

Effect of Replacing Maize with Ripe Plantain and Yam Peels in the Diet of Weaner Rabbits

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Abstract: The effect of replacing maize with ripe plantain peels and yam peels in the diets of weaner rabbits were investigated using 15 weaner rabbits. There were five treatment diets in all designated T₁, T₂, T₃, T₄ and T₅ with plantain peel and yam peel meal replacing maize meal as energy source at 0, 25, 50, 75, 100% levels, respectively. The diets were fed to the rabbits in a completely randomized design. This experiment lasted 56 days. Data were collected on feed intake, weight gain and were used to calculate other growth performance parameter. At the end of the trials two animals were selected from each treatment, slaughtered and were used to evaluate the carcass characteristics. The cost effectiveness of the diets was also evaluated. Data collected were subjected to analysis of variance and significant means were separated using Duncan's multiple range test. There was significant ($p < 0.05$) difference for the values obtained for total feed intake, feed conversion ratio and cost per kg weight gain. Diet 3 had favourable weight gain, feed intake, feed conversion ratio, moderate cost per kg weight gain. Based on this, diet 3 is recommended. For organ weight there were significant differences ($p < 0.05$) in all parameters measured except the heart. Diet 2 compared more favourably with control diet. This was followed by diet 3. For cut-parts, there were significant differences ($p < 0.05$) in all the parameters measured except for back-cut. Diet 4 compared more favourably with control diet, this is followed by diet 3. From the above results, considering average values of growth performance, gross margin, organ weight and cut-parts, diet 3 compared favourably with the control diet and hence recommended.

Key words: Replacing, maize, plantain and yam peels, rabbits diets

INTRODUCTION

Animal protein consumption in Nigeria and other developing countries has been reported to be comparatively low^[1]. This problem has generally been attributed to shortage of Animal protein products. This has led to current high price in animal products making them out of reach of an average Nigerian. This problem can be bridged by directing efforts at the production of animals that are highly prolific, with short generation interval^[2]. One of such is the rabbit. It has high fecundity with short gestation period^[3,4]. They are fast growing and can obviously convert forage and kitchen wastes into meat with very high efficiency^[5].

However, like other monogastrics, the most important aspect of its production is in the nutrition^[6]. Feed accounts for between 70 and 80% of its production^[7]. This has been attributed to the competition among humans, industry and monogastrics, for conventional feedstuffs

such as maize, soybean, sorghum etc^[5]. Hence the quest for replacement of the expensive conventional feedstuffs with cheaper available alternative feeding stuffs^[8]. Kitchen wastes such as plantain peels, yam peels, cassava peels etc are presently being explored by researchers. Nworgu and Ogbosuka^[5] reported the inclusion of plantain peels up to 75% of maize in the diets of grower rabbits produced no deleterious effect. For yam peels^[9] concluded that yam peel meal can replace up to 50% of maize as an energy source in the diet of grower rabbits and its cost effective.

However, no work has been done on the inclusion of plantain peel and yam peel meal in the diet of rabbits as a replacement for maize as an energy source. This forms the basis of this study.

MATERIALS AND METHODS

Experimental site and housing: The site of the experiment was the rabbit unit, College of Animal Science and

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Animal Health Michael Okpara University of Agriculture, Umudike, Nigeria. Umudike bear a coordinate of 5° 28 North and 7° 31 East and lies at an altitude of 122 m above sea level, located within the tropical rainforest zone. The environment is characterized by high rainfall of about 2177 mm. The relative humidity during rainy season is well above 72%, monthly ambient temperature ranges from 17°C to 36°C. March is the warmest month with an average temperature range of 22-30°C.

The experimental weaner rabbits were housed in a long 3-tier wire cage consisting of 15 hutches, three hutches in the columns and five hutches across the rows. The hutches were of 50 cm X 50 cm X 50 cm made of wooden skeleton and wire mesh of 0.3 mm on the sides and floor. Each hutch had a tray built under it for collection of faeces and urine. Each hutch has a feed trough and water trough for concentrates and water, respectively. The cage was housed in a well-ventilated asbestos roofed building of long windows transversing almost whole length of the wall. This is to facilitate proper ventilation and proper dissipation of heat as fast as possible. The floor was made of hard concrete for easier and proper cleaning.

Test feedstuffs, processing and experimental diets: The test feedstuffs (plantain peels and yam peels) were collected as kitchen wastes from the Michael Okpara University of Agriculture environs. The plantains and yam peels were dried and crushed to a coarse consistency, before being used to formulate the diets.

Five experimental diets were formulated. The diets were designated T₁, T₂, T₃, T₄ and T₅ respectively. T₁ was the maize based diet, which also served as the control, while T₂, T₃, T₄ and T₅ had quantitative replacements of maize by plantain and yam peel (i.e. combination of plantain peel and yam peel mixed at a ratio of 3:1, respectively). The replacement of maize by plantain peel and yam peel was at 25, 50, 75, 100% dietary inclusion levels.

