EFFECT OF CRACKED-SOAKED AND COOKED VELVET BEANS (*MUCUNA PRURIENS*) ON THE PERFORMANCE AND ORGAN CHARACTERISTICS OF FINISHER BROILERS

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ABSTRACT

The effects of dietary additions of 0, 20, 25 and 30% cracked-soaked and cooked velvet beam (*Mucuna pruriens*) on performance and visceral organ weights were studied with 4 9 week old broiler chickens. Cracked-soaked and cooked mucuna (CSCM) beans were added to a standard commercial type broiler finisher ration at the expense of maize and soybean meal. The calculated levels of energy and other nutrients were similar in all the diets. At 20 and 25% dietary levels, (CSCM) promoted better growth and efficiency that compared statistically with the control than 30% level. With 30% CSCM, broilers grew 38.83% less than the control. Protein efficiency ratio (1.26) and feed conversion ratio (4.06) were significantly ($P<0.05$) poor but feed intake was unchanged. Weights of liver, kidney and gizzard increased with mucuna bean diets while heart weight decreased. It is concluded that cracking mucuna beans before soaking and cooking in water partially destroys the growth inhibiting factors thus allowing successful use of 25% CSCM in broiler finisher rations. Higher level of CSCM reduced broiler performance.

Key word: Broilers, organs, performance, toxic factors, velvet bean.

INTRODUCTION

The velvet bean plant (*Mucuna pruriens*) is an important cover crop (or green manure crop) in many parts of the world, especially among subsistence farmers (Buckles, 1995). It is valuable in sustainable agriculture because it is hardy, resistant to insects, resistant to drought, easily managed with minimal care and improves soil fertility through nitrogen fixation. The foliage is frequently fed to grazing animals and its beans are sometimes eaten by humans and monogastric animals such as pigs and chickens. Like other beans, velvet beans contain quantities of protein, vitamins and minerals necessary in the diets of many animals including humans. Typical analyses indicated that the bean contains 32% crude protein (Udedibie and Carlini, 1998; Emenalom and Udedibie, 1998), 2370 kcal/kg metabolizable energy (Carew *et al*, 2003) and a good amino acid profile (Siddhuraju *et al*, 1996; Carew *et al*, 2002; Del Carmen *et al*, 1999).

The use of unprocessed raw velvet beans in diets for both humans and monogastric animals such as pigs and chickens is often accompanied by toxic symptoms. In humans, symptoms of neurotoxicity and behavioural changes (Infante *et al*, 1990), as well as severe vomiting (Miller *et al*, 1925) have been reported. For many years, velvet bean was reported to be toxic when fed to poultry in commercial-type ration causing reduction in growth, feed intake and egg production and increased mortality (Harms *et al*, 1961; Emenalom and Udedibie, 1998; Del Carmen *et al*, 1999). Emenalom *et al* (2004) also reported depressed growth, feed intake and mortalities in pigs fed raw velvet bean diets.

Many anti-nutritional and toxic factors are found in velvet bean among them are anti-trypsin factors, tannins and cyanides (Ravindran and Ravindran, 1988; Udedibie and Carlini, 1998; Del Carmen *et al*, 1999), anticoagulants (Houghton and Skari, 1994), analgesic, antipyretic and anti-inflammatory factors (Iauk *et al*, 1993) and others (Olaboro *et al*, 1991). L. Dopa, a potentially neurotoxic agent is found in relatively large amounts in velvet beans (Bell and Janzen, 1971, Daxenbehler *et al*, 1971; Del Carmen *et al*, 1999; Carew *et al*, 2003).

Heat treatment of velvet bean apparently destroys some of the negative factors such as the anti-trypsin factors (Udedibie and Carlini, 1998; Del Carmen et al, 1999) thereby improving their nutritional value (Olaboro et al, 1991, Del Carmen et al, 1999; Emenalom and Udedibie, 1998). However, these reports among others (Esonu, 2001; Udedibie et al, 2001; Emenalom and Udedibie, 2005) indicated that heat and preheat treatments (soaking before cooking) promoted much better growth and efficiency than the raw velvet bean but the values were significantly less than control and the bean so treated could not be tolerated beyond 10 20% dietary levels. Emenalom, et al (2005) observed an improved growth in starter broiler chicks fed 25% dietary level of cracked-soaked and cooked mucuna beans.

This study was therefore designed to determine the effect of cracking before soaking and cooking in water on the nutritional value of Mucuna pruriens beans to partially replace soybean and maize in typical maize/soybean diets for finisher broilers through 4 9 weeks of age.

