Journal of Animal and Veterinary Advances 5 (10): 839-843, 2006

Response of Weaner Rabbits to Xylanase Enzyme Supplemented Maize Milling Waste Based Diets

W.A. Olayemi, A.O. OSO, A.M. Bamgbose, O.O. Oduguwa and S.A. Onadeko
Department of Animal Nutrition, University of Agriculture, Abeokuta, Nigeria

Abstract: A ten-weeks feeding trial was conducted to assess the effect of inclusion of Maize Milling Waste (MMW) with/without xylanase supplementation on the performance characteristics, nutrient digestibility, haematological traits and carcass characteristics of weaner rabbits. A total of 48 unsexed, crossbred weaner rabbits were randomly allotted to the experimental diet in a 2 x 4 factorial arrangement with MMW at graded levels (0, 12, 23 and 35%) and two xylanase levels (0 ppm, 100 ppm). There were eight treatment groups of six rabbits each per treatment group(3 replicate of 2 rabbits per replicate). The final live weight of the rabbit were significantly ($p<0.05$) affected by MMW inclusion levels and it decreases as inclusion level of MMW increases from T_1 to T_4 and T_3 to T_8 respectively. Xylanase inclusion has no effect and hence did not improve the feed intake, final weight or weight gain. Nitrogen retention and crude fibre digestibility were not significantly ($p<0.05$) affected by the treatment. Ash digestibility significantly ($p<0.05$) increases as the inclusion level increases. Carcass yield indicated that shrunk weight, empty carcass weight and head were significantly ($p<0.05$) affected by the treatment imposed. The empty carcass weight reduces with increase in MMW inclusion level from 1165.30 g to as low as 999.30 g T_4. The same trend also applies for the xylanase supplemented diets. The haemoglobin, red blood cell, mean corpuscular volume and white blood cell were all significantly ($p<0.05$) affected by the treatment. The result indicated that above 12% MMW inclusion level may have adverse effect (with/without xylanase enzyme supplementation) on rabbit performance and nutrient utilization and may not be a promising energy supplement beyond inclusion level of 12% in a weaner's diet.

Key words: Wearner rabbits, supplemented maize, waste diets

INTRODUCTION

In view of the growing rate of population in developing countries, there is need for increased animal protein. Alonge[1] emphasized that the drive for attainment of self-sufficiency in meat and animal products in developing countries like Nigeria calls for total exploitation of all potential sources of animal protein to ensure a satisfactory level of protein nutrition in humans. A survey done by FAO[2], reported that daily consumption of meat in Nigeria was as low as 20 gm/day/person while in countries like United States of America (USA) it was up to 304gm/day/person.

The acute shortage of animal protein therefore calls for an exploitation of other sources of protein. Although, animal protein is usually obtained from cattle, sheep, goat and poultry chickens, however, these animals have not been able to close the gap of protein shortages. In order to effectively bridge this gap, production of animals with short production cycles should be emphasized on. Rabbits are examples of such livestock with short production cycles.

Rabbits do not compete for grains but can be raised on low grain, high forage diets unlike chickens. They can be raised successfully on a diet consisting largely of forage plants, grasses and shrubs. Weanling rabbits can gain one kilogram of body weight for each 2.5-4.0 kg of plant/forage consumed while for beef cattle on a similar diet, 12-15 kg of feed are required per kilogram of body weight gain[3]. When compared with meat of other species, rabbit meat is richer in protein, certain minerals and vitamins, possesses little fat and has higher proportion of essential poly-unsaturated linolenic and linoleic fatty acid[4].

The aforementioned importance are influenced by the cost of ingredients required to formulate a rabbit concentrate. Maize, for instance used in brewing, confectionaries, etc is now the cause of the phenomenal increase in the price of livestock feed since it accounts for 30-65% of a tropical rabbit concentrate.

Maize as staple food in humid tropics ensures and guarantees the availability of Maize Milling Waste (MMW), which could be used as a substitute to maize. Maize Milling Waste (MMW) is a by-product in the processing of corn flour. It consists of the testa or seed coat and bran depending on the efficiency of milling. It has been used in feeding goats, however there is dearth of information on its use in the feeding of rabbits.

