# HAEMATOLOGICAL AND SERUM BIOCHEMICAL RESPONSE OF GROWING RABBITS FED GRADED LEVELS OF *Moringa oleifera* LEAF MEAL

**Ewuola E.O., Jimoh O.A., Atuma O.V., Soipe O.D.**

Animal Physiology Laboratory, Department of Animal Science,
University of Ibadan, Ibadan, Nigeria.
*Corresponding author: *bisi_ewuola@yahoo.co.uk*; GSM: +234(8)060862361

## ABSTRACT

An experiment was conducted with 36 crossbred rabbits (7-9weeks) to assess their haematological and serum biochemical response when fed a graded level of *Moringa oleifera* leaf meal (MOLM) to replace soybean meal. The experimental diets had inclusion levels of 0%, 5%, 10%, 15% MOLM in treatments 1(control), 2, 3 and 4 respectively, with nine rabbits per treatment and for a nine week feeding trial. After the feeding trial, blood samples were collected from each rabbit through ear vein using a sterilized disposable syringe. Packed Cell Volume, Red Blood Cell, Haemoglobin, White Blood Cell, Mean Cell Volume, Mean Cell Haemoglobin, Mean Cell Haemoglobin Concentration, platelets and leukocyte differential counts were similar among the four diets, except neutrophils which were significantly higher in control rabbits than others. The serum Total protein, albumin and globulin concentration of animals fed MOLM-based diets were not significantly different from those fed the control diet. The Aspartate Amino Transferase, Alanine Amino Transferase and Alkaline Phosphatase activities examined in rabbits fed 5, 10 and 15% MOLM were not significantly different from those rabbits fed the control diet. However, the values obtained from this study were within the normal range of healthy rabbits. The average daily weight gain were 6.8g, 5.4g, 6.49g and 3.8g for rabbits fed treatments 1, 2, 3 and 4 respectively. The daily dry matter intake of animals on treatments 1, 2, 3 and 4 were 98g, 98g 100g and 94g resp. This suggested that feeding MOLM up to 15% inclusion in rabbit diet will not have adverse effect on the biochemical response of the growing rabbits.

**Key words:** Moringa leaf meal, haematology, serum biochemistry, rabbits.

## INTRODUCTION

As a result of high cost of animal protein source in developing countries and Nigeria particularly, the consumption of legumes has increased. Such legumes being substituted for protein by the poor masses lack essential amino acids in sufficient amount such as methionine, lysine, threonine phenylalanine, as well as $B_{12}$ vitamins. This has informed the need for people to eat meat or other animal protein (such as milk, eggs) to provide these essential nutrient. Therefore, there is presently an increase animal protein demand.

However, due to increasing cost of rearing livestock, it has become necessary to explore avenues for ensuring that the protein requirement of man is met. Monogastric and rabbits have a short generation interval and more importantly, the latter is prolific and its practice of caecotrophy enhances its performance. The cost of rabbit production is low and equally they have a fast growing rate (Oyawoye and Ogunkunle, 1989; Rao *et al*., 1977). Rabbit is an herbivorous monogastric animal and can utilize a wide variety of feed sources (Bamikole *et al.,* 2000). Moringa species are legume shrubs whose exploitation has just begun for livestock production in the tropics. Moringa is reported to be a multipurpose shrubs/trees, it's a fast growing tree which can reach 12m in height at maturity, yielding up to 1020 tonnes/ha/yr when planted very densely for use as forage (Makkar and Becker, 1997). As *Moringa oleifera* trees have a loose canopy, which prevents excessive crop shading, they are useful for

alley cropping. Foliage can be regularly pruned and left in the field to improve soil fertility or fed to livestock in a cut-and-carry system.

Laboratory analysis showed that the protein concentration in Moringa leaves is about 27% with negligible amounts of tannins (1-23g/kg) in all fractions of the *Moringa oleifera* plant and high levels of sulphur-containing amino acids (Makkar and Becker, 1997). The leaves are highly nutritious containing significant quantities of vitamins A, B, and C, Ca, Fe, P and Protein (Makkar and Becker, 1997). Despite the high crude protein (CP) content of *Moringa oleifera* leaf meal, there are few reports in the literature on feeding trials with livestock, and there is little or no report in its effect on blood profile of animals. This prompted the design of this experiment to determine the effect of graded levels of *Moringa oleifera* leaf meal as a replacement for soybean meal on intake, haematology and serum biochemistry of rabbits so as to assess the physiological response of the animals to MOLM-based diets.

