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## Physiological responses of rabbits fed graded levels of *Moringa oleifera* leaf meal (MOLM): Some aspects of haematology and serum biochemistry

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### ABSTRACT

The experiment was conducted to investigate the effect of *Moringa oleifera* leaf meal (MOLM) on haematology and serum biochemical parameters of weaner rabbits. Twenty (20) weaned rabbits of mixed breeds, aged between 4-5 weeks with initial average live weight of 627.5g were randomly allocated into four (4) treatment groups with five (5) rabbits per treatment. Each rabbit served as replicate. The rabbits were fed diets containing 0%, 5%, 10%, and 15% *Moringa* leaf meal in diets designated as T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> respectively. The experimental diets and clean drinking water were supplied ad-libitum throughout the experimental periods of 8 weeks. The result of the experiment showed no significant ( $P>0.05$ ) differences among the treatments for packed cell volume (PCV), red blood cell (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), white blood cell, lymphocyte, neutrophils, monocytes, basophils and eosinophils. Significant effect of diet was only observed on haemoglobin (Hb) concentration whose values were however within the normal range for healthy rabbits. No significant ( $P>0.05$ ) influence of diet was observed on all the serum biochemical parameters studied. Therefore, it could be concluded that inclusion of *Moringa oleifera* leaf meal in the diets of weaner rabbits up to 15% has no adverse effect on blood profile of rabbits.

**Key words:** Rabbits, haematology, serum biochemistry, *Moringa oleifera* leaf meal

### INTRODUCTION

Rabbit meat production has been on the increase in Nigeria in recent years. The rabbit (*Oryctolagus cuniculus*) is the most productive meat producing among all domesticated animals. The feeding habits offer no appreciable competition with man. This is because it can subsist on green as basal diets. In addition to this, rabbits have a number of other characteristics that might be advantageous to subsistence farming system, such as their small body size, short generation interval with a relatively short gestation period of 30-31 days. The use of forage and other agro-industrial by-products have become an area of interest for many researchers because of the challenges posed by the high cost of conventional feedstuff. Recently, there has been interest in the utilization of *Moringa* (*Moringa oleifera*) commonly called horse radish tree or drum stick tree, as potential inexpensive protein source for livestock feeding [1]. It is rich in carotene, ascorbic acid, iron and in the two amino acids generally deficient in other feeds i.e methionine and cystine [2].

Blood analysis is an established means of assessing clinical and health status of animal on feeding trials since ingestion of dietary components has measurable effect on blood composition [3] and may be considered as an

appropriate measure of long term nutritional status. This study was therefore, carried out to investigate the effect of feeding graded levels of *Moringa oleifera* leaf meal on the haematology and serum biochemical indices of rabbits in Southern Guinea Savannah of Nigeria.

## MATERIALS AND METHODS

**Location-**The study was conducted in Makurdi-Nigeria at the University of Agriculture, Livestock Teaching and Research Farm Rabbitry Unit. Makurdi is located at latitude 7°45'N Longitude 8°31' E. The location lies in the middle belt of Nigeria and is characterized by two seasons; dry and wet seasons. Annual rainfall ranges from 508mm to 1016mm [4]. The temperature ranges between 21°C and 35°C and the environment is warm.

**Test ingredient-** *Moringa* leaves were harvested within Makurdi town and air dried under shade to prevent the leaves from being denatured until they were crispy to touch. The leaves were thereafter crushed with hammer mill before incorporation in the test diets. Four (4) experimental diets were formulated. Diet 1 designated as T<sub>1</sub> served as the control diet and contains no (0%) *Moringa oleifera* leaf meal. Diet 2 designated as T<sub>2</sub>, Diet 3 as T<sub>3</sub>, and Diet 4 as T<sub>4</sub> containing *Moringa oleifera* leaf meal at the levels of 5%, 10% and 15% respectively (Table 1).

**Table 1: Ingredient Composition of the experimental diet Diets**

Ingredients	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Maize	35.00	35.45	35.25	34.00
FFSB	25.00	24.5	23.70	22.95
Maize Bran	21.95	17.00	13.00	10.00
Moringa Oleifera	0.00	5.00	10.00	15.00
Rice Offal	15.00	15.00	15.00	15.00
Salt	0.30	0.30	0.30	0.30
Bone Meal	2.50	2.50	2.50	2.50
Premix	0.25	0.25	0.25	0.25
	100.00	100.00	100.00	100.00
<b>Calculated Values</b>				
Crude Protein %	17.07	17.07	17.06	17.06
Crude Fibre %	9.24	9.25	9.34	9.51
Dry Matter %	95.69	95.42	94.34	93.39
Calcium %	0.50	0.50	0.50	0.50
Phosphorus %	0.51	0.51	0.50	0.50
ME (Kcal/kg)	2506.50	2521.51	2514.80	2473.10

T<sub>1</sub>=0% *Moringa oleifera* leaf meal      T<sub>2</sub>=5% *Moringa oleifera* leaf meal  
T<sub>3</sub>=10% *Moringa oleifera* leaf meal      T<sub>4</sub>=15% *Moringa oleifera* leaf meal

**Experimental animals-**Twenty weaner male rabbits of mixed breeds were used in this study. The animals were between 4-5 weeks old and with initial average live weight of 627.5g. The rabbits were randomly allocated to four (4) treatment groups with five (5) rabbits per treatment. Each rabbit served as a replicate. Feed and water were supplied *ad-libitum*. At the end of the feeding period, the animals (three per treatment) were starved of feed for 24hour and thereafter slaughtered.

