HAEMATOLOGICAL INDICES OF WEANER'S RABBIT FED SPROUTED MORINGA SEED MEAL

Raimi, C. O.[1]and Arire, E. O.[2]
[1, 2]Department of Agricultural Technology, School of Agriculture and Agricultural Technology, Federal Polytechnic, Ado-Ekiti, Nigeria
Corresponding Author: *christosinr@gmail.com: 08102256197*

ABSTRACT
In grassland pasture of low nutritive value, feeds, climatic factors and stresses, had led to various responses in blood indices. The haematological indices of growing rabbits fed sprouted Moringa seed meal was evaluated in this study using twenty four (24) New Zealand white rabbits aged 6weeks old. They were randomly allotted into four treatment groups and each treatment consisted of 6 rabbits per replicate and thereafter subjected to ten (10) weeks feeding trial. The diets contained four levels of Moringa seeds meal at 0, 5, 10 and 15 percent levels. Results showed that Packed cell volume of rabbits in T4 was significantly (P<0.05) high (48.00%) compared to other groups. The Red blood cell of rabbits fed T2 and T4 were similar while T1 (7.38 x10^6/L) were significantly higher than T3 (3.15x10^6/L). Haemoglobin level were high in T4 (16:00g/dl) compared to other groups. White blood cell in T4 were also low compared to other groups. MCV were high (123.80fl) and low (4.27pg) in T3 respectively. Lymphocytes of rabbits on T3 (84.00%) were significantly (P<0.05) higher than T2 (26.00%). This study concluded that the blood profiles of rabbits in all the treatment groups were within the normal range; an indication that the test ingredient enhanced feed quality and inadvertently the nutritional and health status of rabbits. Moringa seeds could be incorporated into the diet of rabbits up to 15% without posing health hazards on the animals.
Keywords: Moringa seed meal, haematological indices, rabbits

INTRODUCTION

Monogastric and rabbits have a short generation interval and more importantly, the latter is prolific and its practice of ceacotrophy enhances its performance. The cost of rabbit production is low and equally they have a fast growing rate (Oyawoye and Ogunkunle, 2019; Rao *et al*., 2017). Rabbit is an herbivorous monogastric animal and can utilize a wide variety of feed sources (Bamikole *et al*., 2010). 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 B12 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. 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, 2017). 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.

The incorporation of protein from seed sources in diets for rabbits is fast gaining grounds because of its availability, abundance and relatively reduced cost (Onu and Aniebo, 2011). Seed meals do not only serve as protein sources but also provide some vitamins, minerals and also oxycarotenoids. Studies have shown that multipurpose trees can be used as cheap protein source which can improve general performance of animals. *Moringa oleifera* belongs to the single genus monogeneric family Moringaceae and is well distributed in Africa and Asia. Apart from being a good source of protein, vitamins, amino acids, and minerals for rabbits, they also have medicinal uses (Makkar and Becker, 2016). *Moringa oleifera*, has reputation for many medicinal properties, possesses hypocholesterolemic properties (Fahey, 2015) and could serve as substitute for conventional feedstuffs (Jiwuba *et al*., 2016). The protein content of the seeds are high ranging between 20–35% on a dry weight basis and most importantly, the protein is of high quality, having significant quantities of most essential amino acids (Foidl and Paull, 2008). The seeds are highly nutritious containing

significant amount of Vitamins A, B, C, Ca, Fe, P and protein (Murro *et al*., 2012). The tree has in recently been noted as an outstanding source of highly digestible protein, calcium, iron, vitamin C, and carotenoids suitable for utilization.

Blood indices are considered to be critical indicators of the physiological stages of farm animal, thus reflecting the relationship between their nutrition and health. They are useful for clinical evaluation of various animal diseases and feed quality. According to Belewu (2010), serum creatinine helps in evaluation of liver function and diseases while serum urea evaluates renal function. Packed cell volume and red blood cells help to determine the feed toxicity and anemia in farm animals. Blood parameters change in relation to the physiological status of an animal. These changes could be as a result of several factors such feeding level, feed quality, age, sex, breed, temperature and physiological status of animals. These differences have further underlined the need to establish appropriate physiological and nutritional baseline values for rabbits, which could help in realistic evaluation of the management practice, nutrition and diagnosis of health of the host animal. The high cost of feed ingredients in most tropical countries clearly indicates that the production of feeds for livestock business is grossly inadequate. This major constraint has brought about the search for alternative feed resources that are readily available, inexpensive and less competed for by humans. Moringa seed meal can serve as non-conventional replacement or supplement of the conventional proteins feed stuff in rabbits and other livestock diets.

