The nutritive value of raw *Mucuna pruriens* (var. *utilis*) for broiler finishers

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SUMMARY

The nutritive value of raw *Mucuna pruriens* (var. *utilis*) was studied over a 4-week period using 168 broiler chicks at 28 days of age. They were individually weighed and then randomly allocated to four dietary treatments incorporating, respectively, 0, 50, 100, and 150 g *M. pruriens* per kg of diet. Feed and water were supplied *ad libitum*. Data were collected for feed consumption, growth rate, feed conversion, and mortality. In addition, the effects of *M. pruriens* on carcass and haematological characteristics of broilers were studied. The dietary addition of *M. pruriens* significantly ($P<0.05$) depressed broiler performance, including a lowered feed intake, poorer weight gains, and reduced feed conversion efficiency. The addition of *M. pruriens* also increased the weights of gizzard, liver, and intestines (empty). There were no apparent effects of *M. pruriens* on blood parameters: haematocrit, haemoglobin, total serum protein, globulin, and albumin. Overall, it was less eonomical to feed raw, untreated *M. pruriens* to finishing broilers.

Original scientific paper. Received 4 Apr 97; revised 21 May 98.

RÉSUMÉ

OSEI, S. A. & DEI, H. K *La valeur nutritive de* Mucuna pruriens *(var.* utilis*) cru pour les poulets de chair apprêteurs.* La valeur nutritive de *Mucuna pruriens* (var. *utilis*) cru était étudiée au cours d'une période de quatre semaines, utilisant 168 poussins de chair, ayant ! âge de 28 jours. Ils étaient pésés individuellement et puis reparti au hasard à quatre régimes alimentaires incorporant 0, 50, 100 et respectivement 150 g de *M. pruriens* par kg de régime. Ration et eau étaient fournies *ad lib*. Des données étaient recueillies pour la consommation de ration, la proportion de croissance, la conversion de ration et la mortalité. Des plus les effets de *M. pruriens* sur le cadavre et les caractéristiques hémotologiques de poulets de chair étaient étudiés. L' addition du régime de *M. pruriens* déprimait considérablement ($P<0.05$) la performance de poulet de chair y compris une ration alimentaire baissée, une prise du poids appauvri et une afficacité réduite de la conversion de ration. L' ajout de *M. pruriens* augmentait également les poids de gésier, de foie et d'intestins (vides). Il n'y avaient pas d' effets évidents de *M. pruriens* sur les paramétres sanguins: l'hématocrite, l'hémoglobine, l'ensemble de protéine du sérum, la globuline, l'albumine. D'ensemble, il était moins économique de nourrir les poulets de chair d' apprêtage avec *M. pruriens* cru non-trairé.

Introduction

The seeds of the legume plant, mucuna or velvet bean, *Mucuna pruriens* (var. *utilis*) have been traditionally used in Ghana in food preparations as a thickener for soups and stews (Ahenkora *et al.*, 1994). It is currently being promoted as an efficient cover crop in Ghana (Osei-Bonsu & Buckles, 1993). Due to the very limited quantities used as human food, seeds are left after harvesting. On the other hand, it is a rich source of protein (Ahenkora *et al.*, 1994), containing more than 200 g per kg on dry matter basis. Its potential as a protein source for chickens has not been studied, although work with rats showed that it reduced both total serum lipid and cholesterol levels (Ahenkora *et al.*, 1994). According to Osei-Bonsu & Buckles (1993), *M. pruriens* contains tannins, phytric acid, and other anti-nutritional factors that may potentially pose toxicity problems.

This trial was, therefore, undertaken to study

the nutritional value of raw untreated seeds of *M. pruriens* when added to broiler finisher diets in meal form.

Materials and methods

One hundred and sixty-eight unsexed commercial broiler chicks, aged 28 days and averaging 620.0 g live-weight, were randomly but equally divided into four dietary treatment groups containing 0, 50, 100, and 150 g per kilogram raw untreated seed meal of *M. pruriens,* respectively. The four diets were designated as control, mucuna-1, mucuna-2, and mucuna-3, respectively. The *M. pruriens* were obtained from test plots of the Crops Research Institute, Kumasi. They were milled through a 3-mm sieve in a hammer mill and then incorporated in the stated amounts in the various diets. A representative sample of the milled seeds (5 g) was analysed for its proximate composition by conventional methods (AOAC, 1980).

