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Full Length Research Paper

Utilization of moringa (*moringa oleifera*) leaves meal as a replacement for soya bean meal in rabbit's diets

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An experiment was conducted with 36 crossbred rabbits(49 days old) averaging 730g to assess the performance, haematology, serum biochemistry, carcass and organ weights of growing rabbits fed graded levels of dried Moringa oleifera leaf meal(MOLM) of 0%, 5%,10%, and 15%, as a replacement of soya bean meal (SBM) in 10-week feeding trial. Feed consumption and weight gain were monitored. Blood samples were collected from the animals through the ear vein for haematology and serum biochemistry, while weight of cut parts and visceral organs were collected from the animals after they were stunned and sacrificed after the 10-week feeding trials and weighed. Results showed that there were significant differences ($p<0.05$) in the value obtained for feed conversion ratio, white blood cell count. While the results of carcass and organ weight showed significant ($P<0.05$) difference in values obtained for loin, hind limb, spleen, lungs and heart. While there was no significant difference among the blood constants (MCV, MCH and MCHC). Among the leukocyte differential counts examined, lymphocytes, monocytes and eosinophils were not significantly different among the dietary treatments, the serum proteins examined were not significantly ($p>0.05$) affected by the dietary treatments. The results suggest that MOLM possess good dietary protein quality for optimal growth of rabbits and be incorporated in the rabbit's diets up to 15% inclusion levels without any detrimental effects on the performance, haematology, serum biochemistry, and carcass and organ weights of growing rabbits.

Keywords: Moringa leaf, rabbits, blood, carcass, organ weight

INTRODUCTION

Protein supplementation is often important to improve livestock performance, and this needs to be done with respect to the requirement of the animal in addition to the balance of other nutrient available. Soya bean meal and fish meal have been widely and successfully used as conventional protein sources for livestock (Sarwatt *et al*, 2002).

However, the prices of these protein sources have been increasing continuously in recent times, whilst available is often scarce. The shortage has been worsened due to the increasing competition between humans and livestock for these protein ingredients as food. According to Odunsi, (2003) the rapid growth of human and livestock population, which is creating increased needs for food and feed in the less developed countries, demand that alternative feed resources must be identified and evaluated. Hence, any similar high protein ingredient which could partially or completely be used as a substitute for soyabean meal or fishmeal is desirable. This strategy could help to reduce cost of production and ensure cheaper meat production thereby making available the major crops for human consumption. The economization of feed cost using cheaper and unconventional feed resources (Vasanthakumar et al., 1999; Bhatt and Sharma 2002; Muriu *et al.,* 2002) is an important aspect of commercial rabbit production.

One possible source of cheap protein is the leaf meal of some tropical leguminous browse plants. Leaf meal does not only provide protein source but also some essential Vitamins such as Vitamin A & C, minerals and oxycarotenoids. The constraints to enhanced utilization of

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Table 1: Composition of the experimental diets

Ingredients (%)	T_1 0%	T_2 5%	T_3 10%	T_4 15%
Maize	35.00	35.00	35.00	35.00
Soya bean meal	15.00	10.00	5.00	-
MOLM	-	5.00	10.00	15.00
Rice Husk	17.00	17.00	17.00	17.00
Wheat Offals	20.30	20.30	20.30	20.30
Ground nut cake	9.00	9.00	9.00	9.00
Bone Meal	3.00	3.00	3.00	3.00
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Premix	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**

MOLM : *Moringa oleifera* leaf meal**.**

Table 2: Proximate Composition of Dried *Moringa Oleifera* Leaf Meal (MOLM)

Parameters	%
Dry matter	21.48
Crude protein	29.68
Crude fibre	16.98
Ether extract	5.76
Ash	7.54
Nitrogen free extract	40.11
Organic matter	92.40

leaf meals reside chiefly on factor such as fibre content, the presence of anti-nutritive compounds and deficiencies of certain amino acids. Recently, there has been interest in the utilization of moringa (*Moringa oleifera*) commonly called horse-radish, miracle tree or drum stick bee, as a protein source for Livestock (Makker and Beeker, 1997; Sarwatt *et a*l, 2002). Moringa leaves have quality attributes that make it a potential replacement for soya bean meal or fish meal in non-ruminant diets. Moringa can easily be established in the field, has good coppicing ability, as well as good potential for forage production. Furthermore, there is a possibility of obtaining large amounts of high quality forage from moringa without expensive inputs due to favourable soil and climatic conditions for its growth. Sarwatt *et al.,* (2004) reported that moringa foliages are a potential inexpensive protein source for livestock feeding. The advantages of using moringa as a protein resource are numerous and include the fact that it is a perennial plant that can be harvested several times in one growing season and also has the potential to reduce feed cost. Moringa oleifera is in the group of high-yielding nutritious browse plants with every part having food value (Duke, 1998). Despite the high crude protein content of moringa leaf meal, there is little information available on the use of this unconventional feed resource, especially as an alternative protein supplement for rabbit production. The present study aimed at assessing the possibility of replacing soyabeans meal with moringa leaf meal for rabbit's diets.

