Short Communication

Effect of calcium hydroxide soaked and cooked velvet beans (*Mucuna pruriens*) on the performance of finisher broilers

O.O. Emenalom and I.C. Nwachukwu

Department of Animal Science and Technology, Federal University of Technology, P.M.B. 1526, Owerri, Imo State – Nigeria.

E – mail: emenalom2000@yahoo.com

Abstract

The response of finisher broiler to diets containing pre-calcium hydroxide ($\text{Ca}(\text{OH})_2$) soaked and cooked velvet bean (VB) was investigated. The processed bean meal was incorporated into broiler finisher rations at 0% (control), 20 and 30% levels, respectively and fed for 28 days in a complete randomized design replicated 4 times. Velvet bean diets caused progressive reduction in growth. At the end of trial, broilers fed 20 and 30% VB diets weighed 98.34 and 80.11% of the control respectively. Birds fed 30% VB diet had the lowest feed intake value of 4.38kg, which compared statistically with 4.58kg of the control. Birds fed 30% VB diet had significantly ($P < 0.05$) lower feed conversion ratio (3.02) than the control. Inclusion of 20% VB in the diet significantly ($P < 0.05$) increased the feed intake (4.76kg) of broilers, but allowed better growth (63.00g/d) and feed conversion ratio (2.73), than the 30% VB diet group. At the end of the trial, birds fed 20% VB diet compared statistically with the control in growth rate and feed conversion ratio. We conclude that pre-soaking in $\text{Ca}(\text{OH})_2$ solution for 48 – hr before cooking for 1-hr partially improved the performance of finisher broilers, thus allowing for successful use of 20% processed meal in broiler finisher rations.

Key words: Velvet bean, *Mucuna pruriens*, Finisher broilers, Performance.

Introduction

Many indigenous tropical legumes are little known and used for human food or animal feed in many tropical countries. They are often regarded as low status products and have been neglected for a long time in all respects from research and production to consumption and nutrition or use. The development of these legumes, many of which are unsuitable for human use could help in reducing the over dependence on conventional protein supplement notably, soybean (*Glycine max*) and groundnut (*Arachis hypogea*) and hence reduce the ever increasing

price of concentrate feed for non-ruminant animals if exploited.

Velvet bean (*Mucuna pruriens*), a tropical legume, is little known and used for human food or animal feed but has a high potential as an energy or protein supplement in livestock feed. The crude protein content of the dried seeds ranges from 24 – 32% on dry matter basis (Emenalom and Udedibie, 1998; Udedibie and Carlini, 1998) and the protein have relatively good amino acid profile (Siddhuraju *et al.*, 1996). Siddhuraju *et al.*, (1996) also reported energy content of 16565 kJ/kg⁻¹ DM.

However, the use of VB as protein for non-ruminant animals is limited by its content of anti-nutritional factors. These include trypsin inhibitors, α -amylase inhibitor, cyanide, tannins, phenols, phytic acids and L-3,4-dihydroxyphenylalanine (L-Dopa) (Siddhuraju *et al.*, 1996). Siddhuraju *et al.*, (1996) and Udedibie and Carlini, (1998) however, observed total elimination and/or reduction in most of the anti-nutrition factor (s) present in the raw seed.

Studies on the nutritive value of the bean have shown that the raw bean depressed growth in broilers (Olaboro *et al.*, 1991; Emenalom and Udedibie, 1998; Del Carmen *et al.*, 1999) and reduced egg production in laying hens (Harms *et al.*, 1961). Heat treatment alone (Emenalom and Udedibie, 1998; Del Carmen *et al.*, 1999), soaking in water before cooking (Udedibie *et al.*, 2001; Emenalom *et al.*, 2002), urea treatment before toasting (Esonu, 2001) and cracking the seed prior to soaking in water and cooking

(Emenalom, 2002) only gave indications of partial detoxification, hence its dietary inclusion could not exceed 25% for broilers. Josephine and Janardhanan, (1992) reported that except for L-Dopa, all the anti-nutritional factors detected in the seed are heat-labile and could be eliminated by cooking. Soaking the seeds in $\text{Ca}(\text{OH})_2$ solution (SG 2000) has been found to be effective in reducing the level of L-Dopa in the seeds, hence VB so processed has not been tested on finisher broilers. This study was therefore designed to determine the effect of $\text{Ca}(\text{OH})_2$ soaked and cooked VB meal on the performance of finisher broilers.

