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# EVALUATION OF THE EFFECT OF MORINGA (*MORINGA OLEIFERA)* LEAF MEAL SUPPLEMENTATION ON THE GROWTH AND LINEAR BODY MEASUREMENT OF GROWER RABBITS.

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## ABSTRACT

This study was carried out to assess the effect of moringa leaf meal supplementation on the growth and linear body measurement of grower rabbits. Twenty (20) grower rabbits were randomly distributed to four treatments groups in a completely randomized design (CRD). Each treatment was replicated five times with one rabbit per replicate and were fed on diets containing moringa leaf meal at 0.00%, 8.00, 16.00 and 24.00% respectively. Sample of the moringa leaves was analyzed for proximate and Phytochemical composition respectively. Growth parameters such as initial weight, final weight were measured, weight gain, The linear body measurement was also recorded. The results of proximate composition of the moringa leaf meal (MLM) showed that it contained 26.62% of Crude protein,7.20% of Crude Fiber,5.65% of Ether extract,7.50% of Ash and 53.03% of NFE. The result of Phytochemical analysis showed that MLM contained 3.29mg/100g of tannin,6.40 mg/100g of flavonoid,4.25 mg/100g of alkaloid,3.75 mg/100g of saponin and 3.23 mg/100g of oxalate. Weight gain and feed intake were not significantly ($p>0.05$) different across the dietary treatment groups**.** However, final weight was significantly ($p<0.05$) higher for the rabbits on the MLM diets. The results of the linear body measurement showed a positive and significant correlation between the final body weight and body length with a coefficient of 0.22 and 0.21 respectively. Therefore, it was concluded that moringa leaf meal is rich in vital nutrients and has the potential of sustaining growth, hence 24% inclusion of moringa leaf meal in the diets of grower rabbit is safe.

**Keywords:** Moringa; Leaf meal; Growth; Rabbits; Linear body measurement

## INTRODUCTION

Insufficient supply of animal protein from livestock such as cattle, sheep, goats, pigs and chicken is the basis for the decline in animal protein consumption in many developing countries of the world as pointed out by (FAO, 2006). There is therefore, the need to explore the use of alternative feed resources that have the potential to yield the same output as conventional feeds, and perhaps at cheaper cost. Hence, any similar high protein ingredients which could partially or completely substitutes soyabean meal or fish meal is desirable. 125This strategy could help to reduce the cost of production, and ensure cheaper meat production there by making available the major crops for human consumption (Bhatt and Sharma, 2010). Lowering of feed cost using cheaper and unconventional feed resources is an important aspect of commercial rabbits production (Vasanthakumar *et al*., 1999; Bhatt and Sharma, 2010; Muriu *et al*., 2015). "A possible source of cheaper protein is the leaf meals of some tropical legume browse plants". Leaf meals do not only provide protein source but also some essential vitamins such as vitamins A and C, minerals and oxycarotenoids. According to Foidl *et al*. (2001) "extraction of moringa leaves in 80% ethanol contain cytokinine type hormones". The constraints to promote the utilization of leaf meals is basically due to factors 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 horseradish tree or drumstick tree, as a protein source for livestock (Makker and Becker, (1996; 1997); Sarwatt *et al*., 2012)). Moringa leaves has high nutritional profile that make it a potential replacement for soyabean meal or fish meal in non-ruminant diets. Moringa can easily be established in the field, has good coppicing ability, and also, it has the potential of yielding high quality forage at a cheaper rate due to favourable soil and climatic conditions. Sarwatt *et al*. (2009) reported that moringa foliages are a potential inexpensive protein source for livestock feeding. The advantages of using moringa for 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* belong to the group of high-yielding nutritious browse plants with every part having food value "(Duke, 2007). This study was therefore conducted to determine the growth performance and nutrient digestibility of grower rabbits fed diets containing graded levels of moringa leaf meal.

