

Full Length Research Paper

Response of weaner rabbits to diets containing graded levels of processed velvet beans (*Mucuna pruriens*)

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Accepted 6 May, 2011

An 8-week study was conducted to investigate the effect of feeding graded levels of cooked velvet beans (*Mucuna pruriens*) on growth performance and blood of weaner rabbits. 24, 6 week-old hybrid (Chinchilla x New Zealand white) weaner rabbits with initial average weight of 0.52 kg were housed in a hutch which accommodated two rabbits, partitioned with metallic sheets and wire mesh, and fitted with metallic trays. The rabbits were divided into four treatment groups of six rabbits each and randomly assigned to four diets containing 0 (control), 10, 20 and 30% cooked *Mucuna* seed meal (MSM) processed by boiling for 60 min starting from the boiling point of water, dried and grounded with hammer mill. Measurements taken were average daily weight gain, final live weight, feed and protein intake, feed conversion ratio (FCR), protein efficiency ratio (PER), packed cell volume (PCV), haemoglobin concentration (Hb), red blood cell count (RBC), etc. The results showed that there were no significant ($P > 0.05$) differences among the treatments in feed intake, protein intake, daily weight gain, FCR and PER. There were significant ($P < 0.05$) differences among treatments in PCV, Hb and mean cell volume (MCV). Rabbits fed 0, 20 and 30% MSM diets had significantly ($P < 0.05$) higher PCV and Hb than rabbits fed 10% MSM diet. The MCV of rabbits fed 30% MSM diet was significantly ($P < 0.05$) higher than that of rabbits fed 20% MSM diet. There were no significant ($P > 0.05$) differences among the treatments RBC, mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC). There were significant ($P < 0.05$) differences among the treatments in cost of daily feed intake and feed cost per kg weight gain. The cost of daily feed intake of rabbits on 20 and 30% MSM diets were significantly ($P < 0.05$) lower than those of rabbits on 0 and 10% MSM diets. Feed cost per kg weight gain of rabbits fed 30% MSM diet was significantly ($P < 0.05$) lower than that of rabbits on other dietary treatments. The results obtained in this study revealed that up to 30% of the cooked MSM can be included in the diets of weaner rabbits without any deleterious effect on rabbit performance.

Key words: Processed *Mucuna* seed meal, diets, rabbits, response.

INTRODUCTION

The demand for protein of animal origin in a developing country like Nigeria has far outstripped the supplies. An

average Nigerian for instance consumes only about 10 g per day of the minimum daily intake of 35 g recommended by Food and Agricultural Organization (FAO, 1992). This could be attributed to low level of animal protein production. A solution to the problem is to increase the level of animal production by intensifying the production of high reproducing animal species with short generation intervals such as poultry, pigs and rabbits (Fielding, 1991; Serres, 1992; Smith 2001). However, intensive livestock farming in Nigeria has been greatly affected by the high cost of feeds and feed ingredients, especially the conventional protein ingredients like soy-

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Abbreviations: MSM, *Mucuna* seed meal; FCR, feed conversion ratio; PER, protein efficiency ratio; PCV, packed cell volume; Hb, haemoglobin concentration; RBC, red blood cell count; WBC, white blood cell; MCV, mean corpuscular volume; MCH, mean corpuscular haemoglobin.

Table 1. Percentage composition of experimental diets.

Ingredient	Dietary level of <i>Mucuna</i> seed meal (%)			
	0	10	20	30
Maize	54.44	48.65	42.86	34.30
Wheat offal	23.33	23.33	23.33	23.33
Soybean meal	10.64	6.43	2.22	0.78
<i>Mucuna</i> seed meal	0.00	10.00	20.00	30.00
Palm kernel cake	4.43	4.43	4.43	4.43
Bone meal	4.00	4.00	4.00	4.00
Fish meal	2.66	2.66	2.66	2.66
Salt	0.25	0.25	0.25	0.25
Vit-mineral mix*	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated composition				
Crude protein (%)	15.00	15.00	15.00	15.95
Energy (Kcal of M.E/kg)	2.91	2.90	2.94	2.91

*Vit. A, 4 000, 000 IU; Vit. D3, 8 000 000 IU; Vit. E, 8 000 IU; Vit. K, 900 mg; thiamine, B1 700 mg; riboflavin, B₂ 200 mg; pyridoxine B₆; nicotinic acid, 11 000 mg; Vit B12, 6 mg; panthothenate, 3000 mg; folic acid, 3000 mg; choline chloride, 160 g; antioxidant, 50 g; manganese, 32 g; zinc, 32 g; iron, 20 g, copper, 8 g; iodine, 480 mg; selenium, 80 mg; cobalt, 80 mg.

bean meal and groundnut cake. Consequently, the prices of animal products have escalated, thereby making them out of the reach of the common man. A possible solution to this problem is to explore the nutritive potentials of alternative protein sources, which are cheap and locally available. One of such alternative protein sources is velvet bean (*Mucuna pruriens*).

