Trop. Anim. Prod. Invest. 18 (2): 84-90 (2015)
ISSN: 1115-2540
http://animalsci.agric.ui.edu.ng/TAPI/index.php/tapijournal/index

ORIGINAL RESEARCH ARTICLE

Performance, serum biochemical and haematological responses of weaned rabbits fed *Alternantera braziliana* based diets

***Mako, A. A., Adedeji T.O., Awobajo, K. O and Olabanjo, S. O.**

Department of Agricultural Sciences Tai Solarin University of Education, Ijagun. Ijebu-Ode PMB, 2118, Ijebu-Ode. Ogun State, Nigeria.
*Corresponding Author: jokemako2006@gmail.com ; 08057085436, 08023292736

ABSTRACT

The objective of this study was to evaluate the performance and blood parameters of rabbits fed Alternanthera brasiliana (AB) based diets. The chemical composition of AB leaf meal and the experimental diets was determined. The feeding trial assessed the performance of weaned rabbits fed graded levels of Alternanthera brasiliana leaf meal. Twenty five (25) weaned New- Zealand white breed of rabbit of about 6-8 weeks of age with average weight of 520-560g were allotted to five experimental treatments in a completely randomized design with five animals in each group. Parameters measured include feed intake, weight gain and feed conversion ratio. Blood samples were collected before, during and on the last day of the experiment for haematology and serum biochemical analyses. Results showed that the dry matter intake, weight gain and feed conversion ratio varied significantly among the treatment means. it ranged from 71.16 – 87.98 g/d; 7.35 -11.84g/d respectively. However, it was observed that the animals on 10% AB leaf meal recorded the highest (87.98 g/d) dry matter intake and daily weight gain (11.84g/d). Same trend was observed for the feed conversion ratio. All haematological and serum biochemical values were within normal range and did not vary significantly among the treatments. It is concluded that optimal performance by the weaned rabbits were attained when 10% of the conventional groundnut cake was replaced with Alternanthera brasiliana leaf meal.

Key words: *Alternanthera brasiliana*, groundnut cake, proximate composition, rabbits

INTRODUCTION

Animal proteins are very important to human beings. This is because they are better utilized than plant proteins. Certain essential amino acids such as tryptophan, cystine and lysine are usually deficient in plant protein. The level of animal protein consumption has direct influence on the general well being and health of the ever increasing population. The protein intake in Nigeria has been on a decline as a result of the wide gap between demand and supply of animal protein (FAO, 2002).

The average protein intake in Nigeria between 1971 and 1975 was about 70 grams per head per day (Amaefule et al 2004). About 59 percent of total protein were derived from high-quality animal sources, while the amount of protein derived from pulses (grains legumes) was only about 31 percent (FAO, 2012).

In Nigeria, low animal protein intake has remained a major nutritional problem, especially for the low income and non-wage earners (Amaefule and Obioha, 2005; Akinola, 2009). There is therefore an urgent need to identify a cheap source of animal protein to bridge the wide gap existing between animal protein supply and consumption. However, rabbit has since been identified as an economic livestock that could bridge the wide gap in dietary protein intake in Nigeria. Rabbit is a micro-livestock producing about 42kg of meat per

doe per year, which is enough to solely meet the animal protein requirements of a medium-sized family under small-scale rural farming system (Hassan and Owolabi, 1996). Various researches have reported that the white meat of rabbit is very nutritious, easily digestible and extremely low in cholesterol and sodium (Omole et al., 2005).

Despite the challenges of non-readily available market when the farmers are ready to sell their stock, low knowledge of rabbit genetics/production techniques and inadequate knowledge of information about advantages of eating rabbit meat; the prolific nature of rabbits coupled with its short gestation period, makes the animal of choice for multiplication, and serve as a short way of increasing animal protein intake. Rabbit production, thus have enormous potentials in alleviating the problem of animal protein supply in developing countries.