## MATERIALS AND METHODS

### Experimental site Location

The experiment was carried out at the rabbit unit of the department of animal science teaching and research farm, Ahmadu Bello University Zaria. Zaria is within the northern guinea savanna zone of Nigeria, with latitude 110 140' 44'' N and longitude 70 38'65'' E at an altitude rainfall of 700-1400mm. (Institute for Agricultural Research 2019 to 2020).

**Source of moringa leafs and processing of moringa leaves**

The moringa leaf used for the experiment was purchased from an open market in Giwa local government area in Zaria, Kaduna state. The leaves were allowed to dry at room temperature into crispy form and were bagged until when needed.

**Proximate and chemical analyses of moringa leaf meal**

Sample of the moringa leaf meal taken to the Biochemical laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria.for proximate analysis to determine the dry matter, crude protein, crude fiber, ether extract and ash contents, according to AOAC (2005).

**Determination of phytochemical contents of moringa leaf meal**

Sample of the moringa leaf meal was analyzed for the presence of anti-nutritional factors such as Alkaloids, flavonoids ,Tannin, saponin and oxalates.

**Experimental animals and management**

A total number of twenty growers rabbits of mixed breeds and sex of about 8 to 9 week were used for this experiment. The average body weight of the rabbits ranged from 788g to 845g. They were purchased from department of veterinary medicine Ahmadu Bello University Zaria. The animals were allowed to stay for one week for acclimatization with the environment. They were given prophylactic treatment against internal and external parasites by subcutaneous injection of invomectin (0.2ml/rabbit) and a broad spectrum antibiotics (Oxyteracyline L.A) before the commencement of the experiment. The rabbits were raised under a clean and hygienic environment, this was to ensure good health condition throughout the period of the experiment. The rabbits were housed in wire hutches and were provided with feeders and drinkers. Fresh water and feed was provided for the rabbits *adlibitum*.

**Experimental design**

A total number of twenty (20) of grower rabbits were used for the experiment. The animals were randomly allotted to four treatments groups in a completely randomized design (CRD). Each treatment was replicated five times with one rabbit per replicate. The rabbits were housed in an individual hutch. Four experimental diets were formulated containing moringa leaf meal at 0.00%, 8.00, 16.00 and 24.00% respectively as shown in Table 1. The feeding trial lasted for the period of 8 weeks.

**Growth performance and Linear body measurement**

The initial weight of the animals was recorded at the beginning of the study. Live weight and feed consumption of the rabbits were recorded on weekly basis, while the weight gain, feed conversion ratio were calculated. The linear body measurement (LBM), were taken based on the anatomical reference points for physical body measurement of rabbits described by Yakubu and Ayoade (2009). The LBM taken includes: Body length (Distance from the tip of the shoulder to the tail base), Tail length (Distance measured from the base of the tail to the tip),Ear length (measured from the base of the ear to tip), Head to shoulder length (measured from the tip of nose to the end of shoulder), Length of forelimb (measured from tip of fore toe nail to the shoulder), Length of hindlimb (measured from the tip of the toe to the hock).

**Table 1: Gross Composition of the experimental diet.**

| | Inclusion Levels of Moringa Leaf Meal (%) | | | |
|---|---|---|---|---|
| **Ingredients (%)** | **T1** | **T2** | **T3** | **T4** |
| Maize | 30.00 | 30.00 | 29.00 | 33.00 |
| GNC | 20.00 | 15.00 | 10.00 | 5.00 |
| Maize offal | 32.00 | 30.00 | 29.20 | 25.20 |
| Rice offal | 15.00 | 15.00 | 14.08 | 10.00 |
| Moringa leaf meal | 0.00 | 8.00 | 16.00 | 24.00 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |

Vitamin premix supplied the following vitamins and trace elements per kg diet: vit A (7812.5 IU), vit D3 (1562.5 IU), vit E (25.0mg), vit K3 (1.25mg), vit. B1 (1.8mg), vit B2 (3.44mg), niacin (34.4mg), calcium pantothenate (7.19mg), vit B3 (3.1mg), vit B12 (0.02mg), choline chloride (312.5mg), folic acid (0.6mg),

biotin (0.1mg), manganese (75mg), iron (62.5mg), zinc (50.0mg), copper (5.3mg), iodine (0.9mg), cobalt (0.2mg), selenium (0.1mg), antioxidant (75mg).

