Nigerian J. Anim. Sci. 2016 (2):

Growth Rate and Health Status of Weaned Rabbits Fed Ensiled Water Hyacinth (*Eichhornia Crassipes* Mart. Solms- Labauch) Based Diet

Mako, A. A*., Akinwande, V.O., Oyegunwa A.S., Adedeji, T. O and Falade, A. O.

Department of Agricultural Science, Tai Solarin University of Education, Ijagun, Ijebu-Ode. Ogun State, Nigeria.

***Corresponding Author:** jokemako2006@gmail.com +2348023292736 & 08180069244

Target audience: Goat farmers, feed millers, nutritionist, extension officers

Abstract

In a 6 week feeding experiment, twenty five New Zealand white breed of weaned rabbits, with an average age of 8-10 weeks were used to assess the effect of ensiled water hyacinth (WH) with different additives on growth rate and blood parameters of the animals. The animals were randomly allotted to five dietary groups, with five animals per group. The feeding trial assessed the performance of weaned rabbits, the 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 with values ranging from 66.59 - 67.26; 21.13 – 23.62 and 2.85 – 3.11 g/d respectively. However, it was observed that the animals on WH ensiled with brewers dry grain recorded the highest (67.26 g/d) dry matter intake and daily weight gain (23.62 g/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 treatment means. Values for haemoglobin (g/dl), packed cell volume (%), white blood cells (x 10^3) and red blood cells (x 10^6) ranged form11.01- 13.80; 35.10- 41.00; 6.80-8.00; 4.70- 5.70 respectively, while total protein (g/dl),albumin, globulin (g/dl) and creatinine (mg/dl) ranged from 5.40-6.00; 1.93-2.50; 2.80-3.22; 0.61-0.90 respectively. Diets of WH ensiled with different additives have no detrimental effect on growth rate and blood parameters indicating good performance and excellent health status of the animals.

Key words: Additives, chemical composition, ensiled water hyacinth, growth

Description of the Problem

With the increasing human population in the developing countries of the world, there is stiff competition between man and livestock for available feed resources, particularly those of protein and energy sources. In order to maximize food production and meet the protein requirement in Nigeria, viable options need to be explored and

evaluated (13). This has called for identification and introduction of new and lesser known plants, underutilized as fodder crop. There are many aquatic plants growing on Nigeria water ways that can serve as fodder for livestock. Water hyacinth is one of the most common aquatic plants found on Nigeria water ways. Water hyacinth (*Eichhornia crassipes* (Mart.) Solms-Laubach) is a perennial aquatic herb, growing abundantly throughout the year in rivers, lakes, ponds and dams. It does not compete with other agriculturally useful vegetation for growing space and it is of no dietary importance to man. The constraint of feeding Water hyacinth to livestock is the high moisture content, but it has been proved that wilting, ensiling and sun-curing can improve the dry matter considerably (16).

Rabbits utilize low grain and high roughage diets to produce cheap source of meat which is low in cholesterol, and richer in protein than beef, chicken and pork (7). Expanded rabbit production is a veritable way of alleviating animal protein deficiency in tropics especially in Nigeria(3).

Haematological studies are important because the blood is the major transport system of the body, and an evaluation of haematological profile usually furnishes vital information on the health status of the animal and the body's response to injury of all forms, including toxic injury (14).

This present study is aimed at evaluating the growth rate and health status of weaned rabbits fed water hyacinth ensiled with different additives

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.

Materials used

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 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.

Harvesting of water hyacinth and ensiling

Samples of water hyacinth were harvested from a river in Odogbolu local government of Ogun State. Samples collected in batches of 100kg fresh weights. Ensiling was carried by

separating shoot of the fresh plant from the roots, the shoot were then lacerated and chopped into 3-5cm pieces and then wilted under the shade for 48 hrs on polythene sheets. The chopped wilted water hyacinth was weighed and mixed in turn with each agro-industrial by-products namely, sucrose, cracked maize, brewers dry grain, palm kernel cake and wheat offal. The mixing of the silage was done at ratio 20:80 additives and water hyacinth respectively. Fermentation lasted for 42days as reported by (5).

