A PRELIMINARY STUDY ON GROWTH RESPONSE OF BROILER FINISHERS FED WITH PROCESSED MOTTLE *MUCUNA* BEANS (*Mucuna pruriens* var. *utilis*)

H.K. Dei, S. Mesuna, E.O. Otchere, K.T. Djang-Fordjour, A. Agbolosu,

Department of Animal Science, University for Development Studies, Tamale. Email:hkdei@yahoo.comn

and E. Frey

Formerly of Savanna Agricultural Research Institute, CSIR, Tamale.

ABSTRACT

Mottle "Mucuna" beans (Mucuna pruriens var. utilis) were processed to improve the nutritive value for broiler chickens. The beans obtained from local farmers were soaked in water for 48 hours, dehulled by hand and cooked for one hour to eliminate or reduce the adverse effects of the anti-nutritional factors. One hundred and thirty five (135) chicks (Lohman strain), at 28 days of age, were randomly divided into 9 groups (10 males, 5 females per group) and fed up to 49 days of age. They were fed diets (20% CP, 13 MJME/kg) incorporating 0%, 5% and 10% processed mottle "Mucuna" beans. A completely randomized design was used. Feed and water were supplied ad libitum. The parameters measured included feed intake, live weight gain, feed/gain ratio, mortality, feed cost and dressing percentage. The data were subjected to analysis of variance using the general linear model. No significant differences (P>0.05) were observed in mean daily feed intake (100.0, 102.5, 97.5 g/bird), total live weight gain (1,250.0, 1,262.3, 1,136.3 g/bird), final live weight (1,977.0, 1,989.0, 1,863.0 g/bird), feed/gain ratio (2.3, 2.5, 2.4), dressing percentage (79.1, 77.5, 78.5), dress weight (1,563.0, 1,490.0, 1,463.0 g/bird) and feed cost per kg gain (3,239.00, 3,223.00, 3,273.00 ¢/bird). There was no mortality. Feed cost (4,084.00, 4,064.00, 3,785.00 ¢/bird) was significantly reduced (P<0.05) by 7.3% when the beans were incorporated in the finisher diet at 10% level. Based on these results, the processed mottle "Mucuna" beans can be incorporated in broiler finisher diets up to 10% without adverse effect on growth performance. The use of the processed beans can also spare some of the maize (9%), soybean meal (10%) and fishmeal (50%) in the finisher diet with 7.3% saving on feed cost.

KEY WORDS: *Mucuna* Beans, Anti-nutritive Factors, Processing, Nutritive Value, Broilers

INTRODUCTION

Interest in the production of broiler chicken in Ghana has increased over the last twenty years as a means of bridging the protein malnutrition gap (Smith, 1990) as well as a profit-making business (Buamah, 1992). However, the growth and expan-

sion of the broiler enterprise is hampered mainly by factors such as high feed cost (Inkumsah, 1971; Botchway, 1986) and occasional feed shortage (Daghir, 1995). Poultry feed comes into focus as the greatest problem affecting the productivity and profitability of the broiler enterprise because feed alone constitutes the largest variable cost item in broiler production. At times unavailability of the feed causes anxiety and frustration to the farmers and this often deters other farmers from entering the business (Buamah, 1992).

Attempts to reduce cost of feeding broilers and to ensure sustainable supply of feed include utilization of feed ingredients that are high in both carbohydrate and protein quality such as *quality protein maize* (Osei *et al.*, 1994) and inclusion of agro-industrial by- products like oilseed cakes in the ration (Okai *et al.*, 1989). *Mucuna* beans (*Mucuna pruriens*) also have high nutritional potential in terms of protein and carbohydrate (Osei & Dei, 1998; Del Carmen *et al.*, 1999; Bressani, 2000; Ezeogu *et al.*, 2002). Therefore, it can be used in poultry rations as a source of protein and energy to replace expensive and often scarce conventional feed ingredients such as fish-meal, soyabean cake and maize, provided the antinutritional factors (Ravindra and Ravindra, 1988) present in the beans are eliminated.

