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COST BENEFIT ANALYSIS OF INCLUSION OF EXOGENOUS ENZYME IN MAIZE COB BASED RABBIT DIETS

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ABSTRACT

A study was conducted with thirty weaner rabbit at 6 weeks of age and weighing averagely 500g. Five (5) experimental iso nitrogenous diets were formulated with graded inclusion levels of maize cob meal (MCM) at 10, 20, 30, 40 and 50 percent level of inclusion. A cock tail enzyme Zymos N®, was included in all the treatment diets according to the manufacturer's recommendation. The total feed intake declined (P<0.05) significantly as level of MCM inclusion increased across the dietary treatments, from 3241.5g at 10% MCM to 2065.0g at 50% MCM inclusion level. Nutrient intake significantly (P<0.05) decline across the dietary treatments. The crude fibre intake (CFI) of dietary treatment with 10 and 20%MCM (20.73 and 20. 405g/d) are statistically similar and higher, followed by dietary treatment with 30 and 40%MCM and the least CFI was observed in treatment with 50% MCM, which is statistically lower. Dry matter intake (DMI), Organic matter intake (OMI), and Crude protein intake (CPI) follow similar pattern, which decline significantly (P<0.05) across the dietary treatment. Cost benefit analysis show a percent cost reduction with increase in the MCM inclusion level. At 20% MCM inclusion, 5.01% cost reduction was observed, while at 50% inclusion level, 25.71% cost reduction was incurred. Apparent profit was highest in rabbits fed 20% MCM based diet (₦ 27.49), which declined with increase in MCM inclusion. At 50% inclusion level, ₦ 11.76 profits was accrued, which is twofold lower than the values obtained indiets with10 and 20% MCM diets. From the result of this study, MCM should not be included above 20% with enzyme supplementation according to the manufacturer's recommendation for optimum cost benefit.

Keywords: Cost benefit analysis, exogenous enzyme, maize cob, rabbit

INTRODUCTION

Crop residues are useful source of ruminant animal supplementary feed in the dry season in the tropics (Oroka and Omoregie, 2015). In West Africa and other parts of the tropics, where maize, sorghum, millet and rice are the major cereal crops their residues constitute an important source of animal feed (Ehoche, 2002). Generally maize cobs, straws, stovers are, however, poor quality feeds in their natural state because of their low protein content, low fermentable energy and high fibre content which limit voluntary intake and digestibility by animals (Sundstøl and Owen, 1984).

Limitations in its use in animal diet stems from its high fibre content and low metabolisable energy. The high fibre content lowers digestibility and increased digestibility will enable the animal to meet their need for maintenance, growth and production with less feed cost. The Scientific Committee for Animal Nutrition (2001) concluded that there are no adverse effects on the usage of enzymes to improve digestibility of diets. There are various categories of enzyme preparations with varying degree of substrate specifity. These include xylanase, carbohydrase, cellulose, pectinase, arabinase, lipase and hemicellulase. Enzymes can be added to feeds as multienzyme products that contain a variety of different activities or specific enzymes products that are responsible for a single type of enzymatic activity based on a particular daily substrate.

The objective of this study is to determine the effect of exogenous enzymes on the cost benefit of feeding growing rabbits on maize cob based diets.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at Teaching and Research Farm of the Department of Animal Science, Ahmadu Bello University Zaria, Kaduna State, Nigeria located on latitude 11° 11' N and longitude 07° 38' E (Wikipedia, 2016).It is situated at an altitude of 686m above sea level and lies within the northern guinea savannah zone. The mean relative humidity is 21 and 72% during the dry and raining season respectively (IAR, 2016).

Experimental Animals and Management

Thirty weaned rabbit at 6 weeks of age, averaging 500g obtained from the rabbitry unit of the Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State, Nigeria were used in this study. The rabbits were randomly distributed into five (5) treatments groups, with 5 rabbits per group. The rabbits were housed in galvanizer wire net cages measuring 40cm X 60cm, each cage was equipped with a small rubber bowl drinker and a clay pot feeder.

The animals were given prophylactic treatment with Neo-Terramycin antibiotic and Ivomec® injection against internal and external parasites before the commencement of trial. The experimental period lasted for 6 weeks.

Experimental Diet

Five (5) experimental iso nitrogenous diets (Table 1) were formulated with varied inclusion levels of maize cob at 10, 20, 30, 40 and 50 percent level of inclusion. Each level of maize cobs inclusion level served as dietary treatment. A cock tail enzyme Zymos N®, was included in all the treatment diets according to the manufacturer's recommendation.