MATERIALS AND METHODS

A total of twenty four (6 weeks old) New Zealand white rabbits with an average weight of 750g were used for this ten weeks feeding trial. The rabbits were randomly allocated to four dietary treatments and replicated three times having two rabbit in each pen in a completely randomized design (CRD). Upon arrival they were given antibiotics and multivitamins in their drinking water. Fresh feed and clean water was offered, *ad libitum*, twice daily in the morning and evening throughout the experimental period. Feeders and drinkers was cleaned daily and disinfected every week. At the onset of the study, the rabbits were weighed before placement into experimental pens.

Preparation of *Moringa* Seed

Moringa seeds was separately sorted, cleaned and washed with cold tap water. The seeds was soaked in cold tap water for 12 h (water for soaking the seeds was changed every 2 hours to prevent fermentation) at room temperature ($32^{O}C$). After soaking, the seeds was drained and spread on a clean jute bag and also covered with a damp cotton cloth and left for 72h to germinate. The germination period was chosen based on the results of earlier studies (Chinma *et al*., 2013).Water was sprinkled at 12h interval to facilitate the germination process. At the end of germination, root hairs and seed coats was manually removed from the germinated seeds. Sprouted *Moringa* seeds was dried at $60^{O}C$ in an air-dry oven followed by grinding into fine particle that passed through a 0.45mm mesh size sieve. The sprouted Moringa seed meal (SMSM) was packed in a vacuum bag and stored in a plastic container with lid and then stored for further use in rabbit feed formulation.

Experimental diets

Four experimental diets were formulated based on nutrient requirement of growing rabbit. The dietary treatments consisted of basal diets supplemented with sprouted Moringa seed meal at levels of 0% (control), 5%, 10%, and 15%. The diet were: diet 1 (control) without SMSM, diet 2 (contained 5% of SMSM), diet 3 (contained 10% of SMSM), diet 4 (contained 15% of SMSM). The ingredients for each diet were grinded, mixed and pelletized. The compositions of the experimental diets is shown in (Table 1).

Data collection

The hematological evaluation was carried out on the 70th day of the feeding trial. Blood collection was done aseptically from the ear vein of two randomly selected rabbits per treatment using sterile syringes. Blood samples were transferred into sterile bottles containing ethyl diamine tetraacetic acid (EDTA). The blood sample was used to determine the hematological traits such as, packed cell volume (PCV), red blood cell count (RBC), hemoglobin concentration (Hb), white blood cell count (WBC), mean cell volume (MCV), mean cell hemoglobin (MCH) and mean cell hemoglobin concentration (MCHC). PCV was determined using the microhaematocrit method, while total WBC was determined with a hemocytometer (Thrall and Weiser 2002). Cynamethaemoglobin method was used to determine Hb concentration as outlined by Higgins *et al*. (2008), whereas; MCV, MCH, and MCHC were calculated using the standard formulae of Feldman *et al*. (2000). The leukocytes white

blood cells differential counts such as, lymphocytes, monocytes, eosinophils and neutrophils were also determined. Representative samples of the test ingredient (sprouted Moringa seed meal) were analyzed to determine their proximate contents according to the methods of AOAC (2006).

Table 1. Composition of diet containing graded level of sprouted Moringa seed meal

Ingredients	Dietary Treatments			
	Diet 1 (0%)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)
Maize	34.5	33	31	28
Soya beans meal	23	20	18	16.5
SMSM	0	5	10	15
Palm kernel cake	9	9	9	9
Rice husk	11	11	11	11
BDG	12	12	12	12
Groundnut cake	6.5	6	5	4.5
Bone meal	2.5	2.5	2.5	2.5
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Calculated Analysis				
ME (Kcal/kg)	2399.925	2431.4	2471.449	2491.944
Crude protein (%)	19.78	19.93	20.27	20.96
Crude fibre (%)	10.13	9.9935	9.867	9.783

*Vitamin/Mineral Premix (Animal Care®) Vitamin A12000000IU, Vitamin D3 3000000IU, Vitamin E 30000mg, Vitamin K3 25000mg, Folic Acid 1000mg, Niacin 40000mg, Vitamin B2 5000mg, Vitamin B12 20mg, Vitamin B1 2000mg,Vitamin B6 3500mg, Biotin 80mg, Antoxidant 125000mg, Cobalt 250mg, Selenium 250mg, Iodine 1200mg, Iron 40000mg, Manganese 70000mg, Copper 8000mg, Zinc 60000mg Choline chloride 200000mg .

