Effect of raw and cooked mucuna seed meal based diets on the performance, nutrient digestibility and haematology of weaned rabbits

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Abstract

A study was conducted for eight weeks to determine the effect of raw and cooked mucuna seed meal (MSM) based diets on the performance and haematological characteristics of cross-bred weaned rabbits. Three experimental diets were formulated to contain: 0 % MSM (control /diet A), 10% raw MSM (diet B) and 20% cooked MSM (diet C). Twelve cross-bred weaned rabbits with mean initial live-weight of about 550g were randomly assigned to the three dietary treatments. The experimental design used was completely randomized arrangement. The feed intakes (115.12, 114.44, 116.15g/day) and weight gains (17.19, 12.72, 14.28g/day) for diets A, B and C respectively were similar ($P > 0.05$) for the three treatments. Rabbits fed the control diet A had the best ($P < 0.05$) feed conversion ratio (6.68). The packed cell volume (PCV), haemoglobin (HB), red blood cell (RBC) and white blood cell (WBC) values obtained for the three treatments were not statistically different ($P > 0.05$) from one another. The Hb, RBC, WBC values of rabbits fed on 20% cooked MSM based diet had comparable values to those on the control diet. Based on the weight gain and the haematology, 20% cooked mucuna seed meal can be included in the diet of weaned rabbits.

Keywords: Mucuna seed meal, rabbits, weight gain, haematology.

Introduction

An average Nigerian does not consume enough of protein of animal origin that nourishes the body and needed for tissue development, repairs and healthy living (FA.O.,1993). This has led to serious malnutrition especially among the vulnerable groups (e.g children and poor/low class people) that form the majority in the society.

The intensification of livestock production is one way out of the present nutritional predicament

facing the country. Rabbit production has some advantages over poultry in that it is not capital intensive and the animals can make use of forage as part of their diet. Also, rabbit production has some advantages over cattle, sheep and goat production in that it requires little space to rear them. This makes it convenient for resource poor people and those with small land holding to keep. Their feed requirement is also smaller. Nevertheless, improvement in rabbit production requires the feeding of concentrate as supplement to forages (Butcher *et al*, 1980).

The conventional feed ingredients particularly those of protein origin used in feed formulation such as soyabean cake and groundnut cake are expensive. This has necessitated the search for alternative feed resources. *Mucuna pruriens* (velvet bean) is an under utilized legume. It is high in crude protein (Afolabi *et al* 1985), thus has high potentials as an ingredient for livestock feeding. However, the use of *Mucuna pruriens* is limited by its high content of toxins and anti-nutritional factors (Liener, 1994). It has been reported to contain trypsin inhibitors, phytates, cyanogenic glucosides, tannins and L-3, 4 dehydroxyphenylalanine (L-DOPA) (Ravindran and Ravindran, 1988; Mary Josephine and Janardhanan, 1992). It has however been observed that except for L-DOPA, all the anti-nutritional factors detected in the seeds are heat labile and could be eliminated by cooking (Mary Josephine and Janardhanan, 1992).

Earlier studies have shown that broiler chicks could not tolerate more than 5% raw mucuna seed in their diet (Esonu, 2001). Heat treatment has been found to improve the *in-vitro* protein digestibility of mucuna seed over the raw seed (Iyayi and Egharevba, 1998). Inclusion of 10% raw or toasted mucuna seed in broiler finisher diets depressed the growth rate compared to cooked mucuna seed (Emenalom and Udedibie, 1998). However, at 20% level of inclusion in the diet, cooked mucuna seed meal also depressed the growth rate of broiler finishers.

Few data are available on the use of mucuna seed meal in rabbit feeding. Emenalom *et al* (2001) found that both dehulled and cooked mucuna seed meal at 10% level increased the feed intake of rabbits without affecting their growth rate. There is the need to explore higher levels of mucuna seed meal utilization in rabbit diet. Thus, the objectives of this study were to find the effects of raw and cooked mucuna seed meals at 20% level in the diets of rabbits on their feed intake, growth rate, feed conversion ratio and haematology.

Materials and Methods

This study was conducted at the Rabbitary unit of the Federal College of Animal Health and Production Technology, IAR&T., Ibadan. Raw seeds of *Mucuna pruriens* (velvet bean) were ground and some cooked at boiling point (96°C) for 60 minutes. The cooked seeds were sun-dried and ground before including in the diet. Table 1 shows the ration composition of the diets. The diets were formulated to be iso-nitrogenous with about 17.55% crude protein (CP). There were three treatments comprising 0% mucuna seed meal (MSM) (control), 20% raw mucuna seed meal (RMSM) and 20% cooked mucuna seed meal (CMSM) in diets A, B, and C respectively. Twelve cross-bred weaned rabbits with average initial live-weight of about 550g were randomly assigned to the three experimental diets with four rabbits per treatment each serving as a replicate. The experimental design used was completely randomized arrangement. The animals were housed individually in separate hutches. There was a two -week adjustment period prior to the trial and the experiment lasted for eight weeks. Feed and water were provided *ad libitum* twice daily; morning and afternoon. The feed intake was measured daily while weight changes were taken on weekly basis.