**Blood sample collection-**Blood samples were collected into labeled Ethylene-deamine tetra-acetic acid (EDTA) treated tubes for haematological analysis and into tubes without anticoagulant for serum biochemical evaluation. Evaluation was conducted according to the method already described by [5].

**Data analysis-**Data obtained were subjected to analyses of variance using GenStat (Release 4.24) statistical package [6]. Significant differences between treatment means were separated using Duncan's Multiple Range Test [7].

## RESULTS

The results of the effect of *Moringa* leaf meal on haematological parameters of rabbits are presented in Table 2. The packed cell volume (PCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) mean corpuscular volume (MCV), red blood cell (RBC) count and white blood cell (WBC) count were not significantly ( $p>0.05$ ) different among treatments. Haemoglobin (Hb) content was significantly ( $p<0.05$ ) influenced by dietary treatments.

Table 2: Haematological parameters of weaner rabbits fed graded levels of *Moringa oleifera* leaf meal

## Diets

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Packed Cell Volume (%)	36.00±2.08	39.00±1.15	36.6±0.88	41.00±1.00
Red Blood Cell (x10 <sup>6</sup> /mm <sup>3</sup> )	5.99±0.34	6.51±0.21	6.12±0.13	6.83±0.17
Haemoglobin (g/dl)	11.82±0.53 <sup>b</sup>	12.99±0.40 <sup>ab</sup>	12.23±0.29 <sup>b</sup>	13.6±0.33 <sup>a</sup>
Mean corpuscular volume (fl)	60.09±0.08	60.03±0.02	60.04±0.01	60.00±0.00
Mean Corpuscular Haemoglobin (pg)	19.77±0.24	20.00±0.01	20.00±0.02	20.00±0.00
Mean Corpuscular Haemoglobin Concentration (g/dl)	32.89±0.45	29.96±3.36	33.31±0.03	33.30±0.00
White Blood Cell (x10 <sup>9</sup> /l)	9.60±1.44	9.40±0.64	10.53±1.85	10.53±0.87
Lymphocytes (%)	61.00±0.58	63.00±2.52	66.67±3.33	65.33±0.33
Neutrophils (%)	30.00±0.33	30.00±2.00	25.00±3.00	28.33±2.96
Monocytes (%)	3.33±0.33	2.33±0.33	3.67±0.88	2.33±0.33
Basophils (%)	2.67±0.33	2.67±0.33	2.67±0.67	2.33±0.33
Eosinophils (%)	3.00±1.00	2.00±0.53	2.00±0.58	3.00±0.58

<sup>a,b</sup> means in the same row with different superscript as significantly different ( $P < 0.05$ ). T<sub>1</sub>=0% *Moringa oleifera* leaf meal  
T<sub>2</sub>=5% *Moringa oleifera* leaf meal  
T<sub>3</sub>=10% *Moringa oleifera* leaf meal T<sub>4</sub>=15% *Moringa oleifera* leaf meal

The results of the effect of *Moringa oleifera* leaf meal on serum biochemical parameters of rabbits are presented in Table 3. Total protein, albumin, total cholesterol, Creatinine, conjugated bilirubin, total bilirubin, urea, Alanine aminotransferase, Aspartate Aminotransferase and alkaline phosphatase were not significantly different among treatment groups ( $p > 0.05$ ).

Table 3. Serum biochemical parameters of weaner rabbits fed graded level of *Moringa oleifera* leaf meal

parameters	Diets				Level of significance
	T1	T2	T3	T4	
Total protein (g/dl)	7.49±0.22	7.79±0.30	8.23±0.23	7.72±0.53	ns
Albumin (g/dl)	3.53±0.09	3.80±0.05	3.96±0.05	3.80±0.27	ns
Globulin (g/dl)	3.90±0.19	3.99±0.25	4.28±0.22	3.92±0.26	ns
Glucose (g/dl)	113.17±4.45	112.00±6.76	124.93±0.64	111.13±4.82	ns
Urea (mg/dl)	6.00±0.49	7.33±0.27	9.17±1.39	9.03±0.42	ns
Creatinine (mg/dl)	1.00±0.03	1.10±0.14	1.40±0.11	1.25±1.15	ns
Cholesterol (mg/dl)	98.67±4.51	96.00±5.86	102.67±4.37	103.33±8.67	ns
AST (UI)	96.00±13.30	96.80±12.10	103.30±9.10	106.70±4.40	ns
ALT (UI)	61.70±4.80	65.07±5.31	66.43±5.84	65.93±2.22	ns
ALP (UI)	121.00±4.16	113.67±6.17	124.33±8.35	112.33±4.70	ns

