RESPONSES OF GROWING RABBITS TO INCREASING SUBSTITUTION LEVELS OF PLANTAIN PEEL MEAL FOR MAIZE

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Abstract

This study was conducted to investigate the effect of plantain peel meal based diet in growing rabbit diets. A total of sixty rabbits of mixed sex and breeds with initial average live weight of 519.30g were randomly allotted to five experimental diets in a Completely Randomized Design (CRD) experiment. Each of which was replicated three times with four rabbits per replicate. The rabbits were fed diets with 0, 15, 30, 45 and 60% plantain peels as a replacement for maize, representing treatment diets 1, 2, 3, 4 and 5 respectively. The findings of this study shows that feed intake was not significantly ($p<0.05$) affected by treatment diets. However, birds on treatment diet 2(15%) plantain peels had the most favorable final live weight (1210.00g), Daily weight gain (9.89g) and feed conversion ratio (5.78), this was followed by rabbits in the control, diets 3, 4 an5 in that order. Diet 3 had numerical similar values in the above parameters with rabbits on the control diet. The nutrient retention showed no significant ($p>0.05$) difference across the dietary treatment. Among the carcass parameters measured only the lipid content showed significant ($p<0.05$) difference and only with rabbits on experiment diet 5. The feed cost and the total cost of feed consumed (N) declined as the dietary plantain peel meals increased in the diets. However, rabbits fed diet3 (15% plantain peel meal) recorded the gross profitability (46.85%). It could be concluded that plantain peel meal can replace upto 30% maize without any deleterious effect on performance but with a better profit margin.

Keywords: plantain peel, maize, cost of feed, rabbits.

Introduction

In Nigeria and other developing countries, there is acute shortage of conventional protein and energy sources for use in formulating balance diet (Nsa *et al.,* 2018; Ukorebi *et al.,* 2019). This is partly due to a high demand of it for man, his industries and livestock. This existing competition results in escalated cost prices of these feedstuffs.

However, several low cost agro by-products have been identified. These include yam peel (Inaku *et al*., 2011), palm kernel cake (Omole, 2011), maize sievate (Nsa and Essien, 2019), Plantain peels (Nwogu and Ogboruka, 2003), soya been hulls (Shaahu, *et al., 2011*),pea nut shell (Aduku *et al.*, 1998) and cassava peels (Esonu and Udedibie, 1993).

Plantain peels are waste materials obtained from plantain processing and accounts for about 30 to 40% of the total weight of the fruit (Nwogu and Ogboruka, 2003). These waste if not properly disposed can pollute the environment.

Recent studies have shown that plantain peel meal can be included in the diets of livestock as it is relatively high in energy and if well managed can partially replace maize in even monogastric diets.

In furtherance to this, the use of micro livestock and short-cycled animals is to be encouraged in the face of the high demand for animal proteins due to rapid growth in the population, couple also with the already poor feed supply due to increasing cost of conventional feedstuffs.

Rabbit keeping has gained prominence in the Nigerian Society. This is mainly due to the relatively cheap maintenance cost especially in the area of their feeding which could be mainly forages and kitchen wastes. (Akinmusi and Alade, 2011). Rabbits are very prolific producing at least 4-5 litters per doe per annum under the traditional management system.(Akinmusi and Alade, 2011). This is made even more possible as its gestation period is very short about 30-32 days. Also the cost of housing, equipment and feeding is relatively low.

This research therefore is geared towards the use of plantain peel meal as a partial replacement for maize in a growing rabbit's diets.

Materials and Methods

The experiment was conducted at the rabbitary unit of teaching and research farm of the Department of Animal Science, University of Calabar, Calabar. The peels from unripe plantain were collected from food vendors within Calabar municipality. There were further cut into pieces and air dried for 3 days, there after milled in a meadow's model 35 hammer mill and sieved through a mesh of 5mm. sample of the meal was analyzed for proximate composition, according to AOAC, 2010 method, while the remaining was used to replace maize as follows; 0, 15, 30, 45 and 60% to represent treatment diets 1, 2, 3, 4 and 5 respectively. A fixed quantity of *Stylosantheshamata* was always provided in the morning as a proprietary feed

At the beginning of the experiment sixty weaned rabbits of aged 7-8 weeks of age, were weighed and randomly allocated to five experimental diets in a Completely Randomized Design. Each had 12 rabbits, replicated thrice with 4 rabbits. There were housed in hutches of dimension of 50x50x70cm.

The rabbits were weighed at the beginning of the experiment and at weekly interval, while feed and water was giving *ad libitum*. Feed intake was recorded daily. Weight gain was calculated as the difference between initial weigh and final weight while feed conversion ratio was calculated by dividing feed intake with weight gain.

Meat quality determination

At the end of the feeding trial one rabbit per replicated were selected and sacrificed for meat quality. From the Sacrificed rabbits, rack and loins region were analysed(AOAC, 2010) to determine dry matter by oven drying, protein by the Kjeldahl method, fat by fosslet fat analysis and ash by muttle furnace.

