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EFFECTS OF DIETARY LEVELS OF ENZYME (MAXIGRAIN®) SUPPLEMENTED YAM PEEL MEAL ON PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS

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ABSTRACT

A study was carried out to determine the effects of dietary levels of enzyme supplemented yam peel meal (YPM) on performance and carcass characteristics of weaner rabbits. Five diets were formulated using YPM to replace maize at 0%, 25%, 50%, 75% and 100% representing diets 1, 2, 3, 4 and 5 respectively. All the diets were supplemented with Mixagrain® enzyme at 200g except the control diet 1 (0%). Thirty weaner rabbits consisting of mixed breeds and sexes were randomly allotted to the five dietary treatments with six rabbits per treatment and replicated 3 times with 2 rabbits per replicate in a completely randomized design. On the 56th day of the experiment, 3 rabbits from each treatment were randomly selected for carcass and internal organs evaluation. Result of performance shows no significant differences (P>0.05) across the treatments for all the parameters measured for growth performance. Feed cost/kg (₦ /gain) reduces from ₦225.68 in diet 1 – ₦189.15 in diet 5 (100%) while cost savings increased from ₦ 0.9 in diet 1 - ₦28.33 in diet 5 (100%). Result of carcass and internal organs characteristics did not show any significant differences (P>0.05) except for small and large intestine length in diets 4 (75%) and diet 5 (100%). Based on this result therefore, enzyme supplemented YPM can be used to replace maize completely.

KEYWORDS: Enzymes, yam peel meal, performance, carcass, weaner rabbits

INTRODUCTION

In developing countries including Nigeria, the inadequacy of animal protein intake is well spread and this has greatly affected the living standard of the people. It is evident that there is shortfall in the supply of meat in the country to meet the demand of the ever increasing growing population (FAO, 2001). Rabbits have several characteristics that if properly harnessed can be used to bridge the gap in protein intake. The small body size, short generation interval, rapid growth rate, genetic diversity and high reproductive potentials are characteristics which make rabbit suitable as meat producing mini-livestock in developing countries (Aduku and Olukosi, 1990; Lebas *et al*., 1997; Omole *et al*, 2007).

Conventional feed ingredients that are used in formulating feeds for domestic animals are very scarce and are costly since humans and other monogastric animals like pigs and poultry also compete for the ingredients. This has resulted into escalating cost of production which makes animal protein not affordable to most Nigerians. Most green forages used in rabbit feeding is available only during the rainy season and as such cannot sustain rabbit production throughout the year. Therefore, to arrest the escalating feed cost, there is the need for the integration of some non- conventional feed sources which has no direct human feed value into livestock production (Adeola and Olukosi, 2008). One of such potential alternatives is yam peel meal (YPM) which is cheaply available in Nigeria (Aguihe *et al*., 2015) and can serve as a cheaper energy source in rabbits (Olumo, 2011). Nigeria produces more than 37miillion tons of yam representing 71% of world yam production. Yam peel consists of 11% crude protein with metabolizable energy of 2604kcal/kg (Eka, 1998; Ijaiya et al., 2005). YPM has high dietary fibre in form of soluble non-starch polysaccharides which limit its use in monogastric animals (Ezieshi and Olumo, 2011). Supplementation of fibrous diets with exogenous enzymes has been shown to improve performance, enhance production efficiency and increase the effectiveness of nutrient utilization (Aguihe *et. al*., (2015).

The study therefore was carried out to evaluate the effect of Maxigrain® enzyme supplementation on performance and carcass characteristics of weaner rabbits.

MATREIALS AND METHODS

Experimental site

This study was conducted at the Rabbitry Unit of Gombe State Ministry of Agriculture and is located within Gombe metropolis. Gombe lies between Latitude 10.29^{o} North and Longitude 11.17^{o} East with an altitude of

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449m above sea level. The mean maximum and minimum temperatures are 32.80^{0}C and 18.30^{0}C respectively. Gombe metropolis has a rainfall distribution range from 970.7mm - 1142mm annually, with a mean of 1009.4mm. The vegetation of the area is savannah grass land (Gombe State Government, Diary 2009).

Source and processing of experimental materials

The yam peels were collected from restaurants and several household kitchens within Gombe metropolis. The yam peels were sorted out to remove dirt's and other unwanted substances in the peels. Then it was sun dried on a concrete floor for five days. When properly dried it was then milled in to fine particles of 2mm in diameter using a hammer mill and used to formulate the experimental diets. Maxagrain® enzyme manufactured by Petrus pharmaaceutical pune, India and Market by Polchem group Nigeria was purchased and used for the study.