Statistical analyses

Data were subjected to statistical analysis using a Stat Graphic Computer Package (SPSS 2007), based on analysis of variance (ANOVA) as prescribed for a completely randomized design (CRD). Mean separation was done using Duncan's New multiple range tests, and differences were declared significant at ($P< 0.05$).

RESULTS

Table below showed that Packed cell volume of rabbits in T4 was significantly ($P<0.05$) high (48.00%) compared to other groups. The Red blood cell of rabbits fed T2 and T4 were similar while T1 (7.38 $x10^6$/L) were significantly higher than T3 (3.15$x10^6$/L). Haemoglobin level were high in T4 (16:00g/dl) compared to other groups. White blood cell in T4 were also low compared to other groups. MCV were high (123.80fl) and low (4.27pg) in T3 respectively. The Mean corpuscular haemoglobin concentration were not significantly affected by any of the dietary supplements. The Monocytes of rabbit fed T2 were significantly ($P<0.05$) higher, follow by rabbit fed T4 hence rabbit fed T1 (control) and T3 of monocytes were significantly ($P<0.05$) similar. Lymphocytes of rabbits on T3 (84.00%) were significantly ($P<0.05$) higher than T2 (26.00%).

Table 1. Haematological analysis of weaner's rabbits fed graded levels of sprouted Moringa seed meal diet.

Parameters	Dietary Treatment				±SEM	*p*-Value
	T1	T2	T3	T4		
Packed cell volume (%)	44.00^b	43.00^c	39.00^d	48.00^a	0.97	0.001
Haemoglobin (g/dl)	14.70^b	14.30^b	13.00^c	16.00^a	0.35	0.001
Red blood cell ($x10^6$/l)	7.38^a	6.35^b	3.15^c	6.00^b	0.49	0.002
White blood cell ($x10^9$/l)	8.90^a	6.40^b	4.40^c	4.00^c	0.60	0.002
MCV (fl)	59.10^d	67.70^c	123.80^a	80.00^b	7.51	0.006
MCH (pg)	19.69^c	22.57^b	4.27^d	26.67^a	2.56	0.002
MCHC (g/dl)	33.40	33.25	33.33	33.33	0.12	0.986
Monocytes (%)	0.00^c	4.00^a	0.00^c	2.00^b	0.51	0.032
Granulocytes (%)	60.00^b	70.00^a	16.00^d	58.00^c	6.25	0.041
Lymphocytes (%)	40.00^b	26.00^c	84.00^a	40.00^b	6.58	0.013

[abcd] Means with different superscripts on the same row were significantly (P<0.05) different.
SEM = Standard error of mean. SMSM: sprouted Moringa seed meal.

DISCUSSION

Packed cell volume (PCV) is a measure of the relating mass of blood and involved in the transport of oxygen and absorbed nutrients. However, the PCV (%) values for all the treatment groups fell within the normal physiological range of 30.0-50.0% reported by Onifade and Tewe (2013) for healthy rabbits, suggesting that sprouted Moringa seed meal (SMSM) were tolerated across the treatment groups. This agreed with the findings of Ahamefule (2015) who reported that normal PCV values are indicators of adequate nutritional status of rabbits. Haemoglobin functions in transporting oxygen to tissues of animal for oxidation of ingested food; so as to release energy for the other body functions as well as transport carbon dioxide out of the body of animal (Ugwuene, 2011).

The present study showed significant difference among the treatments groups which suggested that *Moringa oleifera* seed meal protein are of higher quality; a view corroborated by Jiwuba *et al*. (2016) that low level haemoglobin (Hb) of treatment could imply that dietary proteins were not of high quality. The values recorded for MCHC in all the treatment groups, however fell within the normal range (27-37) reported by (Research Animal Resource, 2009). The reported range of the MCHC in this study gave a clear indication of the absence of anaemia among the experimental animals. White blood cells (WBC) function to fight infections, defend the body against invasion by foreign organisms and to produce or distribute antibodies in immune response. The range for WBC count obtained in this study ranged between 4.00 – 10.66 x106 /dl and fell within the normal range for white blood cell (4.5 – 11 (10g/l) reported by (Research Animal Resource 2009). The increase in the level of WBC with the level of SMSM in the diet agreed with the reports of (Jiwuba, 2014). These results indicated that the animals were healthy because decrease in number of WBC below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism, while elevated values (leucocytosis) indicates the existence of a recent infection, usually with bacteria.

