Nigerian J. Anim. Sci. 2021, 23 (3): 167-176

Proximate composition and response of growing rabbits fed sundried yam-cassava peel composite meal as replacement for maize

[*]Gbenge, A.A., Kaankuka, F.G. and Tuleun, C.D.

Department of Animal Nutrition, Joseph Sarwuan Tarka University Makurdi, PMB 2373, Makurdi, Benue State.

Corresponding Author: *alfredgbenge32@gmail.com,* ***Phone Number:*** *+234-8135826132*

Target Audience: *Rabbits Producers, unconventional feedstuffs and Monogastric animal nutritionists*

Abstract

The study was carried out to investigate the effect of replacing maize with sun-dried yam-cassava peel meal on growth performance of growing rabbits in 84-days (12 weeks) feeding trial. Thirty-six (36) weaner rabbits of mixed sex and strain and average initial weight of 500.89g were randomly allotted to six dietary treatments according to live weight in a Complete Randomized Design (CRD). Six dietary treatment were formulated such that, Diet 1 (T1) contained maize and the proportion of maize in diet 1 (T1) was replaced with sundried yam-cassava peel meal (YCPM) mixture in a ratio 6:1 at 20%, 40%, 60% 80% and 100% in diet 2(T2), 3(T3), 4(T4), 5(T5) and 6(T6) respectively. Weighed amounts of feed were served every morning while fresh, cool and clean drinking water was provided ad-libitum throughout the experimental feeding period. Routine management practices were strictly carried out. Proximate composition of YCPM revealed 89.60% dry matter (DM), 10.22% crude protein (CP), 14.29% crude fibre (CF), 1.27% ether extract (EE), 6.25% total ash (TA), 55.98% nitrogen free extract (NFE) and 2416.94kcal/kg metabolizable energy (ME). Results on performance of growing rabbits indicated no significant (P>0.05) difference on all the parameters measured. This suggests that, inclusion of 100%YCPM in diets of growing rabbits has no adverse deleterious effect on performance of growing rabbits.

Key words: *Yam-Cassava peel meal, proximate composition, performance, growing rabbits*

Description of Problem

The production of non-ruminant species and indeed rabbits, which is a micro-livestock, represents the fastest means of meeting up the shortage of animal protein in tropics and producing high quality animal protein for the expanding population (1). Rabbit (Oryctolagus cuniculus) is a pseudo-ruminant with high reproduction rate which is potentially more reflective than other livestock at converting forages and household wastes as well as cereal by-products, agro and industrial by-products and do not compete with man for feedstuff into meat, which is high in protein level (20.8%), low in fat, energy, sodium and cholesterol levels and is bereft of cultural bias (2, 3, 4). It is therefore imperative to increase rabbit production to supply it potentials to bridge the wide gap existing between animal protein supply and consumption and also, competition between human and livestock for conventional feedstuffs that has led to the scarcity and increased in the price (5).

Yam and cassava peels are by-products, resulting from processing of yam and cassava for domestic cooking and other purposes which are readily available at free or cheap costs in many parts of the country because they have limited or no human food value (6, 7). (8) posited that, the proximate composition and energy value of the feedstuffs are indicators of its potential as feed resource capable of replacing maize. Yam peel is reported to consist of 8-13% crude protein, 6.30%CF with metabolizable

energy of 2604-3690.73kcal/kg and gross energy of 2.98kcal/g (9, 10, 11), rich in amino acid (12) while (6) reported 6.70%CP, 19.98%CF and 3380.15kcal/kg DM of metabolizable energy in five (5) hours soaked and sun-dried cassava peel meal. The use of cassava and yam peels in animal feed is hampered by certain limitations. The prussic acid (HCN) and high fiber in cassava peels and anti-nutritional factors in cassava and yam peels limit its utilization by human and livestock (6, 14, 15, 42). Therefore, processing procedures (soaking and sundrying method) aimed at reducing the effect of cyanide (HCN), fibre content and anti-nutritional factors in yam and cassava peel composite meal.