Nutrient retention

Two birds per replicate were randomly selected at the end of the feeding trial and housed in a previously disinfected two- tier wire floor metabolic cages of dimension of 0.7m x 0.6m floor spacing per pen and a dropping tray inserted for easy collection of faecal droppings. After the initial five days of acclimatization where the rabbits were fed *ad libitum* with a known quantity of the test ingredients in the morning hours after which the leftovers were weighed

and sampled. Daily voluntary feed intake was measured and recorded. Their droppings were collected and weighed fresh, dried using GallenKamp® oven at 80°C for about 48 hours to obtain a constant weight, and ground to pass through a standard 0.02mm sieve for proximate composition determination (AOAC, 2010).

Cost Analysis

Cost Analysis using appropriate formulae were used to determine the economics of production based on the current prevailing prices of feedstuffs.

$$\text{Feed cost/kg} = \frac{\text{sum of prices of ingredients}}{\text{Kilogram of feed at the time of experiment}}$$

$$\text{Total feed cost} = \frac{\text{Total feed intake X Feed cost/kg}}{100}$$

Total cost of feed consumed/Kg(N) = cost of feed/Kg(N) X Total feed consumed(Kg/bird)

$$\text{Cost of feed/Kg live weight gain(N)} = \frac{\text{Total cost of feed consumed/kg(N)}}{\text{Total weight gain (g/rabbit)}}$$

Data collected were subjected to Analysis of variance ANOVA (Steel and Torrie, 1980) and where significant differences occurred, means were separated by Duncan's New Multiple Range Test (Obi, 1990). The analysis was carried using version 14 (Minitab, 1991).

Results and Discursions

The chemical composition (Table 1) showed that crude protein (11.69%) and fibre content (16.03%) of plantain peel was more than that of maize which had crude protein and crude fibre of 8.96 and 2.09% respectively. The above ranges of crude proteins and fibre content of both maize and plantain peels fall within the ranges reported by Aduku, (1993).The proximate composition of the diets shows and increasing level of protein and crude fibre with increasing level of dietary plantain peel in the diets. However the ranges of both fibre and protein fall within the recommended range by Lebas, 1980 for growing rabbits.

The formulated diets (Table2) nutrients fall within the recommended levels by Lebas, (1980) for growing rabbits.

Table 3 shows the result of the growth performance of growing rabbits fed plantain peel based diets. There were no significant ($p>0.05$) differences in the diet consumption. This means that there was no inhibition in the consumption of the test diets. Each ingredient in all the diets was included at the same level and received the same treatment. However, only the test ingredients (Plantain peel meal) which replaced maize at different levels (Table 2), therefore, any differences in the utilization of the diets could be attributed to the test ingredient levels of displacement for maize.

The diet containing 15%(T2) replacement level of plantain peel, significantly ($p<0.05$) improved Final body weight (1210.00g), daily weight gain(9.89g) and feed conversion ratio(5.78) than other treatments diets including the raw. Diet 3, 30% replacement level of maize with plantain peels values of Final live weight (1200.22g), daily weight gain (9.72g)

and feed conversion ratio(5.88) were numerically ($p>0.05$) similar to rabbits in the of control diets. The diets containing 60% plantain peel meal significantly ($p>0.05$) final live weight(1190.10g), daily weight gain(9.58g) and Feed conversion ratio (5.95) more than all the treatment diets.

The above ranges (9.58-9.89g) for daily weight gain was however, lower than 12.91 to 17.96g and 18.20 to 19.20g reported by Abejeshi *et al*. (2017); Aduku *et al*. (1988), respectively, when they worked on some tropical evergreen browse. But however, falls within the range of 9 to 20g/day/rabbits reported by George, (2003), for normal range for most rabbits reared in the tropical environment. The earlier observed lower range could be attributed to differences in breed, feed used and other environmental factors.

The results of the economics of production are represented in table 4.

The total cost per feed consumed (N), stood at 633.67, 602.41, 567.77, 535.69 and 504.00 for diets containing 0, 15, 30, 45 and 60% (plantain peel diets as against maize) respectively. The cost tended to significantly ($p<0.05$) decreased with dietary increase of plantain peel meal. This was expected because of the high cost of conventional feedstuff (maize) compared to the low or zero cost unconventional feed stuff (plantain peel) which is even regarded as a waste and imposes a disposal problem.

Nutrient Retention

Retention of nutrients of the diets by broiler birds is recorded in Table 5.

The dry matter (DM), crude protein (CP) and crude fibre (CF) content of the experimental diets did not show any significant ($p<0.05$) difference.

This observation is a clear indication that plantain peel meal is not poorly utilized by growing rabbits. This result is in agreement with findings of (Nsa *et al.,* 2019) non-significant differences on nutrient retention (DM, CP and CF) when they fed growing rabbits with various agro-industrial by products.

Meat quality

Apart from the meat lipid, other, meat composition indicated no significant ($p<0.05$) difference in meat protein, NFE and dry matter and ash. The higher values obtained of meat lipid in meat of rabbit on treatment 5. This could be as a result of appreciable amount of plantain peel, which tended to increase the ether extract content of the diet.