Table 2: Ingredient composition (Kg/100 Kg DM) of concentrate fed Weaner rabbits

Ingredients	Percentage composition (%)
Maize	20.0
Wheat offal	25.0
Corn offal	18.0
Soya bean meal	8.00
Palm kernel cake	10.0
Brewer's dry grain	16.0
Oyster shell	1.75
Salt	1.00
Premix (Ruminant)	0.25
Calculated CP	18.0
Calculated ME (Kcal/k)	2400

Experimental animals

Twenty five (25) weaned New- Zealand white breed of rabbits were allotted to five experimental diets for feeding trial period that covered 42 days (6 weeks) in a completely randomized design at the rabbitary unit of the Teaching and Research farm of Tai Solarin University of Education. Experimental diets which were served in immovable feeding and water troughs to prevent feed wastage. The feeder 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. 3% of body weight of feed was served daily at 8.00hrs and the refusal weighed and recorded the following morning 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 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 5 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). The second 5 mls of blood was collected into anti-coagulant free bottles for the determination of albumin, globulin, creatinine and total protein.

Statistical analysis

Parameters were analyzed in a completely randomized design. Data generated were subjected to the analysis of variance procedure (ANOVA) of (24). Significant means were separated using the Duncan Multiple range F- test of the same package.

Results and Discussion

Growth performance of weaned rabbits fed ensiled water hyacinth is shown in Table 3, same trend was observed for the average daily dry matter intake, weight gain and feed conversion ratio varying significantly ($p<0.05$) among treatment means. It ranged 65.59 – 67.26; 21.13 – 23.62 g/d and 2.85 – 3.11 respectively in water hyacinth ensiled with sucrose and brewers dry grain, these values are higher than values reported elsewhere (20). The high dry matter intake, weight gain and feed conversion ratio recorded for WHBDG could be attributed to the adequate protein and fibre content in the diet, (6) and (10) reported that rabbits require crude fibre in excess of 9 % and 15-16% CP for normal growth. This might be responsible for the low performance of rabbits fed WH ensiled with cracked maize, sucrose and wheat offal when compared with WH ensiled with brewers dry grain. The low weight gain and daily intake also recorded for animals on WHPKC, could be linked to increased dietary fibre and fat content. (19) reported that rabbits will consume less feed when fat content of the diet is high.

Table 1: Chemical composition of ensiled water hyacinth

	Ensiled water hyacinth					
Parameters	WHS	WHCM	WHWO	WHBDG	WHPKC	SEM
Dry matter	11.34^{e}	21.25^{b}	20.55^{c}	22.39^{a}	19.36^{d}	0.35
Crude protein	18.25^{c}	10.27^{e}	14.01^{d}	23.25^{a}	20.10^{b}	0.31
Crude fibre	9.52^{e}	15.01^{b}	13.40^{c}	11.01^{d}	23.34^{a}	0.30
Ether extract	6.15^{b}	2.11^{d}	2.01^{e}	3.02^{c}	6.42^{a}	0.05
Ash	10.12^{d}	10.10^{e}	12.27^{b}	14.01^{a}	10.14^{c}	0.01
Neutral detergent fibre	61.24^{c}	60.36^{d}	53.77^{e}	69.31^{a}	68.01^{b}	0.61
Acid Detergent fibre	20.32^{e}	21.41^{c}	20.80^{d}	24.00^{b}	40.82^{a}	0.32
Acid detergent lignin	3.84^{e}	7.15^{c}	5.00^{d}	10.81^{b}	18.20^{a}	0.25

abcde- means with different superscript along the same row differed significantly ($p<0.05$)
Water hyacinth ensiled with sucrose (WHS), Water hyacinth ensiled with cracked maize (WHCM), Water hyacinth ensiled with wheat offal (WHWO), Water hyacinth ensiled with brewers' dry grain (WHBDG), Water hyacinth ensiled with palm kernel cake (WHPKC), SEM= standard error of mean