Since rabbit production could be the key to eradicate animal protein inadequacy, it is therefore crucial to focus attention not only on the means of increasing rabbit production but also on how to substitute non-conventional feedstuff for the conventional feedstuff which had prevented some people from embarking on rearing rabbit on large scale.

Its ability to thrive on forage by-products therefore makes their production cheap. Since feed cost is estimated to be over 70% of the total cost of production (Ogunfowora, 2006). This is caused by the inability and the steep rise in the price of conventional feed ingredients especially energy and protein sources. However, inadequate information on composition, proper method of processing and utilization of unconventional fodder has limited their uses. *Alternanthera brasiliana* (Joy weed) is available all year round and it is underutilized as fodder for livestock.

This study was therefore conducted to determine the growth performance, haematology and serum biochemical indices of rabbits fed graded levels of *Alternantera brasiliana* (Joy weed) leaf meal based diets.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the rabbitary unit of the Teaching and Research farm of the Department Of Agricultural Production And Management Science, College of Science and Information Technology, Tai Solarin University of Education Ijagun, Ijebu Ode, Ogun State, Nigeria.

Experimental Materials

Four hutches were constructed each of which contained five cells consisting of strong wire netting, iron roofing sheets and galvanized wire netting for cages floor. The hutches were of 60cm×60cm×90cm dimension with wooden stands of 90cm from the floor. Each leg of the hutches was placed inside a cylindrical tin containing a black oil (engine oil) to prevent soldier ants' infestation. Plastic feeding and water troughs used were casted in concrete chambers to prevent tipping over of feeders and drinkers by the rabbits. A kitchen weighing scale was used for feed rationing. A sensitive weighing balance was used to weigh the left-over feeds and a weighing scale was also used to weigh the animals weekly to determine the weight gain of the rabbits during the period of the experiment.

Collection of test ingredient (*Alternanthera brasiliana*]

Alternanthera brasiliana (joy weed) was collected from Tai Solarin University of Education and its surrounding environments (i.e. Ijagun, Ijele, Ijebu Ode etc). The leaves were sun-cured for about 2-3 weeks and later milled into powder form.

Preparation of experimental diets

Five experimental diets were formulated using varying proportions of *Alternanthera brasiliana* Leaf Meal (ABLM) at 0%, 5%, 10%, 15% and 20% for diets 1 to 5 respectively.

Experimental animals

Twenty five (25) weaned New- Zealand white breed of rabbits of about 6-8 weeks of age with average weight of 520-560g were allotted to five experimental treatments in a completely randomized design. They were purchased from Ikorodu area in Lagos State. During the adaptation periods of three days, the rabbits were offered the diets they were taking from where they were purchased.

Experimental diets which were already pelleted were served in immovable feeding and water troughs to prevent feed wastage. The feeding and water troughs were washed daily before serving. The rabbits were housed; one animal per cell and each treatment was replicated 5 times (i.e. 5 animals per treatment). Animals were supplied fresh, clean and cooled water daily before feeding. Known amount of feed was served daily and the refusal; weighed and recorded to determine daily feed intake.

The initial body weights of the animals were taken at the beginning of the feeding trial and subsequently on weekly basis to determine the weekly weight gain of the animals. The feeding trial lasted for six weeks (42 days).

Blood collection and evaluation

Twenty five (25) weaner New- Zealand white breed of rabbits were sampled during experimental period that covered 42 days (6 weeks) at the rabbitry unit of the Teaching and Research Farm of Tai Solarin University of Education. The collection of blood samples were divided into two (2). Ten (10) mls of blood was drawn from each rabbit before, during and at the end of the experimental period into bijou bottles. The first 2 mls of blood was collected into bijou bottles containing 2 mg/ml of EDTA These samples were used to analyse for, haemoglobin concentration (Hb), packed cell volume (PCV), white blood cell count (WBC), red blood cell count (RBC) and mean corpuscular concentration (MCHC)) as described by Ewuola and Egbunike (2008). The second 3 mls of blood was collected into anti-coagulant free bottles for the determination of albumin, globulin, creatinine and total protein as described by Gbore and Egbunike (2009).

