International Journal of Agriculture, Environment and Bioresearch

Vol. 4, No. 02; 2019

ISSN: 2456-8643

EVALUATION OF GROWTH AND ECONOMIC EFFECTS OF CASSAVA FLOUR AS REPLACEMENT FOR MAIZE IN DIETS OF LOCAL TURKEYS

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ABSTRACT

An experiment was carried out to evaluate the growth and economic effects of cassava flour (CF) as an alternative to maize in diets of local turkeys. A total of 135 day- old unsexed local turkey breed were used. The birds were allotted to 5 treatments (T1 – T5). T1 which served as control was a diet without cassava flour, while T2, T3, T4 and T5 were diets in which CF replaced maize by 25, 50, 75 and 100% respectively. Each treatment was replicated three times with each having 9 birds in a completely randomized design (CRD). The experiment lasted for 16 weeks; starter phase (0 – 8 weeks) and grower phase (9 -16 weeks).Feed and water were offered ad libitum. Results showed that at the starter phase there was no dietary effect (P>0.05) on growth parameters. At the grower phase, above 25%, final live weight was reduced (P<0.05). Daily weight and feed: gain ratio were negatively affected by 100%. The 100% replacement resulted to higher feed intake. At 75 and 100% during starter phase, and 50, 75 and 100% during grower phase gross margin was reduced (P<0.05). Therefore replacing maize with CF by 25% in local turkey diets could be adopted.

Keywords: cassava flour, economic, growth, local turkeys, maize.

1. INTRODUCTION

With the sustained increase in the cost of producing of beef, sheep and chicken, which serves primarily as a source of animal protein in Nigeria, it has become crucial to consider other productive, and less common, but possible sources of animal protein for economic viability. Turkey production is an important aspect of poultry production that has contributed greatly to this growth. According to Smith (1990) carcasses of turkeys contain a higher percentage of protein than the carcasses of chicken. However, its production in Nigeria has largely remained at the smallholder level due to high cost of feed, inconsistency in feeding programmes, as well as lack of knowledge of the adequate levels of nutrient requirement Ojewole *et al*. (2002).Manyresearchers earlier had certified the suitability of cassava for feeding animal especially poultry and the potential of cassava meal as a feed substitute for maize, for the various classes of monogastrics (Adesehinwa *et al.*, 2008).

Cassava has been researched to be the world's third largest source of carbohydrates for human consumption (Fauquet and Fargette, 1990) which constitutes a vital component in the diet of over 800 million people globally (FAO, 2008). Cassava (*Manihot esculenta*), a tuber crop planted solely in the tropics and sub-tropical regions of the world, can withstand low nutrient soils, diseases and drought, can produce between 25 to 60 tons/ha (Chauynarong*et al*., 2009).Among the starchy staple foods, it gives carbohydrate yield of approximatly 40% which is higher than rice and 25% greater than maize, making it the cheapest source of calories in both human and animal diets**(**Nyerhovwo, 2004). Early research by (Job *et al.*, 1980; Ogbonna, 1991; Tewe and Egbunike, 1992)on the use of cassava in the diets of poultry either centered on the use of the flour, peels or leaves. Besides, majority of these researches ascertained the suitability of cassava flour or peel to replace maize partially in the diets of poultry. The ply of cassava as an alternative to conventional energy feed stuff like maize could help to reduce feed costs (Ukachukwu, 2005). It could also help to reduce feed scarcity, especially when the demand for maize is higher than the supply.

It has energy value of more than 3000 kcal of metabolizable energy per kg and contains 2.55% CP, 27.75% CF, 0.12% EE and 1.70% ash on a DM basis (Sriroth *et al.*, 2000). Cassava, however, contains cyanogenic glucosides of whose hydrolysis produces hydrogen cyanide (HCN) which is toxic to poultry (Udedibie and Asoluka, 2008). The cyanide can be eliminated to tolerable level through the following processes like boiling, drying, grating, soaking, fermentation, or a combination of these processes to produce final products containing not more than 100 ppm HCN (Udedibie *et al*., 2009). Likewise, as a complimentary energy source for poultry, cassava root contains very little protein which is low in quality. Diets substituting with cassava, therefore, need to be supplemented with adequate protein or synthetic amino acid to make up for the protein deficiency in it.