This study was aimed at investigating the effect of replacing maize with soaked and sun-dried yam and cassava peel composite meal on growth response of growing rabbits.

Materials and Methods

Experimental Site and Location

The experiment was conducted at the Rabbit Unit of the Livestock Teaching and Research Farm, College of Animal Science, Joseph SarwuanTarka University, Makurdi, Benue State, Nigeria. Makurdi is located between latitude 17°14'N and longitude 8° 21'E in the Guinea Savanna Zone of West Africa. It has a tropical climate with distinctive wet and dry season (13). The area has a minimum temperature range of 24.20 ± 1.4^{0}C and maximum temperature range of 36.33 ± 3.70^{0}C. The relative humidity ranges between 39.50 ± 2.20% and 64.00 ± 4.80% (13).

Table 1: Gross and calculated nutrient composition of diets

Ingredient	Experimental diets					
	T_1 (Control)	T_2 20%YCPM	T_3 40%YCPM	T_4 60%YCPM	T_5 80%YCPM	T_6 100%YCPM
White maize	40.63	32.50	24.38	16.25	8.13	-
Yam peel meal	-	6.97	13.93	20.90	27.86	34.83
Cassava peel meal	-	1.16	2.32	3.48	4.64	5.80
Fullfat soya bean meal	14.37	14.37	14.37	14.37	14.37	14.37
Groundnut cake	12.00	12.00	12.00	12.00	12.00	12.00
Rice husk	25.00	25.00	25.00	25.00	25.00	25.00
Brewers dry grains	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Premix*	0.25	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
Coccidiostat[a]	+	+	+	+	+	+
Total	100	100	100	100	100	100
Calculated analysis						
Crude protein (%)	16.49	16.46	16.44	16.42	16.39	16.37
Crude fibre (%)	12.53	12.99	13.45	13.91	14.37	14.83
Lysine (%)	0.70	0.69	0.67	0.65	0.63	0.61
Methionine (%)	0.24	0.22	0.21	0.20	0.18	0.17
Calcium (%)	1.13	1.13	1.14	1.14	1.14	1.14
Available P. (%)	0.64	0.63	0.63	0.62	0.62	0.61
ME (kcal/kg)	2615.62	2581.54	2547.51	2523.63	2479.39	2445.32

*To provide the following per kg of diet; vitamin A – 15,000.00IU, Vitamin D3 - 3, 000,000IU, Vitamin E- 30,000IU, Vitamin K – 3,000mgVitamin B1 3000,mg Vitamin B2-6000mg, Vitamin B- 5,000mg, Vitamin B12-40mg, Biotin 200mg, Niacin-40,000mg, Pantothenic acid 15,000mg,Folic acid 2,000mg, choline 300,000mg,Iron 60,000mg, manganese 80,000mg, copper 25,000mg,Zinc 80,000mg cobalt 150mg, iodine 500mg,selenium 310mg, Antioxidant 20,000mg.

[a(+)]Administered in water at 0.5g/l per rabbit (weekly) to prevent intestinal coccidiosis, YCPM=Yam-cassava Peel Meal and P.=Phosphorus

Table 2: Proximate Composition of YCPM

Parameters	YCPM
Dry matter (%DM)	89.60
Crude protein (%CP)	10.22
Crude fibre (%CF)	14.29
Ether extract (%EE)	1.67
Total ash (%TA)	6.25
Nitrogen free extract (%NFE)	55.98
ME (kcal/kg)	2416.94

Metabolizable Energy (ME) = calculated according to the formula of Pauzenga (1985), ME= 37×%CP+ 81.8×%EE+35.6×%NFE while %NFE = %DM – (%CP + %CF + %EE + %Ash)