Mucuna species are legumes, which are important as cover crops in the tropical areas of India, Africa and Latin America for improving soil fertility and control of noxious weeds. It is currently being promoted as an effective cover crop in Ghana. Presently, limited quantities of the beans are used as human food (Ahenkorah *et al.*, 1999); thus substantial amounts of the beans are left after harvesting. This has been a concern for local farmers. Therefore, finding alternative uses for the beans in the farming system will boost farmers' interest in the crop and also as an avenue for income generation.

Nutritional studies involving the use of raw *Mucuna* beans in broiler chicken diets (5-10 %) showed negative growth response of the birds (Osei and Dei, 1998; Del Carmen *et al.*, 1999; Ukachukwu and Szabo, 2002). The adverse effect of raw beans on broiler performance was attributed mainly to anti-nutritional factors such as L-3, 4 dihydroxyphenylalanine (L-DOPA), trypsin inhibitors and tannins present in the beans (Del Carmen *et al.*, 1999; Iyayi and Taiwo, 2002; Ezeagu *et al.*, 2002). However, appropriate processing of the beans using methods such as soaking in water, dehulling, heat treatment and use of additives (calcium hydroxide) have proved successful in ameliorating the adverse effects on broilers. These methods either eliminate or reduce considerably the adverse effects of the major anti-nutritional factors such as L-DOPA, tannins and trypsin inhibitors (Del Carmen *et al.*, 1999; Ukachukwu, 2000; Ukachukwu and Szabo, 2002; Nyirenda *et al.*, 2002; Diallo *et al.*, 2002).

In this study, three combined processing methods of soaking the beans in water, dehulling and cooking were employed to assess further the usefulness of *Mucuna* beans for broiler finishers.

MATERIALS AND METHODS

Processing of *Mucuna*

Mottle *Mucuna* beans (*M. pruriens* var. *utilis*) were obtained from local farmers in the Northern Region of Ghana for the feeding studies. The beans were soaked in water for 48 hours, dehulled by hand and cooked for one hour.

Experimental birds

Two hundred day-old broiler chicks (Lohman strain) were obtained from the Animal Science Department of Kwame Nkrumah University of Science and Technology, Kumasi. They were raised in litter floored brooder house for 28 days on broiler starter mash (Agricare Ltd, Kumasi). At 28 days of age, a total of 135 chicks were selected and randomly divided into 9 groups with each group comprising 10 males and 5 females. They were reared in a litter-floored house with floor space of 0.216 m^2 per bird.

Experimental Diets

Three diets in which the processed *Mucuna* was incorporated at levels 0% (control), 5% and 10% were formulated (Table 1) to be isonitrogenous (20%) and isocaloric (13 MJ kg^{-1}) of NRC (1994) requirements. The crude protein content and the metabolisable energy content of each of the three diets were calculated to be the same.

Table 1. Composition of Experimental Diets

Ingredients (kg)	Mucuna-0%	Mucuna-5%	Mucuna-10%
Maize	70.0	66.8	63.5
Fishmeal	3.0	2.0	1.5
Soybean meal	25	24.2	23.0
*Processed Mucuna	-	5.0	10.0
Oyster shell	1.0	1.0	1.0
Dicalphos	0.5	0.5	0.5
**Vitamin Premix	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Calculated Nutrient Analysis			
Crude protein (%)	20.0	20.0	20.0
***Metabolisable Energy (MJ/kg)	13.0	13.0	13.0

**Crude protein content of the processed mottle beans was determined to be 23.0% on dry matter basis.*

***Vitamin-mineral premix per 100 kg diet: Vitamin A, 2 million IU; D, 400,000 IU; E 3000 IU; K, 200 IU; B1, 200 mg; B2, 900mg; B12, 2400mg; niacin, 5000mg; and minerals: Fe, 9000mg; Cu, 500mg Mn, 12000;Co, 100mg;Zn, 10000mg; I, 400mg; Se, 40mg.*

****Metabolisable Energy of the processed Mucuna beans was assumed to be 3200 kcal/kg (*Nyirenda *et al.*, 2002). 1 kilocalorie=4.184 kilojoules. 1 megajoule=1000 kilojoules.

