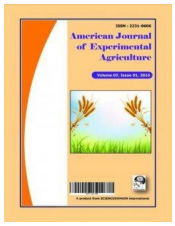

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Performance and Haematological Profiles of Crossbred Male Rabbits Fed Yam and Cassava by Products in the Humid Tropics

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Authors' contributions

This work was carried out in collaboration between all authors. Author JSE designed the study, wrote the protocol and wrote the first draft of the manuscript. Author NNE reviewed the experimental design and all drafts of the manuscript. Author GDE managed the analyses of the study. Author EEAO identified the plants. Author MDU performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to evaluate growth rate and haematological profiles of crossbred weaner males rabbits fed cassava and yam peels meal diets. Thirty-six crossbred weaner male rabbits aged 5-6 weeks were randomly allocated to 4 dietary treatments. Each treatment having 3 replicates with 3 rabbits per replicate in a completely randomized design. Diet 1 was composed by 37% of maize (control group), diet 2-37% of yam peel, diet 3-37% cassava peel and diet 4-37% yam-cassava peel mix. The experiment lasted for 12 weeks. Results obtained revealed that rabbits that received diets 2 performed better ($P<0.05$) than those that were fed diets 1, 3 and 4 in terms of daily weight gain. Haematological parameters assessed indicated no treatment effect ($P>0.05$) among the groups. It is concluded that yam peel, cassava peel, and yam – cassava peel mix could successfully replace maize in rabbits diets.

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Keywords: Cassava peel; growth; haematology; rabbit; yam peel.

1. INTRODUCTION

Rabbits in the tropics are raised at ambient temperatures ranging between 27.44ºC and 28ºC which is outside their comfort zone of 21-23ºC [1]. Yet, rabbit production has been identified as one of the means of attaining sufficiency in the supply of animal protein to the diets of average Nigerians [2]. Rabbit can produce 6 pounds (2.72 kg) of meat on the same feed as a cow will produce 1 pound (0.45 kg) of meat on the same feed [3]. In addition rabbit meat is richer in protein (21%) compared with chicken (19.5%), beef (20%) and pork (17%) [4].

They have potential as meat-producing animals in the tropics. This make rabbit production a new impetus in Africa amongst a wide range of people there by creating the need for alternative cheap sources of rabbit feed to replace cereals in rabbit diets in order to make rabbit production profitable. Among such alternatives are cassava and yam peels which are readily available with little cost. Nigeria is the world largest producer of cassava and yam [5,6], producing more than 4 million tones of cassava and yam peels, annually as livestock feed [7]. These make the cost of these by-products 40% lower than that of maize [8]. A successful replacement of conventional feed ingredients should reduce feed cost in rabbit production. Rabbit production provides a rapid means of increasing animal protein supply because they are known to have such attributes as short generation interval, rapid growth rate and ability to utilize forage agro-industrial by-products and kitchen waste [2]. The present study was designed to evaluate growth rate and haematological profile of crossbreed weaner rabbits fed cassava and yam peel meal diets in the humidtropics.

2. MATERIALS AND METHODS

2.1 Site of Experiment

The experiment was conducted at the teaching and research farm of Akwa Ibom State University Obioakpa campus, Akwa Ibom State University Nigeria. Obioakpa is situated on latitude 5º 28^{1}N and longitude 7º 32^{1}E. It has mean annual rainfall of 2200 mm, annual humidity of 95%, with average temperature of 27ºC [9].

2.2 Source and Processing of Test Materials

The test feedstuffs (yam and cassava peels) which were collected as kitchen waste from the Akwa Ibom State University environs, were sundried for 4 days each before milling in a hammer mill to produce cassava peel meal (CPM), and yam peel meal (YPM). Four diets were formulated: diet 1 (control) contained 37.00% maize as the main energy source. The 37.00% maize in diet 1 was replaced with yam peel meal in diet 2, cassava peel meal in diet 3 and mixture of yam and cassava peel at equal ratio in diet 4. The experimental diets were supplemented with legume (centrosema). The ingredient composition of the diet is shown in Table 1. The diets supplied approximately 17.50% crude protein.

2.3 Experimental Animals

A total of thirty-six cross breed (Dutch x Newzealand) male rabbits, aged 5-6 weeks, an average weight of 582.00 g were used in the experiment. The rabbits were conditioned for two weeks before randomly allotted to the four dietary treatments in groups of 9 rabbits each. Each treatment group was replicated three times with three (3) rabbits per replicate (i.e. 9 rabbits per diet). Each individual rabbit was housed in a hutch measuring 70 cm x 40 cm. The entire hutch system was of the three-tier model. The rabbits were given experimental diets and clean water *ad libitum* throughout the experimental period of 12 weeks.