Test ingredient collection and preparations

The test ingredients, fresh yam (Dioscorea spp) and cassava (Manihot spp) peels were collected from fast food and garri processing joints within Makurdi Metropolis and it environ. They were thoroughly wash to remove sand and other unwanted materials and soaked for twelve hours (12 hrs) in cool and clean water according to (14, 15), drained with a basket and subsequently sun-dried on concrete platforms for 5-7 days depending on the prevailing weather condition to attain less than 10% moisture, prevent deterioration, reduced enzymatic and microbial reactions, nutrient leaching and other forms of spoilage. The soaked and sun-dried yam and cassava peels were turned two-to-three (2-3) times per day to ensure uniformity of dryness and the dried peels were pack and store in polythene bags. The peels were then milled to obtain yam peel meal and cassava peel meal which was later mixed with other feed ingredients to produce the experimental diets. The milled samples of the test ingredient and experimental diets were analyzed for their proximate composition using the standard methods (16).

Experimental design and management of animals

A total of thirty six weaner rabbits of mixed sex, strain and aged (4 – 7 weeks) with initial live weights of 336 - 701g were obtained from local farms within Makurdi town. They were randomly allotted to six dietary treatments according to live weights with six rabbits per treatment in a complete randomized design (CRD) and each treatment was replicated six times with one rabbit per replicate. The animals were individually housed in cages and each cage was supplied with a drinker and plastic feeder, both of which were firmly fixed to prevent being tipped over during feeding and water intake. Prior to commencement of the experiment, the cages were well cleaned and disinfected with saponated creso (Izal) and allowed to dry for seven (7) days before the rabbits were introduced therein. The rabbits were condition for seven days (7) to facilitate adaptation and to acclimatize the new environment before commencement of the experiment. During this period, they were fed commercial ration (grower's mash) and water ad-libitum.The rabbits were treated against external and internal parasites by subcutaneous injection of ivomectin at 0.2ml per rabbit prior to commencement of the experiment. A broad spectrum antibiotic (water soluble powder) and protective, absorbent anti-diarrhoea (dry suspension) were used in drinking water against bacterial infection.

Experimental diets and feeding

Ingredients and nutrient composition of each dietary treatment is shown in Table 1. The six dietary treatments were formulated such that, diet 1 (T_1) served as control with maize as the major energy source. The proportion of maize in diet 1 (T_1) was replaced with soaked and sun-dried yam and cassava peel composite mix in a ratio of 6:1 in diet 2 (T_2), 3 (T_3), 4 (T_4), 5 (T_5) and 6 (T_6) at 20%, 40%, 60%, 80% and 100%

respectively. Weighed feeds (100g) were served to the experimental animals every morning with fresh, cool and clean drinking water ad-libitum. Left-over feed were weighed at the end of each week and actual feed intake were obtained by difference.

Data collection and analysis

Feed intake, initial weight gain, final weight gain, feed conversion ratio (FCR) and protein efficiency ratio (PER) were collected as response criteria used in assessing rabbit performance and All data collected were subjected to one way analysis of variance (ANOVA) using (17). Where ANOVA indicate significance difference between treatment effects, mean were separated using Duncan new multiple range test (18). All statements of significance were based on 5% level of probability ($p<0.05$).

Results and Discussion

The proximate composition of YCPM is presented in Table 2.The metabolizable energy (ME) value of 2416.94kcal/kg of YCPM is lower than the 3271kcal/kg, 3454kcal/kg and 3416.29kcal/kg metabolizable energy (ME) values of maize obtained by (19, 20 and 21)but similar to 2604kcal/kg ME value of yam peel meal obtained by Akanno (9).The crude protein of 10.22% of YCPM is similar to the CP in maize, a conventional energy feedstuff with CP content of 9.25%, 9.65%, 10.10% and 10.65% reported by (22, 19, 20 and 21)and also within the CP range of recommendation by (23) for maize in the National listing of approved ingredients for feedmills in Nigeria.

