

GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF RABBITS FED GRADED LEVELS OF HYDROLYSED AND KERATINASE TREATED FEATHER MEAL DIETS.

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ABSTRACT

Sixty (60) weaned mixed breed of rabbits aged between 6 and 7 weeks were used in an experiment that lasted 91 days. Hydrolysed feather meal was included in their diets at 0%, 10% and 20% levels designated as CTRL, HFM10 and HFM20 respectively while keratinase treated feather meal was included in the diets of the remaining treatment groups at 10% and 20% levels designated as KTFM10 and KTFM20 respectively. Growth and nutrient digestibility parameters were analysed; rabbits fed the keratinase treated feather meal diet at 10%, posted significantly ($P < 0.05$) higher mean values in growth parameters measured. So also they had significantly ($P < 0.05$) higher dry matter and crude protein digestibility, but showed no significant ($P > 0.05$) differences in other digestibility parameters measured. This showed that keratinase treated feather meal could be included in the diets of rabbit for better utilization and performance.

Keywords: Hydrolyse, Enzyme, Feather meal, Growth performance, Digestibility, Rabbits.

INTRODUCTION

The need for animal protein in developing countries of the world is undoubtedly on the increase and the gap between supply and demand is being widened on yearly basis. This is occasioned by rise in population and standard of living of the populace and if nothing is done to checkmate this, most developing countries may be facing meat and dairy shortages by the year 2050 (Osagie, 2012). Rabbit which has short gestation period, can be raised on wide range of non-conventional feed stuffs, perfect size for home consumption, thereby requiring no refrigeration or other means of preservation, fits any taste and also a healthful meat. All these stand rabbit in the good stead (Hernandez, 2004). If the production of rabbit is going to bridge the gap between supply and demand of animal protein, then nutrition must take the centre stage with the aim of providing alternatives to the scarce and not-readily available conventional protein sources in the diet of rabbits. Among the alternatives is feather meal which has been identified as a free ingredient (McDonald *et al.*, 1995), but cannot be fed directly to animals (Ayanwale *et al.*, 2006). Feather has been discovered to have very high crude protein content and it is being hydrolysed through heat treatment before its inclusion into the diet, however the digestibility of the protein has not

been maximised due to the disulphide bonding and cross-linkages of keratin which makes feather hard to degrade due to highly rigid structure. However, the disulphide bond that exists in the protein of feather can be reduced by the enzyme reductase followed by proteolytic keratinases (Gupta and Ramnani, 2006). This research is therefore designed to evaluate the growth performance and nutrient digestibility of rabbits fed graded levels of hydrolysed and keratinase treated feather meal diets.

MATERIALS AND METHODS

Feathers for the meal were gathered fresh, sorted from scraps, debris, eviscerates and other foreign materials. They were washed and boiled in a pressure cooker at temperature of 80°C for 60 minutes (Ayanwale *et al.*, 2006), after which they were air-dried and crushed using electric motor grinder.

Keratinase (enzyme) was prepared according to the method of Sarita and Neeraj (2010). The broth thereby produced was used to treat feathers by soaking the feathers in it for 72 hours, and then dried and grinded, ready to be included in the diets as keratinase treated feather meal.

Hydrolysed feather meal was included in experimental diets at the levels of 0% (CTRL) as the control diet, 10% hydrolysed feather

(HFM10) and 20% hydrolyse feather meal (HFM20) while keratinase treated feather meal was included at the levels of 10% (KTFM10) and 20% (KTFM20) (Table 1).