## RESULT AND DISCUSSION

### *Proximate Analysis of Moringa (Moringa oleifera)* leaf

The results of the proximate composition of the moringa leaf meal (MLM) are as shown in Table 2. The result obtained showed that MLM contained appreciable nutrients that can support growth and general performance of livestock. Crude protein contents in MLM was 26.62%, Crude Fiber (7.20%), Ether extract (5.65%), Ash (7.50%), and NFE (53.03%). The value obtained for crude protein in this study was slightly lower than the CP values of 27.1% and 27.51% reported by Booth and Wickens (1988) and Oduro, *et al*. (2008) respectively. However, it could serve as an alternative source of protein in rabbits diets. The values recorded for the Nitrogen free extract (NFE), and Ash for the MLM in the present study were, however, similar to those reported by Oduro *et al*. (2008). The crude fiber value of 7.20% was lower than the 19.20% reported by Booth and Wickens (1988). The variations in the nutrients may be due to the age of cutting or harvesting, climatic conditions, edaphic factors, agronomic practices as well as methods of processing and analysis (Fuglie, 1999).

### *Phytochemical composition of Moringa oleifera leaf*

The phytochemical content of *Moringa oliefera* leaf is presented in Table 3. The result showed that the leaf contains tannin, flavonoid, alkaloid, saponin and oxalate content of 3.29 mg/100g, 6.40 mg/100g, 4.25 mg/100g, 3.75 mg/100g and 3.23 mg/100g respectively. These quantitative values obtained in this leaf can be useful for determining the nutritional and therapeutic potential of *Moringa oleifera* leaves. The value reported for total flavonoid in this study, 6.40 mg/100g (64 mg per dry weight) was higher than that reported by Chandra *et al*. (2021) who reported that *Moringa oleifera* leaves had total flavonoid content ranging from 21.9 to 33.5 mg per gram of dry weight. The flavonoid contents suggests the antioxidant properties of moringa leaf and also protective measures against insects and herbivores.

**Table 2 Proximate Composition of *Moringa oleifera* Leaf Meal**

| Parameters | (%) |
|---|---|
| Dry matter | 92.20 |
| Crude protein | 26.62 |
| Crude fibre | 7.20 |
| Ether extract | 5.65 |
| Ash | 7.50 |
| NFE | 53.03 |

NFE = Nitrogen Free Extract

**Table 3 Phytochemical composition of *Moringa oleifera* leaf**

| Parameters | Composition (mg/100g) |
|---|---|
| Tannin | 3.29 |
| Flavonoid | 6.40 |
| Alkaloid | 4.25 |
| Saponin | 3.75 |
| Oxalates | 3.23 |

### *Growth performance rabbit fed diet containing graded levels of Moringa oleifera leaf meal*

The final weight was significantly ($p<0.05$) higher for the rabbits on the MLM diets as shown on Table 4 . This result corroborate the finding of Bamikole, *et al*. (2005) who reported an increase in daily weight gain after feeding rabbits with mulberry leaves based diets, but conflicts with that of Famounyan and Meffega (1986) who reported low body weight gain in rabbits fed sun-dried cassava leaves diets in the tropics. In the present study, weight gain and feed intake were not significantly ($p>0.05$) across the treatment groups**.** The observed improved final weight in rabbits fed MLM based diets across the treatments is an indication of the Vitamin contents of the MLM. Vitamin A plays a vital role in rabbit growth. MLM is reported to have a high vitamin A (Booth and Wickens, 1988; Grubben and Denton, 2004; Fuglie, 2005). Pond *et al*. (1995) stated that vitamin A deficiency in the diets of rabbits makes the rabbits to exhibit poor growth.

