GROWTH PERFORMANCE AND ORGAN INDICES OF RABBIT BUCKS FED M*ORINGA OLEIFERA* LEAF MEAL

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ABSTRACT

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A twenty-four weeks experiment was conducted to investigate the effect of Moringa oleifera Leaf Meal (MoLM) on performance and some organs in rabbit bucks. Twenty rabbit bucks aged 7 - 8 weeks old with initial weight range of 1.13 - 1.15kg were randomly allocated to four (4) experimental diets containing MoLM at 0, 2.5, 5.0 and 7.5 % levels as diets 1, 2, 3 and 4 respectively. Record on growth performance such as weight gain and feed intake of the bucks were taken weekly throughout the period of the experiment; the feed conversion ratio was also calculated. At the end of the feeding trial, the animals were weighed, stunned and sacrificed. The visceral organs were harvested and weighed. Samples from the visceral organs were taken for histopathological evaluation. The result showed that inclusion of Moringa oleifera leaf meal in the diet of rabbit bucks resulted in reduced weight gain with values (761.72 – 1016.62 g) obtained significantly ($p<0.05$) different among the treatments. The dietary levels of MoLM had no significant effect on the relative weights of heart, liver, spleen, pancreas and kidney while the weights of lungs, adrenal gland and bile were significantly ($p<0.05$) influenced by the dietary treatments. Varying degree of damages was observed in the organs and rated as mild, moderate or severe. This therefore implies that prolonged consumption of MoLM above 2.5% supplemental level may have toxic effect on visceral organs thus negatively influencing the health status of farm animals.

Keywords*: Histopathology; Organ weight; Growth performance; Rabbit; Moringa oleifera Leaf Meal*

INTRODUCTION

In a bid to explore available feed resources such as leaf meals from tropical trees, some have been reported to contain substances that influence growth and development of farm animals (Ayssiwede *et al*, 2011; Alikwe and Omotosho, 2013) and others that may not be beneficial to the animals. The use of leaf meal in livestock feed composition helps to reduce the cost of production (Ayssiwede *et al.*, 2011), enhance reproductive performance (Adeyemi *et al*., 2014), enhance health status and promote growth (Ukanwoko and Okehielem, 2016) of farm animal, thus increasing overall livestock production when used as a feed component or additive.

Moringa oleifera Lam belongs to monogeneric family of shrubs and tree, Moringaceae and commonly known as "Drumstick". Moringa seeds have no dormancy period, so they can be planted as soon as they are mature and they will retain the ability to germinate for up to one year (Fuglie, 1999). The plant possesses many valuable properties which made it of great scientific interest (Fahey, 2005; Anwar *et al*., 2007; Bamisaye *et al*., 2011). It must also be noted that few parts of the tree contain some toxins that might decrease its potential as a source of food for animals or humans (Makkar and Becker, 1997).

Different morphological parts of the tree has been evaluated as a potential animal feed ingredient with the crude protein (CP) content of fresh leaves, soft twigs and stems as 260, 70 and 60 g kg^{-1} respectively (Makkar and Becker, 1997). The leaves had negligible amounts of tannins (12 g kg^{-1}), while trypsin and amylase inhibitors, lectins, cyanogenic glucosides and glucosinolates were not detected. The phytochemical screening of the leaf indicated the presence of flavonoids, tannins, steroid, alkaloid, saponins in the Moringa leaf extracts (Patel *et al*., 2014). The saponin content of the leaves was 80 g kg^{-1} having no haemolytic activity and a phytate content of 21 g kg^{-1} (Makkar and Becker, 1997). The presence of this substance in feed ingredients may produce various responses in farm animals based on the ability of the animals to utilize the feed components.The efficiency of feed utilization can be expressed in organ development in terms of weight and functions. A reduction or increase in the size of an organ maybe an indication of injury or diseased condition. An understanding of the normal structure and function of different tissues is essential for interpreting the changes that occur during disease. Several research findings on leaf meal and its effects on organs have been reported by Amata and Bratte, 2008; Ogbuewu *et al*., 2011; Olafadehan, 2011 and Sese *et al*., 2014. However, there is paucity of information on the effect of MoLM on organs in rabbit. Thus, this study aimed at determining the effect of *Moringa oleifera* leaf meal as a dietary supplement on weight gain, organ weights and organ-histopatology of rabbit bucks.

MATERIALS AND METHODS

Experimental location

The study was conducted at the Rabbitry unit of the Teaching and Research farm, University of Ibadan which is located between latitudes 7°25' to 7°31' N and longitudes 3°41' to 3°56' E. The site has a mean altitude of 220m above sea level and lies in the South-western agro-ecological zone of Nigeria.