Corresponding Author: W.A. Olayemi, Department of Animal Nutrition, University of Agriculture, Abeokuta, Nigeria

Substituting maize with maize milling waste as an energy source will reduce the overall cost of rabbit production and on the long run increase the protein consumption level of human populace. However, fortification of cereal-based diet with exogenous enzymes in monogastric has been known to improve the performance of poultry birds. Ward[5-7]. The addition of cell wall degrading enzymes such as Xylanase gave a more rapid and extensive digestion of starch, protein and other nutrients and consequently led to higher feed intake and better feed conversion efficiency.

This study was designated to investigate the effect of replacing maize with Xylanase enzyme supplemented maize milling waste on performance, nutrient utilization, carcass and haematological traits of weaner rabbits.

MATERIALS AND METHODS

Processing of Maize Milling Waste (MMW): The MMW was obtained from a maize miller in Abeokuta, Nigeria. The maize grains was poured in a processing plant so as to obtain a corn flour. During processing, the testa of the corn grains in the machine was peeled off together with broken kernel. This was blown off by a fan and the waste accumulated at the base of the milling machine. This was packed and bagged.

Experimental diets and composition: Eight iso-nitrogenous and iso-caloric diets were formulated with diets 1, 2, 3 and 4 containing MMW replacing maize at 0, 12, 23 and 35%, respectively without Xylanase enzyme supplementation. Diets 5, 6, 7 and 8 had MMW replacing maize at 0, 12, 23 and 35%, respectively with 100ppm Xylanase enzyme supplementation. The proximate composition of maize milling waste was determined using the methods of AOAC[8].

Experimental animals and their management: A total of 48 unsexed, crossbred weaner rabbits (weanlings) were procured from the University farm (UNAAB, Nigeria). The rabbits were allotted into eight groups of 6 rabbits each. Each group was replicated thrice with 2 rabbits per replicate. The rabbits were allotted to the diets in a 2x4 factorial arrangement with MMW at graded levels (0, 12, 23 and 35%) and two Xylanase levels (0 ppm, 100 ppm). Other management practices such as routine medication maintenance and cleaning of the rabbit hutches were observed. The rabbits were fed *ad libitum* in a Completely Randomized Design (CRD) and water was provided throughout the experimental period of 70 days.

Parameters measured

Growth response: The mean weekly live weight and weekly feed intake were recorded, while the mean daily weight gain and feed-to-gain ratio were calculated from the data obtained.

Blood collection for analysis: At the end of the feeding trial, a rabbit per replicate was sacrificed by cervical dislocation. Blood was then allowed to flow freely into labeled bijar bottles containing a speck of EDTA. This was processed for analysis of haematological indices while the sacrificed rabbits were used for carcass measurement.

Digestibility trials: At the end of the tenth week, a rabbit per replicate was selected for metabolic trials. The metabolic cages were fitted with removable faecal collection trays. Known weights of respective experimental diets were given to each animal for a period of five days during which faeces voided were also collected daily. Three days of acclimatization period were allowed prior to the commencement of the faecal collection. The urine voided during the trials was also collected in a labeled bottle and frozen in a freezer. Representative samples were taken for analysis of proximate constituents according to AOAC[8].

Carcass characteristics: After the collection of blood samples, the rabbits were weighed, flayed and the shrunk body weight determined. The offals and other gastrointestinal tract were removed and empty body weight was determined. The rabbits were later divided into cut parts to determine the shoulder, rack, loin and head. These were expressed as a percentage of the live weight.

Statistical analysis: Data collected were statistically analyzed by analysis of variance Steel and Torrie[3]. The Duncan's Multiple Range Test Gomez and Gomez[9] was used to detect difference among means

RESULTS AND DISCUSSION

The chemical composition of maize milling waste is shown in Table 1 while nutrient composition of the experimental diets is shown in Table 2. Data on performance and nutrient utilization of weaner rabbits fed MMW is presented in Table 3 while data on carcass traits and haematological indices of rabbits fed MMW with/without Xylanase inclusion is shown in Table 4.