2.4 Data Collection

Feed samples were analyzed for proximate composition according to the procedure of AOAC [10]. The proximate composition of yam and cassava peels are presented in Table 2.

Daily feed consumption was obtained by subtracting the weight of the leftover feed each morning from the weight feed offered the morning of the previous day. Initial weight of the rabbits were taken the first day of the experiment and subsequently on weekly basis.

At the end of the 12 weeks feeding trial, a total of twenty-four rabbits (two per replicate) were randomly selected, starved overnight. Blood

samples for haematological analysis was collected through marginal ear vein into bottles containing ethylene diamine tetracetic acid (EDTA). The blood samples were analyzed for packed cell volume (PCV), haemoglobin concentration (Hb), and white blood cell count (WBC) using the methods described by Monica [11]. The mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) were calculated.

2.5 Data Analysis

Data collected from the experiments were subjected to analysis of variance (ANOVA) [12]. Treatment means were compared using Duncan's New Multiple Range Test (DNMRT) where significant treatment effects were observed. Differences in means were considered statistically significant at $p<0.05$ [13].

3. RESULTS AND DISCUSSION

The performance of rabbits in the feeding trial is shown in Table 3. There were significant differences ($P<0.05$) among treatments in final body weight, daily weight gain and daily feed intake. Rabbits fed diet 2 had the highest final body weight (1798.95 g) while those fed diet 1 had the lowest final body weight (1622.87 g). Similarly, rabbits fed diet 2 had the highest daily weight gain (14.62 g) while the rabbits fed diet 3 had the lowest daily weight gain (12.35 g). The poor performance in weight gain of rabbits fed diet 3 may be attributed to the lowest dietary energy of diet 3 compared to other diets. This is because reduced dietary energy often limits growth in monogastrics including rabbits [14,15]. On the contrary, weight gain was significantly higher ($P<0.05$) in rabbits fed diet 2. This could be invariably linked to the relatively increased dietary energy in relation to diets 3 and 4. It also suggest that the higher protein level of diet 2 might have been well utilized by the animal compared to diet 1. [16,17] had earlier observed that increase dietary protein could contribute to increased growth of animals. Increase crude protein result in increase lean body mass (muscle), which indicate growth.

Feed intake value of 66.98 g, obtained from rabbits fed diet 3, was observed to be highest while the lowest value of 61.00 g was obtained from rabbits fed diet 1. The significant increase in feed intake of rabbits fed diet 3 may be attributed first to the low dietary energy content of diet 3 in relation to diets 1, 2 and 4. This is in agreement with [2] who observed that rabbits usually consume more of low energy feeds such as

Table 1. Composition of experimental rabbit diets

Ingredients	Treatments			
	T_1 (control)	T_2 (YPM)	T_3 (CPM)	T_4 (combined)
Maize	37.00	-	-	-
Yam peel	-	37.00	-	18.50
Cassava peel	-	-	37.00	18.50
Soybean meal	14.00	12.00	16.00	16.00
Wheat offal	30.00	30.00	27.00	28.50
Palm kernel cake	14.50	16.50	14.00	14.00
Fish meal	1.00	1.00	2.50	1.00
Bone meal	1.50	1.50	1.50	1.50
Oyster shell	1.50	1.50	1.50	1.50
Vit/premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated nutrient composition				
Crude protein	17.67	17.87	17.46	17.87
ME(Kcal/g)	2.52	2.35	2.06	2.23
Fibre	5.67	8.78	8.79	8.80
Ash	3.94	6.80	5.86	6.33
Ether	4.60	3.77	5.48	4.62

** Each kg contained vit A. 8500 IU; vit D_3. 2000 IU; vit E, 8000 IU; vit K_3. 1.50 mg; vit B_1, 3.20 mg; vit B_6, 1.80 mg; vit B_{12}, 10 meg; pantothenic acid, 1.50 mg; folic acid, 0.50 mg; biotin, 0.20 mg; choline 0.20 mg; manganese, 0.75 mg; zinc,0. 45 mg; Iron 0.20 mg; Copper, 0.35 mg; Seleniun, 0.20 mg; Cobalt, 0.20 mg; Antioxidant 0.125 mg*

Table 2. Proximate composition of yam peel and cassava peel

Parameter (%)	Yam peel	Cassava peel
Dry matter	89.90	91.24
Crude protein	11.14	5.19
Crude fibre	6.30	19.72
Ash	7.30	7.26
Ether extract	4.12	5.02
NFE	71.14	62.81