Mucuna bean is an important legume that has been found to be useful in the rations of poultry and pigs (Camara et al., 2003), rabbits (Taiwo et al., 2003) and ruminants ((Muinga et al., 2003). Many of the known wild and underutilized legumes (such as *Mucuna* spp., *Canavalia* spp., *Sesbania* spp., etc.) possess adequate amounts of protein, essential amino acids, poly-unsaturated fatty acids (PUFAs), dietary fiber, essential minerals and vitamins along with the presence of beneficial bioactive compounds when comparable to other common legumes (Bhat and Karim, 2009). It is known that raw *Mucuna* bean seed contains such antinutritional/toxic factors as trypsin inhibitors, tannins and cyanide (Ravindran and Ravindran, 1988); anti-coagulants (Hourghton and Skari, 1994); analgesic, antipyretic and anti-inflammatory factors and others (Iauk et al., 1993; Olaboro et al., 1991). The presence of Dopa (a potentially neurotoxic agent) in the raw bean has been reported (Hussain and Manyan, 1997). These antinutritional toxic factors have to be decreased to safe level either by boiling, heating or fermentation before including the bean in livestock rations (Mary-Joesephine and Janardhanan, 1992). However, the concentration

and level of these antinutrients might vary between legumes and also among subaccessions of the same legume source depending on the location of collection, stage of development and availability (Bhat and Karim, 2009). This study therefore was undertaken to determine the feeding value of cooked *Mucuna* seed meals (MSM) to weaner rabbits.

MATERIALS AND METHODS

The experiment was conducted in the Rabbitry Unit of Home Science, Nutrition and Dietetics Department, University of Nigeria, Nsukka.

Processing of *Mucuna* bean seeds (*M. pruriens*)

The velvet bean seeds used for the research were procured from Ibagwa market, near Nsukka, Enugu State, Nigeria. The fully matured and dry bean seeds were boiled in excess volume of water for 60 min at 100°C, timed from the boiling point of water (100°C). The cooked seeds were sun dried for 3 days and ground into meal using a hammer mill. The *Mucuna* meal so produced was used to formulate the experimental diets (Table 1).

Proximate and statistical analyses

Experimental diets were analyzed for proximate composition using the methods of AOAC (1990). Data collected were subjected to analysis of variance (ANOVA) for a CRD (Steel and Torrie, 1980), and differences between the treatment means were separated using Duncan's new multiple range test (Duncan, 1955).

Table 2. Proximate compositions of experimental diets.

Component (%)	Dietary level of <i>Mucuna</i> seed meal (%)			
	0	10	20	30
Dry matter	95.00	95.00	95.50	94.00
Crude protein	14.66	14.56	14.78	14.87
Ash	10.00	10.50	11.00	9.00
Crude fibre	6.50	5.25	6.00	8.00
Ether extract	0.80	0.50	0.50	0.50
Nitrogen-free extract	63.04	64.19	63.22	61.63

Table 3. Performance of weaner rabbits fed graded levels of *Mucuna* seed meal diets

Parameter	Dietary level of <i>Mucuna</i> seed meal (%)				
	0	10	20	30	SEM
Initial body weight (Kg)	0.60	0.75	0.87	0.65	± 0.13
Final body weight(Kg)	1.69	1.92	1.82	1.67	± 0.11
Average daily weight (g)	18.80	20.11	16.19	17.53	± 2.19
Average daily feed intake(g)	66.26	75.86	65.11	64.19	± 4.25
Feed conversion ratio	3.56	3.87	4.21	3.77	± 0.43
Daily protein intake(g)	9.71	11.05	9.62	9.54	± 0.62
Protein efficiency ratio	1.92	1.85	1.74	1.82	± 0.21
Mortality (%)	0	0	0	0	-

