GROWTH RESPONSE AND NUTRIENT DIGESTIBILITY OF CASSAVA ROOT MEAL FORTIFIED WITH ROSELLE SEED MEAL AS A REPLACEMENT FOR MAIZE IN DIETS OF FINISHER BROILER CHICKENS

***Oguntoye, M. A., *Ardo, B. A., *Tirmidhi, A. B., *Shiddi, J. A. and +Olanloye, S. A.**
*Department of Animal Science, Taraba State University, Jalingo.
+Department of Animal Production, Olabisi Onabanjo University, Ayetoro Campus.
Corresponding Author: ingenuityma@gmail.com Phone Number: +234-0803-955-0374

ABSTRACT
Substantial efforts have been made in the past to replace cereals with cassava in poultry feeding but the response, in terms of productive performance of laying hens fed cassava products, has been widely variable. Thus, this study was carried out to evaluate growth response and nutrient digestibility of cassava root meal fortified with roselle seed meal as a replacement for maize in diets of finisher broiler chickens. A total of 240 one-day-old broiler chicks were used in eight weeks feeding trial to investigate the effect of fermented cassava root fortified with roselle seed meal as a replacement for maize on growth response and nutrient digestibility of finisher broiler chickens. Maize is the main energy source for the control diet (T1) while the other five diets (T2, T3, T4, T5 and T6 were partially replaced with varying levels of cassava root meal – roselle seed meal (CRM-RSM) mixture at 10, 20, 30, 40 and 50% inclusion rates respectively. The broiler chicks were allotted to six dietary treatments of 40 birds each. The groups were replicated four times in a completely randomized design of 10 birds per replicate. Parameters measured for growth response include: final weight, total weight gain, daily weight gain, total feed intake, daily feed intake and feed conversion ratio. Dietary treatments revealed significant ($P < 0.05$) effect on final weight, total weight gain daily weight gain and feed conversion ratio. Birds fed control diet (T1) and diet containing 20% cassava- roselle meal mixture (T3) showed higher similar statistical ($P < 0.05$) values of 2051.00g and 2103.30g respectively. Birds fed diets containing 40% (T5) and 50% cassava- roselle meal mixture (T6) showed least values 1725.30g and 1767.00g respectively. Crude fibre and metabolisable energy digestibility were significantly ($P < 0.05$) affected. Birds fed diet containing 50% CRM-RSM recorded least ($p<0.05$) value 70.03% for crude fibre digestibility. In conclusion, inclusion of cassava – roselle seed mixture up to 30% replacement level for maize could be fed to finisher broiler chickens for improved growth response and efficient nutrient digestibility.
Keywords: **Cassava; Roselle; Growth; Chickens; Broiler.**

INTRODUCTION

Cereal grains, particularly maize, normally constitute a major proportion of poultry feed as the energy source. Maize is also the main source of energy in most farm animal feeds. However, the situation is different in the developing countries where cereals, legumes and some other animal feed components constitute staple foods for man (Eruvbetine *et al*. 2003; Onyimonyi and Ugwu 2007). At present the scarcity of conventional protein and energy resources is largely responsible for the high price of livestock feed. In the coming years, poultry producers will definitely have to look beyond maize and other cereal grains because of their low availability and inability to keep pace with ever increasing poultry production (Chauynarong *et al*. 2009). The use of unconventional feed resources in poultry nutrition is one of the ways to overcome this feed crisis in the poultry industry. Alternative feed sources have proved valuable in supporting the performance of livestock and poultry at low cost of production (Babatunde and Oluyemi 2000). Cassava has been reported as a major staple food widely cultivated in the lowlands of the humid tropics and capable of providing higher amount of energy/ha.
Cassava tuber contained very low levels of protein and was deficient in essential amino acids, fat, minerals and vitamins (Chauynarong *et al*. 2009). Therefore, Eruvbetine *et al*. (1994) reported that cassava root alone could not replace maize in layer diets without adversely affecting the performance of layers. Oruwari *et al*. (2003) stated that a complete substitute of maize was enabled by the addition of brewer's yeast to cassava tuber,and increasing protein content in rational feed for broiler. Therefore, cassava tuber meal might be completely replacing maize in poultry diets with proper protein

