



EFFECTS OF MORINGA LEAF MEAL (Moringa oleifera) ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY IN RABBIT

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ABSTRACT

This study assessed the effects of Moringa oleifera leaf meal (MOLM) supplementation on the growth performance, feed efficiency, and nutrient digestibility of weaner rabbits. The eight weeks experiment was conducted at the rabbitry unit of Tai Solarin University of Education, Ogun State, Nigeria, with 16 Hyla breed weaner rabbits randomly assigned to four dietary treatments: 0% (control), 0.5%, 1.0%, and 1.5% MOLM inclusion. Each treatment had two replicates, with two rabbits per replicate. Performance metrics, including feed intake, body weight gain, and feed conversion ratio, were recorded weekly. Digestibility studies were also carried out using fecal samples. The results indicated significant differences (p<0.05) in growth performance across the treatment groups. The final body weight of rabbits fed 1.5% MOLM (T4) was significantly higher (1673.00g) when compared with other treatment groups. Rabbits in the T4 group exhibited the highest body weight gain (1098.00 g), while those in the T2 group recorded the lowest gain (250.00 g). Feed intake was highest in the T3 group, with an intake of 2247g, while the control group (T1) consumed the least (1863.5 g). Feed conversion ratio was most favorable in the T4 group, with a feed conversion ratio (FCR) of 1.79, while the T2 group had the least favorable FCR at 7.69. Nutrient digestibility was also significantly influenced by MOLM supplementation. The highest crude protein digestibility (65.23%) was obtained in the T4 group (1.5% MOLM), whereas the lowest (55.46%) was seen in T1 (0.00% MOLM). Crude fiber digestibility ranged from 20.10% in T3 to 35.08% in T2. The ether extract digestibility was highest in T3 (68.71%) and lowest in the T1 group (59.34%). In conclusion, MOLM supplementation, particularly at 1.5%, improved the growth performance, nutrient digestibility and feed conversion ratio of weaner rabbits. It is therefore recoomended that 1.5% moringa leaf meal can be added to rabbit feed to improve performance and digestibility

Keywords: Digestibility, Performance, Moringa oleifera, Rabbit, Feed

INTRODUCTION

Rabbit meat is characterized by high protein, high lysine, high phospholipids, low fat, low cholesterol, and low calories. It possesses a high nutritional content and favorable health index (Frunza *et al.*, 2023). The profitability of rabbit farms is partly dependent on the effectiveness of weaned rabbits to grow healthy and to protect them from high mortality rates during the fattening period. Antibiotics are frequently used in the diets of growing rabbits because digestive disturbances are the main reason for morbidity and mortality in the rabbit industry (Zotte *et al.*, 2016). As a consequence of the European ban on antibiotic growth promoters (AGPs) and increased consumer awareness about the consumption of healthy and safer animal products, researchers and feed companies have been encouraged to seek new animal feeding approaches to substitute AGPs and synthetic antioxidants (Zotte *et al.*, 2016). Phytogenic feed additives and/or their extracts are being progressively used in animal nutrition due to their beneficial phytochemical compounds. These active components





have been shown to augment appetite, improve carcass yield, enhance digestive enzyme secretion, and stimulate an immune response, and encourage antibacterial and antioxidant properties (Zotte *et al.*, 2016).

Medicinal plants and their extracts are widely used for multiple medicinal purposes all over the world (Husain et al., 2023). Due to their huge extracts and bioactive ingredients, they could be utilized in the management, control, and treatment of many disorders (Rouhi-Boroujeni et al., 2017, Ayeni et al., 2023). A medicinal plant could be defined as any plant that contains bioactive ingredients used in therapy or contains a precursor for drug manufacture (Bhat et al., 2021). Moringa oleifera (MO) is a medicinal plant belonging to the Moringaceae family. Its bioactive material is utilized in the treatment of a huge number of disorders with magical and amazing results to the extent that it is called a miracle tree (Abdel Shakour et al., 2023). Its bioactive components have antipyretic, antioxidant, antiantidiabetic, antihypertensive, inflammatory, antiaging, immunomodulatory, hepatoprotective, and diuretic. Furthermore, recently, the plant has been approved to have antiparasitic activity (Hu et al., 2023), neuroprotective and cerebroprotective (Azlan et al., 2022, Cuschieri et al., 2023), and antiproliferative activity against cancers (Moremane et al., 2023). Despite the high crude protein content of moringa leaf, there is little information available on the use of the unconventional feed resources especially as alternative protein supplement for rabbit production. Also, the wide application of in-feed antibiotics in poultry, rabbits and other non-ruminant animal production has created public health hazards. This study is therefore conducted to determine the effect of supplementing Moringa oleifera leaf on performance and nutrient digestibility of rabbit.