Animals and management

24 6-week old hybrid (Chinchilla x New Zealand white) weaner rabbits of both sexes with initial average weight of 0.52 kg were divided into four groups of six rabbits each. The groups were randomly assigned to the four treatment diets containing 0 (control), 10, 20 and 30% cooked MSM, respectively. Each treatment was replicated three times with two rabbits per replicate placed in a four-tier rabbit hutch that had a total of 12 hutches per tier. Each hutch measured 0.6 x 0.5 x 0.4 m. The hutches were housed inside a building equipped with vents and windows for proper ventilation. Each hutch, which accommodated two rabbits, was partitioned with metallic sheets and wire mesh, and fitted with metallic trays (for collection of faecal droppings) and with stainless feeders and drinkers. The rabbits were provided feed and water *ad libitum* twice daily at 8.00 and 16.00 h for 56 days of the experimental period. The rabbits were weighed at the beginning of the experimental feeding and subsequently on a weekly basis. Parameters measured were daily feed intake and daily weight gain, while feed conversion ratio and protein efficiency ratio were calculated from weight gain, feed intake and protein intake values.

Haematological study

At the 8th week of the experiment, two rabbits from each treatment were selected for haematological studies. Blood samples were collected from their jugular veins with sterile needles and syringes. The blood samples were collected into properly labeled sterilized bottles containing EDTA (ethylene diamine tetra-acetic acid) for haematological analysis. Packed cell volume (PCV) and haemoglobin concentration (Hb) were determined by the methods described by Lamb (1991). Red blood cell (RBC) and total white

blood cell (WBC) counts were estimated using the haemocytometer, while mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) were calculated according to Mitruka and Rawnsley (1977).

RESULTS

Growth performance

Table 2 shows the proximate composition of the experimental diets, while data on growth performance of rabbits fed varying dietary levels of cooked MSM are presented in Table 3. There were no significant ($P > 0.05$) differences among the rabbits fed 0, 10, 20 and 30% MSM in the final body weight, average daily weight gain, average feed intake and average daily protein intake. There were also no significant ($P > 0.05$) differences in feed conversion ratio and protein efficiency ratio among the rabbits fed the treatment diets. There was no mortality of rabbit in all the treatment groups.

Haematological characteristics

Table 4 shows the haematological characteristics of the rabbits fed graded levels of the processed MSM. There were significant ($P < 0.05$) differences among treatments in PCV, Hb and MCV. Rabbits fed 0, 20 and 30% MSM

Table 4. Haematological values of rabbits fed cooked *Mucuna* seed meal.

Parameter	Dietary level of cooked <i>Mucuna</i> seed meal (%)				SEM
	0	10	20	30	
Haemoglobin concentration (g/100 ml)	12.95 ^a	11.00 ^b	13.85 ^a	13.55 ^a	±0.63
Packed cell volume (%)	39.00 ^a	33.00 ^b	41.50 ^a	41.00 ^a	±1.89
Red blood cells (x 10 ⁶ /mm ³)	6.50	6.00	6.93	6.84	±0.39
Mean cellular haemoglobin (pg)	199.00	200.00	200.00	198.00	±1.12
Mean cellular haemoglobin concentration (%)	33.00	33.00	33.00	32.85	±0.07
Mean cellular volume (µm ³)	60.00 ^{ab}	60.00 ^{ab}	59.00 ^b	61.50 ^a	±0.75

^{a, b}Means on the same row with different superscripts are significantly ($P > 0.05$) different. SEM = Standard error of mean.

diets had similar PCV and Hb values, and these were significantly ($P < 0.05$) higher than that of the rabbits fed 10% MSM diet. The MCV of rabbits fed 30% MSM diet was significantly ($P < 0.05$) higher than that of rabbits fed 20% MSM diet, while rabbits fed 0,10 and 20% MSM diets had comparable MCV values. There were no significant ($P > 0.05$) differences in RBC, MCH and mean cell haemoglobin concentration (MCHC) among the treatments.

Cost of feeding graded levels of processed MSM to weaner rabbits

There were significant ($P < 0.05$) differences among the treatments in feed cost and feed cost per kg weight gain. The cost of daily feed intake of rabbits on 20 and 30% MSM diets was significantly ($P < 0.05$) lower than that of rabbits on 0 and 10% MSM diets. The feed cost per kg weight gain of rabbits on 30% MSM diet was significantly ($P < 0.05$) lower than that of the rabbits on other dietary treatments, which had comparable feed cost per kg weight gain. There were no significant ($P > 0.05$) differences among the treatments in total feed intake, cost of total feed consumed and total weight gain.

