

HAEMATOLOGY OF RABBITS FED CASSAVA PEEL MEAL BASED DIETS SUPPLEMENTED WITH ELEMENTAL SULPHUR

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Abstract

This study evaluates the effect of cassava peel meal supplemented with elemental Sulphur (ES) on the haematology of rabbits. Thirty six crossbreed weaner rabbits were allocated to six diets groups containing 0, 25, 50, 75, 100% of ES as replacement for methionine (diets 1-5) while diet 6 had 100% each of methionine and ES dietary concentration. Haemoglobin (Hb) concentration varied significantly ($p < 0.05$) across the treatment groups while rabbits fed diet containing equal quantity of methionine and ES recorded least ($p < 0.05$) Hb of 8.17g/dl. ES as replacement for methionine had no significant ($p > 0.05$) effect on Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH) and Mean corpuscular haemoglobin concentration (MCHC) on rabbits fed cassava peel meal based diets. The study concluded that ES as replacement for methionine in the diets of rabbits containing cassava peel meal as basal ingredient had no negative effects on blood formation of rabbits. ES could be used at 50% replacement for methionine in rabbits fed cassava peel meal diets without detrimental effect on health while combination of methionine and ES each at 100% dietary content reduced rabbit haemoglobin.

Keywords: cassava peel, elemental sulphur, haematology, methionine, rabbit

INTRODUCTION

The demand for protein of animal origin in Nigeria is greater than the supply (Akinmutimi and Onwukwe, 2002) thus the need to produce livestock such as rabbit that is efficient in feed utilization, thrives on roughages, prolific and has good meat quality. Commercial rabbit production however, is faced with the challenge of high feed cost, a phenomenon that makes rabbit production and products expensive.

This challenge has consequently encouraged efforts in researches towards finding and using alternative feed resources that are readily available, less expensive and competed for by man (Osakwe and Nwose, 2008). Cassava peel, a by-product from cassava processing is one of such alternatives. It has high energy content but low crude protein. In order to effectively utilize cassava peel in rabbit feed, the protein content could be made up for by supplementing with yet another less competitive protein source, particularly the amino acids.

Methionine and cystine are among major sulphur-containing (Ostrakhovitch and Tabibzadeh, 2015) amino acids. Methionine has to be supplied in the diet as it forms a large number of key metabolic intermediates essential for life (Marcel *et al.*, 2007). However, methionine as feed ingredient amino acid is expensive. Elemental sulphur (ES) being a component of methionine could serve as an efficient protein supplement (Ehlers, 2018) and in cassava peel meal based diet. When protein is deficient in the animal's normal diet, supplementing its feed with sulfur can improve amino acid balance and also improve pH balance in the blood of animals (Lanka, 2014; Ehlers, 2018).

Blood profile is influenced by the quantity and quality of feed and also the anti-nutritional factors present in the feed (Akinmutimi, 2004). Blood elements can also be used to monitor the protein quality in feeds, especially with feed constituents that affect blood formation (Unigwe *et al.*, 2016). Consequently, haematology could be explored to give assessment of rabbits fed cassava peel meal based diets supplemented with ES.

MATERIALS AND METHOD

This study was carried out at the rabbit unit of the Institute of Food Security, Environmental Resources and Agricultural Research (IFSERAR), Federal University of Agriculture Abeokuta (FUNAAB), Ogun State, Nigeria.

Cassava peel meal was obtained from the International Livestock Research Institute (ILRI), Ibadan, Oyo State, Nigeria while ES was purchased from open market within Abeokuta metropolis. Six diets (Table 1) were formulated containing ES at different levels (0, 25, 50, 75, 100 %) as replacement for methionine to form diets 1-5 while diet 6 had ES added as the same rate with methionine in control diet.

Table 1. Composition of experimental diets

Ingredient	ES inclusion levels as replacement for Methionine (ppm)					
	0	25	50	75	100	ES added as Methionine in control
Maize	22	22	22	22	22	22
Cassava Peel Meal	50	50	50	50	50	50
Groundnut Cake	20	20	20	20	20	20
Wheat offal	2.3	2.3	2.3	2.3	2.3	2.3
Bone	2.5	2.5	2.5	2.5	2.5	2.5
Oyster shell	2.5	2.5	2.5	2.5	2.5	2.5
Lysine	0.1	0.1	0.1	0.1	0.1	0.1
Methionine	0.1	0.075	0.05	0.025	0.0	0.1
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Elemental Sulfur	0.0	0.025	0.05	0.075	0.1	0.1
Total	100	100	100	100	100	100.1
<u>Analysis</u>						
Metabolisable Energy (Kcal/kg)	2918	2918	2918	2918	2918	2918
Protein (%)	13	13	13	13	13	13
Fat (%)	2.64	2.64	2.64	2.64	2.64	2.64
Crude Fibre (%)	7.64	7.64	7.64	7.64	7.64	7.64

Thirty-six (36) cross breed weaner rabbits of weight range between 700 and 800g were used. The animals were reared using dwarf concrete hutch with the base made of galvanized wire mesh of about 2cm sieve size and laid 30cm above the floor. The rabbits were apportioned into six experimental groups according to the diets. Each treatment was replicated six times. Concrete feeders and drinkers were used. Feed and water were given *ad libitum* for 56days.