Experimental Design

A completely randomized design was used. The initial mean live weight per bird per replicate was 726.7g. Each of the diets was randomly allocated to three replicate groups. The diets were fed to the birds from 28 to 49 days of age. Feed and water were supplied *ad libitum* and light was provided throughout the 24-h day.

Parameters Measured

The parameters measured included feed intake, live weight gain and final live weight, feed-gain ratio, mortality, carcass characteristics, feed cost and feed cost per kilogram weight gain. Feed consumption and weight of birds were measured weekly. At the end of 49 days of age, one female and one male from each replicate per treatment were selected randomly for the carcass evaluation. The birds were starved for about 12 hours before being slaughtered for the carcass analysis. No mortality was recorded. Feed cost per kilogram diet and feed cost per kilogram live weight gains were used to determine the economics of the experimental diets.

Statistical Analysis

The data were analyzed by Analysis of Variance using Genstat 5 program (Lawes Agricultural Trust, 1995).

RESULTS AND DISCUSSION

Growth performance

Results of the effects of the processed *Mucuna* beans on growth performance and carcass characteristics of broilers are presented in Tables 2 and 3. There were no significant differences ($P>0.05$) in the feed intakes of the birds on the control diet and their counterparts fed on the processed *Mucuna*. This could be attributed to the fact that all the experimental diets were palatable. This observation agrees with the findings of Del Carmen *et al.* (1999), Ukachukwu and Szabo (2002) and Kodzo (2003)

when calcium hydroxide or ordinary water was used to process the beans. Iyayi *et al.* (2002) also made similar observation when *Mucuna* beans were either autoclaved or roasted. Del Carmen *et al.* (1999) and Ukachukwu and Szabo (2002) explained that the poor feed intake of diets in which raw *Mucuna* beans were incorporated was as a result of unpalatability. L-DOPA present in the raw beans that was implicated in causing anorexia in monogastric animals (Szabo and Tebbette, 2000) could be removed through soaking and cooking in ordinary water (Ukachukwu & Szabo, 2002). Hence, processing of the bean enhanced its palatability.

The feed conversion efficiencies were similar (P>0.05) for all diets. This was an indication that, the anti-nutritional factors in the *Mucuna* beans might have been eliminated completely or drastically reduced. This confirms the findings of Iyayi *et al.* (2002) and Ukachukwu and Szabo (2002). Nyirenda *et al.* (2002) also reported similar results and ascribed the improvement in feed conversion efficiency of the *Mucuna* diets to reduction of L-DOPA concentration in the processed beans. L-DOPA has toxic effect in monogastric animals (Szabo & Tebbette, 2000).

The mean live weight gains and final live weights of birds fed the control diet and the processed *Mucuna* diets were similar (P> 0.05). These findings corroborate those of Iyayi and Taiwo (2002) when 6% roasted *Mucuna* seed meal was fed to broilers and Ukachukwu and Szabo (2002) when *Mucuna* was cooked and fed at 10% in the diet of broilers. They stated that cooking of the beans resulted in drastic reduction of L-DOPA level by 64%. Del Carmen *et al.* (1999) who made similar observation explained that heating of velvet bean partially destroyed its growth inhibiting factors including trypsin inhibtors, thereby allowing successful use of 10% heated velvet bean in broiler rations.

No mortality was recorded in this study, which was an indication of absence of toxic components in the processed bean. This confirms the reports of Ukachukwu (2000) and Kodzo (2003) when these authors used processed beans at such inclusion levels in broiler diets.

No significant differences (P>0.05) were recorded among the treatments for the carcass characteristics including dressing percentage, dress weight and weights of head, gizzard, legs and intestine. The dressing percentages recorded for all treatments were slightly above 75% as reported for poultry (Okorie, 1983).