CONCLUSION

From physiological point, blood profiles of rabbits in all treatment groups are within normal range for rabbit; an indication that the test ingredient enhanced feed quality and inadvertently the nutritional and health status of rabbits. Up to 15% sprouted Moringa seed meal could be recommended as good feeding stuff for concentrate feed formulation for rabbits.

REFERENCES

Ahamefule, F. O., Ibeawuchi, J. A. and Okoye, F. C. 2015. Blood biochemistry and haematology of West African Dwarf (WAD) bucks fed pigeon pea-cassava peel based diets. *Journal Animal of Veterinary Advances* 4(12):1016-1020.

AOAC. 2006. Official methods of analysis. Gaithersburg: Association of Official Analytical Chemists.

Bamikole, M. A., Ezenwa, I., Adewumi, M. K., Omojola, A.B., Akenova, M. E., Babayemi, O.J. and Olusola, O. F. 2010. Alternative Feed Resources for Formulating Concentrate Diets of Rabbits. Jack Bean (*Canavalia ensiforms*) seeds. *World Rabbit Sci*., 8: 131-136.

Belewu, M. A. and Ogunsola, F. O. 2010. Haematological And Serum Indices of Goat Fed Fungi Treated Jatropha curcas Kernel Cake in A Mixed Ration. *Journal of Agricultural Biotechnology and Sustainable Development* 2(3): 35 – 38.

Fahey J. W. 2015. *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. Trees for Life Journal a forum on beneficial trees and plants;. Available:www.TFLJournal.org/article.php/ 20051201124931586

Foidl, N. and Paull, R. 2008. *Moringa oleifera*. In: The encyclopedia of fruit and nuts. CABI, Oxfordshire, UK. 509–512.

Higgins, T., Beutler, E., Doumas, B. T. 2008. Measurement of hemoglobin in the blood. In: Burtis CA, Ashwood ER, Bruns DE, editor. Tietz fundamentals of clinical chemistry. Missouri: W. B. Saunders Company; p. 514–515.

Jiwuba, P. C. 2014. Performance blood profile and apparent nutrient digestibility of West African Dwarf Does fed dietary levels of Moringa oleifera leaf meal. M.Sc. Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Jiwuba, P. C., Ugwu, D. O., Onyekwere, M. U., Ogbuewu, P. I., Okechukwu, S. O., and Olabode, A. D. 2016. Haematological response of weaner rabbits fed dietary levels of *Gmelina arborea* leaf meal; in Proceeding of 41st Annual Conference for Nigeria Society for Animal Production (NSAP). 129-132.

Makkar, H. P. S. and Becker, K. 2016. Nutritional value and anti-nutritional components of whole and ethanol extracted *Moringa oleifera* leaves. *Animal Feed Science and Technology.* 63: 211-228.

Murro, J. K., Muhikambele, V. R. M. and Sarwatt, S. V. 2012. *Moringa oleifera* leaf meal can replace cottonseed cake in the concentrate mix fed with Rhodes grass (*Chloris gayana*) hay for growing sheep. *Livestock Research for Rural Development*. 15:11.

Onifade, A. A. and Tewe O. O. 2013. Alternative tropical energy feed performance in rabbit diets: Growth performance, diets digestibility and blood composition. *World Rabbits Science* 1:17–24.

Onu, P. N. and Aniebo, A. O. 2011. Influence of *Moringa oleifera* leaf meal on the performance and blood chemistry of starter broilers. *International Journal of Food, Agriculture and Veterinary Sciences.* 1(1):38-44.

Oyawoye, E.O., and Ogunkunle, M. 2019. Physiological and biochemical effects of raw jack beans on broilers. Proc. of the Annual Conference of Nigerian Society of Animal Production, 23, 141-142.

Rao, D. R., Chen, C. P., Sunki, C. R. and Johnson, N. M. 2017. Effect of weaning on slaughter ages on rabbit meat production. *J. Anim. Sci.,* 46, 573-577.

Research Animal Resource (RAR). 2009. Reference values for laboratory animals: Normal haematological values. RAR websites, RAR, University of Minnesota; Available:http://www.ahe.umn.edu.rar.refva lues.html

SPSS.Com. 2007. IBM®SPSS®. The advantage for Microsoft ® IBM Corporation Route, 100, Somers, N4. 10589.

Thrall, M. A., Weiser, M. G. 2002. Hematology. In: Hendrix CM, editor. Laboratory procedures for veterinary technicians. Missouri: Mosby Inc; p. 29–74.

Ugwuene, M. C. 2011. Effect of dietary palm kernel meal for maize on the haematological and serum chemistry of broiler turkey. *Nigerian Journal of Animal Science* 13:93- 103.