Table 1: Determined composition of maize milling waste

Proximate fraction	Percentage (%)
Crude protein	8.84
Crude fat (Ether extract)	3.15
Crude fibre	6.34
Ash	7.35
Dry matter	90.49
Moisture	9.51
Calcium	0.04
Phosphorus	0.48
Magnesium	0.41
Arabinoxylans	8.30

Table 2: Percentage composition of experimental diets

	Level of Inclusion							
	T1	T2	T3	T4	T5	T6	T7	T8
Ingredients	0%	12%	23%	35%	0%	12%	23%	35%
Maize	35.00	23.00	12.00	0.00	35.00	23.00	12.00	0.00
MMW*	0.00	12.00	23.00	35.00	0.00	12.00	23.00	35.00
SBM	5.00	5.50	6.00	6.50	5.00	5.50	6.00	6.50
GNC	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Fish meal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PKC	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Wheat offal	34.50	34.00	34.50	33.00	34.50	3400	33.50	33.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Premix	0.25	0.25	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	0.25	0.25
Enzyme+	-	-	-	-	+	+	+	+
Determined analysis								
M.E (Mj/kg)	10.90	10.81	10.79	10.60	10.92	10.75	10.60	10.55
Dry matter(%)	92.40	91.80	90.80	90.08	92.40	91.80	90.80	90.08
Crude protein(%)	18.50	18.40	18.08	18.00	18.50	18.40	18.08	18.00
Crude fibre(%)	11.50	11.90	11.80	12.00	11.50	11.90	11.80	12.00
Ether extract(%)	5.08	5.16	5.36	5.56	5.08	5.16	5.36	5.56
Ash(%)	5.00	5.20	5.26	5.38	5.00	5.20	5.26	5.38
Nitrogen free extract(%)	59.92	59.33	59.21	58.80	59.92	59.33	59.21	58.80

*MMW-Maize Milling Waste, No enzyme supplementation (-) Enzyme supplementation (+, 100 ppm)

Table 3: Performance and nutrient utilization of rabbits fed MMW with /without enzyme inclusion

Parameters	T1	T2	T3	T4	T5	T6	T7	T8	SEM
Initial weight(g)	534.00	534.00	534.00	534.00	534.00	534.00	534.00	534.00	-
Final live weight (g)	1640.00^{a}	1539.00^{b}	1439.30^{c}	1334.00^{d}	1343.00^{d}	1480.00^{c}	1298.30^{e}	1295.00^{e}	0.65
Weight gain (g)	1106.00^{a}	1005.30^{b}	905.30^{c}	800.00^{d}	1000.30^{ab}	946.00^{c}	764.30^{d}	761.00^{e}	26.65
Feed intake (g)	73.00^{a}	71.83^{ab}	71.50^{b}	70.00	71.00	72.00	71.67	73.00	0.24
Feed conversion ratio	4.62	5.01	5.53	6.17	4.97	5.29	6.64	6.73	0.17
Nitrogen intention (%)	72.16	72.22	72.62	72.30	75.86	76.20	75.00	74.27	0.07
Ash digestibility (%)	70.56^{e}	72.56cd	72.55^{cd}	74.64^{ab}	76.05^{bc}	70.86^{de}	74.85^{a}	75.63^{a}	0.37
Ether extract digestibility (%)	81.15^{c}	80.09^{c}	81.31^{c}	83.13^{ab}	83.13^{c}	82.94^{ab}	82.61^{b}	83.96^{a}	0.27
Crude fibre digestibility (%)	82.22	88.00	87.70	89.34	89.34	91.31	91.63	91.64	0.69

Abcdef:Mean with different superscript within a row are significantly different ($p<0.05$), SEM=Standard error of mean

Table 4: Carcass traits and haematological indices of rabbits fed MMW with/without enzyme Inclusion