The proximate analysis of raw and cooked mucuna seed meals and experimental diets was carried out on duplicate samples using A. O. A. C.(1995) methods. The gross energy values in the meals and diets were calculated by Ponzenga (1985) equation: $GE (Kcal/Kg) = 5.72 CP + 95.0 EE + 47.9 CF + 41.7 NFE$ where GE, CP, EE, CF, NFE are gross energy, crude protein, crude fibre and nitrogen free extract respectively.

Blood samples were collected at the 8th week of the trial from three rabbits per treatment via the marginal ear vein in the evening around 17.00hr. The samples were collected in bottles containing ethylene tetra-acetic acid (EDTA) as anticoagulant. They were then taken to the

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Table 1: Composition of the experimental diets (%).

Ingredients	TREATMENTS		
	Diet A (Control) (0% MSM)	Diet B (20% RMSM)	Diet C (20% CMSM)
Maize cob	19.00	19.00	19.00
Maize offals	42.00	38.00	38.00
Soyabean meal	26.00	15.00	15.00
MSM	0.00	20.00	20.00
Wheat offals	10.00	5.00	5.00
Bone meal	2.00	2.00	2.00
Salt	0.50	0.50	0.50
Vitamin/mineral premix	0.50	0.50	0.50
Total	100	100	100

MSM: *Mucuna* seed meal, RMSM: Raw *mucuna* seed meal, CMSM: Cooked *mucuna* seed meal

laboratory for haematological analyses which included packed cell volume (PCV), erythrocyte (red blood cell), leucocytes (white blood cell) and haemoglobin. Haematological parameters were determined as described by Davice and Lewis (1991). Data were analysed by analysis of variance technique (Steel and Torrie 1980), while significant means were separated by least significant difference method.

Results and Discussion

The proximate composition of raw (RMSM) and cooked *mucuna* seed meals (CMSM) and the three experimental diets is shown in Table 2. Cooked MSM had lower content of crude protein (24.08%), crude fibre (6.29) and ether extract (3.05%) compared to the raw sample with values of 29.23 % CP, 8.22% CF and 3.20 % EE. However, the cooked MSM contained higher levels of ash, nitrogen free extract and gross energy. The crude protein (CP) content of raw and cooked *mucuna* seed meals corresponds with the report of Siddhuraju *et al* (1996) which stated that the CP of *Mucuna pruriens* ranged between 24 and 32%.

The lower values for CP, CF and EE in the cooked MSM could be due to cooking effect leading to solubilization of nutrients into the cooking water. This agrees with the findings of Emenalom and Udedibie (1998) that cooking tended to reduce the crude protein content of *mucuna* seeds possibly due to solubilization of some nitrogenous compounds. The crude fibre level in cooked MSM is also supported by the report of Aletor and Ojo (1989).

Data on feed intake, weight changes and feed conversion ratio of the rabbits on the diets are shown in Table 3. The inclusion of 20% raw *mucuna* seed in the diet slightly depressed the feed intake and weight gain of the rabbits. The highest feed intake (116.15g/day) and weight gain (17.19g/day) were recorded on diet C (CMSM) and diet A (control) respectively. However, there were no significant differences ($P>0.05$) among the diets in the two parameters. The slightly high feed intake on diet C (CMSM) could be due to the cooking of the *mucuna* seed which makes the nutrients more available and the diet more palatable, thus enhancing feed intake. It could also be due to the slightly lower

Table 2: Proximate composition of raw, cooked mucuna seed meals and experiments diets (g/100 DM).

Parameters	Raw MSM	Cooked MSM	Diet A control (0% MSM)	Diet B (20% RMSM)	Diet C (20% CMSM)
Dry matter	90.40	90.02	89.78	90.10	89.88
Crude protein	29.23	24.08	16.72	17.37	17.19
Crude fibre	8.22	6.29	9.99	11.26	10.30
Ether extract	3.20	3.05	4.81	5.51	5.21
Ash	4.0	4.23	8.80	10.06	9.80
Nitrogen free extract	45.72	52.37	49.46	45.90	47.37
Gross energy (Kcal/kg)	2771.46	2912.61	3099.43	3076.19	3062.93

MSM: Mucuna seed meal, RMSM: Raw mucuna seed meal, CMSM: Cooked mucuna seed meal

energy content of the diet, which makes the animals to eat more in order to satisfy their energy requirement. The similarity in feed intakes recorded among the diets is opposed to the depression in feed intake noted in broiler finishers when 20% cooked MSM was incorporated in their diet (Emenalom and Udedibie, 1998). The non significant increase in weight gain in diet A (control) could be due to the absence of mucuna seed meal and hence its anti-nutritional factors that could have imparted negative effect on utilization of nutrients particularly protein (Moseley and Griffiths, 1979). The weight gain recorded in rabbits fed 20% cooked MSM (diet C): 14.28g/day in this study is comparable with

the value of 14.45g/day for rabbits fed 10% CMSM diet (Emenalom et al 2001). However, Emenalom and Udedibie (1998) found that 20% cooked *Mucuna pruriens* seed meal in the diet of broiler finisher significantly depressed their growth rate. The value recorded for 20% RMSM; 12.72g/day in this study is lower than that obtained for 10% RMSM diet; 15.45 g/day in another study (Emenalom et al 2001). It is also reported by Ukachukwu et al, (2002) that 0.25% methionine supplementation of 10% boiled mucuna seed meal diet fed to broiler finisher substantially improve the daily weight gain (about 60%) over the un-supplemented diet.