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm of the Federal University of Technology, Owerri, located in the rainforest zone of Nigeria ($5^{0}29'$ and $70^{0}02'$E) and an elevation of 90.91m. The environment has an annual rainfall of 2641mm, temperature of 27.4°C and relative humidity of 86.6%. Mucuna seeds harvested from the farm were first cracked into pieces (2 4 parts/seed) using a 2mm screen wily mill adjusted place electric grinding machine. The cracked seeds were then soaked in water for 48 hours before cooking for one hour at 100°C timed from boiling, sun dried and finally ground into meal. The CSCM so prepared was incorporated into broiler finisher diet at 0, 20, 25 and 30% levels (Table 1).

Table 1: Ingredient composition of broiler finisher diets

Ingredients	Control	CSCM[2]	CSCM	CSCM
	0%	20%	25%	30%
Maize	60.00	52.00	50.00	48.00
Mucuna seed meal	-	20.00	25.00	30.00
Soybean meal	20.00	8.00	5.00	2.00
Brewer's dried grains	5.00	5.00	5.00	5.00
Wheat offal	5.00	5.00	5.00	5.00
Palm Kernel cake	2.00	2.00	2.00	2.00
Fish meal	2.00	2.00	2.00	2.00
Blood meal	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
L Lysine	0.25	0.25	0.25	0.25
L methionine	0.25	0.25	0.25	0.25
Vit/TM premix[1]	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis (%)				
Crude protein (CP)	20.16	19.85	19.78	19.70
Crude fibre (CF)	4.28	3.72	3.60	3.46
Ether extract	4.03	3.97	3.96	3.93
Calcium (Ca)	1.23	1.41	1.45	1.50
Phosphorus	0.96	0.99	1.00	1.01
L methionine	0.42	0.39	0.37	0.35
L Lysine	0.72	0.74	0.88	0.70
ME (Kcal/kg)	3298.2	3226.5	3202.6	3178.7

[1] *Provided the following per kg of feed: Vit A, 10,000iu, Vit. D_3, 2000iu, Vit. E, 30mg, Vit, K, 4mg, Ribofl. 5mg, Panthothenic acid, 134mg, Niacin, 30mg, Choline chloride, 5mg, Vit. B_{12}, 0.2mg.Folic acid, 4mg, Mn, 80mg, Zn, 50mg, Iodine, 1.0mg, Co., Cu; 8mg, Iron, 25mg.*
[2] *CSCM. Cracked soaked and cooked Mucuna*

Two hundred and forty (240) 4 weeks old broilers of Avian 34k strain were randomly assigned to the four dietary treatments in a complete randomized designed (CRD). Each treatment group of 60 birds was further subdivided into four replicates of 15 birds and kept in a pen measuring 3m x 4m. The birds were raised under a 12-hour bright daylight condition. Weight of the individual bird was recorded at the beginning of the trial. Feed and water were provided ad libitum. Feed intake was recorded daily while the birds were weighed weekly. The trial lasted 35 days. At 35-day of the experiment, two birds per replicate were randomly selected starved for 18 hours, slaughtered and eviscerated. The visceral organs (heart, liver, kidney, gizzard and lungs) were exercised, weighed and expressed as percentage of live weights.

Data on feed intake, body weight gain, feed conversion ratio and visceral organs of the treatment groups were subjected to Analysis of Variance (Snedecor and Cochran, 1978). Significant difference between treatment means were determined using standard error of means as outlined by Steel and Torrie (1960) at the 5% level of probability.

RESULTS

Addition of CSCM in finisher broiler diets at 20 and 25% levels caused 15.0% reductions in growth rate and 9.86% and 6.15% reduction in feed intake. These values were not (P>0.05) that were not statistically significant (p>0.05) when compared with the value recorded for control (Table 2). Inclusion of 30% CSCM in the diet caused a significant (p<0.05) decline in growth. Broilers fed 30% CSCM weighed 38.83% less than the control. Feed intake did not differ among the treatment groups. There was marked reduction in feed conversion and protein efficiency values at 30% dietary inclusion level. Percentage carcass yield and organ weights (Table 3) were not significantly (P>0.05) affected by the treatments except the kidney weights. Weights of the liver, kidney and gizzard were heavier in broiler fed CSCM diets while heart weights were lighter than in control.

Table 2: Performance of finisher broiler fed cracked soaked and cooked Mucuna seed meat diets.