Materials and Methods

Source and Processing of velvet beans

The velvet bean seeds used for this study were harvested from the Teaching and Research Farm, Federal University of Technology, Owerri, Nigeria. The seeds were soaked in 4% $\text{Ca}(\text{OH})_2$ solution for 48 hrs, rinsed with tap water, cooked for 1hr at 100°C (timed from boiling), sun dried and finally ground into a meal.

Experimental birds and design

One hundred and fifty day-old Anak broilers were given *ad libitum* access to water and commercial broiler starter diet for 28 days. At 29-day of age, the broilers were weighed and 120 growing broilers within weight range of 850 to 900g were selected and grouped into 3 groups of 40 birds in a complete randomized design (CRD). Within each group, birds were allocated to 1 of 4 pens to give 10 birds/pen, so that overall mean weights and weight ranges were similar within each group. Pens were randomly allocated to the diets within groups. The birds were housed in concrete floored pens covered with wood shaving as the litter material and measured 3m x 3m in length and width, respectively.

Experimental diets

Three experimental diets were formulated such that they contained 0% (control), 20 and 30% VB meal, respectively (Table 1). Each diet was fed as mash to the birds. Feed and water were available *ad libitum* throughout the experiment. The experimental diets were fed for a period of 28 days. Feed intake data (pen basis) was collected daily while individual weights were measured on day 29, 36, 43, 50 and upon completion of the experiment. At the end of the feeding trial, 2 birds with live weights nearest to the pen average were selected from each pen, starved for 18-hrs, slaughtered and eviscerated. Weights of the heart, liver, lungs and gizzard were measured and expressed as percentages of live weights.

Statistical Analysis

The experiment was analysed, using one-way analysis of variance (ANOVA) (Snedecor and Cochran 1967). Differences between means were identified using the standard error of means (Steel and Torrie 1980).

Results and Discussion

The data on the performance of the birds and the proportion of their organs are presented on Tables 2 and 3. The total body weight gain of the group

Mucuna pruriens for finisher broilers

fed 20% VB diet compared favourably with control diet group. At 20 and 30% VB diets broilers weighed 98.34% and 80.11% of the control respectively. Birds fed 30% VB diet recorded a significantly ($P<0.05$) depressed body weight gain when compared with those on the control diet. Feed intake of the group fed 20% VB diet was significantly ($P<0.05$) higher (4.76kg) than those of the control (4.58kg) and 30% VB (4.38kg) groups. The feed conversion ratio recorded from

birds on the control (2.57) and 20% VB (2.73) diets were significantly ($P<0.05$) better than from the 30% VB group. The relative organ weights were slightly increased in the VB diet groups with 20 and 30% VB diets recording a significantly ($P<0.05$) heavier heart weight (0.43, 0.42%) than the control (0.36%). Birds on 30% VB diet recorded a significantly ($P<0.05$) heavier gizzard weight (2.77%) than the control (2.16%).