Sixty (60) weaned mixed breed of rabbits of equal sexes, aged between 6 and 7 weeks were randomly allocated to 5 treatment groups, Rabbits in each group had 3 replicates and each replicate contained 4 rabbits (2 males and 2 females). Treatment 1 (CTRL) were fed 0% feather meal as the control, treatment 2 rabbits were fed hydrolysed feather meal at 10% (HFM10%) inclusion level while treatment 3 rabbits were fed hydrolysed feather meal at 20% inclusion level (HFM20), treatment 4 rabbits were fed keratinase treated feather meal at 10% inclusion level (KTFM10) while rabbits in treatment 5 were fed keratinase treated feather meal at 20% inclusion level (KTFM20) in a complete randomised design. The rabbits were fed and watered *ad libitum* for the period of thirteen weeks. Data obtained for both growth parameters and nutrient digestibility were subjected to analysis of variance. Differences were separated by Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Performance of rabbits fed graded levels of hydrolysed and keratinase treated feather meal diets are shown in table 3. A significantly ($P < 0.05$) high final average weight of 1603.96g was recorded by rabbits fed keratinase treated feather meal diet at 10% inclusion level when compared with the rabbits fed the control and other treatment diets. The same trend was observed in average weekly weight gain, average daily body weight gain and average feed intake, with rabbits fed keratinase treated feather meal recording significantly ($P < 0.05$) highest values. This is in line with the report of Okorie *et al.* (2013) who fed exogenous enzyme supplemented pulverized groundnut husk meal diet to finisher broiler and observed significant ($P < 0.05$) differences in final weight, body weight gain and daily weight gain in finisher broiler fed 15% exogenous enzyme supplemented groundnut husk meal when compared with the ones fed the control diet and other treatment diets. It is also in consonance with the report of Pan *et al.* (2015), in an experiment titled 'Enzymatic feather meal as an alternative animal

protein source in diets for nursery pigs' that piglets getting the enzymatic feather meal diet had a significantly higher average daily gain and final body weights when compared with control piglets. The authors thereby concluded that enzymatic feather meal could be a promising alternative animal protein source in diets for nursery piglets in terms of positive growth performance and intestinal health.

The values for dry matter and nutrients digestibility are presented in table 2. The dry matter digestibility was highest in the rabbits fed the control diets but not significantly ($P > 0.05$) different from the values obtained for the second ranked KTFM10 and third place HFM10. All these were significantly ($P < 0.05$) different from the values obtained for rabbits fed both hydrolysed and keratinase treated feather meal at 20%. Significant difference was also observed in the crude protein digestibility with rabbits fed 10% keratinase treated feather meal having the highest value (86.32%) which did not differ significantly ($P > 0.05$) from the values obtained for rabbits fed KTFM20 and HFM20 but differ significantly ($P < 0.05$) from those of the rabbits fed the CTRL and HFM10. There existed no significant ($P > 0.05$) difference in all other parameters tested. The significantly high crude protein digestibility observed with the rabbits fed KTFM10, conforms to the earlier result of Pan *et al.* (2015), who considered enzymatic feather meal as an alternative animal protein source in diets for nursery pigs and observed that enzymatic feather meal provided high quality and digestible crude protein and amino acid. It is also in line with the findings of Ayanwale *et al.* 2006, who did not observe significant ($P > 0.05$) difference in dry matter digestibility of rabbits fed diets containing 0, 5 10 and 15% feathermeal, but had a significantly high crude protein digestibility in rabbits fed 10% feather meal inclusion.

CONCLUSION

The result of the nutrient digestibility had shown that the treatment of feather with enzyme keratinase and its inclusion at 10% level significantly improved its digestibility consequently significantly improving overall growth performance of rabbits. It can then be recommended that keratinase treated feather

meal could be included in the diets of rabbits at 10% without any detrimental effect.

REFERENCES

- Ayanwale B.A., Kudu Y.S. & Adebimpe, O.M. (2006). Nutrient digestibility and carcass values of rabbits fed feather meal based diets. *Proceeding of the 31st Animal Conference of Nigeria Society for Animal Production (NSAP)*. 256 – 258.
- Cheng, S.W., Hu, H.M., Shen, S.W., Takagi, H., Asano, M. & Tsai, Y.C. (1995) Production and characterization of keratinase of a feather-degrading *Bacillus licheniformis* PWD-1. *Journal of Biological Science, Biotech. and Biochem.* 59: 2239 – 2243.
- Duncan P.B. (1955). New Multiple range and F-tests. *Biometric* 11: 1-42.
- Gupta, R. & P. Ramnani, (2006). Microbial keratinases and their prospective applications: An overview. *Applied Microbiology and Biotechnology*, 70: 21-33.
- Hernandez, P. (2004). Quality and major factors influencing the rabbit carcass and meat quality. *Livestock Production Science*. 75: 11-32.
- McDonald E.A., Edwards A.C., Greenhalgh J.E.D & Morgan C.A. (1995). *Animal Nutrition* 5th Edition Pp534 – 538.
- Okorie, K.C., Esonu, B.O., Ikpe, J.n., Okorie, R.C., Esiegwu, A.C., Oko,E.C. &Okeke, P.C.(2013). Effect of exogenous enzyme supplemented pulverized groundnut husk meal diet on the performance, carcass characteristics, digestibility and cost benefit of finisher broilers. *Global Research Journal of Science*.2 (2):116-126.
- Osagie C. (2012). Business Nigeria, Developing countries meat shortage.www.thisdaylive.com
- Pan, L., Ma, X.K., Wang, H.L., Xu, X, Zeng, Z.K., Tian, Q.Y., Zhao, P.F., Zhang, S., Yang, Z.Y. &Piao, X.S. (2015).Enzymatic feather meal as an alternative animal protein source in diet for nursery pigs.*Journal of Animal Feed Science* 10.10-16 Doi,2015.12.014.
- Sarita A. &Neeraj W. (2010), Degradation of chicken feather, a poultry waste product by keratinolytic bacteria isolated from dumping site at Ghazipur poultry processing plant. *International Journal of Poultry Science*, 9 (5): 482 -489.