MATERIAL AND METHODS

Experimental Site

The eight weeks experiment was carried out at the rabbitry unit of the teaching and research farm of Tai Solarin University of Education, Ijagun, Odogbolu Local Government, Ogun State. Ijagun is 63 meters above sea level with a tropical climate. The short dry has little effect on the overall climate. The temperature here averages of 26.0°C/78.8°F. During the year the average temperature varies by 3.3°C/37.9°F. There is significant rainfall in most months of the year with an annual rainfall of 2020mm/79.5 inch per year. There is 37mm/1.5 inch of precipitation in January between the driest month and the wettest month.

Experimental Animals and Design

Sixteen weaned rabbits (Hyla breed) were allotted to four experimental diets in a Completely Randomized Design (CRD). Each treatment was replicated two times with each replicate having 2 rabbits. Four experimental diets were formulated to include: diet 1 (control or basal) with no moringa leaf supplement; diet 2 (basal + 0.5% moringa leaf supplement); diet 3 (basal + 1.0% moringa leaf supplement); diet 4 (basal + 1.0% moringa leaf supplement); diet 4 (basal + 1.0% moringa leaf supplement). The diets were formulated to meet the nutrient requirement of rabbits in line with NRC (1994).





I reatments/Diets					
Ingredients (%)	T1	T2	Т3	T4	
Groundnut Hay	37	36.5	36	35.5	
Moringa Powder	0	0.5	1.0	1.5	
Yellow Maize	17.5	17.5	17.5	17.5	
Soya bean Meal	17	17	17	17	
Millet	10	10	10	10	
Wheat Bran	14	14	14	14	
Brown Sugar	2	2	2	2	
Limestone	1	1	1	1	
Di-calcium Phosphate	0.7	0.7	0.7	0.7	
Common Salt	0.5	0.5	0.5	0.5	
Premix	0.3	0.3	0.3	0.3	
Total	100	100	100	100	
Calculated nutrients					
Crude protein (%)	21.77	21.78	21.78	21.79	
M. Energy (Kcal/kg)	1713.79	1711.99	1710.05	1707.87	
Crude Fiber (%)	3.44	3.82	4.22	4.57	

Table 1: Gross Composition (%) of Experimental Diets for Growing Rabbits

Management of Experimental Animals

The standard procedures for managing rabbits was adopted during the study. The animals were fed ad libitum while fresh, clean and cool water was provided.

Data Collection

Body weight measurement

The weight of the rabbit measured upon the commencement of the study represents the initial weight while the final weight gain was the weight of rabbits at the end of the experiment

Body weight gain measurement

The body weights gains of the rabbits were measured with measuring scale every week, after adaptation period. The difference in the final weight of the rabbits at the end of the experiment and the initial weight is the weight gain.

Feed intake and feed conversion ratio

The feed consumed in each treatment were calculated by the difference in the feed supplied daily and the leftovers while the feed conversion ratio (FCR) is the ratio of feed intake to body weight gain and calculated thus:

Feed conversion ratio = feed intake

body weight gain

Digestibility studies

Digestibility studies were carried out on the rabbits during the last week of the experiment in a metabolic cage. Fecal samples were collected over the period of five (5) days. One (1) rabbit from each of the four (4) treatments was used for digestibility studies. The faecal droppings collected were oven-dried for a period of 18 hours at a temperature of 105^{0} C and weighed until a constant weight was obtained.

