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Growth Indices and Apparent Nutrient Digestibility in Rabbits Fed Graded Levels of Moringa (*Moringa oleifera*) Leaf Meal.

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Target audience: nutritionist, farmers, extension staff

Abstract

The chemical composition of moringa leaf meal, growth performance and nutrient digestibility of growing rabbits fed graded levels of moringa leaf meal (MLM) were investigated. The MLM was incorporated in rabbit diet at 0, 5, 10 and 15% levels as replacement for soyabean meal (SBM) which constituted treatments 1(control), 2, 3 and 4, respectively. A total of 36 growing crossbred rabbits, 7-9 weeks old with an average body weight of 801±27.83g were randomly allotted to the treatments in an experiment that lasted for 9 weeks. Each treatment has nine animals in a completely randomised design. Results showed that the chemical composition of MLM contains 27.53% crude protein (CP), 9.93% ether extract (EE), 14.05% crude fibre (CF), 7.98% Ash and 40.51 nitrogen free extract (NFE). The final body weight and daily weight gain were not significantly (P>0.05) different among the dietary treatments. The feed conversion ratio (FCR) and dry matter intake of experimental animals were also not significantly (P>0.05) influenced by the dietary treatments, however there was apparent reduction in the value of these parameters as the level of the MLM increases in the diets. The trend observed in the nutrient digestibility indicated that with increase in the level of MLM inclusion in the diets, apparent nutrient digestibility increases significantly (P<0.05) from animals fed control diet to those fed 15% MLM. The CP, CF, EE and Ash digestibility values were significantly (P<0.05) higher in rabbits fed dietary treatments 2, 3, and 4 than those on the control diet. This suggests that Moringa leaf meal (MLM) could be used to replace SBM at 15% level of inclusion in rabbit diets as a non-conventional protein source.

Keywords: Moringa leaf meal, growth, rabbits, digestibility

Description of problem

Soyabean meal and fish meal have been widely and successfully used as conventional protein sources for livestock. However, the prices of these protein sources have been escalating continuously in recent times, and the availability is often unstable. The problem increases due to the competition between humans and livestock for these protein ingredients as food. According to Odunsi (1) 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 therefore be identified and evaluated. Surplus of cereals is generally not available; therefore, it is not advisable to develop a wholly grain-based feeding system. The recommended policy is to identify and use locally available feed resources to formulate diets that are balanced (2). There is the need to explore the use of non-conventional feed sources that have the capacity to yield the same output as conventional feeds at cheaper cost.

Nutrition is one of the factors that could limit productivity especially during pregnancy and lactation (3, 4). Any high protein ingredient could partially or completely be used as a substitute for soyabean meal or fishmeal as desirable to help reduce the cost of production, and ensure cheaper meat production. The economization of feed cost using cheaper and unconventional feed resources (5, 6, 7) is an important aspect of commercial rabbit production. One possible source of cheap protein is the leaf meals of some tropical legume browse plants. Leaf meals such as moringa do not only provide protein source but also some essential vitamins such as vitamins A and C, minerals and oxycarotenoids.

Recently, there has been interest in the utilization of moringa (*Moringa oleifera*) commonly called horseradish tree or drumstick tree, as a protein source for livestock (8, 9). Moringa leaves have quality attributes that make it a potential replacement for soyabean meal in non-ruminant diets. It can easily be established in the field and has good potential for forage production. Furthermore, there is the 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*. (9) reported that moringa foliages are a potential inexpensive protein source for livestock feeding. The advantages of using moringa as a protein source in animal diet are numerous which 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 (10). 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 was conducted to evaluate the chemical composition of moringa leaf meal, growth response and apparent nutrient digestibility of growing rabbits fed graded levels of *moringa oleifera* leaf meal as a replacement for soyabean meal.

Materials and Methods

Experimental site and Moringa leaf meal

The study was carried out at the Rabbitry Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria.

Moringa leaf meal was obtained from National Centre for Genetic Resources, Research and Biotechnology(NACGRAB), Moor Plantation, Ibadan and within the University premises. The harvested moringa leaves were air dried under a shed until they were crispy to touch while retaining their greenish colouration. The leaves were then milled to obtain a product herein referred to as moringa leaf meal (MLM). The MLM was analysed for its chemical composition as described by AOAC (11).

Experimental diets

The MLM was included in rabbit diets at 0%, 5%, 10%, 15% constituting treatments 1(control), 2, 3, and 4 respectively. The gross composition and chemical composition of experimental diets are shown in Tables 2 and 3. Thirty-six crossbred growing rabbits were used for the experiment. The rabbits used for the study were between 7 and 9 weeks of age with an average body weight of 801±27.83g and the experiment lasted for 9 weeks. The rabbits were acclimatized and quarantined during the physiological adjustment period of 2 weeks before the feeding trial. The animals were randomly allotted into the four dietary treatments with each treatment having nine replicates housed individually in 55cm x 50cm x 40cm wooden cages. The rabbits were weighed individually at the start of the experiment, thereafter at the end of each week to determine the weekly live weight gain for the animal.