**Table 4 Growth performance of grower rabbits fed diets containing graded levels of *Moringa oleifera* leaf meal**

| | Inclusion Levels of Moringa Leaf Meal (%) | | | | |
|---|---|---|---|---|---|
| **Parameters** | **0.00** | **8.00** | **16.00** | **24.00** | **SEM** |
| Initial weight (g) | 816.00 | 788.20 | 807.60 | 845.00 | 40.37 |
| Final weight (g) | 1119.20$^{ab}$ | 1080.80$^{b}$ | 1114.00$^{ab}$ | 1193.40$^{a}$ | 47.51 |
| Weight gain (g) | 303.20 | 292.60 | 306.40 | 348.40 | 43.74 |
| Feed Intake (g) | 2750.80 | 2526.20 | 2660.60 | 2524.00 | 154.78 |
| FCR | 9.41$^{ab}$ | 9.62$^{b}$ | 8.96$^{a}$ | 9.31$^{ab}$ | 0.31 |
| Feed cost (₦/kg) | 176.00 | 204.00 | 233.00 | 269.50 | NA |
| FC/Kg gain (₦/kg) | 1655.56$^{a}$ | 1962.47$^{ab}$ | 2088.10$^{b}$ | 2507.99$^{c}$ | 192.75 |

$^{abc}$Means with the same letter superscript along the same row are not significantly different, SEM: standard error of mean.

**Relationship between growth and linear body measurement of grower rabbits fed dietary levels of *Moringa oleifera* leaf**

The correlation between the linear body measurement of grower rabbits and body weight is presented in Table 5. The result showed that the relationship between the treatments and final body weight and body length were significant and positive with a coefficient of 0.22 and 0.21 respectively, implying a low level of relationship. This means that as levels of moringa in the diet increases, the final body weight (FBW) and body length (BL) slightly increases. This higher body weight and length as result of increase in levels of *Moringa oleifera* leaves meals indicates higher nutrient availability. This implies that higher final weight and weight gain in growing rabbits could be predicted with increase in nutrient availability. This corroborate to the findings of Martínez-Vallespín *et al*. (2018) who reported that rabbits fed a high-fiber diet had lower body weight, body length, and chest circumference than rabbits fed a low-fiber diet, indicating slower growth where as those fed high quality diet had higher body weight.

The morphometric traits; ear length, length of fore limbs, head to shoulder length were positively correlated with treatments. This indicates positive relationship, implying increase the traits as levels of test material increases. However, feed intake (FI) do not showed any significant relationship with any trait nor the treatment which means, that the inclusion of *Moringa oleifera* leaf meal in growing rabbits diets do not have any significant effect on their feed consumption. Gidenne and Feugier (2010), investigated the relationship between individual characteristics and variability in BLMs of growing rabbits. The results showed that body weight, body length, and chest circumference were highly correlated, while heart girth and rump width were less correlated. The study concluded that BLMs can be useful for monitoring growth and nutritional status in growing rabbits, but that individual variability should be taken into account when interpreting the data. In another study, Zembal and Wierzbicka (2012) reported that body weight,

**Table 5 Correlation between growth and linear body measurement of grower rabbits fed diets containing graded levels of *Moringa oleifera* leaf meal**