At the end of the collection period, the fecal samples collected from each replicate were taken for proximate analysis by the method of AOAC (2009), and the results obtain were used to calculate the apparent digestibility by using the formula below: Apparent digestibility coefficient (%) =





Nutrient in feed – Nutrient in faeces x 100 Nutrient in feed 1

Data Analysis

Data obtain were subjected to analysis of variance (ANOVA) statistical analysis software (SAS, 2012) and mean were separated using the Duncan multiple range test (1955)

RESULTS AND DISCUSSION

Proximate Composition of Dried Moringa oleifera leaves

The result of the proximate composition of the *Moringa oleifera* leaf meal (MOLM) are presented in table 2. The MOLM was found to be rich in crude protein (5.31%), dry matter (89.71%), crude fibre (6.85%), Ash (6.13%), Fat (4.70%), Nitrogen Fixed Extract (66.73%), Calcium (1.51%) and phosphorus (0.82).

Parameters	% composition (%)			
Dry matter	89.71			
Crude protein	5.31			
Crude fiber	6.85			
Fat	4.70			
Ash	6.13			
NFE	66.73			
Phosphorus	0.82			
Calcium	1.51			

Table 2: Proximate Composition of Dried Moringa oleifera Leaf (%DM basis)

Performance of Weaner Rabbits fed Different Inclusion Levels of *Moringa oleifera* in the Diet

The performance of rabbits given various diets with or without *Moringa* is shown in Table 3. The result indicates that there were significant differences in the final body weight. The rabbits on T4 which consumed 1.5% moringa recorded the highest final weight (1673.00g), while the rabbits on T2 that consumed 0.5%/ of moringa recorded the least body weight (845.00g). There was significant difference (p<0.05) in the body weight gain of the rabbits, with the highest value (1098.00g) being recorded in T4 while the least value for weight gain (250.00g) was recorded in T2 with 0.5% Moringa inclusion. The rabbits on T4, that were fed a 1.5% Moringa diet, were the most efficient in converting the feed, as recorded by their lowest feed conversion ratio (1.79). Although the feed conversion ratio values in treatments 1 and 3 (4.41 and 3.31) were similar, they were significantly less than the number in T2 (7.69) which indicates better efficient utilisation of feed than in treatment 2.

The significantly increased weight gain in treatments 3 and 4 corroborate those of El-Badawi *et al.*, (2014) and El-Wardany *et al.*, (2015), who found that rabbits fed diets supplemented with 0.15% and 0.30% moringa exhibited superior body weight, average daily gain, and feed conversion ratio compared to the control group. When Helal *et al.*, (2017) fed 0.5% *Moringa oleifera* to rabbits, similar result was reported. Both Abubakar *et al.*, (2015) and Mankga *et al.*, (2022) observed a similar trend in the body weight and feed conversion ratio of the rabbits fed *Moringa oleifera* meal. Bioactive compounds, minerals like calcium, magnesium, and phosphorus, amino acids like lysine and methionine, and certain vitamins which are present in *Moringa oleifera* may be responsible for rabbits performance. According to some researchers (Ahmed, 2017; Briones *et al.*, 2017; El-Desoky *et al.*, 2018;





Mahfuz and Piao, 2019; Sebola *et al.*, 2017), these compounds mentioned previously promote animal development. Furthermore, *Moringa oleifera* was shown to enhance the quantity of beneficial gut microorganisms in rabbits, which improved their productive performance (El-Badawi *et al.*, 2017).

According to Hashem *et al.*, (2017) and Soltan *et al.*, (2018), amides/alkaloids and organosulphur compounds are present in moringa leaves. These substances have a potent effect on harmful bacteria. Moreover, it has immunomodulatory and anti-inflammatory qualities (Khatab *et al.*, 2016 and Hashem *et al.*, 2017). These substances could strengthen the microbiome in the rabbit's gut, which would strengthen its immune system and digestive system and consequently raises body weight and enhances the digestibility of fiber and crude protein, which accounts for the improved feed conversion ratio.

Furthermore, flavonoids and the high concentration of vitamins C and A found in moringa leaves (Konmy *et al.*, 2016 and USDA, 2016) function as potent antioxidants and can counteract the negative effects of an excess of free radicals brought on by heat stress. Therefore, it is possible that *Moringa oleifera's* excellent supply of nutrients, including crude protein, minerals, organosulfur chemicals, amides/alkaloids, phenolic compounds, and antioxidants, is the reason for the boost in productive performance shown in rabbits in this study.

