

IMMUNE POTENTIAL OF RABBITS FED DIETS CONTAINING GRADED LEVELS OF CASSAVA PEELS- GRIT-MORINGA LEAF BLEND AS REPLACEMENT FOR MAIZE

Majekodunmi, B. C.¹, Omilelewe, O. D.², Bello, K. O.^{3*}, Adebawale, T.⁴, Adeoye, S. A.⁵, Oyekale, T. O.³ and Adeola A. A.³

¹Department of Animal Physiology

²Department of Animal Production and Health

³Institute of Food Security, Environmental Resources and Agricultural Research

⁴Agricultural Media Resource Centre

⁵Department of Pasture and Range Management

Federal University of Agriculture, Abeokuta

*Corresponding author: beloko@funaab.edu.ng; kazeembello19@gmail.com; +2348032204658

ABSTRACT

Immune system of animal plays essential roles in disease resistant ability and it depends on factors like diet among others. While diet is influenced by the available feed ingredients, it has prompted the search for alternative feed sources leading to the exploration of agro-industrial by-products and unconventional feed materials like cassava peels and moringa leaves. The study determined the immune potential of rabbits. An 8-week feeding trial was carried out on forty mixed sex grower rabbits. They were randomly allotted to four diets containing cassava-peel-grit-moringa-leaf blend at 0%, 25%, 50% and 75% replacement for maize. At 6th week three rabbits were selected from each treatment for white blood cell and the differentials analyses. At week 7, three rabbits which weight represented the group average were sacrificed for carcass analysis. Data were collected on fur, spleen and liver weights. All data were analyzed using ANOVA and significant means were separated using Duncan multiple range test. Results of white blood cell ($6.37-7.77 \times 10^9/L$), differentials, weight of fur (45.00-103.33g), spleen (4.45–7.30g) and liver (50-60g) showed no significant ($p>0.05$) variations with diets. The study concluded that use of cassava-peel-grit-moringa-leaf blend as replacement for maize had no adverse effect on the immunological properties of rabbits.

Keywords: cassava, cassava-peels, immunity, moringa, rabbit

INTRODUCTION

Rabbits are source of quality animal protein and improving their health would be vital in the attainment of the food security target of the developing countries. This could be achieved using alternative feedstuff like cassava peels. Cassava (*Manihot esculenta*) is a starchy root crop and widely cultivated in tropical region. Cassava peels is a by-product of cassava processing. It is rich in energy (Ande *et al.*, 2018). Inclusion of cassava peels in animal diets can help reduce feed cost and mitigate environmental pollution associated with cassava waste disposal. Due to its low protein content, cassava peels could be improved using non-conventional protein source like Moringa.

Moringa oleifera is a fast-growing, drought-resistant tree. Its leaves are highly nutritious, containing essential amino acids, vitamins, and minerals (Moyo *et al.*, 2011). Moringa leaves have been shown to possess immunomodulatory properties, making them a promising feed additive for enhancing the immune system in animals (Fahey, 2005). Combination of cassava peels and moringa leaves in animal feed could have the ability to improve the nutritional profile of the diet which is opined to boost the immune system of livestock.

The immune response of rabbits to different dietary interventions can provide valuable insights into the usefulness of feed ingredients as it is a critical factor in determining their overall health and productivity. In recent years, there has been a growing interest in exploring alternative feed ingredients that can enhance the immune function of livestock with significant implications for the development of cost-effective and nutritionally balanced feeds. By replacing maize with cassava peels and moringa leaves in a blend form, farmers can potentially enhance the livestock health under good animal husbandry practices (Odetola *et al.*, 2012). This study aimed to broaden the use of cassava-peels and moringa leaves as alternative feed ingredients and their potential benefits to quality feed formulation strategies in promoting sustainable and healthier rabbit production.

MATERIALS AND METHODS

The study was conducted at the rabbit unit of the Institute of Food Security and Environmental Resources and Agricultural Research (IFSERAR), Federal University of Agriculture, Abeokuta, Ogun State. High quality cassava peel (HQCP) was sourced from International Livestock Research Institute (ILRI), Ibadan, Oyo State. Freshly harvested moringa leaves were air dried. The dried moringa leaves were mixed together with HQCP cassava peels at ratio 1:3 to form cassava peels- grit-moringa leaf blend (CPLMB) using Pearson's square method. Four diets

(Table 1) were formulated at 0%, 25%, 50% and 75% of blend as replacement for maize and pelletized. The diets were fed to 40 crossbred un-sexed rabbits that were purchased from reputable farms. Each rabbit was allocated to a hutch and was fed respective diet *ad libitum* on daily basis. Each group was replicated 10 times. The feeding trial lasted for 8 weeks.