Experimental plan and parameters measured

Feed intake (FI) was determined by finding the difference between the amount of feed supplied and the leftover feed for each replicate. Body weight and body weight gain (BWG) of the animals were measured weekly. Feed conversion ratio (FCR) was calculated from the ratio of feed intake to body weight gain during the experimental period. Feed consumed and faecal voided for six (6) days towards the end of the experimental period were measured, aliquot taken, oven dried and analyzed for proximate composition.

Laboratory analysis

Proximate analysis of moringa leaf meal, feeds and faecal samples were carried out at Central Laboratory, Department of Animal Science, University of Ibadan, Ibadan as described by AOAC (11). The results were used to estimate the nutrient digestibility of the feed in the experimental rabbits.

Data analysis

All data obtained from the study were tested using one-way ANOVA at P=0.05 using the statistical analysis system (12) package.

Table 2: Gross composition (%) of experimental diets

	Dietay inclusion levels of Moringa leaf meal (MLM), %			
Ingredient (%)	0	5	10	15
Maize	15.00	15.00	15.00	15.00
Soybean meal	16.00	11.00	6.00	1.00
Moringa Leaf Meal	-	5.00	10.00	15.00
Groundnut cake	2.00	4.20	7.10	10.22
Palm karnel cake	20.00	20.00	20.00	20.00
Wheat offal	26.25	24.05	21.15	18.05
Fish meal	1.00	1.00	1.00	1.00
Corn bran	17.00	17.00	17.00	17.00
DCP	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Methionine	0.12	0.12	0.12	0.12
Lysine	0.13	0.13	0.13	0.13
Total	100	100	100	100
Calculated nutrient				
Crude protein (%)	18.86	18.60	18.99	18.82
Crude fibre (%)	10.52	10.74	10.91	10.07
Digestible Energy (Kcal/kg)	2660	2512	2368	2224

DCP: Di-calcium phosphate; MLM: Moringa Leaf Meal

Table 3: Chemical composition (g/100g DM) of experimental diets fed to growing rabbits.

	Dietay inclusion levels of Moringa leaf meal (MLM), %			
Nutrient (%)	0	5	10	15
Dry matter	90.52	90.70	90.20	90.45
Crude protein	18.30	18.35	18.48	18.00
Ether extract	10.25	10.30	10.55	10.05
Ash	8.80	8.93	8.58	8.23
Crude fibre	14.03	14.20	14.23	13.93
NFE	48.62	48.22	48.16	49.79

NFE: Nitrogen Free Extract

Results and Discussion

The proximate composition of moringa leaf meal as shown in Table 1 revealed that the MLM contained 27.53% crude protein, 9.93% ether extract, 14.05% crude fibre, 7.98% Ash and 40.51% nitrogen free extract. These values were similar to the result of Fuglie (13) who also observed crude protein of 29%, lower ether extract value (5.20%), higher crude fibre (19.10%) as compared to result obtained in this study. The growth response of rabbits to varied inclusion levels of MLM in the diets is as shown in Table 4.The final body weight and the daily weight gain of rabbits fed T1 (0% MLM) and T3 (10% MLM) were apparently higher than those fed T2 (5% MLM) and T4 (15% MLM) but the treatment means were not significantly different. The dry matter intake of rabbits fed MLM- based diets was not significantly different from those that fed control diet. The FCR values of experimental animals were not significantly influenced by the dietary treatments. However, the values apparently increased with increase in the level of MLM in the diets. This may probably be an indication of improper utilization of the diets which was pronounced in rabbits fed 15% as compared to others.

Table 1: Chemical composition of air dried Moringa leaf meal (MLM).

Nutrient	Composition (%)
Moisture	9.28
Dry matter	90.72
Crude protein (CP)	27.53
Ether Extract (EE)	9.93
Crude Fibre (CF)	14.05
Ash	7.98
Nitrogen Free Extract (NFE)	40.51

The dry matter intake (DMI) was apparently higher in rabbits fed 10% MLM followed by rabbits fed 5% and 0% MLM, but was lower in rabbits fed 15% MLM, however, the treatment means were not significantly (*P*>0.05) different among the treatments. This trend in feed intake by the rabbits on 10 and 5% MLM may probably be as a result of the fact that leaf meals contain relatively high fibre which tends to increase the total fibre content of the diet and dilute other nutrients. Rabbits eat to meet their energy requirement to sustain rapid growth and development, hence, the increased feed intake. This assertion generally agrees with the findings by other researchers (14, 15). The result, however, contradicted the findings by Nworgu *et al*. (16) who reported a reduction in feed intake by rabbits on increased forage meal in the diet.