Table 3. Effects of experimental diets on performance of weaner rabbits (n=36)

Parameters	T_1(control)	T_2(yam peel)	T_3(cassava peel)	T_4(yam/cassava)
Initial body height	580.98	570.81	584.98	589.89
Final body weight	1,692.91^{c}	1,798.95^{a}	1,622.87^{d}	1,683.89^{b}
Total weight gain	1,111.93^{b}	1,228.14^{a}	1,037.89^{d}	1,094.00^{bc}
Daily weight gain	13.24^{b}	14.62^{a}	12.35^{d}	13.02^{bc}
Daly feed intake	61.00^{c}	63.00^{b}	66.98^{a}	62.50^{bc}
Feed conversion ratio	4.61	4.31	5.42	4.80

^{abc} *means along the same row having no superscript are not significantly different (P>0.05)*
SEM = standard error mean

Table 4. Effects of experimental diets on haematological indices of rabbits (n=36)

Parameter	Treatments			
	T_1 (control)	T_2 (YPM)	T_3 (CPM)	T_4 (YPM/CPM)
Packed cell volume (%)	37.42	38.50	36.80	37.40
Haemoglobin (g/dl)	11.45	12.16	10.70	11.40
Red blood cell ($x10^6/mm^3$)	5.68	5.75	4.50	5.20
White blood cell ($x10^3/mm^3$)	7.36	6.82	7.26	6.98
MCV (F1)	6.59	6.69	8.20	7.19
MCH (Pg)	20.16	21.15	23.78	21.92
MCHC (g/100 ml)	30.59	31.58	29.10	30.48

^{abc} *means along the same row having no superscript are not significantly different (P>0.05)*
SEM = standard error mean

cassava peel meal to satisfy their energy needs. The result of this study corroborate Olorunsanya et al. [18] who observed highest daily feed intake when 100% maize was replaced with sun-dried cassava peel meal.

Feed conversion values obtained indicated non-significant difference (P>0.05) among treatment although the highest value (5.42) was obtained from rabbits fed diet 3 and the lowest value (4.31) from rabbits fed diet 2. The similarity in feed conversion ratio of the rabbits on this trial is an indication that replacement of maize with cassava peel meal or yam peel did not impair nutrient utilization in the growing rabbits.

3.1 Haematological Indices

The results of the haematological indices are presented in Table 4 above. There was no significant difference (P>0.05) among the treatment. Packed cell volume was highest (38.50%) in rabbits fed diet 2 while those fed diet 3 had the lowest (36.30%). Similarly, highest Hb concentration (12.16 g/dl) was obtained from rabbits fed diet 2 while the lowest Hb value (10.70 g/dl) was obtained from rabbits fed diet 3. There were no significant difference (P>0.05) among the treatment means. The PCV and haemoglobin (Hb) concentration values obtained were within limits for PCV (33.00 – 35.00%) and Hb (9.4 – 17.4 g/dl) reported by Hillyer [19] and Fudge [20], respectively, for growing rabbits. RBC values obtained showed that animals given diet 2 had the highest (5.75) while those fed diet 3 had the lowest (4.50). The values were within the range of 3.07 to 7.50 x 10^6 /mm^3 reported by Fudge [20]. The apparent increase in values of PCV, Hb and RBC for rabbits fed diet 2 seems to be an influence of the high dietary protein in yam peel. This corroborates Hackbath [21] and Tuleun et al. [22] who observed that increase in

dietary protein could lead to increase in RBC, PCV and Hb. Maxwell et al. [23] reported that blood parameters are important in assessing the quality and suitability of feed ingredients in farm animals. The WBC, MCV, MCH and MCHC values obtained indicated no significant differences (P>0.05) between the treatment groups and that were within limits for WBC (5 to 13 x 10^3 /mm^3), MCV (18 to 24 pg), MCH (50 to 75 um^3) and 26 to 34% for MCHC reported by Anon[24] and Anon (1980). The similarities (P>0.05) for all the haematological parameters in all the treatments and within normal ranges reveal that yam peel, cassava peel and yam – cassava mix meal can successfully replace maize in rabbit diets as far as nutritional and health status of rabbits are concern.

4. CONCLUSION

Based on the comparable results obtained from growth performance and haematological indices, it can be deduced that maize can be successfully replaced with either cassava peel meal, yam peel meal or yam – cassava mix meal. Yam peel meal diet is however preferred since it enhanced weight gain.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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