At sixth week of the feeding trial, three rabbits per treatment, each animal serving as replicate were sampled for white blood cell and white blood differentials. About 3ml of blood sample was collected from each rabbit via the ear pinnae and was emptied into each sample bottle containing ethylene diamine tetra-acetic acids (EDTA) as anti-coagulant. The bottle was gently shaken to ensure proper mixing of the blood with EDTA to prevent coagulation. At week 7 of the study, 12 rabbits were humanely sacrificed for carcass analysis. Three rabbits whose weights were close to the group average from the four treatments were used. The fur was determined using singeing method. The fur weight was calculated using the difference between bled and singeing weights. The liver and spleen were also carefully excised from the hot carcass and were weighed using a sensitive scale. The procedure adopted in this study were carried out according to the guidelines as approved by the Animal Care and Use Committee of the Federal University of Agriculture, Abeokuta, Nigeria, Animal Ethics Committee (UNAABACUCF003/1009). Data obtained from the study were subjected to analysis of variance (ANOVA) using (SAS, 2012) and significant means were separated using Duncan multiple range test as contained in SAS.

Table 1: Experimental diets and composition

Ingredient	Diet 1	Diet 2	Diet 3	Diet 4
	% Replacement of blend			
	0	25	50	75
Maize	35.00	26.25	17.5	8.75
Blend (HQCP+Moringa)	0.00	8.75	17.5	26.25
Wheat offal	40.00	40.00	40.00	40.00
Palm Kernel Cake	13.00	13.00	13.00	13.00
Bone	6.00	6.00	6.00	6.00
Dicalcium	3.00	3.00	3.00	3.00
Salt	2.50	2.50	2.50	2.50
*Premix	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00
<u>Proximate Analysis (%)</u>				
ME (kcal/kg)	2424.50	2424.50	2424.50	2424.50
Protein	12.77	12.77	12.77	12.77
Fat	3.38	3.38	3.38	3.38
Fibre	5.66	5.66	5.66	5.66

*Premix composition per kg diet: Vit A:400000IU, Vit D:80000IU, Vit E:40000ng, Vit k3:800mg, Vit B1:1000MG, Vit B2:6000mg, Vit B6:500mg, VitB12:25mg, Niacin:6000mg, Panthothenic acid:2000mg, Folic acid: 200mg, Biotin:8mg, Manganese:300000g, Iron:8000mg, Zinc:20000g, Cobalt:80mg, Iodine:400mg, Selenium:40mg, Choline:800000g; ME = Metabolisable Energy

RESULTS AND DISCUSSION

The white blood cell and white blood differentials as immune indicators of the rabbits fed diets containing cassava-peel-grit-moringa-leaf blend as replacement for maize is shown in Table 2. The parameters revealed no significant differences ($p>0.05$) with the white blood cell ($6.37\text{--}7.77 \times 10^9/\text{L}$), Heterophils (36.67-39.33%), Lymphocytes (59.00-61.83%), Monocytes (1.00-2.00%). White blood cells are essential towards the proper functioning of the body's immune system. The blood cells fight bacterial, viral and fungal infections by "eating" the germs. In this study, the immune of the rabbits could be considered good because of no elevation of the white blood cells. Good diet and nutrition is one of the possible preventive approaches to improve the nonspecific immunity resistance of rabbits (Abd El-Rahim, 2017). A number of micronutrients and feed additives have been shown to affect various aspects of immunity in rabbits; insufficient contents of micronutrients in diets are related with low disease resistance (Kubes and Jenne, 2018). Consequently, the CPLMB diets in this study could be adjudged to contain sufficient nutrients necessary to confer the required immunity in rabbit production.