Table 1: Composition of the treatment diets (gkg⁻¹)

Ingredients (g/kg)	Dietary levels of velvet bean meal (%)		
	0.0	20.0	30.0
Maize	600.0	520.0	480.0
Velvet bean meal	0.0	200.0	300.0
Soybean meal	200.0	80.0	20.0
Brewer's dried grains	50.0	50.0	50.0
Wheat offal	50.0	50.0	50.0
Palm kernel cake	20.0	20.0	20.0
Fish meal	20.0	20.0	20.0
Blood meal	20.0	20.0	20.0
Bone meal	30.0	30.0	30.0
L-lysine	2.5	2.5	2.5
L-methionine	2.5	2.5	2.5
Vit./trace mineral premix ¹	2.5	2.5	2.5
Salt	2.5	2.5	2.5
Total	1000.0	1000.0	1000.0
Calculated chemical composition (gkg⁻¹ DM)			
Crude protein	201.6	198.5	197.0
Crude fibre	42.8	37.2	34.6
Ether extract	40.3	39.7	39.3
Calcium	12.3	14.1	15.0
Phosphorus	9.6	9.9	10.0
L-methionine	3.0	2.9	2.6
L-lysine	7.4	8.8	10.0
ME (MJkg ⁻¹)	12.8	12.5	12.3

¹Provided the following per kg of feed.

Vitamin A, 10,000iu; Vit D₃, 2000iu; Vit. E, 30 mg; Vit. K, 4mg; Ribofl, 5mg; Pantothenic acid, 13mg; Niacin, 30mg; Choline chloride, 5mg; Vit. B₁₂, 0.2mg; Folic acid, 4mg; Mn, 80mg; Zn, 50mg; Iodine, 1.0mg; Co.0.2mg. Cu, 8mg; 8mg; Iron, 25mg.

Velvet bean has been processed in various ways by different investigators with their results indicating no more than partial detoxification (Emenalom and Udedibie 1998; Del Carmen *et al.*, 1999; Esonu, 2001; Udedibie *et al.*, 2001; Emenalom *et al.*, 2002, Emenalom, 2002), which limited its dietary inclusion to 10 - 25%. The very poor growth and feed conversion ratio

recorded by finisher broilers fed 30% calcium hydroxide soaked and cooked VB is in agreement with earlier reports on water soaked and cooked (Udedibie *et al.*, 2001) and cracked water soaked and cooked VB (Emenalom 2002) respectively.

This tends to show poor nutrient absorption and utilization since the birds fed 30% VB had a

Table 2: Effect of calcium hydroxide soaked and cooked velvet bean on the performance of finisher broilers.

Parameters	Dietary levels of velvet bean meals (%)			SEM
	0.0	20.0	30.0	
Initial body weight (kg)	0.90	0.90	0.90	
Final body weight (kg)	2.71 ^a	2.68 ^{ab}	2.35 ^b	0.12
Total weight gain (kg)	1.81 ^a	1.78 ^{ab}	1.45 ^b	0.12
Growth rate (g/d)	65.00 ^a	63.00 ^{ab}	52.00 ^b	4.04
Total feed intake (kg)	4.58 ^b	4.76 ^a	4.38 ^b	0.12
Feed conversion ratio	2.57 ^b	2.73 ^{ab}	3.02 ^a	0.13
Mortality	-	-	-	-

^{a,b}Means within a row with different superscripts are significantly different P<0.05.

Table 3: Effect of calcium hydroxide soaked and cooked velvet bean on the internal organ characteristics of finisher broiler

Organs (% body weight)	Dietary levels of velvet bean meals (%)			SEM
	0.0	20.0	30.0	
Heart	0.36 ^b	0.43 ^a	0.42 ^a	0.03
Liver	1.45	1.67	1.57	0.12
Lungs	0.51	0.56	0.61	0.06
Gizzard	2.16 ^b	2.42 ^{ab}	2.77 ^a	0.14

^{a,b}Means within a row with different superscripts are significantly different p<0.05.

comparable feed intake with the control. The reasons for the high organ weights of the VB diets relative to the control is not clear but could be attributed to incomplete detoxification of the bean. The result of this trial shows that pre-soaking in 4% Ca(OH)² solution for 48hrs before cooking for 1hr, could not also improve the nutritive value of VB beyond 20% dietary level compared to 30% optimal dietary level of soybean meal. Although, pre-soaking in Ca(OH)² solution before cooking has been found to reduce the L-Dopa content of the bean (SG, 2000), the results shows that VB so processed could not improve the performance of finisher broilers at 30% dietary inclusion level possibly due to improper cooking associated with inadequate cooking time. A cooking time to normal softness of 6.0, 4.5 and 2.5-hr has been observed for samples with no soaking, 12-hr and 24-hr soaking, respectively and should therefore be explored.