Economic implication

Statistically, feed cost per kilogram live weight gain (i.e. economy of gain) when the experimental birds were fed the control diet and processed *Mucuna* diets did not differ significantly (P>0.05). However, there was significant (P<0.05) reduction in feed cost by 7.3% when the processed bean was used in the diet at 10% inclusion level. At the time of the experiment, the relative cost per kilogram of fishmeal, soybean meal, maize and the estimated cost of the processed *Mucuna* were ¢6,160.00, ¢3,200.00, ¢

1,300.00 and ¢1,446.50 respectively. In this study, the processed *Mucuna* bean fed at 10% inclusion level spared the use of maize (8.6%), soybean meal (10%) and fishmeal (50%). This showed that the processed bean could serve as partial substitute for conventional feedstuffs in broiler finisher diets. The use of non-conventional feedstuffs often leads to reduction in feed cost of broilers (Pido and Adeyanju, 1980).

Implications for development

The results obtained in this study are vital for development at the rural farm level and the poultry industry in particular. The raw bean, which hitherto had no feeding value for broilers, could now be used in broiler finisher diet as an alternative non-conventional feed resource for fishmeal. Fishmeal is one of the commonest feed ingredients in poultry diet in the country, which is often scarce and expensive. Therefore, the entry of *Mucuna* beans into the poultry feed resource base would reduce dependency on protein feed ingredients and ensure continuous supply of poultry products. By processing the beans this way, local farmers can safely use the excess beans as a valuable source of protein and carbohydrate for feeding their local birds to enhance productivity. Local birds mainly scavenge for their own food, which is either inadequate or imbalanced in nutrients resulting in poor productivity. Presently, the excess beans after planting are regarded by the farmers as waste. Farmers can also generate income from the sale of excess beans to either feed mills or commercial poultry farmers, who would like to use the beans as an alternative feed resource during periods of feed scarcity or as a way of reducing feed cost.

Table 2: Effects of Processed *Mucuna* on Feed intake, Weight gain, Final weight, Feed cost and Feed cost/kg gain of broilers (4-7 weeks of age)

	Mucuna-0%	Mucuna-5%	Mucuna-10%	±SEM
Feed intake (g/bird/day)	100.0	102.5	97.5	1.022^{ns}
Weight gain (g/bird/day)	59.5	60.1	54.1	2.600^{ns}
Final Weight (g/bird)	1,977.0	1,989.0	1,863.0	31.800^{ns}
Feed/gain ratio	1.7	1.7	1.8	0.034^{ns}
Feed cost (¢/bird)	$4,084.00^{a}$	$4,065.00^{a}$	$3,785.00^{b}$	57.500*
Feed Cost/kg gain (¢/bird)	3,241.00	3,226.00	3,337.00	65.000^{ns}

SEM-Standard Error Mean NS-Not significant (P>0.05) Means with different letters are significant (P<0.05)

Table 3. Effects of Processed *Mucuna* on Dressing percentage, Dress weight and Offal weights of broilers (4-7 weeks of age).

	Mucuna-0%	Mucuna-5%	Mucuna-10%	±SEM
Dressing (%)	77.7	77.0	75.3	0.476 ^{ns}
Dress weight (g)	1,563.0	1,490.0	1,463.0	75.200 ^{ns}
Legs (shanks) (%)	3.7	4.0	4.3	0.276 ^{ns}
Head (%)	2.5	2.4	2.8	0.265 ^{ns}
Empty gizzard (%)	1.9	2.0	2.4	0.078 ^{ns}
Empty intestine (%)	2.5	3.1	3.1	0.119 ^{ns}

SEM- Standard Error of Mean ***NS- Not Significant (P>0.05)***

CONCLUSION

The feeding of the processed *Mucuna* beans to broiler finishers had favourable nutritional effects on feed intake, live weight gain and feed conversion efficiency. Therefore, the processed bean can be incorporated in the diet of finishing broilers up to 10 % without any adverse effects on their growth performance. Besides, inclusion of processed bean in the diet had no health-related problems. Processing of the mottle bean significantly reduced feed cost by 7.3 % and can replace 9 % of maize and 50 % of fishmeal in broiler finisher diet. It is recommended that farmers who have adopted *Mucuna* spp. as cover crop should be taught how to process the beans for feeding their birds as a way of ensuring food and nutrition security and generation of wealth.

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