Table 3: Feed utilization by weaned rabbits fed ensiled water hyacinth

Parameters	WHS	WHCM	WHWO	WHBDG	WHPKC	SEM
Initial weight (g)	729.19	757.47	751.00	712.50	714.50	
Final weight (g)	1616.50	1676.84	1709.25	1704.40	1652.00	
Body wt. gain (g)	887.31^{e}	919.37^{d}	958.25^{b}	991.90^{a}	937.50^{c}	0.5 3
Daily wt gain (g/d)	21.13^{e}	21.89^{d}	22.82^{b}	23.62^{a}	22.33^{c}	0.2 0
Total daily DM intake (g/d)	65.59^{e}	65.89^{d}	67.06^{b}	67.26^{a}	66.10^{c}	0.1 0
Feed conversion ratio	3.11^{a}	3.01^{b}	2.94^{c}	2.85^{d}	2.96^{c}	0.0 1

abcde- means with different superscript along the same row differed significantly ($p<0.05$)
Water hyacinth ensiled with sucrose (WHS), Water hyacinth ensiled with cracked maize (WHCM), Water hyacinth ensiled with wheat offal (WHWO), Water hyacinth ensiled with brewers' dry grain (WHBDG), Water hyacinth ensiled with palm kernel cake (WHPKC), SEM= standard error of mean

There were no significant variations among the treatment means for all haematological parameters and serum biochemistry (Tables 4 and 5) of weaned rabbits examined in this study. The values of haemoglobin (Hb) ranged from 11.01 - 13.80 g/dl in WHPKC and WHBDG respectively. These values are

within the normal value range (7-15 g/dl) and (9.4-17.4 g/dl) reported by (8) and (17) respectively, however, these values are higher than the value range of 0.65-8.4 g/dl reported by (2). Hb influences transportation of oxygen from respiratory organs to peripheral tissues (20). It can therefore be inferred that, the ensiled WH based diets influenced transportation of oxygen, hence the normal values obtained.

The PCV values were also within the normal range (33 -50 %), but higher than the values (19.6- 28.5 %) reported elsewhere (2) It ranged from 35.10 - 41.00 % in WHS and WHBDG respectively. The PCV is an index of toxicity and its distribution vary with breeds. Reduction in the concentration of PCV in the blood usually suggests the presence of a toxic factor (e.g. haemagglutinin) which had adverse effect on blood formation (23). This can be attributed to low levels of toxic factors in WH and the additives which are below lethal levels (15), hence the normal values obtained.

It has been reported that the higher the value of WBC the better phagocytosis and hence the ability to fight disease (22) 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 (1). However the values reported for WBC in this study are within the normal range (5 – 8 x 10^3) reported for rabbits (17) indicating that the experimental animals were not challenged by any disease condition. These values are in agreement with the values reported by (2). The values of Red blood cells (RBC) obtained in this study did not differ significantly. It ranged from 4.1-5.7 x10^6 in rabbits fed ensiled WH based diets, with WHBDG recording the highest value (5.7x10^6). However the values obtained in this study are within normal range of 3.8-7.9 x10^6 reported for rabbits (8).