Cassava roots can also be used to make flour with an energy value of more than 3000 Kcal of metabolizable energy per kg (Kirchgessner, 1985). Since the product is available all year round, it is essential to identify its utilization as a substitute for maize in the diets of turkey (0-16 weeks).This study was therefore designed to evaluate the performance of turkey poults fed different graded levels of processed cassava flouras replacement for dietary maize.

2. MATERIALS AND METHODS

2.1 Experimental Site

The research was conducted at the poultry farm located in Ifa Ikot Akpan in Uyo local Government area ofAkwa- Ibom State, Nigeria. The site lies between latitude of 50-27^0 N and longitude of 7^0-32^0 E, and at an altitude of 125m above sea level. It is ecologically situated in the rainforest zone of southeast of Nigeria with annual rainfall of 800mm, average temperature of 28^{0}C and average relative humidity of 70%.

2.2 Procurement and Processing of Test Ingredients

The cassava used was harvested from farms owned by Akwa Ibom State of Nigeria Agricultural Development Programme and University of Uyo. The Fresh cassava roots were peeled with

knife, washed manually and cut into two or three halves depending on the length of the tuber. The halves were sliced longitudinally to facilitate the removal of the central fibre. The sliced roots were washed with clean water and grated using a mechanical grating machine. The ground cassava mash were spread on a tray and dried for 4 - 5 days and milled with a hammer milled and the flour passed through a sieve of 0.8mm and packaged into polythene bags, stored at room temperature awaiting use

Table 1: Composition of experimental starter turkey diets

Ingredient	**T_1 (0%)**	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**	**T_5 (100%)**
Maize	38	28,50	19.00	9.50	0.00
Cassava meal	-	9.50	19.00	28.50	38.00
Palm kernel cake	8.50	8.50	8.50	8.50	8.50
Soyabean	44.00	44.00	44.00	44.00	44.00
Fish meal	5.30	5.30	5.30	5.30	5.30
Bone meal	3.00	3.00	3.00	3.00	3.00
Palm oil	0.50	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Nutrient composition (%)					
Crude protein	28.31	27.64	27.23	26.72	26.21
Ether extract	4.52	4.45	4.44	5.31	4.12
Crude fibre	9.47	9.54	9.58	8.17	9.18
Ash	10.19	12.27	10.90	10.99	7.92
Calcium	1.27	1.28	1.30	1.32	1.33
Phosphorus	0.99	0.97	0.95	0.94	0.90

Energy (KcalME/kg)**	2869	2904	2939	2974	3009

***Premix contained per kg:** vitamins A (5,000.000 I.U), Vitamin D3 (1,000.000 I.U). Vitamin E (16,000mg), Vitamin K3 (800mg), Vitamin BI (1,200mg) Vitamin B2 (22,000gm), Niacin (22,000mg), Calcium pantothanate (4,600mg), Vitamin B12 (10mg) Folic acid (400mg), Biotin (32m)Choline chloride (260,000mg), Manganese (948,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg) Lodine(600mg), Cobalt (120mg), Selenium (48mg) Anti-oxidant (48,000mg). **Values calculated.

2.3 Experimental Animals and their Management

A total of one hundred and thirty- five (135) day –old local turkey poults were used for this experiment. On arrival the turkey poults were fed a commercial broiler starter diets for 1 week (brooding) after which the poults were randomly allotted to five dietary treatments with twenty-seven poults per treatment, and replicated three times with nine poults per replicate. The experiment was divided into two phases: the starter phase (0-8weeks) and the grower phase(8-16weeks).The experiment lasted for 16 weeks. During this period, the birds were daily fed and watered*ad libitum* using the appropriate feeding and watering troughs. The birds were managed in deep litter pens during the brooding and rearing phases. Routine medication and littermanagement were carriedout.

2.4 Experimental Diets and Composition

Five experimental turkey starter and grower diets were formulated such that the cassava replaced maize at 0%, 25 %, 50%, 75% and 100% in the diets and were tagged T_1, T_2, T_3, T_4, and T_5 respectively. They were respectively formulated to conform to the nutrient requirement of turkey starter and grower rations according to (NRC, 1984). These were represented in Tables 1 and 2.