Table 2: White Blood Cells and White Blood Differential of Rabbits Fed Cassava-peels-grit-moringa-leaf blend

Parameter	Blend replacement for maize (%)				SEM	P-value
	D1(0)	D2(25)	D3(50)	D4(75)		
White blood cells (x 10 ⁹ /L)	6.77	7.77	6.37	7.52	1.27	0.13
Lymphocytes (%)	59.00	61.33	61.00	61.33	20.85	0.88
Monocytes (%)	1.33	1.00	2.00	1.33	0.42	0.35
Heterophils (%)	38.33	37.00	36.67	39.33	4.56	0.86
Eosinophils(%)	1.00	0.67	0.33	0.83	0.24	0.74
Basophils (%)	0.33	0	0	0	0.08	0.44

Table 3 shows the results of the immune organs of rabbits fed diets containing cassava-peels-grit-moringa-leaf blend as replacement for maize. Weights of the fur (45.00-103.33g), spleen (4.48-7.30g) and liver (50-60g) of the rabbits were not influenced ($p>0.05$) by the dietary treatments. Fur has been reported to play a crucial role as physical barrier against external pathogens, activating immune cells, regulating inflammation and housing beneficial microbes which help maintain a healthy skin micro biome (Carpenter *et al.*, 2009). Similarly, the spleen functions as blood filter removing bacteria and other infectious organisms, producing antibodies, developing and producing mature immune cells (B and T-lymphocytes), helping the immune system to recognize and attack foreign pathogens and allege (Fernandez, 2023). Also, the liver has been described as a key immune tissues, ideally positioned to detect pathogens entering the body via the gut. None of these immune organs in this study has indicated or could be assumed to have been compromised because they were not significant. Nutrient and feed additive have been reported to have influence on immune response (Kubes and Jenne, 2018). CPLMLB as feedstuff in this study could be said to be a non-toxic feedstuff ingredient while the resultant diets could be adjudged as balance diets which conferred necessary immunity that the rabbits in this study required. Therefore, fur weight, spleen and liver of the rabbits in this study did not comprised their immune functions.

Table 3: Selected immune organs (fur, spleen, liver) of Rabbits fed Cassava-peel-grit-moringa-leaf blend

Parameter	Blend replacement for maize (%)				SEM	P-value
	D1 (0)	D2 (25)	D3 (50)	D4 (75)		
Fur Weight (g)	103.33	63.33	45.00	60.00	27.69	0.49
Spleen (g)	4.45	4.85	7.30	4.95	3.13	0.46
Liver (g)	60.00	60.00	50.00	50.00	13.16	0.22

CONCLUSION

From the findings of this study, it was concluded that Cassava-peel-grit-moringa-leaf blend as feed ingredient had no adverse effect on the immune potentials of rabbits.

REFERENCES

- Abd El-Rahim, M. I. (2017). The role of nutrition in immunity and diseases resistance in Rabbits. *Egyptian Journal of Rabbit Science*, 27 (2): 171- 195
- Ande, K. O., Oluwatosin, O. O., Sanni, L. O., Oso, A. O., Bello, K. O., Adebayo, K., Lala, A. O. (2018). Performance and economic benefits of meat-type chickens fed diets containing white and yellow cassava supplemented with different additives. *Food Chain*. 7(2): 71-86. <https://doi.org/10.3362/20146-1887.0007>
- Carpenter, B. M., Whitmire, J. M., Merrell, D. S. (2009). This Is Not Your Mother's Repressor: the Complex Role of Fur in Pathogenesis. *Infect Immun* 77:. <https://doi.org/10.1128/iai.00116-09>
- Fahey, J. W. (2005). *Moringa oleifera*: a review of the medical evidence for its nutritional, therapeutic and prophylactic properties. Part 1. <http://www.tfljournal.org/article.php/2005120.1124931586>
- Fernandez, J. (2023). *Spleen Disorders and Immunodeficiency. Reviewed. Cleveland Clinic Lerner College of Medicine at Case Western Reserve University*
- Kubes, P. and Jenne, C. (2018). Immune responses in the livers. *Annual Review of Immunology*, 36: 247-277. <https://doi.org/10.1146/annurev-immunol-051116-052415>
- Moyo, B., Masika, P. J., Hugo, A., and Muchenje, V. (2011). Nutritional characterization of Moringa (*Moringa oleifera* lam.) Leaves. *African Journal of Biotechnology*, 10(6): 12925-12933.
- Odetola, O.M., Olagunju, R.O., and Adekunle, O.A. (2012). Economic analysis of feed cost and performance of growing rabbits fed diets containing varying levels of cassava peel meal. *Nigerian Journal of Animal Production*, 39(1): 100-110.