Chemical analysis

Proximate components, crude protein, crude fibre, ether extract and total ash of silage, urine and feacal samples were analyzed in triplicates using standard procedure of A.O.A.C (1995). The crude protein was determined with the micro Kjeldahl distillation apparatus, while chemical components the acid detergent fibre, neutral detergent fibre and acid detergent lignin were determined by Van Soest method (1994).

Statistical analysis

The experimental design was completely randomized design and data generated were subjected to the analysis of variance procedure (ANOVA) of SAS (2003). Significant means were separated using the Duncan Multiple range test of the same package.

RESULTS AND DISCUSSION

The chemical composition of the test ingredients and groundnut cake is shown in Table 1. The value of dry matter (DM) of the test ingredients (90.8%) obtained in this study is comparable to the DM value of (90.1%) reported for guinea grass (Mako, 2013). The level of crude protein (31.2 %) in *Alternanthera brasiliana* leaf meal (ABLM) obtained in this study was higher than some common leguminous fodder as reported by Ngwa *et al*. (2003). This value was also higher than the value range of 8.9-27.6% reported for some dry season browse and legumes (Babayemi, 2004). The CP content of ABLM is above the minimum level of (7.7%) recommended for maintenance of goats (NRC, 2001) and (12-16 %) for rabbits (Blas and Wiseman 2003). This is an indication that diets based on ABLM will meet the CP requirements of rabbits. The gross composition of the experimental diets with 0%, 5%, 10%, 15% and 20% ABLM level of inclusion is as shown in Table 2

Table 1: Chemical composition of *Alternanthera brasiliana* leaf meal and groundnut cake

Parameters	Values (g/ 100 g DM)	
	ABLM	GNC
Dry matter	91.8	80.31
Crude protein	31.2	42.5
Crude fibre	11.0	6.92
Ether extract	6.50	5.01
Ash	12.0	4.81
Neutral detergent fibre	39.5	34.11
Acid detergent fibre	22.6	27.61
Acid detergent lignin	12.4	17.60

Table 2: Ingredient composition of experimental diets for rabbits

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Ingredients	0%	5%	10%	15%	20%
Maize offal	66.80	66.80	66.80	66.80	66.80
ABLM	0.00	5.00	10.00	15.00	20.00
GNC	20.00	15.00	10.00	5.00	0.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Bone meal	1.50	1.50	1.50	1.50	1.50
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00

CALCULATED
Crude Protein (CP) =18.05%
Crude Fibre (CF) =9.87%

Proximate composition of experimental diets is shown in Table 3, the diets were formulated according to standard recommendations for weaned rabbits in the tropics (Aduku and Olukosi 1990). It was observed that the CP content of the experimental diets decreased with increasing level of ABLM. It ranged from 13.32 to 16.40 % in 20% and 0 % ABLM inclusions respectively, while the CF content increased with increasing level of ABLM, it ranged from 6.01 to 12.87 % in 0 % and 20 % ABLM inclusions respectively.

Table 3: Proximate composition (g/100g dm) of experimental diets

	Level of *Alternanthera brasiliana* leaf meal				
Parameters	0% ABLM	5% ABLM	10% ABLM	15 % ABLM	20 % ABLM
Dry matter	89.52	88.91	88.57	87.85	89.26
Crude protein	16.40	14.95	13.89	13.45	13.32
Crude fibre	6.01	7.96	10.52	11.88	12.87
Ether extract	4.89	5.00	5.01	7.04	7.10
Ash	7.00	10.88	11.62	12.05	13.78
Nitrogen free extract	65.7	61.21	59.10	57.41	54.8