Experimental animals and management: Fifteen weaner rabbits of mixed breeds and sexes, crosses of the Chinchilla and New Zealand and Dutch, with initial weight of 425-600 g were used for the investigation. They were randomly assigned to five diets formulated. The experiment lasted for 56 days. Experimental diets and water were made available *ad-libitum* through out the study period.

Data collection: Initial average weight of the birds was taken on the first day of the experiment. Average weight and weight gain were subsequently taken on weekly basis. Feed Conversion Ratio (FCR) was calculated by dividing the average feed intake by the average weight

gain. Percentage mortality was calculated using Number of dead birds/Overall number of birds X 100.

Gross margin/profitability test of the diets were calculated according to Sonaiya. Evaluations of carcass quality and organ weight were carried out as described by Ojewola and Longe, 1999.

Chemical and statistical analysis: The proximate composition and gross energy of the diets and the test feedstuffs were determined using the procedure of AOAC^[10]. The data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan's Multiple range test as described by Gomez and Gomez^[11].

RESULTS AND DISCUSSIONS

The proximate composition of the experimental diets and the test ingredients is as shown in Table 2. The values are closely related to the calculated ones and they all fall within the range of nutrient requirements for weaner rabbits diet. The proximate composition of the test ingredients particularly the crude protein and the energy

Table 1: Experimental diets showing levels of maize replaced with plantain and yam peel meal

Ingredients	T ₁ 0%	T ₂ 25%	T ₃ 50%	T ₄ 75%	T ₅ 100%
Maize	45.00	33.75	22.50	11.25	-
Fish meal	1.00	1.00	1.00	1.00	1.00
GNC	15.00	15.00	15.00	15.00	15.00
PKC	20.00	20.00	20.00	20.00	20.00
Wheat offal	15.30	15.30	15.30	15.30	15.30
Plantain peel	-	8.44	16.87	25.31	33.75
Yam peel	-	2.81	5.63	8.44	11.25
Bone ash	3.00	3.00	3.00	3.00	3.00
Salt	0.45	0.45	0.45	0.45	0.45
Vitamin-premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Crude protein (%)	17.95	17.91	17.87	17.84	17.80
ME(kcal/kg)	2786.1	2636.6	2487.2	2337.7	2188.2

Table 2: Proximate composition of experimental diets

Constituents %	T ₁ 0%	T ₂ 25%	T ₃ 50%	T ₄ 75%	T ₅ 100%
Dry matter	89.90	90.02	89.78	89.61	90.09
Crude protein (%)	17.15	17.26	16.79	17.27	17.05
Crude fibre (%)	7.45	5.93	6.87	5.89	7.0
Fat (%)	4.41	4.7	5.1	4.59	4.80
Ash (%)	8.72	7.96	8.32	9.11	8.9
Gross energy (kcal/g)	3.124	3.018	3.214	3.197	3.208

Proximate composition of test feedstuffs

Table 3: Proximate composition of Yam Peel Meal (YMP)

Constituents %	Proximate value	Proximate value
Dry matter	91.66	90.90
Crude protein	11.33	9.19
Crude fibre	9.50	6.43
Ether extract	1.20	5.67
Moisture	8.34	9.10
Ash	9.80	17.23
Gross Energy (kcal/g)	2.988	2.993

Table 4: Mean values for growth performance and cost analysis for weaner rabbits fed experimental diets

Parameters	T ₁ 0%	T ₂ 25%	T ₃ 50%	T ₄ 75%	T ₅ 100%	SEM
Initial weight (g)	550.00	533.38	483.33	450	487.33	16.39
Final weight	1.375.00	1308.33	1266.66	1175.00	1130.00	37.37
Weight gain (56 days)	825.00	775.00	783.33	725.00	642.66	13.09
Growth rate (g/rabbit/day)	14.73	13.98	13.84	12.94	11.48	0.00
Total feed intake (g/rabbit/day)	2533.33 ^d	2501.67 ^e	2566.67 ^e	2645.00 ^a	2634.00 ^b	0.00
FCR	3.10 ^b	3.23 ^b	3.33 ^b	3.67 ^{ab}	4.10 ^a	0.0647
Cost/kg feed N	N35.16k	N30.10k	N25.04k	N20.45k	N14.91k	
Cost/kg weigh gain	117.037	98.56	83.31	74.41	61.12	

a, b, c, d, e = Means in the same row with different superscripts differ significantly