Blood collection was done twice; the first at the beginning of the study (Day 1) as baseline data and the second at day 56. Blood sample (2.5 ml) was drawn from each animal according to treatment and replicate and emptied in EDTA bottle for haematological analysis. PCV, Hb and WBC were determined according to Mitruka and Rawnsley (1977) while RBC (Total Erythrocyte Count) was determined according to Baker and Silvertown (1982). Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH) and Mean corpuscular haemoglobin concentration (MCHC) were estimated using a standard formula.

Data obtained were subjected to one way analysis of variance. Significant differences among treatment means were determined using LSD as contained in SAS (2002) package.

RESULTS

Result of haematology of rabbits fed cassava peel meal based diets with ES as replacement for methionine is shown in Table 2. Only Hb concentration varied significantly ($p < 0.05$) across the treatment groups. The value ranged from 8.17 - 15.20g/dl. Rabbits fed diet containing equal quantity of methionine and ES recorded least ($p < 0.05$) Hb of 8.17g/dl. Other haematological parameters (PCV, RBC and WBC) were similar ($p > 0.05$) across the dietary groups. Also, ES as replacement for methionine had no significant ($p > 0.05$) effect on MCV, MCH and MCHC of rabbits fed cassava peel meal based diets (Table 2).

DISCUSSION

Haematological values showed that PCV of rabbits across the treatment groups were within the range of 33 to 50% recommended for healthy rabbits (Hillyer, 1994). This suggested nutritional adequacy of the diets since PCV values did not indicate mal-or-under nutrition according to Church *et al.* (1984).

Haemoglobin functions in transporting oxygen to tissues of animals for oxidation of ingested food. Rabbits on diet containing methionine and ES at same level recorded the least value. Low values of haemoglobin concentration could be due to the harmful effects of high dietary content of ES. Haemoglobin of rabbits fed diets containing 0-100% replacement of methionine by ES were within the normal ranges (9.3 - 19.3g/dl) reported by Mitruka and Rawnsley (1977). According to Togun *et al.* (2007), this is an indication that the diets did not have any adverse effect on energy carrying capacity of the blood of the animals. However, low Hb concentration recorded in rabbits on diet containing same level of methionine and ES could suggest intolerable level and consequently may not be a viable combination level in diets of rabbits perhaps due to antagonistic or toxicity effect. Sulphur is an oxidizing agent and could portend oxidative stress when in excess. This view was supported by Rai *et al.* (2009) who reported that excessive methionine is associated with metabolic syndrome, oxidative and nitrosative endoplasmic reticulum stress in rabbits. According to Mecif *et al.* (2017), methionine is sulphur based protein, excess causes large plasma variations which is associated with the metabolic syndrome.

The RBC values recorded in this study were within the range of 3.07 to 7.50 x 10⁶ /mm³. Similarly, WBC values were still within the normal ranges (2.5 – 12.5 x10³/µl) reported by Canadian Council on Animal Care (2017). Riley and Rupert (2015) opined that normal range of values for WBC indicated that the animals were healthy because decrease WBC below the normal range is an indication of allergic conditions and certain parasitic infections.

The MCV, MCH and MCHC values were within the range of 50 - 75 fl, 18 - 24 pg and 34 - 37g/dl respectively, as reported by Gillet (1996) and they are important morphological characteristics used in detecting anaemia (Campbell, 2006). The results therefore indicated that the rabbits were not anaemic and the experimental diets support blood formation in rabbits.

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, the following conclusion could be drawn:

1. ES as replacement for methionine in the diets of rabbits containing cassava peel meal as basal ingredient had no negative effects on blood formation of rabbits
2. ES could be used safely at 50% replacement for methionine in rabbits fed cassava peel meal diets.
3. Combination of each of methionine and ES at 100% dietary content in rabbits diets containing cassava peel meal as basal ingredient reduced haemoglobin content of blood.