Table 1. Gross Composition of Experimental Diets

Ingredient	Percent inclusion level of maize cobs				
	10	**20**	**30**	**40**	**50**
Maize offal	65.05	52.90	40.15	27.70	15.30
SBM	22.45	24.60	27.35	29.80	32.20
Maize cob meal	10	20	30	40	50
BM	2.0	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5	0.5
Enzyme	0.0083	0.0083	0.0083	0.0083	0.0083
Total	100	100	100	100	100
Price/kg (N)	57.95	55.01	52.79	50.25	47.62

Management of Animals and Data collection

The rabbit were fed and given water ad libitum throughout the period of the trial which lasted for eight (8) weeks. The animals were fed at 8:00am every morning and the weights were taken weekly to ascertain weight gain by the rabbit. Feed were measured on a daily basis and average is taken at the end of the week to determine the amount of feed intake. At the end of the experiment, average daily feed intake, average daily live weight gain, feed

conservation and feed cost per key live, weight gain and cost savings were computed.

Proximate Analysis

The dry matter (DM) of the feed samples was determined based on weight loss after oven drying at a temperature of 105^0C to constant weight. Nitrogen (N) content of feed, faecal and urine samples were determined by the micro Kjeldahl method according to (AOAC 2005) procedure and crude protein (CP) calculated as nitrogen content multiply by 6.25 (N x 6.25). The ash content was determined as the residue remaining after incinerating the sample at 600^0C for 3 hours in a Muffle furnace. Ether extract (EE) and crude fibre (CF) were determined according to the (AOAC, 2005) procedure.

Statistical analysis

Data collected on intakes were subjected to ANOVA procedure of SAS software (SAS Institute, 2002). Where significant difference was observed, DDMRT of SAS software was used to compare treatment means.

RESULTS AND DISCUSSION

Proximate Composition of Experimental Diets

The result of the proximate composition of the maize cobs and experimental diets are presented in table 2. The proximate composition of the maize cobs used in this study has a low crude protein content of (4.21%) and crude fibre level of 32.59%. is similar to 4.97% crude protein reported by (Abdu *et al*., 2012). The low crude protein observed in this study of the maize cobs is in line with the finding of (Leng, 1990), who reported that most cereal straws and stovers and residues are characterized by low crude protein and readily fermentable carbohydrate. The crude protein content of the experimental diets are adequate and within the range reported by (Abdu *et al.,* 2009; Aduku and Olukosi, 1990), for growing rabbits in the tropical region. Increasing the inclusion level of maize cobs in the diet resulted in an increase in the crude fibre level, from 12.62 to 20.24%. This is obvious, because of the high fibre level reported in the maize cobs.

Table 2. Proximate composition of the experimental diet (%)

Parameters	Maize cobs inclusion levels					Maize cobs
	10	20	30	40	50	
Dry matter	88.290	88.107	87.920	87.740	87.57	92.87
Organic matter	81.37	81.33	81.27	81.23	81.18	85.01
Crude protein	17.80	17.43	17.35	17.18	16.99	4.21
Crude fibre	12.62	14.53	16.42	18.34	20.24	32.59
Ether extract	8.03	7.59	6.097	5.96	5.83	7.86
NFE	54.277	54.118	53.869	53.660	53.469	54.34

NFE=Nitrogen free extract

Nutrient intake

The result of nutrient intake is presented in table 3. Statistical ($P<0.05$) difference were observed in the parameters measured. The total feed intake declined ($P<0.05$) significantly as level of maize cobs inclusion increased across the dietary treatments, from 3241.5g at 10% maize cobs to 2065.0g at 50% maize cobs inclusion level. The reduced feed intake as level of maize cobs increased in the diet is in support of the findings of (Alawa and Amadi, 1991) who indicated that intake of highly fibrous diet by rabbits depends on the age of the rabbits, level of replacement, nature of fibrous sources and length of adaptation period of their digestive system to the fibre sources.

Table 3. Nutrient intake of growing rabbits fed graded level of maize cobs based diets supplemented with enzyme Zymos- N®

Parameter (g/day)	Maize cobs inclusion levels					SEM
	10	20	30	40	50	
Total Feed Intake	3241.5[a]	2982.5[b]	2935.0[b]	2315.0[c]	2065.0[d]	54.8
Ave. Daily Feed Intake	77.179[a]	71.012[b]	69.881[b]	55.119[c]	49.167[d]	1.30
Dry Matter Intake	71.521[a]	66.907[b]	65.877[b]	57.972[c]	43.30[d]	3.39
Organic Matter Intake	66.458[a]	62.093[b]	60.105[b]	47.408[c]	43.350[d]	1.14
Crude Protein Intake	12.364[a]	11.2838[b]	11.2648[b]	8.8466[c]	8.0191[d]	0.21
Crude Fibre Intake	20.730[a]	20.405[a]	19.828[b]	15.814[c]	13.983[d]	0.36

[sabc] Means on the same row having different superscripts are significantly different ($P < 0.05$)

The average daily feed intake and nutrient intakes in this study with enzyme supplementation, declined with increase in maize cobs inclusion, but the intake is higher than 40.62g per day reported by (Ukachukwu*et al*., 2011) in rabbits fed composite cassava leaf meal. The increase in feed and nutrient intake may be attributed to the enzyme supplementation, even though there is decline with increasing inclusion of maize cobs in the experimental diets.