Table 3: Performance of rabbits fed raw and cooked mucuna seed meal diets.

Parameters	Diet A (0% MSM)	Diet B (20% RMSM)	Diet C (20% CMSM)	SED
Total feed intake (g)	6446.88	6408.81	6504.62	275
Av. feed intake(g/day)	115.12 ^a	114.4 ^a	116.15 ^a	4.91
Initial body weight (g)	562.5	550	575	
Final body weight (g)	1525	1262	1375	
Actual weight gain (g)	962.5	712.5	800	
Weight gain/day (g)	17.19 ^a	12.72 ^a	14.28 ^a	1.63
Feed conversion ratio	6.68 ^b	9.03 ^a	8.24 ^a	0.63

^{a,b,c}: Means within a row with similar superscripts are not significantly different (P > 0.05), MSM: Mucuna seed meal, RMSM: Raw mucuna seed meal, CMSM: Cooked mucuna seed meal, SED: Standard error of difference.

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The control diet A had the best ($P < 0.05$) feed conversion ratio (FCR) (6.68) while the poorest FCR was recorded on the raw MSM based diet B (9.03). However, there was no significant difference in the FCR values between the raw and cooked mucuna seed meal diets. The FCR values obtained with graded levels of raw pigeon pea seed in the diets of weaned rabbits (Amaefule *et al*, 2004) were better (1.63 to 2.38) than values recorded in this study. No mortality was recorded during the experiment. This indicated that both the raw and cooked mucuna seed meal diets did not have any deleterious effect on the experimental animals. Table 4 shows the haematological characteristics of rabbits fed raw and cooked mucuna seed meal diets. There were no significant differences ($P > 0.05$) among the diets in the parameters measured. The PCV value for rabbits on the control diet A was within the normal physiological range while those obtained for the animals on mucuna based diets were slightly below the normal range (Olomu *et al*, 2003). The haemoglobin values recorded for all the diets were within the normal range of values (Scarborough, 1932 quoted by Schalm, 1965).

The RBC values recorded in this study are lower

than the range of $6-11 \times 10^6$ per mm^3 of blood (Olomu *et al*, 2003). However, rabbits on the control diet A and 20% cooked mucuna meal diet C had values within the range $4.5-7.0 \times 10^6 / \text{mm}^3$ stated by another author (Scarborough, 1932 quoted by Schalm, 1965). The WBC values recorded in this study: $4.07-5.6 \times 10^3$ per mm^3 of blood are within the range of $4-13 \times 10^3 / \text{mm}^3$ given by Scarborough (1932). The haemoglobin, RBC and WBC values of rabbits fed on the 20% cooked MSM diet C had comparable values to those on the control diet A and the values are within normal physiological range (Schermer 1954; Scarborough, 1932 quoted by Schalm, 1965). The study of Akinmutimi and Abasiokong (2002) demonstrated that the inclusion of 20% cooked *Mucuna utilis* seed meal in the diet of broiler finisher birds could replace soyabean meal without any adverse effect based on the biochemical and haematological indices. In this study, inclusion of 20 % raw and cooked mucuna seed meal in the diets of weaned rabbits promoted good weight gain. However, there is the need for caution in including 20% raw mucuna seed meal in rabbits' diet because of the depression of the red blood cell values of the animals on this diet.

Table 4: Haematological values of rabbits fed raw and cooked mucuna diets.

Haematological characteristics	Diet A (0% MSM)	Diet B (20% CMSM)	Diet C (20% CMSM)	SED
PCV (%)	41.33	33.00	27.33	9.11
Haemoglobin (g /100 ml)	13.8	11.0	9.10	3.02
RBC (per mm^3)	4.67×10^6	3.10×10^6	4.43×10^6	1.48×10^6
WBC(per mm^3)	5.6×10^3	4.33×10^3	4.07×10^3	1.17×10^3

MSM: Mucuna seed meal, RSM: Raw mucuna seed meal, CMSM: Cooked mucuna seed meal, SED: Standard error of difference, PCV : Packed cell volume, RBC : Red blood cell , WBC : White blood cell.

Conclusion

Cross-bred weaned rabbits fed on 20% raw mucuna seed meal (MSM) based diet had comparable performance to the control diet without MSM and the 20% cooked MSM based diets in terms of feed intake and weight gain.

However, the 20% raw MSM based diet depressed the red blood cell in rabbits compared to 20% cooked MSM based diet. Therefore, 20% cooked mucuna seed meal can be included in the diet of weaned rabbits while 20 % raw mucuna seed meal should be used with caution.

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