Experimental animals and management

Twenty cross bred rabbit bucks (New Zealand white × Chinchilla) aged 7-8 weeks old with weight range of 1.13 - 1.15kg were used for the experiment. The bucks were housed individually in wooden cages that were raised from the floor. The control diet contained 16.34% Crude Protein, 2540.59Kcal/kg digestible energy and 10.51% crude fibre (Table 1). The *Moringa oleifera* leaf meal (MoLM) was air-dried, milled, incorporated into the diet to obtain the four experimental diets and analyzed. The proximate composition of the *Moringa oleifera* leaf meal and experimental diets was determined (Table 2) using the method of AOAC (1990).

Table 1: Gross composition of the experimental (control) diet

Ingredients	Quantity (%)
Maize	42.00
Rice husk	25.00
Soya bean meal	20.00
Wheat bran	10.25
Common salt	0.25
Premix	0.25
Di-calcium phosphate	2.00
Methionine	0.13
Lysine	0.12
Total	100.00
Calculated analysis:	
Crude Protein (%)	16.34
Crude Fiber (%)	10.51
Digestible Energy (kcal per kg)	2540.59

Source: Adeyemi *et al*. (2014)

The bucks were fed the experimental diets for 24weeks after two weeks of acclimatization. Feed and clean water were provided *ad-libitum*. Diet 1 served as the control diet containing no MoLM while Diets 2, 3 and 4 contain MoLM at 2.5, 5.0 and 7.5 % inclusion levels respectively in replacement of the equivalent proportion of the control diet as - Diet 1: 100% Control diet + 0% MoLM; Diet 2: 97.5% Control diet + 2.5% MoLM; Diet 3: 95.0% Control diet + 5.0% MoLM; Diet 4: 92.5% Control diet + 7.5% MoLM

Growth study

All the rabbits were weighed at the beginning of the experiment before they were allocated to the treatments. Record on the performance was taken weekly throughout the period of the experiment. Daily feed was provided *ad libitum* as a known quantity of feed - 70 to 120g/rabbit/day (NRC, 1977) was offered to the animals twice daily depending on their growth requirement per time. Daily feed consumption was recorded and the feed leftover and/or wastage were weighed daily before supplying fresh feed. Record of average daily feed intake and daily body weight gain were taken. Feed Conversion Ratio (FCR) was calculated as the ratio of feed intake to weight gain.

Organ assessment

The bucks on each treatment group were weighed, sacrificed and skinned. The head and paws were removed. The animals were dissected and eviscerated; all the internal organs were removed after which the dressed weights were taken using sensitive digital scale. The direct weights of organs such as liver, kidney, etc were taken using the analytical weighing balance and recorded to the nearest 0.01gram as absolute weight. Paired organs were weighed individually and recorded; both were added together to obtain the paired weight of the organs. Percentage relative weights of the organs were calculated using the formula below:

$$Relative\ weight\ of\ organ = \frac{Absolute\ weight\ of\ the\ organ}{Live\ weight\ of\ the\ rabbits} \times 100$$

Liver, kidney and ileum were carefully removed from the twenty (20) bucks, weighed and fixed in 10% formalin solution and processed for histopatholgical examination at the department of Veterinary Pathology of the University of Ibadan as described by Ewuola (2009). The severity of cell damage observed in each organ was rated as mild, moderate and severe.

Data analysis
Data obtained on growth performance and relative organ weights were subjected to statistical analysis of variance (ANOVA) procedure using Statistical Analytical System (SAS, 2003). Treatment means were compared using Duncan multiple range test of the same software. Result on organ histopathology was analyzed using descriptive statistics.

RESULTS

The proximate composition of the *Moringa oleifera* Leaf Meal and the experimental diet is presented in Table 2. It was observed that the values obtained for crude fibre, ether extract and crude protein were slightly higher than that of the control (diet 1).

Table 2: Proximate composition of *Moringa oleifera* leaf meal and experimental diets

Nutrients	MoLM	Diet 1 0% MoLM	Diet 2 2.5% MoLM	Diet 3 5.0% MoLM	Diet 4 7.5% MoLM
Dry Matter (%)	88.0	90.5	90.4	90.4	90.3
Crude Fibre (%)	11.0	13.7	13.6	13.5	13.4
Ether Extract (%)	13.0	5.00	5.23	5.41	5.76
Crude Protein (%)	27.9	16.8	17.1	17.4	17.6
Ash (%)	11.5	10.0	10.0	10.1	10.1
Nitrogen Free Extract (%)	24.56	45.0	44.5	44.0	43.5