Substantial efforts have been made in the past to replace cereals with cassava in poultry feeding but the response, in terms of productive performance of laying hens fed cassava products, has been widely variable. It would seem to be more desirable and advantageous if cassava could be used to completely replace maize in layer feeds. This study was therefore conducted to investigate the effect of fermented cassava root fortified with roselle seed meal as a replacement for maize on growth response and nutrient digestibility of finisher broiler chickens.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Poultry unit of the Teaching and Research Farm of Taraba State University, Jalingo located between latitude 6° 30' and 9° 30' N and longitude 9° 00' and 12° 00' E in Guinea Savannah Zone of Northern Nigeria (Kefas, 2020). It has an annual rainfall range of 1000mm – 1500mm, the ambient temperature of the area range between 30 – 38°C with an average of 29°C.

Experimental birds and management

A total number of 240 one-day-old unsexed broiler chicks of commercial strain (Cobb 500) were purchased from a reputable hatchery. The chicks were weighed and allotted to six dietary treatment groups of four replicates each in a Completely Randomized Experimental Design. Each replicate consists of 10 chicks, to have a total of 40 birds per treatment group. The birds were brooded for two weeks. Birds were reared on deep litter housing system. Routine vaccinations and medications were strictly followed and feed and water were provided *ad libitum*.

Source and processing of test ingredient

Fresh cassava roots were purchased from a reputable farm in Jalingo environment. The cassava roots were washed, peeled and sliced into small pieces. Sliced fresh cassava roots were fermented for 5 days under an air-tight environment, sun dried (for 2-3 days) and packed in a sack for ration formulation. Roselle seeds were spread on a concrete floor and sun dried until they become crispy. The sun-dried seeds were pulled together and milled. Cassava roots were milled, in a 2mm sieve harmer mill and mixed at a ratio of 1kg cassava root meal with 200g roselle seed and used to replace maize at varying proportions in the basal diet.

Experimental diets

The experimental diets were formulated to meet (NRC, 1994) minimum nutrient requirement. Maize is the main energy source for the control diet (T1) while the other five diets (T2, T3, T4, T5 and T6 were partially replaced with varying levels of fermented sundried cassava root – roselle seed meal at 10, 20, 30, 40 and 50% inclusion rates respectively as shown in Table 1.

Data Collection

Performance characteristics

The initial weights of the birds were taken on arrival. The live weights of the birds as well as the feed consumption of each replicate were measured weekly. Feed conversion ratio for each replicate was determined by dividing the feed intake by the weight gain.

Nutrient digestibility

Metabolic trial was conducted at the 8th week of the study. A bird per replicate was randomly selected and housed separately in appropriate metabolic cage fitted with feeder and drinker. The birds were allowed to acclimatize for two days before the commencement of 4 days feeding and excreta collection. A known weight of feed was given and excreta collected per bird per day was oven dry at 60°C and used for analyses. Proximate composition of the feed and that of excreta were analyzed for dry matter, crude protein, ether extract, crude fibre and ash using standard method of AOAC (2000).

Statistical analysis

Data collected were subjected to One–way Analysis of Variance (ANOVA) in a Completely Randomized Design using SAS while significant means were separated using Duncan's Multiple Range Test at 5% level of significance.

Table 1: Percentage composition of broiler diets

FCR-RSM levels:	0%	10%	20%	30%	40%	50%
	Treatments					
	T1	T2	T3	T4	T5	T6
Ingredients:						
Maize	58.00	52.20	46.40	40.60	34.80	29.00
FCR-RSM	0.00	5.80	11.60	17.40	23.20	29.00
Soya bean meal	20.10	20.10	20.10	20.10	20.10	20.10
Groundnut cake	9.60	9.60	9.60	9.60	9.60	9.60
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00
Wheat offal	6.00	6.00	6.00	6.00	6.00	6.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Lime stone	1.00	1.00	1.00	1.00	1.00	1.00
DL-Methionine	0.20	0.20	0.20	0.20	0.20	0.20
L-Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis:						
ME (kcal/kg)	3019.40	3013.20	3010.14	3008.20	3005.40	3002.30
Crude protein (%)	19.81	19.83	19.85	19.86	19.88	19.88
Crude fibre (%)	3.28	3.28	3.28	3.28	3.28	3.28
Ether extract (%)	6.88	6.88	6.88	6.88	6.88	6.88
Ca (%)	1.15	1.15	1.15	1.15	1.15	1.15
P (%)	0.48	0.48	0.48	0.48	0.48	0.48
L-Lysine (%)	1.03	1.03	1.03	1.03	1.03	1.03
DL-Methionine (%)	0.53	0.53	0.53	0.53	0.53	0.53

FCR-RSM = Fermented Cassava Root – Roselle Seed Meal.