Crude fibre (CF) content of 14.29% in this study is higher than the CF of 1.99%, 5.50%, 2.80% and 3.00% of maize obtained by (19, 20, 21) and (23) in National listing of approved ingredients for feedmills in Nigeria. However, the CF of 14.29% is lower than the CF of 20.22% and 19.98% obtained by (6) in unsoaked and five hours soaked and sundried cassava peel meal but similar to 13.67% and 14.21% obtained by (24) in boiled and sundried cassava peel meal though, higher than the CF of 10.69% and 9.87% in ensiled and fermented cassava peels. (14) also reported lesser CF values (12.57%, 10.98%, 8.89% and 8.54%) in cassava peel meal than the present study using different processing methods (unprocessed, sundried, ensiled and retted) and 12.24% CF has also been reported by (23) in sundried yam peel meal. Ether extract (EE) value (1.67%) is found to be lower than the EE values of 3.98%, 2.25%, 4.35%, 3.34% and 4.0% of maize obtained by (19, 20, 25, 21) and (22) in the National listing of approved ingredients for feed mills in Nigeria.

The proximate composition of experimental diets (Table 3) revealed that, diets were formulated according to the standard of (26, 27 and 28).The metabolizable energy (ME) values ranged from 2306.88 - 2585.63kcal/kg were within the ME of 2120-2600kcal/kg recommendations of (27) for healthy growth and productive performance of growing rabbits. (29) also recommended a metabolizable energy level of about 2380kcal/kg for growing rabbits within the ages of 4-12 weeks. The inconsistent numerical decrease in ME values from T2 to T6 compare to T1 is similar to report by (7) with replacement levels of ripe plantain and yam peel in diets of weaner rabbits. The crude protein content of the experimental diets was similar among all the treatment groups in accordance with the recommendation of 17-20% recommendation of (29, 30 and 31) but slightly above 15-17%CP as stated by (19, 27) and (26).

Table 3: Proximate composition of the experimental diets (Analyzed)

	Experimental Diets					
Parameters	T_1	T_2	T_3	T_4	T_5	T_6
Dry matter (%DM)	92.41	92.92	93.93	92.99	92.80	92.98
Crude protein (%CP)	18.38	18.40	18.59	18.60	18.66	18.68
Crude fibre (%CF)	13.19	13.58	13.66	13.97	14.52	15.65
Ether extract (%EE)	3.30	2.85	2.60	2.13	1.71	1.49
Total ash (%TA)	12.03	11.00	12.60	11.53	12.51	15.08
Nitrogen free extract (%NFE)	45.51	47.09	46.48	46.76	45.40	42.08
ME (kcal/kg)	2565.96	2585.63	2515.05	2522.41	2442.00	2306.88

Metabolizable Energy (ME) = calculated according to the formula of (35), ME= 37×%CP+81.8×%EE+35.6×%NFE while %NFE = %DM – (%CP + %CF + %EE + %Ash).T_1= Control diet containing 0%YCPM, T_2= Diet containing 20%YCPM, T_3= Diet containing 40%YCPM, T_4= Diet containing 60%YCPM, T_5= Diet containing 80%YCPM, T_6= Diet containing 100%YCPM and YCPM = Sundried Yam-Cassava Peel Meal

The crude fibre (CF) content of the experimental diets were within the range of 12-15% in accordance to that, stated by (32) and (33) but slightly above the 10-12%CF recommendation for growing rabbits in the tropics by (30). The %CF and CP increased with increased % levels of YCPM replacing maize while ME (kcal/kg) and ether extract (EE) decreased as the level of YCPM increased. The progressive increase in CF content of the experimental diets with % levels of yam-cassava peel meal corroborate the work of (34) who reported similar increased in diets of growing rabbits using yam and Irish potato peel meals. Result of this study is also similar with the work of (10) who reported increased in CP, CF, EE and Ash but decrease in ME and NFE in rabbit diets with increased level of yam peel meal. (36) also observed that, there is a reduction in energy intake with increased fiber intake in diets of monogastric animals which reduces both growth and energy utilization. Therefore, due to the higher fiber content of YCPM relative to maize, the fiber level in the experimental diets increased from 13.19–15.65% as the level of YCPM increased.