The result on growth performance of rabbit bucks fed varied levels of *Moringa oleifera* leaf meal (MoLM) is presented in Table 3. Inclusion of MoLM in the diet of rabbit bucks resulted in reduction in weight gain. Bucks fed 2.5, 5.0 and 7.5 % MoLM had lower weight gain (761.72 – 871.92 g/rabbit) compared with those fed 0% MoLM (1016.62g/rabbit). Weight gain was significantly ($p<0.05$) influenced by the dietary levels of MoLM. Daily weight gain ranged from 4.54 to 6.05 g/rabbit. No significant effects were recorded in feed intake (83.87 – 85.53 g/rabbit/day) and the feed conversion ratio of the bucks (9.08 - 12.00).

Table 3: Growth performance of rabbit bucks fed varied levels of Moringa oleifera leaf meal

Parameters	Diet 1 (0% MoLM)	Diet 2 (2.5% MoLM)	Diet 3 (5.0% MoLM)	Diet 4 (7.5% MoLM)	±SEM
Initial Weight (g per rabbit)	1136.91	1124.24	1146.32	1126.14	5.13
Final Weight (g per rabbit)	2153.53	1994.48	1908.04	1998.06	51.10
Total Weight Gain (g per rabbit)	1016.62a	870.24b	761.72b	871.92b	52.28
Daily weight Gain (g per rabbit)	6.05a	5.18b	4.54b	5.19b	0.31
Average Feed Intake (g per rabbit per day)	84.71	85. 53	83.87	85.09	0.35
Feed Conversion Ratio	12.0	10.18	9.08	10.25	0.63

a,b -Means in the same row with different superscript are significantly ($P< 0.05$) different

The relative weights of some internal organs of the rabbit bucks fed *Moringa oleifera* leaf meal (MoLM) is presented on Table 4. Lungs, adrenal gland and bile weights were significantly ($p<0.05$) influenced by the dietary treatments but did not follow a similar trend. The relative weight of the lungs was higher (0.93%) in bucks fed 2.5% MoLM with the least (0.55%) in bucks fed 5.0% MoLM. Values obtained for adrenal gland weight was significantly higher (0.3%) in bucks on the control diet than in those fed 7.5% MoLM (0.01%). It was also observed that a significantly highest relative bile weight (0.05%) was recorded in bucks fed diet 3 while those fed diet 4 had the least weight (0.02%). The levels of MoLM fed to the bucks had no significant effects on the relative weights of heart, liver, spleen, pancreas and kidney.
The result on organ histopathology of liver, kidney and ileum are presented on Table 5. The result revealed various level of damage done to the organs by the dietary treatment. Lesions observed on the organs based on the effect of *Moringa oleifera* leaf meal were rated as mild, moderate and severe. It was observed that all the bucks fed 2.5% MoLM had mild lesion / necrosis in their liver, kidney and ileum. Moderate lesions (100%) were observed in the liver and kidney of bucks fed 5.0 and 7.5 % MoLM levels. Thirty-three percent (33%) of the bucks fed 5.0 and 7.5% had moderate lesion/sloughing off of the ileum while 66.67% of them had severe lesions.

DISCUSSION

Performance of rabbit bucks fed varied levels of *Moringa oleifera* leaf meal

Makkar and Becker (1997) reported that polyphenols, commonly known as tannins, occur widely in many different plants, especially from tropical regions. Their consumption by animals has adverse effects on productivity and health. The reduction in weight gain observed in this study with increase in the quantity of *Moringa oleifera* leaf meal (MoLM) consumed by the rabbits may be as a result of the cumulative effect of tannin and saponin present in MoLM. Kakengi et al 2003 reported that MoLM contain about 1.23g/kg of tannin, hence consistent consumption of the leaf meal may have a toxic effect on body organs over a period of time. The result from this study is in agreement with the findings of Odeyinka *et al.* (2008) who reported that replacement for *Centrocema pubescens* with *Moringa oleifera* had no significant effect on average body weight of rabbits. However, the result from this study contradicts the report of Nuhu 2010 who observed significant increase in weight gain when growing rabbits were fed MoLM based diet. Zaku *et al*. (2015) reported that *Moringa oleifera* possess growth enhancing property when its methanolic extract was sprayed on young plants. This property was obviously not expressed in promoting growth in bucks fed MoLM in this study. The average feed intake was not significantly different among the treatments. Dietary levels of MoLM had significant effect on average weight gain of the rabbit bucks.