RESULTS AND DISCUSSION

Growth response

The results in Table 2 showed the growth response of finisher broiler chickens fed diets containing fermented cassava root meal fortified with roselle seed meal as a replacement for maize. Dietary treatments revealed significant ($p<0.05$) effect on final weight, total weight gain daily weight gain and feed conversion ratio (FCR). Though not significantly different from value 2051.00g obtained for birds fed control diet (T1), birds fed diet containing 20% cassava root meal-roselle seed meal (CRM-RSM) mixture showed higher ($p<0.05$) value of 2103.30g for final weight at comparative level. Least ($p<0.05$) value of 1725.30g was obtained for birds fed diet containing 40% CRM-RSM. The observation is at variance with report of (Salami, 2000)) who found that weight was not affected by diet containing 50% CRM. Amino acid is a key to tissue build up, decreased values obtained in the study with increased level of CRM could be attributed to poor amino acid profile of cassava. The protein in cassava has higher arginine content while methionine, threonine, cysteine, phenylalanine, isoleucine, and proline are low (Muller *et al*., 1975). Birds fed diet with 10% and 30% CRM-RSM recorded similar statistical values 1987.30g and 2021.06g respectively. Final weight did not follow any specific trend as observed in the result of this study. Total weight gain and daily weight gain followed similar trend with final weight. Though not statistically different from the Control, birds fed diet containing 20% CRM-RSM showed higher similar statistical values for total weight gain and daily weight gain across dietary treatments. Least ($p<0.05$) value 1558.90g was recorded for total weight gain in birds fed diet with 40% CRM-RSM. Daily weight followed the same trend with birds on diet with 40% showed least ($p<0.05$) value 74.23g. This reduced performance observed in the birds

fed 50% CRM inclusion could be attributed to high fibre content in cassava and poor amino acid profile. Improved value 1.85 was recorded for FCR in birds fed 20% CRM-RSM. At comparative level, similar higher statistical values 2.12 and 2.07 were recorded for FCR in birds fed diet containing 40% and 50% CRM-RSM respectively. The observation in this study supported the report (Bhuiyan and Iji, 2015) who reported poor FCR in birds with cassava chips compared to maize based control diet.

Table 2: Effect of graded levels of cassava root meal fortified with roselle seed meal (CRM-RSM) on growth response of finisher broiler chickens

FCR-RSM levels:	0%	10%	20%	30%	40%	50%	
			Treatments				
	T1	T2	T3	T4	T5	T6	SEM
Parameters:							
Initial weight (g)	166.43	166.05	166.46	166.34	166.40	166.27	0.06
Final weight (g)	2051.00^{ab}	1987.30^{abc}	2103.30^{a}	2021.00^{abc}	1725.30^{c}	1767.00^{bc}	46.65
Total weight gain (g/bird)	1884.60^{ab}	1821.30^{abc}	1936.90^{a}	1854.70^{abc}	1558.90^{c}	1600.70^{bc}	46.64
Daily weight gain (g/bird)	89.74^{ab}	86.72^{a}	92.23^{abc}	88.32^{abc}	74.23^{bc}	76.22^{c}	2.22
Total feed intake (g/bird)	3578.70	3501.30	3598.70	3508.00	3289.30	3315.70	48.65
Daily feed intake (g/bird)	170.41	166.73	171.36	167.05	156.63	157.88	2.32
Feed conversion ratio	1.90^{bc}	1.93^{abc}	1.85^{c}	1.89^{bc}	2.12^{a}	2.07^{ab}	0.03

^{abc} Mean on the same row having different superscripts were significantly (P<0.05) different.