The growth performance of weaned rabbits fed ABLM based diets is shown in Table 4. The average daily intake varied significantly ($p<0.05$) among the treatment means. It did not follow a particular trend, but it was observed that, animals on 10% ABLM inclusion had the highest (87.98 g/d) feed intake, while the lowest (71.16 g/d) feed intake was recorded for animals on 0% ABLM. These results are comparable to the findings of Fasanya and Ijaiya (2002). The average daily body weight gain also differed significantly ($p<0.05$) ranging from 7.35g/d to 11.84g/d in rabbits fed 0% and 10% ABLM respectively. The poor performance of rabbits in the control diet (0% ABLM) may be due to the inadequate fibre in the diet. Bamgbose *et al*. (2002) reported that rabbits require crude fibre in excess of 9% for normal growth. The lowest body weight gain recorded for treatment with sole GNC, may be due to the fact that GNC as sole protein source is not efficient for good body weight gain. This findings is in close agreement with the findings of Bamgbose *et al*. (2002) and Ghadge *et al*. (2009). Ironkwe (2004) also reported that mixed feeding regime comprising of concentrate and forage promotes better growth rate than sole concentrate or forage diet, this might be responsible for the high weight gain obtained for animals on 5%, 15% and 20% and higher weight gain obtained in animals on 10% ABLM inclusion.

High fibre and fat content in diets of monogastrics promotes easy passage of materials and reduce feed intake (Weber and Thompson, 1981), while oils and fats are good sources of essential fatty acids and boost growth in monogastrics, high fat content can also depress feed intake and nutrient utilization (Weber and

Thompson, 1981), this might be the reason why the 10% level of ABLM inclusion appears better than 15% and 20% level of inclusion.

Table 4: Growth performance of rabbits fed ABLM based diets.

Parameters	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)	T_5 (20%)	SEM
Initial weight (g)	520	550	550	543	560	
Final weight (g)	828.6	950.40	1047.22	1003.75	980.42	
Body wt. gain (g)	308.7^{d}	400.4^{c}	497.23^{a}	460.75^{b}	420.42^{b}	0.02
Daily wt gain (g/d)	7.35^{c}	9.52^{b}	11.84^{a}	10.97^{a}	10.01^{a}	0.68
Total daily DM intake (g/d)	71.16^{d}	84.75^{c}	87.98^{a}	85.62^{b}	85.43^{b}	0.42
Feed conversion ratio	9.86^{a}	8.91^{b}	7.43^{e}	7.80^{d}	8.53^{c}	0.30

^{abcde}= means on the same row with different superscripts are significant ($p<0.05$)

Feed conversion ratio of the rabbits ranged between 7.43 and 9.68 in animals feed 10% and 0% ABLM inclusion. Conversion of feed to meat was lowest in rabbits on control diet, while the rabbits on 10% ABLM inclusion converted feed to meat efficiently. All blood parameters (haematology and serum biochemical indices) considered in this study (Tables 5 and 6) did not record any significant differences ($p>0.05$) across dietary treatments. All haematological and serum biochemical values were within normal ranges for rabbits as reported by Mitruka and Rownsley (1997). The implication of this is that the dietary treatment had no adverse effect on the blood level and rabbits were not anaemic, as indicated by the normal RBC and PCV levels, (Lamidi *et al*., 2014) also the immunity of the rabbits were not negatively affected by experimental diets due to similarity in the levels of RBC (Lamidi *et al*., 2014). It has been reported that the higher the value of WBC the better phagocytosis and hence the ability to fight disease (Roberts *et al*., 2003). But abnormally high WBC could suggest the invasion of a 'foreign body' in the body, which will trigger off immune response by the production of more WBC (Amaefule, 2005). However the values reported for WBC in this study are within the normal range (5.0 – 8.0 x 10^3) reported for rabbits (Mitruka and Rawnsley 1997)) indicating that the experimental animals were not challenged by any disease condition. The normal values of total protein suggests good protein in the diets, since the higher the value of the total protein, the better the quality of the test feed stuff (Eggum, 1990), treatment 3 (10% ABLM) recording the highest value. Same trend was observed for serum albumin, globulin and creatinine. This is in agreement with the opinion of Babatunde and Oluyemi (2000), that the higher the value of serum globulin, the better the ability to fight diseases. The animals on ABLM diet did not gained weight more than the control. This is an indication that ABLM does not contain factors that are deleterious to normal blood formation, and does not impart negatively on the physiological, pathological and nutritional status of rabbits.