Nutrient intake significantly ($P<0.05$) decline across the dietary treatments. The crude fibre intake (CFI) of dietary treatment 1 and 2 (20.73 and 20. 405g/d) are statistically similar and higher, followed by dietary treatment 3 and 4 and the least CFI was observed in treatment 5, which is statistically lower. The dry matter intake (DMI), Organic matter intake (OMI), and Crude protein intake (CPI) follow similar pattern, which decline significantly across the dietary treatment. This is in consonance with the report of (Doma*et al*., 1999), who observed crude protein intake to decline significantly ($P < 0.05$) from 10.26 to 8.44g as level of maize cobs was increased from 20 to 40% in young rabbit's diet.

Cost benefit analysis

The result of cost benefit analysis presented in table 4 show a percent cost reduction with increase in the maize cobs inclusion level. At 20% maize cobs inclusion, 5.01% cost reduction was observed, while at 50% inclusion level, 25.71% cost reduction was incurred. The reduction in the cost of feed is as a result of the cost of the maize cobs used, which is cheaper, when compared with other feed ingredients. This agrees with (Abdu *et al*., 2012) when carrot leaf meal was included in rabbit diet, there was a reduction in the cost of the feed. Also Bhatt and Sharma, (2001) and Muriu*et al*. (2002) recommended economization of feed cost using cheaper and unconventional feed resources is an important aspect of commercial rabbit production.

Table 4. Cost analysis of rabbits fed maize cobs diets supplemented with ZymosN®

Parameters	Percent inclusion level of maize cobs				
	10	**20**	**30**	**40**	**50**
Cost of Rabbit meat (₦)/g	0.118	0.118	0.118	0.118	0.118
Dressing %	59.42	58.967	58.69	54.07	53.33
% Cost Reduction	-	5.01	11.90	18.82	25.71
Cost/kg diet	4.11	3.90	3.62	3.34	3.00
ADFI (g)	77.18	71.01	69.88	55.11	49.17
Total feed intake (kg)	3.24	2.98	2.93	2.31	2.07
CDFC (₦)	0.32	0.28	0.25	0.18	0.15
ADWG (g)	12.5	13.39	8.74	7.44	6.83
Feed cost efficiency	0.03	0.02	0.02	0.02	0.02
TWG (g)	525.0	562.5	367.0	312.5	287.0
CTFI (₦)	13.32	11.64	10.62	7.72	6.30
Income Accruable (₦)	36.81	39.13	25.42	19.94	18.06
Apparent Profit (₦)	23.49	27.49	14.79	12.22	11.76

ADFI=average daily feed intake CDFC=cost of daily feed consumed ADWG=average daily weight gain TWG=total weight gain CTFI=cost of total feed intake

Apparent profit which is the money accruable to the farmer after deduction the cost of feed consumed was highest in rabbits fed 20% maize cobs based diet (₦ 27.49), which declined with increase in maize cobs inclusion. At 50% maize cobs inclusion level, ₦ 11.76 profits was accrued, which is twofold lower than the values obtained at 10 and 20% maize cobs diets. This shows a decline in the profit margin. The result shows a 17.02% marginal increase over the 10% maize cobs inclusion. The result of this study concurs with the finding of (Abdu *et al.*, 2012), when carrot leaf meal was included in the diet of rabbits, an apparent net profit was incurred as a result of the carrot leaf meal inclusion in the diet of rabbit and also (Udedibie and Igwe, 1989) in laying hens fed pigeon pea leaf meal. The net profit is as a result of the reduction in the cost of feed and also the growth rate of the rabbits on the diet.

CONCLUSION AND RECOMMENDATION

The result of this study shows a reduction in the cost of feed with increase in the inclusion level of maize cobs in the diet. At 20% maize cobs inclusion, 5.01% cost reduction was observed, while at 50% inclusion level, 25.71% cost reduction was incurred.Inclusion of maize cobs at 20% has resulted in 17.02% marginal increase over the 10% maize cobs inclusion.Apparent profit which is the money accruable to the farmer after deduction the cost of feed consumed was highest in rabbits fed 20% maize cobs based diet (₦ 27.49), which declined with increase in maize cobs inclusion.