Conclusion

It can therefore be concluded that up to 30% plantain peel meal can be used to replace maize in growing rabbits' diets without any deleterious effects on biologic and economic of production.

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Table1. proximate composition of plantain peels and maize

	Plantain peels	Maize
Dry matter	92.09	87.98
Crude protein (CP)	11.69	8.96
Crude fibre (CF)	16.03	2.09
Ether extract	4.01	3.24
Nitrogen Free Extract	68.27	85.71
ME(Kcal/Kg)	2790.41	3438.02

Table 2 Gross composition of experimental diets

Ingredients	Levels of inclusion (%)				
	0	15	30	45	60
Maize	52	42.20	36.40	23.40	20.80
Plantain peel meal	-	7.80	15.60	28.60	31.20
Soya bean meal	27.00	27.00	27.00	27.00	27.00
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.20	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Premixes	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated composition (%)					
Crude Protein	15.63	15.67	15.71	15.75	15.79
Energy(ME. Kcal/Kg)	2550.22	2541.03	2532.00	2523.40	2514.80

*premix contained the folowing(Univit. 15 Roche) 1500 I.U, Vit A. 1500I.U. Vit D:3000I.U, Vit E:3.0g, Vit K 2.0g, Vit B2, 0.3g, Vit B6, 8.0mg, Vit B12, 8.0g, Nicotinic Acid, 3.0g, Ca-Pantothenate; 5.0 mg, Fe, 10.00g, AI, 0.2g, Cu, 3.5mg, Zn,0.15mg, I, 0.02g, Co, 0.01g
**ME(Kcal/Kg=37x%CP+81.1x%EE+35.5x%NFE(Panzege, 1985)

Table 3.Performance characteristics of rabbits fed plantain peels based diets.

Parameters	0%	15%	30%	45%	60%	SEM
Initial Weight, g	520.50	518.00	520.00	518.50	519.50	7.80
Final Live Weight, g	1200.50^{b}	1210.00^{a}	1200.22^{b}	1195.80^{c}	1190.10^{d}	3.99
Total Weight gain, g	680.00^{b}	692.00^{a}	680.22^{b}	677.30^{c}	670.60^{d}	1.90
Daily weight gain,g	9.71^{b}	9.89^{a}	9.72^{b}	9.68^{c}	9.58^{d}	0.22
Total feed intake,g	3987.50	3999.00	3998.40	3993.50	3997.00	8.43
Daily feed intake, g	56.96	57.13	57.12	57.05	56.96	4.90
Feed conversion ratio	5.87^{b}	5.78^{c}	5.88^{b}	5.89^{b}	5.95^{a}	0.13
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

^{A,b,c,d} Mean on the same row with same superscript are not significantly different ($p<0.05$)

Table 4. Economic implication of feeding plantain peel meal to growing rabbits

Parameters	0%	15%	30%	45%	60%	SEM
Cost of feed/Kg	158.90^{a}	150.64^{b}	142.00^{c}	134.14^{d}	126.41^{e}	1.49
Total cost of feed consumed(N/Kg)	633.61^{a}	602.41^{b}	567.77^{c}	535.69^{d}	504.00^{e}	3.57
Selling price(N/Rabbit)	2500	2,500	2,500	2,500	2,500	--
Cost of rearing(N/Rabbit)	1733.61	1702.41	1767.77	1775.69	1704.00	11.08
Profit (N)	766.36	797.59	732.23	724.31	796.00	8.32
Gross profitability(%)	44.21	46.85	41.42	40.79	46.71	3.60

^{A,b,c,d,e} Mean on the same row with same superscript are not significantly different ($p<0.05$)

Table 5. Nutrient retention of growing rabbits fed plantain peel based diets.

Parameters(%)	0%	15%	30%	45%	60%	SEM
Dry matter	65.87	67.00	67.10	66.90	65.80	7.60
Crude protein	56.00	60.70	58.75	57.45	54.43	2.80
Crude fiber	45.90	47.00	46.18	46.00	45.60	7.09
Ether extracts	60.00	61.68	59.05	57.97	56.85	9.05
Ash	76.00	77.80	74.70	72.76	77.65	5.81
NFE	58.01	59.60	57.32	55.90	58.68	2.00

Table 6. Meat quality of growing rabbitsfed plantain peel based diets.

Parameters(%)	0%	15%	30%	45%	60%	SEM
Dry matter	60.23	61.90	61.90	60.20	61.08	2.00
Crude protein	48.67	50.57	51.70	51.00	50.70	3.88
Crude fiber	49.09	49.80	49.30	50.30	50.10	5.99
Lipid	40.30^{b}	41.69^{b}	42.00^{b}	45.00^{b}	56.55^{a}	4.87
NFE	59.99	59.00	60.10	57.97	56.09	4.88

^{A,b,c,d,e} Mean on the same row with same superscript are not significantly different ($p<0.05$)