References

- Del Carmen, J., Gernat, A.G., Myhrman, R. and Carew, L.B. 1999. Evaluation of raw and heated velvet beans. (*Mucuna pruriens*) as feed ingredients for broilers. *Poultry Science*. 78:866 – 872.
- Emenalom, O.O. 2002. Evaluation of the seed of *Mucuna pruriens* (velvet beans) as feed ingredient in poultry and pig diets. Ph.D. Thesis. Federal University of Technology, Owerri – Nigeria.
- Emenalom, O.O. and Udedibie, A.B.I. 1998. Effect of dietary raw, cooked and toasted *Mucuna pruriens* seeds (velvet bean) on the performance of finisher broilers. *Nig. J. Anim. Prod.*, 25(2) 115 – 119.
- Emenalom, O.O., Udedibie, A.B.I.; Esonu, B.O. and Agowuik, U.B. 2002. Comparative performance of broiler chicks fed diets containing differently processed *Mucuna*

***Mucuna pruriens* for finisher broilers**

- pruriens* seed meals. *Proc. 27th Ann. Conf. Nig. Soc. For Anim. Prod. (NSAP) March. 17-21: 2002.* PP 139-140.
- Esonu, B.O. 2001. Comparative evaluation of raw and urea/toasted velvet bean (*Mucuna pruriens*) for broiler chicks. *Nig J. Anim. Prod.* 28(1): 40-44.
- Harms, R.I., Sampson, C.F. and Waldroup, P.W. 1961. Influence of feeding various levels of velvet beans to chicks and laying hen, *J. Nutr.* 75: 127.
- Josephine, R.M. and Janardhanan, K. 1992. Studies on chemical composition and anti-nutritional factors in three germplasm seed materials of the tribal pulse, *Mucuna pruriens* (L). DC. *Food Chemistry* 43:1,13-18.
- Olaboro, G., Okot, M.W., Mugerwa, J.S. and Latshaw, J.D. 1991. Growth depressing factors on velvet bean fed to broiler chicks. *E. Afri. Agric. For. J.*, 57(2): 103-110.
- Sasakawa Guinea (SG) 2000. *Mucuna*: Restoring the soil's nutrients. In: Feeding the Future: Newsletter of the Sasakawa African Association. Issue 16:5.
- Siddhuraju, P., Vijayakumari, K. and Janardhanan, K. 1996. Chemical composition and protein quality of the little know legume, velvet bean (*Mucuna pruriens* (L) DC). *J. Agric. Food Chemistry*. 44, 2636-2641.
- Snedecor, G.W. and Cochran, W.G. 1967. *Statistical Methods*. The IOWA State Univ. Press, Ames. IOWA 6th edition.
- Steel, R.G.D. and Torrie, J.H. 1980. *Principles and procedures of Statistics: A Biometrial Approach*. 2nd edn (New York, McGraw-Hill).
- Udedibie, A.B.I. and Carlini, C.R. 1998. Brazilian *Mucuna pruriens* seeds (Velvet bean) lack haemagglutinating activity. *J. Agric and Food Chem.*, 46(4): 1450-1452.
- Udedibie, A.B.I., Emenalom, O.O. and Obikaonu, H.O. 2001. Comparative evaluation of Nigerian and Brazilian *Mucuna pruriens* (velvet bean) as feed ingredients in broiler diets. *Int. J. Agric. Rural Dev.* 2:9-13.

(Received 23 April 2003; Accepted 14 February 2005)