Experimental rabbits and management

Thirty weaner rabbits aged 6-8 weeks were used for the experiment. The rabbits were sourced from the National Veterinary Research Institute (N.V.R.I.) VOM, Jos, Plateau State, Nigeria. After arrival of the rabbits, they were allowed to acclimatize to the new environment for a week before the experiment begins. During the period they were given anti-stress (vitalite®) and were feed with hay and maize offal. They were also dewormed using Piperazine® against intestinal parasites. The rabbits were housed in individual cages with feeders and drinkers provided in each cage. All management practices as recommended by Aduku (1990) were observed.

Experimental diets and design

Five experimental diets were formulated and evaluated during the 56days : Diet 1was the control diet without YPM; diet 2 contains 25% YPM, diet 3, 50% YPM, diet 4, 75% YPM while diet 5 was 100% YPM. Maxigrain® enzyme was supplemented at 200g in all the diets except the control. The ingredients composition of the experimental diets is shown in Table 1. Thirty (30) weaner rabbits were randomly assigned to the five dietary treatments consisting of six (6) rabbits per treatment and replicated three times with two (2) rabbits per replicate in a completely randomized design.

Table1: Percentage composition of experimental diets.

Ingredients (%)	Diet 1 (0%)	Diet 2 (25%)	Diet 2 (50%)	Diet 4 (75%)	Diet 5 (100%)
Maize	39.20	33.30	19.5	5.70	0.00
Yam peel meal	0.00	5.70	19.5	33.30	39.00
Groundnut cake	17.50	17.50	17.50	17.50	17.50
Wheat Offal	40.00	40.00	40.00	40.00	40.00
Bone Meal	2.50	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25	0.25
Vitamin premix$^+$	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20
Enzyme^{++}	0.00	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Determined Analysis					
Crude protein	18.06	18.25	18.29	18.32	18.69
Ether extract	5.48	5.81	5.60	5.77	5.87
Crude fibre	11.48	12.36	12.56	12.61	12.89
Nitrogen free extract	58.82	58.33	59.27	58.03	57.52
Ash	6.54	6.67	7.71	8.64	8.94
ME (kcal/kg)	3201.87	3198	3164.68	3123.99	3120.60

+ Vitamin premix provides per Kg; Vitamin A, 8000, IU; vitamin D3, 1600 IU; Vitamin 51 IU; Vitamin K3, 2 mg; Thiamine B1 1.5mg; Niacin, 15mg; Pantothenic acid, 0.5mg; Vitamin B2, 4mg;Vitamin B12, 0.01mg; Folic acid;5mg; Vitamin B6, 1.5mg; Biotin, 0.02mg;Antioxidant,0. 125mg; Zn0.095; Fe 0.02g; Cu 0.005g; I 0.0012g; Se 0.2g; Co 0.2g.
++Maxagrain ® enzyme produced by Petrus pharmaceutical Pune, India and marketed by Polchem group Nig.

Data collection

Body weight was taken weekly while feed intake was recorded daily for a period of 56days. Body weight gain was obtained by subtracting initial body weight gain from final weight of the rabbits and the FCR was calculated by dividing feed intake by body weight gain. Feed cost/kg was calculated from current market prices of feed ingredients as of the time of the study.

Carcass and internal organs measurement

At the end of week eight, three (3) rabbits were randomly selected from each treatment and fasted for 12hrs but water was provided *ad libitum*. Thereafter the rabbits were weighed, slaughtered, flayed (skinned) and eviscerated to obtain the carcass weight. The pelt (skin) and all the internal organs were weighed separately. The dressing percentages were calculated as described by Olumo (2011)

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

Chemical analysis

Proximate analysis of YPM and the five experimental diets were carried out to determine their

proximate components using the analytical methods described by AOAC, (2006).

Statistical analysis

All the data obtained during the experiment were subjected to one way analysis of variance (ANOVA) as described by Steel and Torrie (1980), and means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Proximate composition of yam peel meal (YPM)

The proximate composition of YPM is presented in Table 2. The result of the analysis showed that YPM contained 92.86% DM, 10.695 CP, 2.85% EE, 8.5% CF, 4.61% Ash and 73.35% NFE. The CP content of 10.69% observed in this study was similar to the values of 10.52% reported by Aguihe *et al*., (2015) but lower than 12.10% reported by Yakubu *et al.*, (2013). The ether extract (EE) was above the reported value of 1.30% (Akinmutimi *et al,*, 2006) and 0.95% (Ekenyem; 2006). The crude fiber (CF) which is the amount of indigestible carbohydrates present in the feed sample was lower than the values of 9.47 reported by Aduku (1990) but higher than 7.20% reported by Akinmutimi and Anakebe, (2008), 7.78% (Uchewa *et al.*, 2014). and 6.30% (Ekpo *et al*., 2015). The nitrogen free extract (NFE) value observed in this study indicates that YPM can be used as a good source of energy in rabbit production.