The birds were reared in deep litter pens that allowed about 0.2 m^2 per bird, and each treatment was replicated three times; the completely randomized design was used. Table 1 shows the various diets and their chemical composition. Each contained about 200 g crude protein per kilogram. Feed and water were provided *ad libitum.* The experiment lasted 4 weeks. The parameters studied included feed consumption, live weight gain, mortality, and feed conversion efficiency. In addition, carcass parameters including dressing percentage and weights of various organs were determined. For carcass studies, three birds per replicate were randomly selected at the end of the trials. They were slaughtered by slashing the throat and 5 ml of blood were collected into vacutainer tubes for haematological studies. They were dressed after scalding in water. Dressed birds were eviscerated, the organs under study removed and weighed by an electronic balance. The blood was analyzed for haemoglobin, packed cell volume (haematocrit), total serum protein, albumin, and globulin according to methods described by Stroev & Makarova (1989).

The analysis of variance technique was used to analyze all the collected data and significant differences were separated by means of Fisher's least significance difference test (Steel & Torrie, 1980).

Results and discussion

The chemical analysis of raw *M. pruriens* seed meal showed that it contained 89.1 per cent dry matter. Each 100 g of dry matter, in turn, consisted of 28.2 g crude protein, 5.5 g ether extract, 6.99 g crude fibre, 3.0 g ash, and 56.3 g nitrogen-free extracts. The composition compares favourably

TABLE 1

Composition and Analysis of M. pruriens *Experimental Diets (g per kg DM, except ME)*

Ingredient	*Control diet*	Mucuna-*1*	Mucuna-*2*	Mucuna-*3*
Maize	600.0	600.0	600.0	600.0
Fishmeal	80.0	70.0	60.0	50.0
Groundnut cake	160.0	160.0	160.0	160.0
Wheat bran	140.0	100.0	60.0	20.0
Oyster shell	10.0	10.0	10.0	10.0
Premix*	5.0	5.0	5.0	5.0
Common salt	5.0	5.0	5.0	5.0
Mucuna meal	-	50.0	100.0	150.0
Calculated analysis				
Crude protein	200.0	201.0	203.0	204.0
MEn (MJ/kg)**	11.76	11.98	12.2	12.4
Ether extract	42.2	43.2	44.3	45.4
Crude fibre	48.6	47.5	46.4	45.3
Methionine***	3.7	3.6	3.7	3.5
Cystine	3.0	3.1	2.6	2.7
Lysine	8.5	8.2	8.2	8.1
Tryptophan	1.9	1.8	1.7	1.6

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

**MEn value for *M. pruriens* estimated according to Janssen (1989) while ***amino acid values were calculated from Achinewhu (1982).

with the data of Ahenkora *et al.* (1994) which also showed that 97.8 per cent of the protein was true protein. The crude protein level of *M. pruriens* is higher than the values reported for cowpea, chickpea, and Jackbean (Hsu *et al.*, 1977; Marfo *et al.*, 1990). *M. pruriens* may, therefore, serve as a protein source.

Table 2 shows the effects of *M. pruriens* on the performance of broilers. With the exception of dressing percentage and mortality, the addition of *M. pruriens* significantly ($P<0.05$) depressed the performance of broiler chicks at all levels. For example, relative to the control, birds on 50, 100 and 150 g *M. pruriens* per kg diet weighed 93.4, 85.8 and 68.9 per cent, respectively, and their weight gains averaged 90.6, 79.7 and 55.8 per cent, respectively. On the average, birds receiving no *M. pruriens* in their diets consumed 8 per cent more feed and were 22.5 per cent more efficient in converting feed to body constituents than those receiving *M. pruriens.* Little experimental data are available on the nutritive value of *M. pruriens* for chickens. Vieira & Carvalho (1996) and Rocha & Raino (1954), quoted by Vieira & Carvalho (1996) had earlier concluded that *M. pruriens* could not be successfully used as feed for chicks after they fed it at the level of 35 per cent of the diet as a replacement for wheat bran and middlings. Similar trials, in which *M. pruriens* was substituted for soybean meal, led Souza (1989), according to Vieira & Carvalho (1996), to recommend that it could be used in layer diets at levels not exceeding 10 per cent. Ahenkora *et al.* (1994) fed rats on diets containing about 42 per cent *M. pruriens* and observed that they grew at a rate equivalent to 50 per cent of rats receiving a maize-casein diet.