The growth performance of growing rabbits fed different levels of YCPM is presented in Table 4. There were no significant ($P>0.05$) difference in all the performance parameters measured. This agreed with (37) and (38) who recorded no significant ($P>0.05$) difference in performance parameters (except intake) in weaner rabbits fed replacement levels of yam sweet potato peel meal and millet based offal diets. Growing rabbits fed diet 6 (100%YCPM) recorded a no significant ($P>0.05$) but numerical higher values in their final body weight and average daily weight gain compared to growing rabbits fed control and other experimental diets containing YCPM at graded levels. This result agreed with the report of (7, 10, 16, 35, 39 and 40) who recorded no significance ($P>0.05$) difference in the observed values of growing rabbits reared under tropical condition. This study is similar to report of (37) which opined that, average daily weight gain of growing rabbits in control diet were not significant ($P>0.05$) to sweet potato meal based diets. However, it disagreed with (41) who observed a significant ($P<0.05$) decrease in average daily weight gain of growing rabbits fed graded levels of sweet potato meal in place of maize-based diets

compare to the control and also contradicted report of (11) who opined an inconsistent significance (P<0.05) but numerical increase in average daily weight gain on weaner rabbits fed yam and cassava by-products in the humid tropics. Result of this study on average daily feed intake agreed with (10, 11, 16, 39 and 41) who opined that, feed intake increases with increased dietary fibre inclusion in diets of growing rabbits at the expense of maize. This is particularly in agreement with (27) who opined that, increased crude fibre resulted in increased

Table 4: Effect of experimental diets on performance of growing rabbits

	Experimental Diets						
Parameters	T_1	T_2	T_3	T_4	T_5	T_6	SEM
Number of rabbits	6	6	6	6	6	6	
Mean Initial weight (g)	501.33	501.33	502.83	499.83	500.00	499.83	15.614 NS
Mean final weight (g)	1168.17	1094.17	1186.33	1145.83	1175.83	1187.67	37.031 NS
ADFI (g/rabbit/day)	33.13	31.11	32.94	38.77	40.24	39.03	1.858 NS
ADWG (g/rabbit/day)	7.94	7.06	8.14	7.69	8.05	8.19	0.403 NS
Feed conversion ratio (FCR)	4.17	4.41	4.05	5.04	5.00	4.77	0.226 NS
Protein efficiency ratio (PER)	0.75	0.78	0.72	0.91	0.88	0.87	0.039 NS

SEM = Standard error of mean, NS = No significant (p>0.05) difference, ADFI = Average daily feed intake and ADWG = Average daily weight gain, T_1= Control diet containing 0%YCPM, T_2= Diet containing 20%YCPM, T_3= Diet containing 40%YCPM, T_4= Diet containing 60%YCPM, T_5= Diet containing 80%YCPM, T_6= Diet containing 100%YCPM and YCPM = Sundried Yam-Cassava Peel Meal

voluntary feed intake in growing rabbit as a means of compensating for feed. Contrary to this is (25) who opined that, a high dietary fibre level depressed nutrient intake in animals. (36) observed a reduction in energy intake with increase fibre intake which reduces both growth and energy utilization by broiler birds. The inconsistent no significant (P>0.05) increase in average daily feed intake may be attributed to the slight lower energy value of the diets containing the test ingredient and hence increased feed intake to meet their energy requirement (7, 37 and 41).