The variation observed in the proximate composition of YPM when compared with other workers could be due to differences in specie of the yam (Akinmutimi *et al*., 2006), agronomical practices such as fertilizer application, soil type, and rainfall as reported by Uchewa (2014). The metabolizable energy which was calculated using the formula described by Pauzenga (1985) as: ME (kcal/kg) = 37 x %CP + 81.1 x % EE + 35.5 x % NFE was 3230kcal/kg and was higher than the values reported by Ezieshi and Olumo, (20011) and Aguihe *et al*., (2015).

Table 2: Proximate composition of yam peel meal (YPM).

Parameters	Percentage
Dry matter	92.86
Crude protein	10.69
Ether extract	2.85
Crude fibre	8.50
Ash	4.61
Nitrogen free extract	73.35
Metabolizable energy(Kcal/Kg)	3230

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Performance characteristics

Table 3 shows the performance of weaner rabbits fed diets containing different levels of YPM supplemented with Maxagrain ® enzyme as replacement for maize. There was no significant difference (P<0.05) across the treatments for parameters measured for growth performance. The final weight ranged from 1641.67g - 1800g. This was higher than the range of 850g-1450g reported by Abdu *et al.,* (2011) and 1271.24-1432.96g reported by Yakubu *et al*., (2013). The observed differences could be as a result of enzyme supplementation of the yam peels as reported by Biswas *et al*., (1999); Swain and Johri, (1999); Midau *et al*., (2011). It has been reported that enzymes supplementation resulted in improved feed utilization efficiency (Penge *et al*., 2003) and reduce viscosity of ingesta in the intestine and showed a marked improvement on the various morphological effects of feeding fibrous materials to monogastrics (Adeyemi *et al*., (2013). It was however lower than 2.06kg-2.34kg reported by Ukachukwu et al., (2011) on graded dietary levels of composite cassava meal.

The average daily feed intake showed no significant difference (P>0.05) between treatments but the rabbits tend to eat less as the level of YPM inclusion increases. The range for feed intake observed in this study was 62.47g-65.67g. Diverse reports exist on the relationship between exogenous enzyme supplementation and feed intake. Adizal and Ohtani, (2002); and Rahman *et al*., (2005) reported that enzymes have no effect on feed intake while Kadam *et al*. (1991) reported reduction in feed intake as a result of enzyme supplementation. Similarly, average daily weight gain and feed conversion ration were similar (P>0.05 across all the treatments. Rabbits on diet 5 (100% YPM) however had a higher ADWG (16.10g) on numerical basis. This agrees with the reports of Classen *et al*. (1995) and Scott *et al*. (1998). Feed conversion ratio (FCR) also showed no significant difference (P>0.05) between the treatments but rabbits on diet 5 (100% YPM) had a superior FCR of (3.93) when compared to other treatments.

Feed cost decreased as the level of inclusion of YPM increases. Several studies have shown that increasing the inclusion levels of YPM led to reduction in feed cost (Agunbiade *et al*., 2002, Ekenyen *et al*., 2006; Ajayi *et al.,* 2007). Rabbits on diet 1(0% YPM) had the highest feed cost (₦55.63/kg) while rabbits on diet 1 (100% YPM) had the least feed cost (₦48.78/kg). This was similar to the values obtained by Yakubu *et al.* (2013); Ayoola and Akinban (2011) and Ademola *et al.* (2012) who observed lower fed cost/kg gain when dietary fibre sources were supplemented with Mixagrain® enzymes. The result shows that 100% enzyme supplemented YPM was more economical for feeding rabbits than using maize. This is because YPM are cheaper and less competitive when compared to maize (Ukachukwu, 1997). The value for the feed cost saving increased from ₦0.9 - ₦28:00 as the level of enzyme supplemented yam peel meal increased.