## MATERIALS AND METHODS

### Experimental site and management of animals

The study was carried out at the rabbitry unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. 36 growing cross bred rabbits were used for the experiment. The rabbits used for the study were between 7-9 weeks of age with an average body weight of 801 ± 28g and the experiment lasted for 9 weeks. The rabbits were acclimatized and quarantined during the physiological adjustment period for 2 weeks. The animals were allotted in a completely randomised design into four treatments, with each treatment having nine rabbits housed in a wooden hutch (55cm x 40cm x 40 cm) suspended from the ground.

### Experimental diets

Moringa leaf meal was obtained from National Centre for Genetic Resources, Research and Biotechnology (NACGRAB), Moor Plantation, Ibadan and within the University premises. The moringa leaves were harvested in batches and 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 oleifera* leaf meal (MOLM). Four experimental diets were formulated to include MOLM at 0%, 5%, 10%, 15% inclusion respectively. The ingredients of the experimental diets are shown in Table 1. The diets were not pelleted and animals were fed *ad libitum* and water was made available to the animals throughout the period of the experiment. Both the feed intake and weight gain were monitored.

### Blood collection and analysis

At the end of the feeding period (17 weeks old, mean weight of 1230g LW), blood samples were collected from the ear vein of each rabbit using a sterilized disposable syringe and needle before the meal. An initial 2ml blood was collected into labelled sterile vacuum tube containing ethylene-diamine-tetra-acetic acid (EDTA) as anticoagulant which was used for haematological analysis. Another 3mls of blood was collected into labelled sterile sample bottles without anticoagulant and used for the serum biochemical analysis. Biuret method of serum total protein determination was employed in this assay as described by Kohn and Allen (1995). Albumin was determined using Bromcresol Green (BCG) method as described by Peter *et al.* (1982). The globulin concentration was obtained by subtracting albumin values from the total protein while the albumin/globulin ratio was obtained by dividing the albumin value by the calculated globulin value. Alkaline Phosphates (ALP), Alanine amino transferase, Aspartate amino transferase activity was determined using spectrophotometric method. The Red Blood Cell (RBC) counts, total White Blood Cell (WBC) counts, haemoglobin (Hb) concentration and Packed Cell Volume (PCV) parameters were determined as describe in Ewuola and Egbunike (2008). Blood constants (MCH, MCV, MCHC) were determined using appropriate formulae as described by Jain (1986).

**Table 1:** Ingredient and calculated composition (%) of experimental diets

| Ingredient (%) | T1 (0% MLM) | T2 (5% MLM) | T3 (10% MLM) | T4 (15% MLM) |
|---|---|---|---|---|
| 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 |
| 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

### Data analysis

The mean values obtained for the determination of various indices in respect of the 4 treatments were subjected to a one way Analysis of Variance (SAS, 2003).

## RESULTS AND DISCUSSION

All the haematological parameters measured in the present experiment were within the normal physiological ranges reported for rabbits most especially haemoglobin, packed cell volume, red blood cells, white blood cells, neutrophils, lymphocytes and eosinophils (Jenkins, 1993; Hillyer, 1994). Madubuike and Ekenyem (2006) indicated that haematological characteristics of livestock suggested their physiological disposition to the plane of nutrition. The PCV, RBC, Hb, WBC, MCV, MCH, MCHC, platelets and leukocyte differential counts of rabbits fed test diets and the control were not significantly influenced by the dietary treatments, except the neutrophils which were significantly higher in rabbits fed control diet (+10 units) than those on T2. The daily dry matter intake and average daily weight gain were not significantly influenced among the dietary treatments. The average daily weight gain were 6.81g, 5.41g, 6.49g and 3.79g for rabbits fed treatments 1, 2, 3 and 4 respectively. The daily dry matter intake of animals on treatments 1, 2, 3 and 4 were 98.0g, 98.1g 100.0g and 94.3g respectively.