Table 5: Haematological indices weaned rabbits fed ABLM based diets.

	Level of ABLM					
Parameters	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)	T_5 (20%)	SEM
Haemoglobin (g/dl)	12.05	12.17	14.01	11.45	11.23	1.01
Packed cell volume (%)	35.10	36.05	40.10	36.00	38.11	1.10
White blood cell (x 10^3)	7.77	7.29	8.05	7.02	7.21	0.30
Red blood cell (x 10^6)	4.1	4.7	5.91	5.2	5.5	1.00
Mean corpuscular haemoglobin concentration (%)	32.53	32.04	32.63	31.70	31.65	1.05

Table 6: Serum biochemistry of weaned rabbits fed ABLM based diets

	Level of ABLM					
Parameters	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)	T_5 (20%)	SEM
Total protein (g/dl)	5.81	5.55	6.00	5.46	5.83	0.27
Albumin	2.41	2.12	2.30	2.50	1.93	0.23
Globulin (g/dl)	3.20	2.84	3.35	3.12	2.70	0.22
Creatinin (mg/dl)	0.85	0.61	0.88	0.72	0.70	0.14

CONCLUSION

The estimated chemical composition of ABLM was a proof of its potential in sustaining animals (rabbit) production. The enhanced values of crude protein, dry matter of the forage, normal values of haematological and serum biochemical indices of experimental animals connotes the ability of ABLM to meet the protein requirement, without negative effect on the health status of tropical animals. The rabbits performed optimally without any deleterious effect when ABLM replaced GNC at 10% level of inclusion.

REFERENCES

Aduku, A.O. and Olukosi, J.O. 1990: Rabbit Management in the Tropics: Production, Processing, Utilization, Marketing, Economics, Practical training, Research and Future Prospects, Living Book Services, G.U. Publications, Abuja.

Ahamefule, F. O. (2005). Evaluation of pigeon pea- cassava based diets for goat production in south eastern Nigeria. PhD dissertation. Micheal Okpara University of Agriculture. Umudike

Amaefule, K. U. and Obioha, F. U. (2005). Performance of pullet chicks fed raw or processed pigeon pea (Cajanuscajan) seed meal diets. Live Reserved for rural Development. *http.//cipav.orgco/lrrd.Assessed on 23rd August 2009*

Amaefule K.U, Nwaokoro C.C, and Iheukwumere F.C (2004) "The Effect of Graded Levels Of Raw Pigeon Pea Seed (CajanusCajan) Meal On The Performance, Nutrient Retention And Carcass Characteristics Of Weaner Rabbits. Nigerian Journal Of Animal Production. 31: 194-199.

Akinola, L.A.F. (2009) Economics of rabbit production in Gokan Local Government Area of Rivers State, Nigeria. Proceedings of 34th Annual Conference of Nigerian Society for Animal Production (NSAP) held at University of Uyo, Uyo, AkwaIbom State on March 15 - 18, 2009, pp 70 - 72.

AOAC: Association of Official Analytical Chemist. 1995. Official Methods of Analysis, 13th Edition, Washington, D. C.

Babatude, B.B and Oluyemi, J.A. 2000. Comparative digestibility of three commonly used fibrous ingredients in maize – soyabean meal – fish diet by broiler chicks. *Tropical Journal of Animal Science* 3: 105-111

Babayemi OJ, Ajayi FT, Taiwo AA, Bamikole MA, Fajimi AK 2004. Performance of West African dwarf goats fed *Lablab purpureus, Leucaena leucocephala* and *Gliricidia sepium* foliages. Niger. J. Anim. Prod. 33: 102-111

Bamgbose, A. M; Abimbola, M; Olayemi, W. A; Oaofowora, A.O; Oso, A.O and Ojo, O. T 2002. Performance of weaner rabbits fed supplemented Tridax procubencs diets. In Proc. 7th Ann. Conf. Animal. Sci. Asso. of Nig. (ASAN). Sept. 16-19. University of Agriculture Abeokuta E.ds. A.O Fanimo and J. A. Olanite. Pp 69-70