Table 5: Mean weight of organ as a percentage of dressed weight

Organs	T ₁ 0%	T ₂ 25%	T ₃ 50%	T ₄ 75%	T ₅ 100%	SEM
Spleen	0.0900 ^b	0.1267 ^a	0.0633 ^c	0.0433 ^{c,d}	0.0233 ^d	0.00508
Heart	0.2600	0.22	0.2300	0.2233	0.1800	0.01108
Kidney	0.9000 ^a	0.8927 ^a	0.8300 ^a	0.7233 ^b	0.8967 ^a	0.014475
Liver	3.7000 ^a	3.8667 ^a	3.3367 ^{ab}	3.0667 ^{b,c}	2.6267 ^c	0.06335

a, b, c, d Means with different superscripts on the same row differ significantly (p<0.05)

Table 6: Mean weight of cut parts as a percentage of dressed weight

Parts	T ₁ 0%	T ₂ 25%	T ₃ 50%	T ₄ 75%	T ₅ 100%	SEM
Thigh	20.41 ^b	20.81 ^b	23.22 ^b	25.09 ^a	21.17 ^b	0.25
Drumstick	6.07 ^b	7.67 ^a	7.88 ^a	8.57 ^a	8.32 ^a	0.13
Chest cavity	16.30 ^a	14.83 ^b	15.11 ^{ab}	16.14 ^a	15.73 ^a	0.16
Back cut	33.58	37.36	36.66	36.15	34.54	0.32
Fore arm	6.63 ^b	7.41 ^b	8.07 ^{ab}	9.75 ^a	8.32 ^{ab}	0.20
Shoulder	6.95 ^c	6.69 ^c	8.11 ^b	9.36 ^a	8.32 ^{ab}	0.45
Dress weight(%)	46.56 ^a	47.20 ^a	41.43 ^b	43.16 ^b	43.27 ^b	0.32

a, b, c Means with different superscript in the same row differ significantly (p<0.05)

content of 11.33 and 2.988 kcal/g and 9.19% and 2.993 kcal/g for yam peels and plantain peels respectively, makes them a potential alternative source to maize.

Table 4 shows the growth performance of weaner rabbits fed control diet and test diets. There was no significant difference (p>0.05) for the final live weight, weight gain and growth rate (weight gain /rabbit/per day). There was significant (p<0.05) difference for the values obtained; for total feed intake, feed conversion ratio and cost per kg of weight gain. The high values for feed intake for diets 4 and 5 could be attributed to the lower energy values of the diets and hence increase in feed intake to meet the energy requirements of the animals placed on them^[12]. The significantly lower values for diets 2 and 3 may still be due to the effect of anti-nutritional factors e.g. tannin^[13,14]. For feed conversion ratio, there was no significant (p>0.05) difference between the control diet and diets 2, 3 and 4 but diet 5. Diet 2 compared more favourably with the control diet among the test diets. For cost per kg weight gain, diet 5 performed better than all, which may be due to low cost of the test ingredient and then at 100% replacement of maize, resulted in lowest cost per kg of feed. Considering favourable weight gain, comparable feed intake, feed conversion ratio, moderate cost per kg of feed and cost per kg of weight gain. Diet 3 is recommended.

The mean weight of organs expressed as a percentage of dressed weight of weaner rabbits fed both control diet

and test diets is as shown in Table 5. There were significant differences (p<0.05) in all the parameters measured except the heart. The spleen and the kidney did not follow a specific pattern that could be attributed to the test diets fed. The non-significant difference recorded for the heart is in agreement with the report of Orunmiyi^[15] who reported same when weaner rabbits were fed graded levels of sorghum-spent grain. In case of the liver, diets 1 was not significantly (p>0.05) difference from diets 2 and 3 but differed from diets 4 and 5. This is in agreement with the work of Anugwa^[16] who reported decrease in liver's weight at high level of diets containing high fibre content. Considering the values of heart, kidney and liver diet 2 compared more favourably, with diet 1, closely followed by diet 3.

Table 6 shows mean weight of cut parts expressed as percentage dressed weight of weaner rabbits fed control diet and test diets. There were significant differences (p<0.05) in all the parameters measured except back-cut.

For thigh, the control diet, diet 2 and diet 5 were not significantly different from one another but significantly (p<0.05) different from diet 4. The numerical values for test diets were higher than control diet. This implies that the test diet supports the deposition of tissues for thigh than the control diet^[17]. Diet 4 performed better than all. Drumstick values for test diets were significantly higher than that of control diet, like the result of thigh, diet 4 had numerical value that is greater than all which still implies

better issue deposition for this cut part^[17]. For chest cavity, among the test diets, diet 4 also compared favourably with control diet. Forearm and shoulder values follow similar pattern, in that diet 4 performed better than the test diets and significantly higher than the control diet. For dress weight percentage, diet 2 performed significantly better than the test diets. Based on the above result, diet 4 performed better followed by diet 3 for cut parts.

CONCLUSION

From the above results, considering growth performance, gross margin, organ weights and carcass quality. Diet 3(50%) compared favourably with the control diet, hence recommended.

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