Table 4: Relative organ weights of rabbit bucks fed varied levels of *Moringa oleifera* leaf meal (MoLM)

Parameters	Diet 1 (0% MoLM)	Diet 2 (2.5% MoLM)	Diet 3 (5.0% MoLM)	Diet 4 (7.5% MoLM)	±SEM
Heart (%)	0.21	0.22	0.23	0.22	0.002
Liver (%)	0.56	0.60	0.70	0.51	0.04
Lungs (%)	0.59b	0.93a	0.55b	0.59b	0.09
Spleen (%)	0.04	0.04	0.04	0.03	0.003
Adrenal gland (%)	0.03a	0.02ab	0.02ab	0.01b	0.005
Bile (%)	0.03ab	0.03ab	0.05a	0.02b	0.007
Kidney (%)	0.41	0.46	0.51	0.50	0.02
Paired testis (%)	0.27	0.35	0.23	0.25	0.03

a,b -Means in the same row with different superscript are significantly ($p< 0.05$) different

Table 5. Organ histopathology of rabbit bucks fed varied levels of *Moringa oleifera* leaf meal (MoLM)

Parameters	Diet 1 (0% MoLM)	Diet 2 (2.5% MoLM)	Diet 3 (5.0% MoLM)	Diet 4 (7.5% MoLM)
Liver (%)				
Necrosis/lesion				
Mild	0(0/0)	100(3/3)	0(0/0)	0(0/0)
Moderate	0(0/0)	0(0/0)	100(3/3)	100(3/3)
Severe	0(0/0)	0(0/0)	0(0/0)	0(0/0)
Kidney (%)				
Necrosis/lesion:				
Mild	0(0/0)	100(3/3)	0(0/0)	0(0/0)
Moderate	0(0/0)	0(0/0)	100(3/3)	100(3/3)
Severe	0(0/0)	0(0/0)	0(0/0)	0(0/0)
Ileum (%)				
Necrosis/lesion:				
Mild	0(0/0)	100(3/3)	0(0/0)	0(0/0)
Moderate	0(0/0)	0(0/0)	33.3(1/3)	(1/3)
Severe	0(0/0)	0(0/0)	66.7(2/3)	66.7 (2/3)

Plants are generally known to possess phytochemicals which may be beneficial or harmful to animals if consumed at certain quantities; the effect is often expressed in the weight of some of the visceral organs. Organ weight changes have long been accepted as a sensitive indicator of chemically induced changes of organs (Sese and Berepubo, 1996; Michael *et al.*, 2007). Results from this study showed that organ weights of the rabbit bucks were not adversely affected by MoLM consumption. The changes observed in the relative weights of some organs as observed in this study despite the increase in the inclusion levels of MoLM in the diets might implies higher physiological activity of these vital organs in maintaining homeostasis. It has been reported that increased metabolic rate of an organ in an attempt to reduce toxic elements to non-toxic metabolites result in differences in the weight of the organ (Bone, 1979). However, Sese *et al*., 2014 reported that dietary MoLM consumption

within six to eight weeks in different farm animals may not exert any significant abnormalities on internal organs. Findings from this study showed that the anti-nutritional components of the test ingredient might have contributed to the varying effect observed in the internal organ when the duration of consumption is long (beyond eight weeks). The changes observed in some organs in this study could be attributed to the presence of toxins present in the leaf meal which can disrupt the integrity of the cells. Findings from this study corroborates the variation observed in the values of Alanine aminotransferase and Asparte aminotransferase from previous study as reported by Adeyemi *et al.* (2016) which is an indication of organ damage. Oyagbemi *et al*. (2013) reported that rats that received Methanolic extract of MoLM at 200 and 400 mg/kg body weight had significantly increased serum ALT, AST, blood urea and creatinine which points to hepatic and kidney damage. Changes observed in the liver hepatocyte varied from mild to moderate. Sloughing off of the epithelium and congestion of the renal blood vessels were observed at the inclusion of MoLM in the diets which ranged from mild in rabbits on 2.5% MoLM to severe in rabbits on 5.0 and 7.5 % MoLM. Insufficient surface area for nutrient absorption in the small intestine might have resulted due to the lesions observed in the ileum, hence the reduced weight gain observed in rabbit bucks despite adequate feed intake.

CONCLUSION

Based on the findings from this study, it can be concluded that *Moringa oleifera* leaf meal had no significant effect on growth performance of rabbit bucks. Feeding MoLM above 2.5% to rabbits had toxic effect on visceral organs. Prolong consumption or chronic administration of *Moringa. oleifera* leaves may predispose animals to hepatic and kidney damage. Thus, *Moringa oleifera* leaf meal can be included up to 2.5% as a feed supplement in the diet of rabbit bucks.

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