De Blas, C. and Wiseman, J. 2003. The nutrition of the Rabbit. CABI publishing, Oxon, UK

Eggum, B. O. 1980. Blood urea measurement as a technique for assessing protein quality. *British Journal of Nutrition* 24: 983-988

Fasanya, A. O and Ijaiya, M.O. 2002. Effect of varying levels of dietary protein on the

performance of rabbits. Nig. J. Anim. Prod. 29 (2): 16-170

FAO/WHO/UNU, 2002. "Protein and amino acid requirement in human nutrition" report of a joint FAO/WHO/UNU Expert Consultation on protein and amino acid requirement in human nutrition. Technical report series 938, Geneva, Switzerland. Pp 1-4.

FAO 2012. Food and Agricultural Organisation of the United Nations. Dietary protein quality evaluation in livestock. Report of Expert Protein Consultation. Rome

Ghadge, V.N; Upase, B. T; and Patil, P. V. 2009. Effect of repacing Groundnut cake by Soyabean meal on performance of Broilers. Veterinary World Journal 2 (5): 183-184

Hassan, W. A. and Owolabi, R. O. 1996. Production performance of domesticated rabbit in

semi-arid zones of Nigeria. Proceedings of the World Rabbit Congress. Toulouse, France, 3, 359-363

Ironkwe, M. O. 2004. Comparative performance of weaner rabbits fed concentrate, forage and concentrate plus forage. Proceedings of the 9th Annual Conference of Animal Science Association of Nigeria (ASAN) on September 13 – 16 Ebonyi State University Abakaliki Nig. pp. 185-187.

Lamidi, A W, Umoru, J.I, Ojelade, A.Y.P, Agbaye, F.P and Ajibade, A.S. 2014. Performance, Serum biochemical and haematological responses of broiler chicken fed mixture of ginger (zingiber officinale) and garlic (Alliun sativum) in diets. Proceedings of the 39th Annual Conference of the Nigerian Society for Animal Production, held 16th- 19th March 2014 at Babcock University, Ilishan Remo, Ogun State.

Mako, A. A**.** 2013. Performance characteristics of West African Dwarf goats fed graded levels of sun-cured water hyacinth (*Eichhornia crassipes* Mart. Solms-Laubach) replacing Guinea grass 25 (7) 2013

Mitruka, B. M. and Rawnsley, H. M. (1997). Clinical biochemical and haematological reference value in normal experimental animals. Mansom publishing company, New York. Pp 35-50

Ngwa, A. T., Nsahlai, I. V., Iji, P. A. 2003. Effect of feeding legume pods or alfafa in combination with poor quality grass straw on microbial enzyme activity and production of VFA in the rumen of Osuth African Merinosheep. Small ruminant Research, 48: 83 – 94.

NRC 2001 Nutrient requirements for dairy cattle seventh revised edition. National Research Council. National Academy of Science press.Washington DC, USA.

Ogunfowora O.B. 2006, "structural cost and rations in feed mill" paper presented at the feed mill management training workshop, department of agricultural economics, university of Ibadan.

Omole AJ, Omueti O, Ogunleke O 2005. Performance characteristics of weaned rabbits fed graded levels of dry cassava peel fortified with soycorn residue J. Agric. Environ. 4: 36- 38.

Roberts, K.M., Darly, K.G., Peter, A.M and Victor, W.R. 2003. Harpers Biochemistry 25th edn. Mc Graw-Hill, New York. 25:763-765.

SAS 2003. Statistical Analytical Systems, user's guide, version 8th ed., SAS Institute, Carry, North Carolia, USA.

Weber, C. W and Thompsom, S. A. 1981. Effects of fibre sources on tissue minerals levels in chicks. Poultry Science. 60: 840-845

Van Soest, P. J. 1994. Nutritional Ecology of Ruminants, 2nd edn. Cornell University Press, 476 pp.