REFERENCES

- Akinmutimi, H.A. (2004). Evaluation of Sword Bean as an alternative feed resource for broiler chickens. Ph.D Thesis. Michael Okpara University of Agriculture, Umudike, Nigeria.
- Akinmutimi, A.H. and Onwukwe, C.C. (2002). Effect of cooking with various concentrated potash on nutrient composition of Lima Beans. *J. Agric. Biotech. Environ.* 1:1-3.
- Baker, F.S. and Silverton, R.E. (1982). Introduction to Medical Laboratory Technology, 5th edn Butterworth S.C., London, pp 481-494.
- Campbell, L. (2006). Liver: Metabolic functions. *Anaesthesia and Intensive care medicine*, 7 (2) 51-54 <https://doi.org/10.1383/anes.2006.7.2.51>
- Canadian Council on Animal Care (2017). Guide to the Care and Use of Experimental Animals Volume 1, 2nd Edition. E.D. Olfert, B.M. Cross, A.A. McWilliam (Editors). Publication Date: 1993 Revision Date: March 2017. Pp 209. 1993 ISBN: 0-919087-18-3
- Church, J. P., Judd, J. T., Yong, C. W., Kebay, T. L. and Kim, W. W. (1984). Relationship among dietary constituents and specific serum clinical components of subjects eating self- selected diets.
- Ehlers, J. (2018). What is sulphur responsible for in animals? Retrieved March 08, 2018 from petsonmom.me
- Gillet, C.S. (1996). Selected drug dosage and clinical reference data. In: The Biology of the Rabbits, 2nd Ed, PJ Mauning, DH Ringler and CE Newcomer (eds), Academic Press, Florida, USA, pp: 467-472
- Hillyer, E.V. (1994). Pet Rabbits. *The Veterinary Clinics of North America, Small Animal Practice*, 24(1):25-65
- Lanka, K. E. (2014). The importance of macro minerals: Sulphur. *The Agri-King Advantage*, 5(1) 1-2.
- Marcel, E.N., Han, B., Cordoba, F. (2007). Are we getting enough sulphur in our diets? <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2198910/>
- Mecif, K. O., Bouguerra S. A., Benazzoug, Y. (2017). Plasma and Aorta biochemistry and MMps activities in females rabbit fed methionine enriched diet and their offspring. *Journal of Nutrition Metabolism*, 2017; 2017: 2785142 published online; doi:10.1155/2017/2785142 PMID: PMC5241488, PMID: 28133545 (accessed 13/7/2019, 5:56 (+1 GMT))
- Mitruka B.M. and Rawnsley H. M. (1977). Clinical biochemical and haematological reference values in normal experimental Animal, Masson. N. Y.
- Osakwe, I. I. and Nwose, R. N. (2008): Feed intake and nutrient digestibility of weaner rabbits fed cassava peel as replacement for maize. *Animal Research International*, 5(1): 770 – 773
- Ostrakhovitch, E. A. and Tabibzadeh, S. (2015). Homocysteine in chronic Kidney disease. *Advances in Clinical Chemistry*, 72: 77-106. <https://doi.org/10.1016/bs.acc.2015.07.002>
- Unigwe, C. R.; Marire, B. N.; Omeke, B. C. O.; Abonyi, F. O.; Oladipo, T. A.; and Adebayo, D. M. (2016). Effects of maize-replaced fermented cassava peels and enzyme-supplemented diet on haematology and serum biochemistry of cross-bred female pigs. *International Journal of Advanced Research in Biological Sciences*, 3(6):198-208.
- Rai S., Hare D. L., Zulli A. A. (2009). Physiologically relevant atherogenic diet causes severe endothelial dysfunction within 4 weeks in rabbit. *International Journal of Experimental Pathology*. 90(6): 598-604. Doi:10.1111/j.1365-2613.2009.00668.x. (Accessed 13/7/2019 – 6:10 (+1 GMT))
- Riley, L. K. and Rupert, J. (2015). Evaluation of patients with leukocytosis. *American Family Physician* 92(11):1004-1111
- SAS. 2002. SAS/STAT Software: Changes and Enhancements through Release 8.1, SAS Institute Inc., Cary, NC.
- Togun, V. A., Oseni, B. S. A., Ogundipe, J. A., Arewa, T. R., Hammed, A. A., Ajonijebu, D. C., . . . Mustapha, F. (2007). Effects of chronic lead administration on the haematological parameters of rabbits – a preliminary study (p. 341). Proceedings of the 41st Conferences of the Agricultural Society of Nigeria.

Table 2: Haematology of rabbits fed cassava peel meal based diets with ES as replacement for methionine

Parameters	ES as replacement for Methionine (ppm)					ES added as Methionine in control diet	p-value
	0	25	50	75	100		
Packed cell volume (%)	36.33±1.36	37.00±1.16	37.67±1.20	38.67±2.03	38.64±0.17	34.77±1.23	0.075
Haemoglobin (g/dl)	11.67±0.70 ^a	13.57±0.97 ^a	15.20±0.67 ^a	13.67±1.66 ^a	14.35±0.43 ^a	8.17±2.13 ^b	0.020
Red blood cell (10 ³ /µl)	5.83±0.34	6.77±0.50	7.63±0.35	6.83±0.81	7.15±0.20	5.08±0.88	0.208
White blood cell (10 ³ /µl)	7.18±0.50	5.37±0.77	5.50±0.67	6.47±1.30	6.02±0.01	5.40±0.04	0.188
Mean-corpuscular Volume (fl)	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	60.00±0.00	0.127
Mean-corpuscular haemoglobin (pg)	20.00±0.00	20.00±0.00	20.00±0.00	20.00±0.00	20.00±0.00	20.00±0.00	0.167
MCHC (g/dl)	33.00±0.00	33.00±0.00	33.00±0.00	33.00±0.00	33.00±0.00	33.00±0.00	0.167
ab: Means within row with different superscript differs significantly (p<0.05)							
MCHC	=		Mean	corpuscular	haemoglobin	concentration	