Nutrient digestibility

Results of nutrient digestibility of broiler chickens fed diets containing CRM-RSM mixture as a replacement for maize is presented in Table 3. Dietary treatment had significant (p<0.05) effect on parameters determined. Crude fibre and metabolizable energy were significantly (p<0.05) influenced by dietary treatments. Values recorded for crude fibre digestibility ranged between 70.03 to 78.79%. Birds fed diet containing 50% CRM-RSM recorded least (p<0.05) value 70.03% for crude fibre digestibility. Higher value for crude fibre digestibility was recorded for birds fed control diet. Birds fed diet containing 30% CRM-RSM showed least (p<0.05) value 74.71% for metabolizable energy. The observation in this study could be attributed to high fibre content in cassava. A strong negative correlation between the fibre fractions and nutrient digestibility and utilization has been reported (Hetland *et al*., 2005).

Table 3: Effect of graded levels of cassava root meal fortified with roselle seed meal (CRM-RSM) on nutrient digestibility of finisher broiler chickens

FCR-RSM levels:	0%	10%	20%	30%	40%	50%	
			Treatments				
	T1	T2	T3	T4	T5	T6	SEM
Parameters:							
Dry matter (%)	86.59	84.83	84.64	84.69	84.74	84.00	0.62
Crude protein (%)	85.10	84.18	85.20	86.34	83.32	83.62	0.65
Crude fibre (%)	78.79^{a}	74.95^{ab}	73.87^{ab}	73.21^{ab}	71.04^{ab}	70.03^{b}	0.68
Ether extract (%)	84.99	86.20	86.79	83.33	84.22	83.64	0.65
Ash (%)	74.16	74.77	73.27	76.32	74.02	73.52	0.51
NFE (%)	86.65	85.57	80.40	81.78	84.51	81.80	0.89
ME (%)	78.34^{ab}	79.39^{a}	76.00^{ab}	74.71^{b}	75.35^{ab}	76.44^{ab}	0.19

^{ab} Mean on the same row having different superscripts were significantly (P<0.05) different.

CONCLUSION

Graded inclusion levels of cassava root meal – roselle seed meal (CRM-RSM) mixture improved weight gain for finisher broiler chickens. CRM-RSM mixture could replace maize up to 30% replacement level for improved growth performance.

REFERENCES

Babatunde BB, Oluyemi JA. 2000. Comparative digestibility of three commonly used fibrous ingredients in maize-soyabean meal-fish diet by broiler chicks. Tropical Journal of Animal Science, 3: 33-43

Bhuiyan and Iji, P. (2015). Energy Value of Cassava Products in Broiler Chicken Diets with or without Enzyme Supplementation. Asian. Journal of Animal Science 28:1317-1326.

Chauynarong, N., Elangovan, A. V. and Iji, P. A. (2009). The potential of cassava products in diets for poultry. World's Poultry Science Journal, 65: 23 – 35

Eruvbetine D, Biobaku WO, Onwuka CFI. 1994. Cassava flour as energy source for laying hens. Journal of Agriculture and Technology, 2: 76-80.

Eruvbetine D., Tajudeen I. D., Adeosun A. T. and Olojede A. A. (2003). Cassava (manihot esculenta). Leaf and tuber concentrate in diets for broiler chickens. Bioresource Technology, 86: 277-281.

Hetland, H., Svihus, B. and Choct, M. (2005). Role of insoluble fiber on gizzard activity in layers. Journal of Applied Poultry Research, 14:38–46.

Kefas, P. K., Ali, S., Ofem, K. I. and Umeugokwe, C. P. (2020). Genesis and classification

Muller, Z., Chou, X.C. and Nah, X.C. (1975). Cassava as a total substitute for cereals in livestock and poultry rations. Proceedings of the 1974 Tropical Products Institute Conference, 1–5 April, pp. 85–95.

NRC. (1994). Nutrient Requirements of Poultry, Ninth ed.; National Academy Press: Washington, DC.

Onyimonyi AE, Ugwu SOC. 2007. Bioeconomic indices of broiler chicks fed varying ratios of cassava peel/bovine blood. International Journal of Poultry Science, 6: 318-321.

Oruwari BM, Anibo AO, Nkanta DM. 2003. Effect of replacing maize with cassava/brewers dried yeast blend cassava yeast on performance of broiler chicks and feed cost in Southern Nigeria. Nigeria Journal of Animal Production, 30: 168-178.

Salami R. I. (2000). Preliminary studies on the use of parboiled cassava peel meal as substitute for maize in layers diets. Tropical Agriculture, 199 -204.

SAS (2000). SAS/STAT User's Guide: Statistics. Version 6. For Windows. SAS Institute Inc. Cary, N.C. USA.