| | **Trt** | **FBW** | **WG** | **FI** | **EL** | **EW** | **LF** | **LH** | **TL** | **HS** | **BL** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trt** | 1.00 | | | | | | | | | | |
| **FBW** | 0.22** | 1.00 | | | | | | | | | |
| **WG** | 0.03 | 0.47*** | 1.00 | | | | | | | | |
| **FI** | 0.15 | 0.09 | 0.04 | 1.00 | | | | | | | |
| **EL** | 0.22** | 0.47*** | 0.28*** | 0.12 | 1.00 | | | | | | |
| **EW** | 0.08 | 0.42*** | 0.09 | 0.07 | 0.62*** | 1.00 | | | | | |
| **LF** | 0.18* | 0.64*** | 0.27*** | 0.09 | 0.40*** | 0.47*** | 1.00 | | | | |
| **LH** | 0.11 | 0.64*** | 0.23** | 0.03 | 0.50*** | 0.53*** | 0.80*** | 1.00 | | | |
| **TL** | 0.14 | 0.62*** | 0.25** | 0.03 | 0.59*** | 0.67*** | 0.56*** | 0.62*** | 1.00 | | |
| **HS** | 0.27*** | 0.54*** | 0.27*** | 0.09 | 0.31*** | 0.26*** | 0.46*** | 0.43*** | 0.30*** | 1.00 | |
| **BL** | 0.21** | 0.63*** | 0.37*** | 0.12 | 0.37*** | 0.23** | 0.50*** | 0.44*** | 0.40*** | 0.50*** | 1.00 |

*Significant at 10%, **Significant at 5%, ***Significant at 1%, Trt: Treatment, FBW: final body weight, WG: weight gain, FI: feed intake, EL: ear length, EW: ear width, LF: length of fore limbs, LH: length of hind limbs, TL: tail length, HS: head to shoulder, BL: Body length.

**Table 6 Nutrient digestibility of grower rabbits fed graded dietary levels of Moringa leaf meal**

| | Inclusion Levels of Moringa Leaf Meal (%) | | | | |
|---|---|---|---|---|---|
| **Parameters** | **0.00** | **8.00** | **16.00** | **24.00** | **SEM** |
| **Dry matter (%)** | 64.32 | 64.20 | 64.25 | 63.30 | 1.04 |
| **Crude protein (%)** | 76.25$^{c}$ | 78.66$^{b}$ | 79.11$^{ab}$ | 79.97$^{a}$ | 0.44 |
| **Crude fibre (%)** | 76.48$^{d}$ | 77.92$^{c}$ | 79.23$^{b}$ | 81.09$^{a}$ | 0.05 |
| **Ether extract (%)** | 80.61$^{b}$ | 87.20$^{a}$ | 80.79$^{b}$ | 81.66$^{b}$ | 2.56 |
| **NFE (%)** | 56.52 | 55.54 | 54.92 | 53.72 | 2.77 |

$^{abcd}$Means with the same letter superscript along the same row are not significantly different, SEM: standard error of mean.

The apparent digestibility values recorded for rabbits on the various dietary treatments are shown in Table 6. The lower apparent digestibility values recorded for rabbits fed on the control diet (0%MOLM) was somehow unexpected due to its relatively lower crude fibre content as compared to those fed on 8%MLM, 16%MLM), and 24%MLM. This may be an indication of the similarity in the CF contents across the dietary treatments, hence the digestion of the various nutrients investigated were not affected. However, the digestibility of crude protein(CP) was observed to increased with increased in the inclusion level of MLM . This is in agreement with the findings of Fahey *et al*. (2001) who reported that moringa is an outstanding indigenous source of highly digestible protein. The present digestibility values of 64.20 -64.32% for DM, 76.25 - 79.97% for CP, 76.25-81.90% for CF and 80.61-87.20% for EE are generally higher than the 55.72-64.35% for DM, 26.28-62.48% for CP, 8.40-48.53% for CF and 65.0-69.00% for EE reported earlier by Iyeghe-Erakpotobor, *et al* (2006) . This observation may be due to the fact that moringa leaf is highly digestible.

**Conclusion**

It was concluded that moringa leaf meal has adequate nutrients. it contained 26.62% of Crude protein,7.20% of Crude Fiber,5.65% of Ether extract,7.50% of Ash and 53.03% of NFE. And also contained some phytochemicals such as tannin (3.29mg/100g), flavonoid (6.40 mg/100g), alkaloid (4.25 mg/100g), saponin (3.75 mg/100g ) and oxalate (3.23 mg/100g). Therefore, it enhances digestibility and can support the growth of rabbits without negative effect.

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