Table 4: Haematological parameters of weaner rabbits fed ensiled water hyacinth based diets

	Ensiled water hyacinth					
Parameters	WHS	WHCM	WHWO	WHBDG	WHPKC	SEM
Haemoglobin (g/dl)	11.05	11.20	12.15	13.80	11.01	1.01
Packed cell volume (%)	35.10	36.05	38.00	41.00	40.11	1.00
White blood cell (x 10^3)	7.00	7.77	6.80	8.00	7.21	0.28
Red blood cell (x 10^6)	4.7	4.8	4.1	5.7	5.4	1.01

Water hyacinth ensiled with sucrose (WHS), Water hyacinth ensiled with cracked maize (WHCM), Water hyacinth ensiled with wheat offal (WHWO), Water hyacinth ensiled with brewers' dry grain (WHBDG), Water hyacinth ensiled with palm kernel cake (PKC), SEM= standard error of mean

Serum total protein values ranged from 5.4-6.00 g/dl in rabbits fed WHWO and WHBDG respectively. These values fell within the normal range (5.0-7.5 g/dl) reported by (8), values and are also in agreement with values of 5.4 – 7.5 g/dl (17), but lower than the range of 6.5-8.0g/dl reported for rabbits elsewhere (12).

Serum albumin is a strong predictor of health; a low albumin concentration is a sign of poor health and predictor of bad outcome (11). It ranged from 1.93 -2.50 g/dl for rabbits fed WHPKC and WHBDG respectively. These values, except values (1.93 g/dl) obtained for

WHPKC fell within normal range of 2.5 – 4.0 g/dl reported for rabbits (8). The low concentration of albumin in the sera of the rabbits fed WHPKC suggests deficient protein synthesis. This indicates that animals on diets WHS, WHCM, WHWO and WHBDG will not be prone to excessive haemorrhage as the diets promoted adequate serum albumin which is important for blood clotting (4). However, the rabbits on WHPKC with low serum albumin did not show any sign of haemorrhage

The values of globulin ranged from 2.80-3.30 g/dl for rabbits fed WHPKC and WHBDG respectively. These values are within the normal range of 1.5 – 3.3 g/dl (8). These values are adequate. It has been reported that low levels of globulin affects the ability of the animal to fight disease (4). Serum creatinine ranged from 0.06 – 0.09 mg/dl for rabbits WHCM and WHBDG respectively. These values are within the normal range of 5.4 – 7.5 mg/dl (17), however these values are high when compared with the value range of 0.36 – 0.70 mg/dl (2). It had been reported that abnormally high blood creatinine would indicate muscle wastage and imply that the animal was surviving at the expense of body reserves which also results in weight loss (23)

Table 5: Serum biochemistry of weaner rabbits fed ensiled water hyacinth based diets

	Ensiled water hyacinth					
Parameters	WHS	WHCM	WHWO	WHBDG	WHPKC	SEM
Total protein (g/dl)	5.80	5.50	5.40	6.00	5.80	0.27
Albumin	2.41	2.12	2.30	2.50	1.93	0.23
Globulin (g/dl)	3.22	2.94	3.10	3.32	2.80	0.22
Creatinin (mg/dl)	0.70	0.61	0.70	0.90	0.71	0.14

Water hyacinth ensiled with sucrose (WHS), Water hyacinth ensiled with cracked maize (WHCM), Water hyacinth ensiled with wheat offal (WHWHO), Water hyacinth ensiled with brewers' dry grain (WHBDG), Water hyacinth ensiled with palm kernel cake (PKC), SEM= standard error of mean

Conclusion and Application

The feeding of weaner rabbits with water hyacinth ensiled with different additives had no deleterious effect on the growth rate, haematological and serum biochemical parameters of the animals. All parameters examined fell within the normal range. The animals fed water hyacinth ensiled with BDG performed optimally. It can be concluded that water hyacinth can be ensiled with any of these additives as supplement feed during dry season when forages are usually scarce and low in nutrients

References

1. 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
2. Ahamefule, B.E., Obua, I. A., Ukweni, M. A. and Amaka, R. A. (2008). Haematological and biochemical profile of weaner rabbits fed raw or processed pigeon pea seed meal based diets. African Journal of Agricultural Research. Vol.3 (4):315-319