FCR values obtained in this study indicated no significant (P>0.05) difference among all treatment groups which agrees with (39) with highest and least values obtained from growing rabbits fed diet 4(5.04) and diet 3(4.05) indicating that, rabbits fed on the test diet 3 utilized their diet better than others numerically. The similarity in feed conversion ratio of the rabbits on this trial is an indication that, replacement of maize with YCPM did not impair nutrient utilization in the growing rabbits. This is in agreement with (11) who opined a similar trend in weaner rabbits fed yam and cassava by-products as replacement for maize in the humid tropics. It is also noted that, the numerical decrease in FCR with increased dietary fibre decrease feed conversion efficiency (FCE) at T4, T5 and T6 regardless of increased dietary crude protein thereby favoring T1, T2 and T3. This finding is supported with the works of (10 and 41) who obtained best feed efficiency in diets of weaner rabbits fed lesser dietary levels of sweet potato peel meal and yam peel meal at graded level. (39) reported a similar trend in weaner rabbits fed graded levels of wheat offals and sorghum offals as replacement for maize. The protein efficiency ratio (PER) also showed no

significant (P>0.05) difference among all the treatment groups with highest (0.91) and least (0.72) values obtained from growing rabbits fed diet 4 and 3 indicating that, rabbits fed on the test diet 3 utilized their diet better.

The general performance of growing rabbits confirmed the nutritive adequacy yam-cassava peel meal and by implication, any of the diets can be used for rabbits production to successfully replace maize in the diets of growing rabbits in areas where shortage of maize abound. This also implied that, even at 100% dietary level of inclusion, the effect of phytochemicals and anti-nutritional factors were within a tolerable level (41). However, growth performance result of this study numerically showed that, diet 3 is the choice diet judging from good feed intake with least value for protein efficiency ratio and feed conversion ratio when compare with other experimental diets however, there was no significant difference (P>0.05) in all the performance parameters.

Conclusion and Applications

From the results obtained, it can be concluded that;

- The YCPM is a good alternate feedstuff in replacing maize as energy source in diets of growing rabbits
- The YCPM used in this study relatively improved growth performance of the growing rabbits
- Based on the conclusion drawn from the study, 100%YCPM inclusion is recommended to farmers for improved growth production of growing rabbits since no significant difference occurred across all the dietary treatment groups.

References

1. Apata, D.F. and Ojo, V. (2000). Efficacy of Trichoderma viride enzyme complex in broiler starter fed cowpea testa based diets. In Animal Production in the New Millennium, Changes Options. Nigerian Society for Animal Production (S.N. Uwachukwu et al. eds) 25th Annual Conference, Michael Okpara University of Agriculture, Umudike, Abia State 19-23 March, 2000, Pp. 23-133.
2. Iyeghe-Erakpotobor, G.T. (2009), Performance of rabbits on stylo and groundnut haulms. Nigerian Journal of Animal Production, 36(2):288- 296.
3. Jamala, G.Y and M. Mohammed (2013). Performance and Nutrient Digestibility of Rabbit Fed Urea Treated Cowpea Husk. IOSR Journal of Agriculture and Veterinary Science, 5(2):34-37
4. Shaahu, D.T., Anthony, T.I. and Ikurior, S.A. (2014). Performance of Rabbits Fed Different Levels of Tridax procumbens in Cassava-Based Rations. Journal of Agriculture and Veterinary Science (IOSR-JAVS), 7(5)1:60-64
5. Aduku, A.O. and Olukosi, J.O. (1990). Rabbit Management in the Tropics. Production, processing, utilization, marketing, economics, practical training, research and prospects Living Book Series. 1st Edition, G.U. Publications. Abuja. FCT, Nigeria.
6. Oluremi, O.I.A. and Nwosu, A. (2002). The effects of cassava peels on weanling rabbit. The Journal of Food Technology in Africa, 7(1).
7. Akinmutimi, A.H., Odoelam, V.O. and S.F. Obasiekong (2006). Effect of replacing maize with ripe plantain and yampeels in the diet of weaner rabbits. Journal of Animal Veterinary, 5:737-740.
8. Oluremi, O.I.A., Ngi, J. Andrew, I.A. (2007). Evaluation of the nutritive potential of the peels of some Citrus fruit varieties as feedstuff in livestock production. Pakistan Journal of Nutrition, 6(6):653-656.