	Dietary levels of CSCM				
Parameters	**0%**	**20%**	**25%**	**30%**	**SEM**
Average initial weight (kg)	0.97	0.97	0.98	0.97	0.001
Average final weight (kg)	2.91^a	2.62^b	2.62^b	2.16^c	0.09
Average weight gain (kg)	1.93^a	1.64^a	1.64^a	1.18^b	0.09
Daily weight gain (g/b/d)	55.17^a	46.90^a	46.80^a	33.75^b	0.40
Feed intake (kg)	5.37^a	4.84	5.04	4.79	0.37
Protein ratio	1.79^a	1.71^a	1.64^a	1.26^b	0.12
Feed conversion ratio	2.78^b	2.95^b	3.08^b	4.06^a	0.16

^{abc}: *Means within a row with different letter superscripts differ significantly (P<0.05).*

Table 3: Dressed and organ weights of finisher broilers fed cracked soaked and cooked Mucuna meal diets.

	Dietary levels of CSCM				
Parameters	**0%**	**20%**	**25%**	**30%**	**SEM**
Average live weight (kg)	2.90[a]	2.66[a]	2.65[a]	2.29[b]	0.13
Dressing out percentage (%)	68.78	66.33	68.26	64.51	2.87
Liver (%)	1.35	1.63	1.60	1.72	0.20
Kidney (%)	0.14[a]	0.19[ab]	0.20[ab]	0.21[a]	0.20
Heart (%)	0.55	0.51	0.46	0.46	0.30
Gizzard (%)	1.85	2.03	2.02	2.13	0.19
Lungs (%)	0.60	0.69	0.64	0.53	0.09

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

DISCUSSION

Inclusion of CSCM from 20 30% level in finisher broiler ration depressed growth except that at the end of the experiment broilers which had been fed 20 and 25% levels grew as well as the control. This suggest that cracking the bean before soaking and cooking in water reduced more of the growth depressing factor(s) found in the raw (Olaboro et al, 1991; Udedibie and Carlini, 1998), cooked (Emenalom and Udedibie, 1998) toasted (Emenalom and Udedibie, 1998; Del Carmen et al, 1999; Esonu, 2001) and soaked and cooked (Emenalom and Udedibie, 2005) velvet beans. Thus, it appears that when cracked, soaked and cooked velvet bean could possibly be used in commercial broiler rations up to a level of 25% contrary to earlier reports on soaked and cooked whole seeds (Emenalom and Udedibie, 2005).

However, the growth depressing factor still present in the processed bean that caused the slight decrease in growth and feed intake with increasing dietary inclusion of CSCM in the diets is not known. Also, the effect of processing procedures such as heating or water extraction on the available amino acids is not known. Part of this effect may be explained by lack of knowledge about nutrient availability especially amino acids in the processed velvet bean although the diets were nutritionally balanced based on the data available. Carew, et al (2002) observed similar dosage related depression in growth rate and feed intake when growing chicks were fed L. Dopa, a heat stable anti-nutritional factor present in velvet bean. If that is the case, the presence of L. Dopa and other unidentified heat stable toxic compounds in the bean may be responsible for the dosage related reduced appetite and growth when CSCM are used.

Our result show that feed intake is less severely affected by CSCM than growth and none of the treatments significantly reduced intake. Similar result has been reported for starter broiler chicks fed CSCM (Emenalom, et al, 2005). This implies that CSCM may have inhibited the metabolic processes leading to growth apart from an equally depressed appetite. Thus, the marked growth depression from feeding CSCM especially at 30% dietary level cannot be entirely explained by decrease in feed intake. This suggests that the effect of CSCM on metabolic processes should be examined further.

Feed conversion and protein efficiency ratio were markedly affected only at 30% level of CSCM reflecting their depressive effect on growth. This agrees with the report on starter broiler chicks (Emenalom et al, 2005). As expected, dressed carcass weights also declined although percent carcass yields were only slightly affected by the treatments. Consumption of CSCM caused an increase in the weights of the liver, kidney and gizzard in spite of the fact that the broiler grew less than the control. Heart weights decreased with increasing dietary level of CSCM while the lungs weight decreased only at 30% level. A decrease in organ weights would be expected as animal grows slowly and the change in heart weight followed this expectation. This agrees with the report of Carew et al (2003). The slight increase in gizzard weights may represent greater work of digestion and metabolism by the organ in processing the bean. The observation that liver and kidney weights did not decrease with the low weights of the birds may mean that they were slightly enlarged compared to expectations and this may also represent metabolic work of these organs in processing the bean.

Cracked-soaked and cooked mucuna bean in broiler diets.

It appears from the result of the current study that CSCM may be considered as a source of protein and energy in the diet of broilers and may be incorporated in the diets of finisher broilers up to 25% level without deleterious effect on growth and organ weights.

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