3. Akinnusi, F. A. O., Bamgbose, M., Sogunle, O. M., Oso, A. O and Afolabi, F. O. (2007). Comparative effect of different animal protein concentrate on the carcass quality of rabbits. In: E. A. Agiang, L. N. Agwunobi and O. O. Olawoyin. Proceeding of the 32nd Annual Conference of the Nigerian Sciety for Animal Production, held March 18-21, at the University of Calabar, Cross Rivers State, Nigeria.
4. Akinmutimi, A. H. (2004).Evaluation of sword bean (*canavalia gladiata*) as an alternative feed resources for broiler chickens. Ph. D Thesis
5. Babayemi OJ (2009). Silage quality, dry matter intake and digestibility by West African dwarf sheep of Guinea grass (*Panicum maximum* cv Ntchisi) harvested at 4 and 12 week regrowths, *African J. Biotech*., .8:3983-3988.
6. 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
7. Biobaku, W. O. and Oguntona, E. B. (1997).Effect of feeding multi-nutrient block and pelleted diet on growth of rabbits. Nigerian Journal of Animal Production.Vol. 24: 147-149
8. Bruke, J. (1994). Clinical care and medicine of pet rabbit, In Proceeding of the Michigan Veterinary Conference. Pp 49-77
9. Daramola, J. O., Adeloye, A. A., Fatoba, T. A. and Soladoye, A.O. (2005). Haematological and serum biochemical paremeters of West African Dwarf goats. Livestock Research for Rural Development, 17 (8). Available a t:http://www.irrd.org17/8/clara/17095.htm
10. De Blas, C. and Wiseman, J. 2003. The nutrition of the Rabbit. CABI publishing, Oxon, UK
11. Dr. Kastow.com (2009). Globulins, total protein. Available at http/;//www.drkastow.com/htm/protein.albumin.globulin.html
12. Gbore and Akele (2010). Growth performance, haematology and serum biochemistry of female rabbits fed dietary Fumonisin. Vet archive 80: 431-433
13. Jiya, E.A., Ijaiya, A.T., Olorunsanya, A.O. and Ayanwale, B. A (2013).Performance of rabbits fed diets containing graded levels of processed tallow (*Detarium microcarpum*) seed meal. Nigerian Journal of Animal Production. Vol 40, No. 2: 59-70
14. Ihedioha, J.T., Okafor, C. and Ihedioha, T.E. (2004). The haematological profile of the Sprague Dawley out bred albino rats. *Nsukka. Animal Research International* 1:125-13
15. 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

16. Mako, A. A, Akinwande, V.O. and Akinsoyinu, A.O. (2014) Effect of different processing methods on the nutritive value *of water hyacinth (Eichhornia crassipes Mart. Soms-Laubach). Nigerian* Journal of Farm Management. 15(1): 95-101
17. Melillo, A. (2007). Rabbit clinical pathology. *Journal of Exotic Pet Medicine* 16: 135-145
18. 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
19. Omale,, A.J., Ajasin, F.O., Oluokun, J.A/ and Tiamiyu, A.K. (2007). *Feed and feeding.Rabbit* farming without tears. Back to Agric (7) Green choice Agric Publication 15-18
20. Oragaya, K.T and Goholshak, P.M (2014) Comparative evaluation of effects of different sources of groundnutnut meals on digestibility, growth performance and economics of production of growing rabbits.the Nigerian Journal of Animal Production vol 41, NO 1. PP 272 - 283
21. Oyawoye, E. O. and Ogunkunle, M. (1998). Physiological and biochemical effect of raw Jack beans on broiler. Proceedings of Annual Conference of Nigerian Society for Animal Production. 23: 141-142
22. 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
23. Ross, J.G., Halliday, W.G. and Jones, R.M. (1978). Haematological and bloodchemistry comparism values for clinical pathology. *Poultry Veterinary Recoed* 102: 29-39
24. SAS (2003). Statistical Analytical Systems, user's guide, version 8 ed., SAS Institute, Carry, North Carolia, USA.