There were no significant differences in the mean values of the various biochemical components of rabbits studied (Table 3). This observation agrees with the results of Ghasi *et al*. (1999) and Ewuola *et al., (*2011), who reported that crude extract from moringa leaves was found to be a potent hypocholesterolemic agent. Ghasi *et al*. (1999) reported in their study with Wister rat, that even when moringa juice extract was given at the relatively low dose of 1mg/g, co-administered with a high fat diet daily over a period of 30 days, cholesterol was reduced in serum. The serum enzymes activities assessed (ALT, AST and ALP) of rabbits fed moringa diets were within the normal range reported by CCAC (1980). This result corroborates with the report of Ewuola *et al.* (2011) who observed that serum enzyme activities of gestating and lactating rabbits administered crude moringa extract were not significantly different from the control rabbits. This implies that animals fed test diets were not adversely affected because of no indication of organ toxicity from the serum enzymes assessed.

**Table 2:** Haematological values of rabbits fed graded level of moringa leaf meal

| Components | T1 (0% MOLM) | T2 (5% MOLM) | T3 (10% MOLM) | T4 (15% MOLM) | P Level | MSE |
|---|---|---|---|---|---|---|
| PCV (lit.) | 0.31 | 0.31 | 0.38 | 0.33 | 0.47 | 0.007 |
| RBC ($10^{12}$/lit.) | 2.80 | 3.62 | 3.93 | 3.67 | 0.17 | 6.2 |
| Hb (mmol/lit.) | 6.32 | 6.40 | 7.84 | 6.89 | 0.47 | 2.8 |
| WBC ($10^9$/l) | 5.89 | 7.91 | 7.61 | 7.78 | 0.43 | 4.6 |
| MCV (fl) | 1.10 | 0.92 | 0.99 | 0.92 | 0.73 | 0.079 |
| MCH (fmol) | 0.23 | 0.19 | 0.20 | 0.19 | 0.73 | 0.0034 |
| MCHC (mmol/l) | 2.06 | 2.07 | 2.06 | 2.06 | 0.73 | 0.00008 |
| Neutrophils (%) | $34.8^{a}$ | $25.2^{b}$ | $27.8^{ab}$ | $28.0^{ab}$ | 0.13 | 39.0 |
| Lymphocytes (%) | 60.6 | 69.6 | 68.4 | 67.2 | 0.24 | 52.1 |
| Eosinophils (%) | 2.20 | 2.00 | 1.20 | 2.40 | 0.62 | 2.3 |
| Monocytes | 2.40 | 2.40 | 2.60 | 2.40 | 0.99 | 1.3 |
| Platelet ($10^9$/l) | 125 | 170 | 173 | 158 | 0.32 | 19.0 |

Means for nine rabbit per goup. ab - means in the same row with different superscript are significantly ($P<0.05$) different. PCV=Packed cell volume, RBC=Red blood cell, Hb=Haemoglobin, WBC=White blood cell, MCV=Mean cell volume, MCH=Mean cell haemoglobin, MCHC=Mean cell haemoglobin concentration, MSE= Mean Square Error.

**Table 3:** Serum Biochemical response of rabbits fed varied levels of moringa leaf meal.

| Components | T1 (0% MOLM) | T2 (5% MOLM) | T3 (10% MOLM) | T4 (15% MOLM) | P Level | MSE |
|---|---|---|---|---|---|---|
| Total protein | 8.00 | 7.35 | 7.28 | 6.61 | 0.41 | 1.597 |
| Albumin (l) | 0.07 | 0.06 | 0.06 | 0.05 | 0.16 | 1.12 |
| Globulin (l) | 7.93 | 7.29 | 7.22 | 6.56 | 0.30 | 1.24 |
| AST (µmol) | 0.14 | 0.16 | 0.17 | 0.12 | 0.89 | 0.010 |
| ALT (µmol) | 0.18 | 0.18 | 0.17 | 0.14 | 0.19 | 0.0009 |
| ALP (nmol/s/l) | 2.41 | 2.54 | 2.55 | 2.39 | 0.84 | 0.129 |
| Urea (mmol/l) | 5.90 | 6.41 | 6.08 | 7.22 | 0.28 | 1.22 |
| Creatinine (µmol/l) | 92.9 | 98.3 | 85.4 | 80.6 | 0.23 | 0.074 |
| Cholesterol (mmol/l) | 3.99 | 4.11 | 3.91 | 3.62 | 0.86 | 0.856 |
| Glucose (mg/dl) | 142 | 119 | 114 | 125 | 0.30 | 5.73 |