9. Akanno E.C. (1998). The true metabolizable energy.Nitrogen corrected true metabolizable energy and true digestible protein of selected nonconventional feeding stuffs using poultry. B.Sc. thesis, Michael Okpara University of Agriculture, Umudike, Nigeria. pp. 4-28.
10. Uchewa, E.N., Orogwu, C.E. and Nwakpu, P.E. (2014). Effect of Yam Peel Meal (YPM) Replacement for Maize on the Growth Performance and Carcass Traits of Weaner Rabbits.International Journal of Agriculture Innovations and Research, 2(4):2319-1473.
11. Ekpo, J.S., Etim, N.N., Eyo, G.D., Offiong, E.A. and Udo, M.D. (2015).Performance and Haematological Profiles of Crossbred Male Rabbits Fed Yam and Cassava By-Products in the Humid Tropics. American Journal of Experimental Agriculture, 8(2):93-98.
12. Eka, O.U. (1985). The Chemical Composition of Yam Tubers In: Advances in Yam Research; The Biochemistry and Technology of Yam Tubers. Osujin Ged. Pub.By Biochemical Society of Nigeria in Collaboration with ASUTECH, Enugu. Pp. 51 – 75.
13. TAC, (2011). Home page (http://www.nist.gov/tac/2011).
14. Olurotimi, A.O., Oluwatoyin, O.O., Cletus, O.O., Aliyu, M.Y., Adewumi, K.M., Omotugba, S.K. and Nyam, E.D. (2012). Influence of processing cassava peels on the hydrogen cyanide concentration, nutritive value and performance of growing rabbits, Tropical Animal Health Production. 44:285–291
15. Oloruntola, O.D., Agbede, J.O., Onibi, G.E. and Igbasan, F.A. (2016). Replacement value of rumen liquor fermented cassava peels for maize in growingrabbit diet. Archieves Zootechnology,65(249):89-97.
16. AOAC, (2006). Official Method of Analysis of the AOAC (W. Horwitz Editor, 18th Edn).Washighton, D.C.
17. SAS, (2008).SAS Users Guide Statistics, SAS inc. Cary, North Califonia, 2008 edn. Seed Storage Compounds: Biosynthesis, Interactions and Manipulation, Oxford, UK, Pp.175-190.
18. Steel, R.G.D. and Torrie S.H. (1990).Principles and Procedure of Statistic. 2nd (Edn), McGraw-Hill, New York.
19. Abubakar, M., Dome, D.U., Kalle, D.J.U., Nngele, M.B. and A. Augustine (2006). Effects of dietary replacement of maize with malted and unmalted sorghum on the performance of weaner rabbits. Livestock Research for Rural Development. 18 (5):20-26.
20. Igwebuike, J.U., Medugu, C.I., Raja, A.O. and Bature, I. (2013a). Growth and Economic performance of growing rabbits fed two varieties of sorghum as replacement for maize in a hot tropical environment. Global Journal of Bio-scienceand Bio-technology, 2(2);238-242.
21. Gbenge, A.A. and S.A. Ikurior (2019). The effect of grain type on growth performance and economics production of rabbits. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS), 12(10)2:17-23
22. Tuleun, C.D., Njike, M.C., Ikurior, S.A. and Ehiobu, N.G. (2005). Laying performance and egg quality of hens fed cassava root meal/brewer's yeast slurry based diets. Production Animal Techniques, 1: 148-152.
23. NIAS, (2019). National listing of approved ingredients for feedmills in Nigeria. NIAS/RA/LAFI
24. Unigwe, C.R., Raji, A.M., Popoola, A.M., Balogun, F.A., Adekunle, F.O and Nwokwu, G.N. (2017). Effect of

Different Processing Methods on the Proximate Composition of Cassava Peels, Journal of Plant and Animal Sciences, 2(1):19-25