MATERIALS AND METHODS

Experimental plan

Fresh moringa leaves were harvested from different farm location within Ibadan metropolis in Oyo state south west of Nigeria. The harvested moringa leaves were air dried in shade under a shed until they were crispy to touch, while retaining their greenish colouration. The leaves were then milled to obtain a product here in referred to as moringa leaf meal/Moringa Oleifera Leaf Meal (MOLM) which was stored in air tight container until when needed for compounding. Four experimental diets comprising (MOLM) used as a replacement of soyabean meal at 0, 5, 10, and 15% which constitutes treatments 1 (control), 2, 3, and 4 respectively, were prepared with the addition of other ingredients as shown in Table 1.

Thirty six, 49- day old New Zealand x Chinchilla rabbits with initial average live weight of 730g were used. The animals were treated against endo and ectoparasites. The animals were randomly divided into four main groups of the dietary treatments. Each group was then replicated thrice with 3 rabbits per replicate. The experimental feed and water were supplied *ad- libitum* twice daily at 8.00h and 16.00h and the experiment lasted for 10 weeks.

Blood collection and evaluation

At the completion of the feeding period, three rabbits per treatment were randomly selected, bled through the ear vein using sterilized hypodermic needle and syringe, the blood were pooled into carefully labeled sample bottles. The blood samples collected in EDTA was used for the determination of haematological parameters such as, packed cell volume (PCV), haemoglobin (Hb), white blood cell (WBC), red blood cell (RBC), blood constants such as mean corpuscular haemoglobin concentration

Table 3: The Performance Characteristics of Rabbit fed dried *Moringa oleifera* leaf meal

	T_1	T_2	T_3	T_4	SEM ±
Initial Weight (g)	0.81	0.73	0.71	0.69	20.57
Final weight (g)	1.22	1.22	1.39	1.36	0.40
Feed consumed (g)	1.51	1.60	1.54	1.53	18.76
Weight gain (g)	0.41	0.35	0.68.	0.67	0.20
Feed conversion ratio	3.68 [b]	4.57 [a]	2.26 [ab]	2.28 [ab]	0.14

a,b and ab means with different superscript on the same row are significant difference (P<0.05

Table 4: Serum Biochemical Indices of Rabbit Fed dried *Moringa oleifera* leaf meal.

\	T_1	T_2	T_3	T_4	SEM ±
Total protein	5.48	5.40	4.81	5.20	0.31
Albumin	5.21	4.825	5.72	5.79	0.30
ASGPT	34.90	36.73	34.98	39.23	1.32
ALYGOT	61.36	83.16	69.38	89.72	4.98
Glucose	60.71	107.65	98.02	89.33	7.99

SEM = Standard Error of Mean

(MCHC), mean corpuscular haemoglobin (MCH) and Mean cell volume (MCV) and leucocyte differential counts, such as lymphcytes, monocyte, basophil and eosinophil. The remaining blood sample was centrifuge and the serum was dispensed into a clean tube for analysis. The cell counts were carried out by the use of haematocytometer, while Hb, PCV and serum chemistry indices were determined using standard methods (Baker and Silverton, 1985).

Carcass evaluation

At the end of the feeding trial, three rabbits per treatment were randomly selected, starved for 12hrs sacrificed through cervical dislocation, dressed and weight of various parts and organs were taken and recorded.

Statistical analysis

Data generated on performance, digestibility, haematological, serum biochemical indices and carcass yield were subjected to one- way analysis of variance as described for completely randomized design (CRD) and significant treatment mean were separated using the Duncan's multiple range test (Steel and Torrie, 1990) using SAS (2007) package.

Results

The results of the performance characteristics of rabbits fed MOLM are as presented in Table 3. The mean values obtained for initial weight, final weight, weight gain and feed consumed were not significantly (P>0.05) influenced by the dietary treatments. However, the feed conversion ratio (FCR) was significantly (P<0.05) influenced by the dietary treatments with T2 having the highest value (4.57) and T3 had the lowest value (2.26).

The haematological and serum biochemical profile of rabbits fed dried MOLM is as presented in Table 4 and 5. There was no significant difference (P>0.05) in all the haematological parameters measured when compared with the control except white blood cell which decreases as the inclusion level of *moringa oleifera* increases. However, all the serum biochemical parameters measured were not significantly (P>0.05) influenced by the dietary treatment.

Table 6 shows the carcass and organ weight of rabbits fed dried MOLM. The mean values obtained for hind limb and loin were significantly (P<0.05) influenced by the dietary treatment. The values obtained for loin ranged from 8.64% - 10.91%, with the control having the lowest and T4 (15% MOLM) having the highest value. For the hind limb, rabbits on control diet had the lowest (17.68%) value, while those on T2 (5% MOLM) had the highest (22.00%) value. The values obtained for the weight of visceral organs, apart from kidney and liver, were significantly (p<0.05) different among the dietary treatments.

