0.002
Liver	1.81[a]	2.07[b]	1.74[a]	2.06[b]	1.85[a]	0.27
Kidney	0.25[a]	0.17[b]	0.25[a]	0.19[b]	0.17[b]	0.001
Gizzard	4.31[a]	5.06[b]	4.57[a]	5.01[b]	5.18[b]	0.04
Mortality (%)	0.00	0.00	9.09	0.00	0.00	

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

The 9% mortality (2 birds) obtained from the group on 10% CMSM was difficult to blame on *Mucuna* seeds in view of the fact that the other three *Mucuna* diet groups were mortality-free.

Much less is known about the feeding value of *Mucuna* beans. Dietary raw Mucuna seeds have been reported to reduce growth rate of broiler chicks and egg production of laying hens (Harms *et al.*, 1961; Afolabi *et al.*, 1985; Olaboro *et al.*, 1991) which the results of this study have confirmed. Some authors have tried to blame the toxicity of the *Mucuna* seeds on L-DOPA (Prieris *et al.*, 1980; Afolabi *et al.*, 1985; Josephine and Janardhanan, 1992). This assumption does not seem to have strong scientific basis. L-DOPA has of recent gained a prominent place in the treatment of Parkinsonism. If L-DOPA is actually responsible for the poor performance of these animals, similar effects are likely to occur in patients of Parkinsonism who consume L-DOPA on regular basis. L-DOPA has also been shown to be toxic only in individuals with glucose-6-phosphate dehydrogenase (G-6-PD) deficiency in their erythrocytes (Nechama and Edward, 1967). Recent studies in India (Siddhuraju *et al.*, 1996) have shown that the Indian Mucuna seeds contained lectins which could not be completely eliminated by autoclaving for 15 minutes. It appears therefore that the proponents of L-DOPA theory are ignorant of the strong toxic and antinutritional activities of lectins on nonruminants, particularly under *ad libitum* feeding system (Jayne-Williams, 1973; Hague, 1975; Jaffe, 1980; Pusztai, 1989; Larue-Achagiotis *et al.*, 1992; Liener, 1994). Although this study could not involve analysis of toxic and antinutritional factors, the poor performance of the birds on RMSM, CMSM and TMSM diets is most likely to be due to combined effects of lectin and protease inhibitor activities. It can be speculated that the poor performance of the birds observed in this trial was most probably due to inadequate treatment of the seed. There is need, therefore, for a rigorous interdisciplinary nutritional and biochemical approach to research on its detoxification for realization of the apparent nutritive potential.

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