The performances of the growing rabbits fed the various diets were not significantly influenced by the dietary treatments. The apparently low final body weight and the average weight gain of rabbits fed 15% MLM may probably be attributed to low dietary energy of the diet. This result agrees with the findings of (17). The apparently low average daily weight gain in rabbits fed 15% therefore suggests that the MLM diets may probably contain tannin which has been found to affect digestibility and therefore the rate of utilization of dietary nutrients in non-ruminant is reduced (18, 19). Also saponin which has been observed to be present in moringa leaves have been reported to cause depression in feed intake (20). The feed conversion ratio of rabbits fed 5%, 10% and 15% MLM that was apparently increased with increasing level of MLM which might have also contributed to the apparently reduced growth rate and weight gain by the rabbits on the MLM-based diets as compared to the control. This implies that the animals on high MLM inclusion levels require more feed to gain a unit weight than those on the control diet. This could be attributed to low dietary energy level in the MLM based diets since the energy level of MLM is lower than the soyabean meal replaced.

Table 4: Growth indices of growing rabbits fed varied levels of MLM based diet

	Dietay levels of Moringa leaf meal (MLM), %				
Parameters	0	5	10	15	SIG
Average initial live wt. (g)	801	801	801	801	
Average final body wt. (g)	1230±121.8	1145±107.9	1210±111.1	1040±79.7	NS
Average wt. gain (g/day)	6.81±1.7	5.41±2.0	6.49±1.7	3.79±2.5	NS
DMI (g/day)	98.00±5.4	98.17±6.7	100.03±5.4	94.34±5.9	NS
FCR	10.69±2.7	11.94±3.8	12.35±3.9	18.37±9.5	NS

NS = Not significantly different (*P>0.05);* SIG = Significance level FCR: Feed Conversion Ratio DMI: Dry Matter Intake

The apparent nutrient digestibility values of rabbits fed varied moringa leaf meal-based diets are shown in Table 5. The crude protein, crude fibre and ether extract were significantly (*P<0.05*) influenced by the dietary treatment. Crude protein, crude fibre and ether extract and Ash digestibility were significantly (*P<0.05*) higher in rabbits fed MLM based diets than the control rabbits. The least value was recorded in those that fed control diet. The trend observed indicated that the apparent nutrient digestibility of rabbits significantly increased with increase in the level of MLM inclusion in the diets. The significantly higher nutrient digestibility values recorded for rabbits on MLM-based diet was an indication that the presence of MLM in the diets improved and enhanced nutrient digestibility in the animals which tend to increase with increase in the level of MLM in the diets. This might be due to the fact that MLM was more digestible and therefore improve the digestibility of the total diet in MLM-based diets. Fahey *et al.* (21) reported that moringa is an outstanding indigenous source of highly digestible protein. The nutrient digestibility values of this study are generally higher than the 55.72-64.35% (DM), 26.28-62.48% (CP), 8.40-48.53% (CF) and 65.0-69.00% (EE) reported in earlier studies (22, 23, 24) in the tropics. This observation may be as a result of the highly digestible nature of moringa leaves which shows that it is a promising good feed additive.

Table 5: Apparent nutrient digestibility of growing rabbits fed varied levels of moringa leaf meal

	Dietay inclusion levels of Moringa leaf meal (MLM), %				
Nutrient intake	0	5	10	15	Level of Sig
Crude protein	86.08±0.05^{d}	88.73±0.05^{c}	93.33±0.13^{a}	91.09±0.26^{b}	*
Ether extract	86.49±0.13^{c}	87.80±1.32^{bc}	92.37±0.61^{a}	90.32±0.98^{ab}	*
Ash	82.65±1.11^{c}	86.08±1.04^{b}	90.61±0.59^{a}	87.93±0.98^{ab}	*
Crude fibre	72.89±1.74^{d}	78.29±0.73^{c}	88.00±0.33^{a}	83.84±0.54^{b}	*
NFE	73.93±0.04^{d}	79.60±0.24^{c}	88.54±0.20^{a}	85.74±0.31^{b}	*

a,b,c,: Means along the same row with different superscripts are significantly (P<0.05) different. SIG (*) = Significance level ($P<0.05$) NFE: Nitrogen Free Extract

Conclusion and Application

Based on the results of this study, it can be concluded that

1. Moringa leaf meal could be used to improve daily weight gain, and dry matter and crude protein digestibility of rabbits.
2. Moringa leaf meal up to 10% in rabbit diet can be considered optimumfor rabbit.

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