DISCUSSION

Growth performance

It was observed (Table 3) that inclusion of varying dietary levels of cooked MSM had no significant effect on growth performance of rabbits. This result agrees with the findings of Taiwo et al. (2003, 2006) that the performance of crossbred weaner rabbits fed 20% cooked MSM based diets was relatively comparable to that of rabbits on control diet. However, the result contradicts that of Emenalom et al. (2001), which showed that weaner rabbits fed 10% cooked MSM diets, had depressed growth rate. The daily feed intake of rabbits in this study

(64.19 to 75.86 g/day) were higher than (23.78 to 24.04 and 47.4 to 50.1 g/day) that reported by Amaefule et al. (2004) and Udedibie et al. (2005) for pigeon pea seed meal and jack bean, respectively. However, the values are comparable with (76.07, 64.72 and 71.50 g/day) reported by Biobaku and Dosumu, (2003) and Bawa et al. (2005, 2007) for sunflower seeds, neem seed cake and African locust bean, respectively. Also, the daily weight gain (16.19 to 20.11 g/day) and mature live weight (1670 to 1920 g) obtained in this study were higher than the values reported by Amaefule et al. (2004), Udedibie et al. (2005), Bawa et al. (2005, 2007) and Taiwo et al. (2006) who fed weaner rabbits with pigeon pea seed meal, jack bean, neem seed cake, mucuna seed meal and African locust bean, respectively. The lack of remarkable differences in growth performance observed in this study might be either due to the fact that cooking reduced the anti-nutritional factors (ANFs) in raw *Mucuna* seeds to such a level that did not cause distortions or disproportionate growth of rabbits, or the levels of cooked MSM in the diets were not high enough as to depress performance of rabbits. Perhaps, there may be the need to investigate the effects of higher dietary levels (above 30%) of cooked MSM on growth performance of weaner rabbits.

Haematological characteristics

As shown in Table 4, rabbits fed 20 and 30% processed MSM had comparable PCV, Hb, RBC, MCH, MCHC and MCV values to those on the control diet. The PCV values (33 to 41.5%) obtained in this study were within the normal range (38 to 45%) reported by Swenson and Reece (1993). The values (12.0 to 13.85 g/100 ml) for haemoglobin concentration (Hb) obtained in this study are also within the normal range (12.9 to 13.85 g/100 ml) reported by Schalm et al. (1975). The PCV and Hb values obtained in this study are comparable with the values reported by Taiwo et al. (2003, 2006). The RBC values (6.00 to 6.93 x 10⁶/mm³ of blood) are comparable

Table 5. Cost of feeding graded levels of cooked *Mucuna* seed meal to rabbits.

Parameter	Dietary level of cooked <i>Mucuna</i> seed meal (%)				SEM
	0	10	20	30	
Total feed intake (kg)	3.51	4.40	3.78	3.76	±0.45
Cost of daily feed intake (₦)	2.85	3.07	2.48	2.31	±0.17
Cost of feed/kg (₦)	43.03	40.55	38.08	36.05	-
Cost of total feed consumed (₦)	151.04	178.42	143.82	135.55	±15.36
Total weight gain (g)	1090.00	1166.67	956.67	820.00	±110.28
Cost of feed/kg weight gain (₦)	153.33	156.93	160.19	103.11	±40.86

to the values (6 to 11 x 10⁶/mm³ of blood) reported by Olomu et al. (2003), but higher than the values (3.10 to 4.67 x 10⁶/mm³ of blood) reported by Taiwo et al. (2006). The result of the haematological parameters recorded in this study showed that inclusion of 30% processed MSM in the diets of growing rabbits did not cause any adverse effect on the haematological indices of the rabbits.

Cost of feeding graded levels of processed MSM to weaner rabbits

The cost of daily feed intake, and the cost of total feed consumed followed the same trend as the daily feed intake, which was observed to decrease as the level of cooked MSM in the diets increased (Table 3). Also, total weight gain followed the same trend as the daily weight gain. There was significant reduction in feed cost per kg weight gain at 30% MSM inclusion level (Table 5). The result tend to suggest that inclusion of cooked MSM at high levels (above 10%) in the diets of weaner rabbits may result in reduced cost of production in terms of feeding. This agrees with the views of Longe (1986), Ani and Adiegwu (2005) and Ani (2007) that the use of alternative livestock ingredients tends to reduce the overall cost of production with a concomitant improved profitability.

Conclusion

In conclusion, up to 30% of cooked MSM can be included in the diet of weaner rabbits without any adverse effect on rabbit performance. Inclusion of 30% MSM in the diet of weaner rabbits results in reduced feeding cost, cost of production, and thus enhanced rabbit meat production.

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