Discussion

The crude protein content of the MOLM used was 29.68% (Table 6). This was higher than the CP values of 27.51% reported by Oduro *et al,* (2008). Respectively, the variations in the nutrients could be attributed to the age of cutting, harvesting, climatic condition, edaphic factors as well as methods of processing and analysis (Fuglie, 1999). The CP of MOLM as observed was lower

Table 5: Haematological Parameters of rabbits fed dried *Moringa oleifera* leaf meal.

Parameters	T1	T2	T3	T4	±SEM
Packed cell volume (m/%)	33.33	32.66	32.00	35.00	0.69
Haemoglobin(g/dl)	11.13	10.90	11.03	11.73	0.22
Red blood cell($x10^6/mm^3$)	4.14	4.91	4.47	4.42	12.60
Mean cell volume(μ^3)	0.81	0.68	0.72	0.79	0.31
MCHC (%)	33.39	33.36	34.51	33.53	0.28
MCH (fl)	0.26	0.21	0.24	0.26	0.01
White blood cell ($X10^3/mm^3$)	14.96^{a}	8.00^{ab}	6.46^{ab}	5.93^{b}	1.53
Lymphocyte %	70.66	62.66	68.33	68.33	1.17
Monocytes %	2.33	2.00	2.33	1.33	0.48
Eosinophils %	4.00	2.00	2.33	1.33	0.01
Neutrophils %	23.00	33.33	44.00	28.33	4.53

abc, means values with different superscript are significantly different(P< 0.05)

Table 6: Carcass and organ weight of Rabbits fed dried *Moringa oleifera* leaf meal

Parameters (%)	**T1**	**T2**	**T3**	**T4**	**SEM**
Live weight (g)	1266.70	1250.00	1381.70	1570.00	6.88
Eviscerated weight	57.60	63.35	60.41	61.44	4.42
Loin	8.64^{b}	10.26^{ab}	10.35^{ab}	10.91^{a}	0.92
Hind limb	17.68^{b}	22.00^{a}	21.50^{a}	21.18^{ab}	1.63
Fore limb	8.06	8.78	7.55	9.19	0.72
Organ					
Kidney	0.60	0.62	0.54	0.61	0.04
Spleen	0.04^{b}	0.03^{b}	0.06^{a}	0.05^{a}	0.01
Lung	0.51^{b}	0.55^{b}	0.53^{b}	0.61^{a}	0.05
Liver	2.41	2.62	2.28	3.50	0.04
Heart	0.24^{a}	0.22^{ab}	0.15^{b}	0.24^{a}	0.00

than that of soya bean meal (44%) or fish meal (60%) used conventionally as sources of protein in rabbit rations.

The higher weight gains in the rabbits fed MOLM diets in T_3 may, therefore, be partly due to a better protein quality, possibly arising from a higher methionine and lysine supply (Booth and Wickens, (1980). Vitamin A is important in rabbit growth. MOLM is reported to have a high Vitamin A (Booth and Wicken, 1988; Grubben and Denton, 2004; Fuglie, 2005). The control diet (0% MOLM) might have provided insufficient Vitamin A for the rabbits, hence resulting in poor growth since Vitamin A aids in promoting growth in rabbits. Pond *et al.*, (1995) stated that Vitamin A deficiency in the diets of rabbits makes the rabbits to exhibit poor growth.

The superior feed conversion ratios for the MOLM diets might have also contributed to the superior growth rate and weight gain by the rabbits on the MOLM diets as compared to the control Okorie (2003). Another associated factor for the increased feed intake might also be due to greater palatability of MOLM diets as compared to the control diet. The FCR in this study were 3.68, 4.57, 2.26 and 2.28 which was fall between the ranges of 2.63 – 4.50 that was earlier reported by researchers in the tropics (Ayers *et al.,* 1996; Okorie 2003). Blood is an important index of physiological, pathological and nutritional status in the organism (Olorode *et al.,* 2007; Ewuola *et al*., 2004). Reports by Aletor and Egberongbe (1992) and Aletor (1989) indicated that the blood variables most consistently affected by dietary influence

includes RBC, PCV, and plasma protein. The non-significant difference (P>0.05) observed for this parameters is an indication of better utilization of MOLM by the rabbits. The lower value of WBC observed in rabbits fed MOLM based diets compared with the control is an indications that the immunity levels of the rabbits were not challenged.

Conclusion

This study has demonstrated that *Moringa oleifera* leaf meal possess good dietary protein quality for optimal growth of rabbits. It could be used to improve daily weight gain and feed intake of rabbits. And also MOLM can be used to replace soya bean meal in the rabbit's diet up to 15% inclusion level without any detrimental effect on the performance, haematology and serum biochemistry of rabbits.

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