The deleterious effects of *M. pruriens* have been attributed to a variety of causes, including amino acid deficiencies or imbalances (Ahenkora *et al.*, 1994), the presence of anti-nutritional factors like tannins, antitrypsin, L-DOPA, and phytic acid (Leiner & Kakade, 1969; Sathe & Salunke, 1984). In Ghana, humans consume the beans without any harmful effects on health. However, the beans are generally hard-boiled, and the seed coats are removed while the cooking water is discarded before consumption. Heat treatment can remove a considerable portion of the toxic factors in leguminous

TABLE 2

Effects of Experimental Diets on the Performance of Broilers

Parameter	*Control*	Mucuna-*1*	Mucuna-*2*	Mucuna-*3*	± *Overall SEM**
Initial body weight, g/bd	620.0	620.0	620.0	620.0	-
Final body weight, g/bd	2082.4a	1945.2b	1785.7c	1435.7d	57.9
	(100)2	(93.4)	(85.8)	(68.9)	
Ave. weight gain, g	1462.4a	1325.2b	1165.7c	815.7d	57.9
	(100)	(90.6)	(79.7)	(55.8)	
Food intake, g/bd/d	141.4a	140.5a	135.0a	114.9b	3.91
	(100)	(99.4)	(95.5)	(81.3)	
Food: gain	2.71d	2.97c	3.25b	3.96a	0.10
	(100)	(109.6)	(119.9)	(146.1)	
Dressing percentage	74.6	76.8	77.6	77.4	2.26
Total mortality	1/42	0/42	0/42	0/42	
Cost/tonne food, US$	482.45c	521.35c	554.55b	597.58a	12.28

*SEM = standard error of mean

( )2. Figures in brackets are percentages taking the control as 100 a, b, c, d. Figures in a row with different letters are significantly different ($P<0.05$).

crop products (Nwokolo, 1996).

The feeding of *M. pruriens* had no significant effect on carcass parameters (Table 3) including dressing percentage, as well as the weights of the crop heart, kidney, and the small intestine (full). However, at the highest level of dietary *M. pruriens* (150 g per kg), increases in the weights of the liver, gizzard (both full and empty), and the small intestine (empty) were significant ($P<0.05$). The authors are not aware of any studies relating the feeding of *M. pruriens* to the weight of organs, although the hypertrophic effects of legume seed meals on the pancreas have been reported by Huisman (1989) who attributed them to anti-nutritional factors. Rubio & Brenes (1989) observed significant increases in the relative lengths of the duodenum, jejunum, ileum, and ceca of chicks fed raw faba bean meal compared to chicks on a control diet.

Table 4 shows data on haematological parameters. Dietary *M. pruriens* had no significant influence on the blood chemistry of broiler chicks ($P>0.05$), and the values recorded fell within the range of normal values for chickens.

The study indicates that raw *M. pruriens* seed meal is not a good source of nutrients for broiler chickens. Further work on the effects of heat treatment on the nutritive value of mucuna is needed.

Acknowledgement

The authors greatly appreciate the material and

TABLE 3

Carcass Parameters as Affected by Dietary Mucuna

*Parameter**	*Control diet*	Mucuna-*1*	Mucuna-*2*	Mucuna-*3*	± *Overall SEM**
Dressing percentage	74.6	76.8	77.6	77.4	2.26
Crop weight	2.3	2.4	2.4	2.4	0.08
Heart weight	0.5	0.5	0.4	0.5	0.06
Kidney weight	0.5	0.5	0.5	0.6	0.05
Small intestine, full	4.4	4.5	4.5	4.6	0.15
Small intestine, empty	1.9	2.3	2.5	2.6	0.20
Liver weight	2.7b	2.7b	2.8ab	2.9a	0.04
Gizzard weight, full	2.5b	2.4b	2.9ab	3.1a	0.11
Gizzard weight, empty	1.3b	1.4b	1.6ab	1.7a	0.10

*All weights expressed as percent of liveweight

a, b. Figures in a row with different letters are significantly different ($P<0.05$)

TABLE 4

*Effects of Diets on Haematological Parameters of Broilers**

*Parameter**	*Control diet*	Mucuna-*1*	Mucuna-*2*	Mucuna-*3*	± *Overall SEM**
Packed cell volume	26.5	26.2	25.0	27.7	0.89
Haemoglobin, g/dL	8.6	8.2	8.4	9.0	0.35
Total serum protein, g/dL	38.5	40.4	41.0	40.7	1.56
Serum albumin, g/dL	15.4	13.3	14.8	14.5	1.50
Serum globulin, g/dL	23.2	26.9	26.2	26.1	2.30
Albumin/globulin ratio	0.68	0.51	0.56	0.59	0.11

*Treatments had no significant effects on haematological variables

financial assistance of Sasakawa Global 2000, Accra Office.

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