Means for nine rabbit per goup. AST= Aspartate amino transferase, ALT= Alanine amino transferase, ALP= Alkaline phosphatase. MSE= Mean Square Error

## CONCLUSION

From this study, it was concluded that *Moringa oleifera* leaf meal did not affect the biochemical blood profile or the haematology and serum biochemistry of rabbits. It may be recommended as good feeding stuff for concentrate feed formulation for rabbits when further results will be obtained on intake, growth and health performances on a larger number of animals.

## REFERENCES


Bamikole M.A., Ezenwa I., Adewumi M.K., Omojola A.B., Aken'ova M.E., Babayemi O.J., Olusola O.F., 2000. Alternative Feed Resources For Formulating Concentrate Diets of Rabbits. Jack Bean (*Canavalia ensiforms*) seeds. *World Rabbit Sci.*, 8 , 131-136.

Canadian council on animal care, CCAC (1980). Guide to the care and use of experimental animals. CCAC, 182-90.

Ewuola E.O., Sanni K.M., Oyedemi O.M., Alaba O., Lawal T.J., 2011. Serum biochemical response of gestating and lactating does administered graded moringa leave extract. *Proc. of 16th Annual Conference of Animal Science Association of Nig. (ASAN)* held at Kogi State University Ayingba on 12th-16th 2011. 158-162.

Ewuola E.O, Egbunike G.N., 2008. Haematological and serum biochemical response of growing rabbits bucks fed different levels of dietary fumonisin $B_1$. *African J. Biotech.*, 7, 4304-4309.

Ghasi S., Nwobodo E., Ofili J.O., 1999. Hypocholesterolemic effects of crude extract of leaf of *moringa oleifera* Lam in high-fat diet fed Wister rats. *Journal of Ethnopharmacology*, 69, 21-25.

Hillyer E.V. 1994. Rabbits. Small Anim Pract., 24,25-65.

Jain N.C., 1986. Scanning electron micrograph of blood cells. In: Schalm's veterinary haematology 4th ed. P Lea& Febinger, Philadelphia, 4,63-70.

Jenkins J.R., 1993. Rabbits. In: Jenkins, J.R.and Brown, S.A. (ed.) Practioner's Guide to Rabbits and Ferrets. American Animal Hospital Association, Lake wood, U.S.A., pp 1-42.

Kohn R.A, Allen M.S., 1995. Enrichment of proteolitic activity relative to nitrogen in preparation from the rumen for *in vitro* studies. *Anim. Feed Sci. Technol.*, 52, 1-14.

Madubike F.N, Ekenyem B.U., 2006. Haematology and Serum Biochemistry Characteristics of Broiler Chicks fed varying Dietary Levels of Ipomoea Asarifolia leaf meal. *Int. J. Poult. Sci.*, 5, 9-12.

Makker H. P. S, Becker K.1997. Nutrients and anti quality factors in different morphological parts of the *Moringa oleifera* tree. *J. Agric. Sci. (Cambridge)*, 128,311-322.

Oyawoye E.O., Ogunkunle M., 1989. Physiological and biochemical effects of raw jack beans on broilers. *Proc. of The Annual Conference of Nigerian Society of Animal Production*, 23, 141-142.

Peter T., Biamonte G.T, Doumas B.T., 1982. Protein (total protein) in serum, urine and cerebrospinal fluids; Albumin in serum. In:selected method of clinical chemistry. Volume9 (Paulkner W.R., Meites S., Eds) American Association for clinical chemistry, Washington, D.C.

Rao D.R., Chen C.P., Sunki C.R., Johnson N.M., 1977. Effect of weaning on slaughter ages on rabbit meat production. *J. Anim. Sci.*, 46, 573-577.

SAS Institute Inc. 2003. SAS/STAT User's guide, version 8 for windows. SAS institute Inc., SAS campus drive, Cary, North Caroline, USA.