Table 1. Composition of experimental diets fed to rabbits (%)

Ingredient	CTRL	HFM 10	HFM 20	KTFM 10	KTFM 20
Maize	54.00	58.50	62.00	58.50	62.00
Groundnut cake	18.00	13.50	9.90	13.50	9.90
Soya bean meal	18.00	14.00	10.10	14.00	10.10
Feather meal	0.00	4.00	8.00	4.00	8.00
Maize bran	4.00	4.00	4.00	4.00	4.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Bone meal	2.00	2.00	2.00	2.00	2.00
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
**Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated values					
Feather meal %	0.00	10.00	20.00	10.00	20.00
Crude protein %	20.21	20.40	20.33	20.40	20.33
Energy Kcal/kg ME	2800.24	2800.21	2800.01	2800.35	2800.19

** To provide the following per 100kg of diet: 440mg riboflavin, 720mg calcium pantothenate, 2g niacin, 22.00g choline chloride, 15mg folic acid, 1mg vitamin B12, 15mg retinol, 165g vitamin D2, 1000mg D2-tocopherol acetate, 1700mg copper, 200mg iodine, 300mg manganese, 500mg Zinc, 10,000mg iron

Table 2. Growth performance of rabbits fed diets containing graded levels of hydrolysed and keratinase treated feather meal

Parameters (g)	CTRL	Treated feathers proportions				SEM	LS
		Hydrolysed (%)		Keratinase (%)			
		10	20	10	20		
Average final weight	1494.00 ^b	1486.09 ^b	1449.47 ^b	1603.96 ^a	1455.01 ^b	16.45	*
Average initial wt.	961.10 ^a	697.20 ^b	838.90 ^{ab}	811.1 ^{ab}	936.10 ^{ab}	37.78	*
Avg. daily body wt.	5.87 ^{cb}	8.57 ^{ab}	6.71 ^{abc}	8.71 ^a	5.70 ^c	0.47	*
Average feed intake	418.15 ^b	449.27 ^c	402.93 ^{bc}	454.23 ^a	408.51 ^b	8.76	*
Feed conversion ratio	10.22 ^a	7.92 ^{bc}	9.36 ^{abc}	7.47 ^c	10.62 ^a	0.43	*

^{abc}Means with different superscripts in the same row are significantly (P < 0.05) different

SEM – Standard error of mean, LS – Level of significance, * - Significant,

Table 3. Nutrient digestibility of rabbits fed graded levels of hydrolysed and keratinase treated feather meal diets.

Parameters (g)	CTRL	Treated feathers proportions				SEM	LS
		Hydrolysed (%)		Keratinase treated (%)			
		10	20	10	20		
Dry matter	86.50 ^a	79.56 ^{ab}	79.56 ^b	83.41 ^{ab}	80.43 ^b	0.81	*
Crude protein	67.69 ^c	79.84 ^b	80.57 ^{ab}	86.32 ^a	84.59 ^{ab}	1.88	*
Crude fibre	84.38	82.46	80.38	85.58	83.67	0.83	Ns
Ash	68.39	73.33	63.99	71.27	68.60	1.59	Ns
Ether extract	58.41	60.27	57.26	58.38	53.45	1.02	Ns
Nitrogen free extract	79.29	79.54	78.34	75.34	77.30	0.95	Ns

^{abc}Means with different superscripts in the same row are significantly (P < 0.05) different

SEM – Standard error of mean, LS – Level of significance * - Significant, NS – Not significant