Parameters	T1	T2	T3	T4	T5	T6	T7	T8	SEM
Live weight (g)	1640.30	1569.30	1439.30	1334.00	1534.30	1480.00	1298.30	1295.00	0.65
Shrunk body weight (g)	1543.30^{a}	1442.70^{b}	1342.70^{c}	1237.30^{d}	1437.70^{b}	1386.70^{c}	1201.70^{d}	1195.00^{e}	6.57
Empty body weight (g)	1246.70^{a}	1165.30^{b}	1084.30^{d}	999.30^{e}	1161.00^{b}	1120.00^{c}	970.00^{e}	1195.00^{f}	1.47
Shoulder (g)	159.00	148.33	139.33	127.33	147.67	142.67	123.67	124.33	2.70
Rack (g)	215.67	201.33	188.69	173.00	201.00	193.67	168.00	169.00	0.65
Loin (g)	300.33	281.00	263.67	241.33	280.00	270.67	234.00	235.67	5.08
Head (g)	163.77	153.00	138.00	132.00	152.33	149.33	129.33	117.00	0.25
PCV (%)	20.00	37.67	37.33	46.00	43.00	38.67	40.00	36.00	1.52
Hb (g/dl)	6.70^{g}	12.80^{d}	12.30^{e}	15.30^{a}	14.30^{b}	13.10^{c}	13.30^{c}	12.03^{f}	0.50
RBC (ml/mm^{3})	2.30^{e}	4.30^{cd}	4.06^{d}	5.20^{a}	4.80^{b}	4.40^{c}	4.50^{c}	4.43^{c}	0.16
MCV (cu/micron)	87.00^{de}	88.00^{cd}	88.00^{cd}	88.33^{bc}	88.66^{bc}	86.67^{e}	89.33^{ab}	90.33^{a}	0.24
WBC (no/mm^{3})	5620^{d}	6000^{b}	58.00^{c}	54.00^{e}	62.00^{a}	58.00^{c}	5833.30^{c}	5600^{d}	49.66

Abcdef:Mean with different superscript within a row are significantly different ($p<0.05$), SEM=Standard Error of Mean

Table 1 shows that MMW contains 8.84% crude protein, 3.15% crude fat, 6.34% crude fibre and 7.35% while the mineral content is as follows: Calcium (0.04%), Phosphorus (0.43%) and Magnesium (0.41%).

The determined crude protein for the treatment diets ranged from 11.50 to 12.00%. The calculated metabolisable energy ranged from 10.55 MJ/kg to 10.90 MJ/kg.

Performance of weaner rabbits on the various levels of MMW is presented on Table 3. Among the various parameters considered only the weight gain and feed consumed was significantly different ($p<0.05$) among the treatments. The weight gain significantly reduces as the level of MMW inclusion increases. Ash digestibility and ether extract digestibility was significantly affected by the treatment.

The final live weight of the rabbits was significantly ($p<0.05$) affected by MMW inclusion levels. It decrease as inclusion level of MMW increased from T1 to T4 and

T3 to T8 respectively with or without Xylanase enzymes supplementation. It could be noted that as the MMW inclusion level increased, there was a reduction in feed intake with corresponding reduction in body weight gain. This could be due to the increasing fibre level of the diet. Wiseman[3] reported that the bulkiness of the diet and the physical from in which it is presented influence the dietary energy value of the diet, with bulkier feeds resulting in increase in the rate of passage of ingesta, reducing the digestibility hence the weight gain.

Xylanase enzyme inclusion has no effect and hence did not improve the feed intake, final weight or weight gain as could be seen from Table 3 when T1 to T4 is compared with T5 to T8. This is contrary to the findings of Atteh[10] which showed a better response of weaner pigs and weaner rabbits to nutrase-xyla when supplemented with rumen content based diet.

Feed Conversion Ratio (FCR) was very poor with increased levels of MMW inclusion especially at (23% MMW) inclusion and 35% MMW with or without enzyme inclusion. However the FCR values for rabbits placed on 12% MMW and control diets (0% MMW) were similar likewise the FCR values of rabbits placed on 23% MMW and 35 MMW with/without Xylanase supplementation. Choct[11] already reported that cereal based diet is high in Non Soluble Polysaccharides (NSP) which is a limiting factor as it is resistant to degradation by digestive enzyme. However, Doma[12] stated that inclusion of agro industrial by products above 20% inclusion compromises productive performance in rabbits. Nitrogen retention and crude fibre digestibility were not significantly ($p<0.05$) affected by the treatment (Table 3). Ash digestibility significantly ($p<0.05$) increases as the inclusion level increases. This could result from the high level of ash content of MMW.