25. Omole, A.J., Okpeze, C.N., Fayenuwo, J.A. and T.O. Olorungbohunmi (2013). Effects of partial replacement ofmaize with yam peel (Discorea rotundata) in diet of juvenile snails (Archachatinamarginata). African Journal of AgriculturalResearch, 8(16):1361-1364
26. NRC (1994). Nutrient Requirement of Poultry (9th rev. ed). National Academy Press, Washington DC, USA.p. 3.
27. Lebas, F. (1980). Influence of dietary energy on growth and performance of rabbits. Journal of Applied Rabbit Research, 3(2):15
28. Carew, S.N., Shaahu, D.T., and Ukah, L.I. (2007). Maize and full fat Soyabean Compared as Energy Sources for Rabbits in Low Technology. Proceedings of the 32nd Annual Conference of the Nigerian Society for Animal Production Calabar, March 18th -21st, pp 464-466.
29. Lebas F., Coudert. P., Rocchambeau. H. and Theabault, R.G. (1997).TheHabbit Husbandry, Health and Production. FAO, UN, Rome. pp. 1-126.
30. Omole, A.J., Ajasin, F.O., Oluokun, J.A. and Tiamiyu, A.K. (2007). Rabbit farming without tears. Green choice Agricultural publication, Ibadan. Pp. 2-40.
31. Amy, E.H. (2010). Nutritional requirements for rabbit. Shur-gain, nutreco Canada inc.
32. De-Blas, J.C., Santana, G. and Fraga, M. J. (1986). Fibre and starch levels in fattening rabbit diets. Journal of Animal Science, 63:1897-1909.
33. Amy E. H, (2008). Caecotrophy in Rabbits. Shur-gain, nutreco Canada inc.
34. Mohammed, G., Joseph, U., Igwebuike, B.S., Adamu, L.G., Ashiekh, S.S. Garba,U. and Kolo, M. (2015). Effect of dietary replacement of maize with yam and irish potato peel meals on the Growth and Economic Performance of Growing Rabbits. An International Journal of the Nigerian Society for Experimental Biology,27(2):106–110
35. Pauzenga, U. (1985). Feeding Parents Stock. Zootechnica International. (3) Pp.22-25.
36. Close, W. (1993). Fibrous diet for pigs. Animal production in developing countries (Editors: M. Gills, E. Owen, G.E. Pollot and T.L.J. Lawrence), British Society of Animal Production Occasioned Publication No. 16, pp. 107-117.
37. Akinmutimi, A.H. and Anakebe, O.C. (2008). Performance of weaner rabbits fed graded levels of yam and sweet potato peel meal in place of maize base diets. Pakistan Journal of Nutrition, 7(5):700-704.
38. Ogunsipe, M.H. and Agbede, O.J. (2012). Effect of millet offal-based diets on performance, carcass cuts and haematological profile of growing rabbits African Journal of Food Science, 6(10):280- 286
39. Igweibuike, J.U., Medugu, C.I., Kwari, I.D. and Dauda, A. (2013b). Growth performance and nutrient digestibility ofgrowing rabbits fed two varieties of maize as energy source in tropical environment. Global Journal of Bioscience and Biotechnology, 2(2), 167-172.
40. Ayoola, M.A. and Akinbani, A.S. (2011). Effects of replacing maize with sun-dried yam peel meal on growth performance, carcass characteristics and economics of production of meat-type rabbits Animal Research International, 3(4): 70-73.
41. Akinmutimi, A.H. and C.C. Osuagwu (2008). Response of Weaner Rabbits Fed Graded Levels of Sweet Potato

Meal in Place of Maize-Based Diet. Pakistan Journal of Nutrition 7(5):705-709

42. Yusuf, K.O., Ajeigbe, O.M., Oyebo, A.T., Aderinboye, R.Y. and Onwuka, C.F.I. (2017). Nutrients and anti-nutrients content of some crop by-products and residues for ruminant feeding in Nigeria. Journal Animal Production Resource, 29(1):321-334