ALT = Alanine Aminotransferase AST=Aspartate Aminotransferase ALP = Alkaline phosphatase  
T<sub>1</sub>=0% *Moringa oleifera* leaf meal T<sub>2</sub>=5% *Moringa oleifera* leaf meal T<sub>3</sub>=10% *Moringa oleifera* leaf meal T<sub>4</sub>=15% *Moringa oleifera* leaf meal ns = not significant

## DISCUSSION

Haematological components of blood are valuable in monitoring feed toxicity especially with feed constituents that affect the formation of blood [8]. Packed cell volume (PCV) is a measure of the relative mass of blood [9]. The result obtained in this study shows that PCV of rabbits were within the normal range reported by [10] who considered the normal PCV of a healthy rabbit to be between 30-50%. The normal PCV value is suggestive of adequate nutritional status of the rabbits [3]. The result is in agreement with the findings of [11] who observed no significant ( $P > 0.05$ ) effect of feeding *Moringa oleifera* leaf meal in the diet on PCV of Rabbit.

Red blood cells (RBC) function to transport oxygen. The values of RBC obtained in this study were within the normal range ( $5.46-7.94 \times 10^6/\text{mm}^3$ ) reported by [12]. No significant effect of diet was observed on RBC values. Similarly [11] found no significant influence of diet on RBC of rabbit fed *Moringa oleifera* leaf meal. These workers however reported lower values ( $3.2-3.35 \times 10^6/\text{mm}^3$ ) which were below the normal range. It has been [13] reported that increased RBC values were associated with high quality dietary protein and disease free animal.

The mean haemoglobin (Hb) value of rabbits in treatment four (T<sub>4</sub>) was significantly ( $P > 0.05$ ) higher than those in treatment one (T<sub>1</sub>) and treatment three (T<sub>3</sub>) but similar ( $P > 0.05$ ) to the values of treatment two (T<sub>2</sub>). The Hb values of rabbit on T<sub>2</sub> and T<sub>3</sub> were numerically higher than the mean value of T<sub>1</sub> (control). This implies that *Moringa*

*oleifera* proteins are of higher quality. It has been reported [14] that the low level of Hb of rabbits on the treatment diets imply that the dietary proteins were not of high quality. Values however, were within the standard range (10.4-17.4gm/dl) recommended for clinical healthy rabbits [12]. There were no significant differences ( $P > 0.05$ ) in the mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCH), and mean corpuscular haemoglobin concentration (MCHC). The values obtained were within the normal ranges reported [12]. This suggests that the animals responded positively to the test diet. The Red Blood cells indices (MCH, MCV, and MCHC) are important morphological characteristics of anaemia [15].

Leucocytes perform a defensive function in the body system especially when transported to the body tissues. The white blood cell counts were not significantly ( $p > 0.05$ ) different. Values obtained in this study were within the recommended normal range reported [12]. These results indicate that the animals were healthy because decrease in number of WBCs below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism while elevated values indicate the existence of recent infection usually with bacteria [16].

The neutrophils, eosinophils, monocytes, basophils and lymphocytes were not significantly ( $P > 0.05$ ) affected by dietary treatments, thus indicating probably normal physiology of the animals fed *Moringa oleifera* leaf meal. It also implies that the immune system of rabbits were adequate; the numerical difference observed were probably due to individual variations among these rabbits. The presence of monocyte in the rabbit fed dietary treatments contradicts the observations of [5] who recorded total absence of monocytes in male rabbits fed pawpaw peel meal. Since there was no difference in the white blood cell counts and its differentials, there is no fear of imminent hazard that may be associated with the use of *Moringa oleifera* leaf meal. The non significant ( $P > 0.05$ ) influence of diet on most of the haematological indices and the positive influence of the test diet on haemoglobin suggest the nutritional adequacy and safety of the test diet. This is because [17] reported that reduction or abnormal values of haematological parameters may indicate low protein intake, anaemia or parasitological infestation.

The total protein was not significantly ( $p > 0.050$ ) influenced by dietary treatments. Values obtained fall within the normal range (6.00 to 8.30) recommended [12]. The mean values of albumin and globulin obtained in the study were also not significantly ( $p > 0.05$ ) influenced by dietary treatments. Since total protein, albumin and globulin are generally influenced by the quality and quantity of protein intake [18], the values obtained in the study indicate nutritional adequacy of the dietary protein. No significant ( $p > 0.05$ ) influence of diet was observed on serum glucose, cholesterol, urea and creatinine. This was a good indication that the dietary protein of *Moringa oleifera* leaf meal was well utilized by the rabbits. The non significant ( $p > 0.05$ ) effect of diet on aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) is an indication that the treatments have no untoward effect on the health status of the rabbits. The values for all the parameters were within the normal ranges established [12].

## CONCLUSION

The result of this study showed that *Moringa oleifera* leaf meal will support a normal blood profile. Therefore, *Moringa oleifera* leaf meal can be conveniently used as good ingredient in feeding rabbits.

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