Xylanase inclusion seems to improve ash digestibility in weaner rabbits containing high levels of MMW. This was noted when T3, T4 is compared with T7 and T8.

The result of the carcass yield and evaluation indicated that shrunk weight, empty carcass weight and head were significantly ($p<0.05$) affected by the treatment imposed. The empty carcass weight reduces with increase in MMW inclusion levels from 1165.30 to as low as 999.30 g in T4. The similar trend also applied for the Xylanase supplemented diets when T5 is compared with T8. It supported the findings of Lebas[13] that variation in nutritional requirement of growing rabbits may modify the anatomical equilibrium of the carcass, composition of carcass tissues and components of the muscle.

Haemoglobin (Hb), Red Blood Cell (RBC) and Mean Corpuscular Volume (MCV) were significantly affected by the treatment imposed. Carcass traits and haematological indices of rabbits fed MMW as presented in Table 4 shows that only the live weight, shrunk weight and empty body weight were significantly ($p<0.05$) affected by the treatments. The empty body weight and shrunk weight reduces significantly ($p<0.05$) as MMW inclusion level increases with /without Xylanase enzyme inclusion.

Though the haemoglobin, red blood cell, mean corpuscular volume and white blood cell were all significantly affected by the treatment, only the white blood cell followed a regular pattern. The haemoglobin values are within the range of normal physiological values of rabbits.

CONCLUSION

It could be observed that rabbits fed control and 12% MMW inclusion level had similar performance characteristics with or without Xylanase supplementation. The same also goes for their carcass characteristics and nutrient digestibility. The result of the study indicated that above 12% MMW inclusion level may have adverse effect (both with or without Xylanase enzyme supplementation) on rabbit performance and nutrient utilization and may not be a very promising energy supplement beyond inclusion levels of 12% in rabbit diet.

REFERENCES

1. Alonge, D.D., 1987. Hand book for Rabbit. 1st . UPL., pp: 1-2.
2. F.A.O., 1990. Feed and Agricultural Organization of the United Nutrition report.
3. Wiseman, J., 1987. Feeding of non-ruminant Livestock. Butter worth’s, London.
4. Beyman, P.R., 1984. Rabbit Feeding and Nutrition. Academic press Florida.
5. Ward, M.E., 1995 Enzymes use in viscous inducing cereal diets examined. Feedstuff, 67: 1-4.
6. Bedford, M 12 and Morgan 00, 1995. Mechanisms of action and potential environment benefit from the use of feed enzyme. Anim. Feed Sci. Tech., 53: 145155.
7. Atteh, I.O., 2001. Apparent time and Nitrogen Corrected metabolisable energy of Xylanase (Nitrase Xyla) supplemented wheat and rice milling by-products. Seminar: Flour mills in Nigeria, Lagos.
8. Association of Official Analytical Chemists (AOAC), 1990. Official method of Analysis (15th) Edn. washing ton DC.
9. Gomez, A.K. and A.A. Gomes, 1985. Statistical Procedure for Agricultural Research Vineyard. sans Inc. New York.

10. Atteh, J.O., 2002. Response of weaner pigs fed rumen content supplemented with Nitrase-Xyla. Seminar on Versatibility of nutrase Xylase as a feed a additive for MMW gastric animals, Lagos, Nigeria.
11. Choct, O., 1997. Non-Starch poly sachande and Arabinoxylans content of some frequently used cereals for acceptability of Nutrase Xyla as a feed additives fro monogastrics Animal Bio ingredients Limited. Lagos Nigeria, pp: 58.
12. Doma, D., T.A. Adegbola, A.M. Bamgbose and P.A. Umeh, 1999. Utilisation of Cowpea Shell and maize cobs in diets for rabbits. Trop. J. Anim. Sci., 1: 27-32.
13. Lebas, F. and Laplace F.P., 1982. Mensuration Viscerales chezle lapin 4. Effects de divers modes de restriction alimentane sin la Croissance corporadle et viscerale. Annuals de Zootechnic, 31: 391.