Parameters	T1	T2	T3	T4	SEM
	Contol (No	0.5%	1%	1.5%	
	Moringa)	MOLM	MOLM	MOLM	
Initial weight(g)	650.50	595.00	580.00	575.00	2.39
Final weight (g)	1028.5°	845.00 ^d	1259.00 ^b	1673.00 ^a	14.07
Weight gain (g)	423.00 ^c	250.00^{d}	679.00 ^b	1098.00^{a}	9.68
Feed intake (g)	1863.50 ^b	1923.00 ^b	2247.00 ^a	1970.00 ^b	31.67
Feed Conversion Ratio	4.41 ^b	7.69 ^a	3.31 ^b	1.79°	0.28
Mortality (%)	25.00 ^a	0.00^{b}	0.00^{b}	0.00^{b}	8.84

Table 3: Performance of Rabbits Fed with Moringa oleifera Leaf Meal in the Diets

^{A,B,C,} Means on the same row with different superscripts are significantly different (P<0.05). SEM= standard error of mean. MOLM= *Moringaoleifera* leaf meal

Nutrient Digestibility of Weaner Rabbits Fed Moringa oleifera Leaf Meal in the Diets

It was observed that apparent digestibility of Crude Protein and Crude Fiber differed significantly (p<0.05). Digestibility of Crude protein range from 55.46 to 65.23% in T1 and T4, while digestibility Crude fiber ranges from 20.10 to 35.08 in T3 and T2 respectively. The digestibility for Ether extract ranged from 59.34 in T1 to 68.71 in T3 while digestibility of ash were similar (p>0.05) all through. Nutrients digestibility and nutritive values of growing rabbits as affected by feeding *Moringa* leaves supplemented diets showed that the incorporation of the different levels of dried *Moringa* leaves in growing rabbit diets resulted in varying values in the digestibility coefficients of crude protein crude fiber, ether extract and Ash. The increased digestibility coefficients of crude protein (CP) and crude fiber (CF) in rabbits fed diets supplemented with 1.5% (T4) and 0.5% (T2) of moringa leaf meal, compared to the control could be attributed to the optimal inclusion of moringa leaf meal at these levels. Moringa leaves are rich in nutrients and bioactive compounds that can enhance digestive efficiency. According to Henrrietta (2023), moringa contains enzymes and essential nutrients that improve the digestibility of proteins and fibers in animal diets. El-Aidy *et al.* (2017) stated that crude protein digestibility of suckling buffalo calves was





significantly (P<0.05) higher in diets containing up to 15% dried *Moringa oleifera* leaves compared with those fed the control ration. The rabbis feed 1% *Moringa oleifera* present the highest digestibility coefficient values of ether extract (EE) followed by those fed diet 1.5% with the least value (59.34) in the control group without Moringa supplementation. In a similar study, Muhammad *et al.* (2016) showed that the digestibility coefficients of EE in lactating buffaloes were higher (P<0.05) by 11.32% in group fed *Moringa* containing diet compared to those fed the control diet. According to Rahajo (2011), high ether extract digestibility is directly related to the ability of the animals to utilize dietary fat.

Diets					
Parameter	T1	T2	Т3	T4	SEM
Dry matter (%)	2.95	3.99	3.24	2,5	0.01
Crude Protein	55.46°	58.75°	60.61 ^b	65.23ª	10.02
(%)					
Crude Fiber (%)	25.90°	35.08 ^a	20.10 ^d	31.99 ^b	14.02
Ether Extract (%)	59.34°	59.50°	68.71ª	65.31 ^b	9.01
Ash (%)	59.04	53.89	55.75	53.94	0.01

 Table 4: Nutrient Digestibility of Weaner Rabbits Fed Moringa oleifera Leaf Meal in the Diets

^{a,bc,} Means on the same row with different superscripts are significantly different (P<0.05). SEM= standard error of mean. MOLM= *Moringa oleifera* leaf meal

CONCLUSION AND RECOMMENDATION

Based on the findings from this study, *Moringa oleifera* leaf meal (MOLM) supplementation in rabbit feed at inclusion level of 1.5%/ improves the animals' growth performance (final live weight and average weight gain and better FCR) and nutrients digestibility of the rabbits. We therefore recommend that *Moringa oleifera* be used in rabbit feed as supplement in order to have positive effects on the health, growth, and nutritional value of the rabbits. However, further study to promote enhanced methods of producing the *Moringa* plant is required to help farmers produce the meal at a cheaper cost for profitable usage in animal feeding.

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