Table 3: Performance and exosmic characteristics of weaner rabbits fed enzyme supplemented yam peel meal

Parameters	Diet 1 (0%)	Diet 2 (25%)	Diet 3 (50%)	Diet 4 (75%)	Diet 5 100%	SEM
Initial weight (g)	825.00	841.67	900.00	866.67	900.00	62.47^{ns}
Final weight (g)	1700.00	1641.67	1683.33	1691.67	1800.00	79.58^{ns}
Average daily feed intake (g)	63.00	65.67	64.93	63.77	62.47	1.38^{ns}
Average daily weight gain (g)	15.63	14.30	13.90	14.70	16.10	1.08^{ns}
Feed conversion ratio	4.10	4.97	4.77	4.37	3.93	0.38^{ns}
Feed cost ₦N/kg	55.63	54.39	51.92	49.91	48.78	-
Cost of total feed intake (₦/kg)	198.57	197.61	188.48	176.39	170.24	-
Feed cost/kg (₦/gain)	225.68	266.14	241.62	212.52	189.15	-
Cost savings	-	0.96	10.09	22.18	28.33	-

Carcass and internal organs characteristics

The effect of enzyme supplementation of YPM on carcass and internal organs characteristics of weaner rabbits is shown in Table 4. Results revealed that there was no significant variation (P>0.05) in all the parameters measured. This was similar to the results obtained by Sagheer and Hassanein (2014) who recorded no significant effect in carcass criteria in their study due to enzyme supplementation in the diets of rabbits, except in the weight of the liver. The dressed weight (836.67g) and dressing percentage (51.50%) were higher in rabbits on diet 5 (100%).

The result indicates that the diet had no adverse effect on the carcass traits of rabbits. The increase in dressing percentage recorded in this study with enzyme supplemented YPM agrees with the report of Lesson *et al.* (1996). Similarly Abbas *et al.* (1998) reported that enzyme supplementation of fibrous diet improved the growth rate, thereby increasing the dressing percent. Bharathidhasan *et al.* (2009) also reported an increased dressing percent and carcass yield in birds fed enzyme supplemented diets.

The internal organs measurements were also similar across the treatments accept for small and large intestine lengths. There was a progressive increase in length of small and large intestines from 59.00-92.67cm and 17.33-24.67cm respectively as the levels of enzyme supplemented YPM increase. This could be as a result of high fibre content of YPM. Results also showed that internal organs that are involved in detoxification were not affected by replacement levels of YPM indicating that the ingredient is safe for rabbit feeding. It has been reported that, if there is any major effect of anti-nutritional factors, organs like kidney and liver would be affected since they are the major detoxification organs (Uchewa, 2014).

Table 4: Carcass yields of rabbits feed enzyme supplemented yam peal meals

Parameters	Diet 1 (0%)	Diet 2 (25%)	Diet 3 50%	Diet 4 (75%)	Diet 5 (100%)	SEM
Live weight (g)	1526.67	1540.00	1480.00	1556.67	1603.3	107.55^{ns}
skin weight (g)	126.67	132.33	136.67	113.33	150.00	13.98^{ns}
Dressed weight (g)	780.00	780.00	763.33	766.67	826.67	5.38^{ns}
Dressing %	51.26	50.37	51.28	49.11	51.50	2.28^{ns}
Internal organs						
Lungs weight (g)	8.40	8.53	12.60	9.33	10.13	1.50^{ns}
Heart weight (g)	3.70	3.23	3.17	3.57	3.63	1.03^{ns}
Liver weight (g)	50.80	37.97	35.97	42.20	38.47	3.29^{ns}
Kidney weight (g)	9.13	10.23	9.67	10.60	12.87	0.89^{ns}
Stomach weight (g)	85.43	74.33	54.67	83.70	48.80	9.87^{ns}
Small intestine weight (g)	119.27	107.57	110.80	99.80	103.77	11.42^{ns}
Large intestine weight (g)	55.87	73.43	53.57	63.00	48.17	6.27^{ns}
Ceacal weight (cm)	6.73	6.50	6.03	5.30	7.60	1.04^{ns}
Small intestine length (cm)	59.00^{c}	63.00^{c}	72.67^{b}	76.33^{b}	92.67^{a}	6.34^{*}
Large intestine length (cm)	17.33^{b}	18.33^{ab}	21.33^{ab}	24.00^{a}	24.67^{a}	1.81^{*}

abc; Means on the same row bearing different superscript differ significantly (P<0.05)

CONCLUSION

From the results obtained in this study, it can be concluded that YPM can replace maize completely in the diets of weaner rabbits. The uses of Maxagrain ® enzyme also resulted in reduction in cost of feed and therefore recommend 100% inclusion of enzyme supplemented YPM in weaner rabbit's diet.

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