From the result of this study, it recommends for optimum benefit by the farmers, that maize cobs should not be included above 20% with enzyme supplementation according to the manufacturer's recommendation. Further studies to be conducted with increase in the inclusion of the enzyme above the recommended level of the manufacturer.

REFERENCES

Abdu, S.B., Jokthan, G.E., Hassan, M.R., Adamu, H.Y., Yashim, S.M. and Ikani, E. (2012). Effects of Inclusion Levels of Carrot (*Daucus carota*) Leaf Meal on Performance of Growing Rabbits. *World J Life Sci. and Medical Research*, 2(2):65-70

Abdu, S.B., Yashim, S.M., Adamu, S.B., Hassan, M.R. and Adamu, H.Y. (2009). Nutrient digestibility and nitrogen balance in rabbits fed graded levels of Roselle (*Hibiscus sabdariffa*) seed meal. *Tropical Journal of Animal Science.* 11:129-134

Aduku, A.O. and Olukosi, J. O. (1990). *Rabbit management in the tropics*. Production, processing, utilization marketing, economics, research and future prospect. Living book service Abuja.

Alawa, J. P. and Amadi, C. (1991).Voluntary Intake and Digestibility of Diets containing Corn Cob, Brewer's Dried Grain and Wheat Bran by Rabbits. *Journal of Animal Production Research* 11(1 & 2):67-75

AOAC (2005). Official method of analysis. Association of Official Analytical chemists, Washington D.C., USA (48).

Bhatt, R. S. and Sharma S. R. (2001). Nutrient utilization and growth performance of broiler rabbit fed oat plant meal and tall fescue hay. *Asian-Australasian Journal of Animal Science*, 14: 1228-1232.

Doma, U. D., Adegbola, T. A., Bamgbose, A.M. and Umeh, A. P. (1999) Utilization of Cowpea Shell and Maize Cobs in Diets for Rabbits. *Tropical Journal Animal Science*, 2(1): 27-32.

Ehoche, O.W. (2002). Feeding strategies for improving milk production. In: Famine, A.O and Olanite, J. A. (eds): Contributory role of animal production in national development, *Proceedings of the 7th Annual Conference of the Animal Science Association of Nigeria. Abeokuta, Nigeria,* 16-19 September 2002. Pp 19-26

I.A.R. (2016). Institute of Agricultural Research. Meteorological Service Unit, *Weather report*. Samaru, Ahmadu Bello University, Zaria.

Leng, R.A. (1990). Factors affecting the utilisation of 'poor quality' forages by ruminants particularly under tropical conditions. *Nutrition Research Reviews*3, 277– 303.

Muriu, J. I., Njoka-Njiri, E. N., Tuitoek, J. N. and Nanua, J. N. (2002). Evaluation of sorghum (*Sorghum bicolor*) as replacement of maize in the diet of growing rabbit (*Oryctolaguscuniculus*). *Asian-Australasian Journal of Animal Science*, 15: 565-569.

Oroka, F. O. and Omoregie, A. U. (2015). Nutritional Composition of Residues Available for Ruminant for Rice + Cowpea Intercrop during the Dry Season in Nigeria. *Journal of Biology, Agriculture and Healthcare,* 5(8):105-109

SAS (Statistical Analysis Systems) Institute Inc. (2002). SAS/ STAT. User's guide version 8. 3rd Edn. Cary. North Carolina, USA. Pp. 944.

Scientific Committee for Animal Nutrition, (2001). Report of the Scientific Committee for Animal Nutrition (SCAN) on the use of certain Enzymes in Animal Feeding Stuffs. hht://Europe.eu.int/comm/food/fs/sc/scan/out52-en.pdf .

Sundstøl, F. and Owen, E. (1984). *Straw and other fibrous by-products as feed.* Elsevier, Amsterdam. Pp. 604

Udedibie, A.B.I. and Igwe, F. (1989). Dry matter yield and chemical composition of pigeon pea leaf meal and the nutritive value of pigeon pea leaf meal and grain meal for laying hens. *Animal Feed Science and Technology* 24:111-9.

Ukachukwu, S. N. Ekwe and C. C. Ojewola, G. S. (2011). Performance of weaned rabbits fed graded dietary levels of composite cassava meal. *Nigerian Journal Animal Science*, 13:143-154

Wikipedia. (2016). Nigerian Google satellite Maps. Retrieved May 6, 2014 from www.maplandia.com/.../samaru