2.5 Parameters Measured

The initial weights of birds were taken at the beginning of the experiment, and then subsequent weighing was carried out onweekly basis. Final weight gain was obtained by subtracting initial weight from the final weight. Data on feed intake was obtained by using the difference between the quantity given and the quantity of the left- over each day. The feed- to- gain ratio were calculated by dividing the total feed intake per bird by the total weight gain. All collected datawere subjected to analysis of variance (ANOVA) according to Steel and Torrie (1980) using Statistical Package for Social Science (SPSS). Means separation were carried out using the Multiple Range Test as described by Duncan(1955).

2.6 Economics of Analysis

Cost analysis was carried out at the end of each phase to assess the economic viability of the ingredients used as described by Shonaiya*et al*. (1986) and reported by Ekwu (2008).

Table 2: Composition of experimental grower turkey diets

Ingredient	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)
Maize	52.00	39.00	26.00	13.00	-
Cassava meal	-	13.00	26.00	39.00	52.00
Palm kernel cake	11.80	11.80	11.80	11.80	11.80
Soyabean	28.00	28.00	28.00	28.00	28.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Palm oil	0.50	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Nutrient composition (%)					
Crude protein	22.32	21.54	20.76	19.98	19.20
Ether extract	2.33	1.77	1.99	1.74	2.19
Crude fibre	9.91	8.92	7.88	4.99	3.72
Ash	6.21	5.89	7.99	7.90	8.10
Calcium	1.17	1.20	1.22	1.24	1.27
Phosphorus	0.90	0.88	0.86	0.83	0.81
Energy (KcalME/kg)**	2913	2960	3008	3055	3103

***Premix contained per kg:** vitamins A (5,000.000 I.U), Vitamin D3 (1,000.000 I.U). Vitamin E (16,000mg), Vitamin K3 (800mg), Vitamin BI (1,200mg) Vitamin B2 (22,000gm), Niacin (22,000mg), Calcium pantothanate (4,600mg), Vitamin B12 (10mg) Folic acid (400mg), Biotin

(32m)Choline chloride (260,000mg), Manganese (948,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg) Lodine(600mg), Cobalt (120mg), Selenium (48mg) Anti-oxidant (48,000mg). **Values calculated.

3. RESULTS

Data on growth performance of turkey poults fed graded levels of cassava flour(starter phase) as a substitute for maize is presented in Tables 3. The inclusion of cassava flour(CF) did not show any significant (P>0.05) effect on all the parameters measured during the starter phase. Marginally all the growth parameters were negatively affected as the level of cassava flour meal was increased.

On the economics of production (Table 4) feed cost per kilogramme increased significantly as level of cassava flour meal was increased. Replacement of maize with CF by 75 and 100% increased feed cost/weight gain. There were no differences between those of control, 25 and 50% level of replacement. There were no significant (P>0.05) difference in revenue. The gross margin was reduced by 75 and 100% replacement level, while there were no differences between those of control, 25 and 50%.

Table 3: Effect of cassava flour on growth performance of local starter turkeys

Parameter	T_1(0%)	T_2(25%)	T_3(50%)	T_4(75%)	T_5(100%)	SEM
Initial weight (g/bird)	49.00	50.67	49.39	49.32	48.70	0.29
Final live weight (g/bird)	666.68	645.37	625.92	608.23	603.70	14.70
Daily weight gain (g/bird)	11.03	10.62	10.31	9.99	9.90	0.26
Daily feed intake (g/bird)	30.68	30.59	30.57	30.23	29.69	0.27
Feed: gain ratio	2.78	2.88	2.96	3.02	3.10	0.07

The growth performance of local turkey grower birds fed varying levels of CFas replacement for maize is presented in Table 5. There were significant P<0.05) effects of dietary treatments on final body weight, daily feed intake, daily weight gain, daily protein intake and feed: gain ratio.

The final live weight deteriorated beyond 25% of replacement. Nevertheless, those of control and 25 were similar. Feeding of diet in which maize was replaced by 100% CF resulted to a significant increase in daily feed intake. The same parameter was similar in control and other

levels of replacement. While the daily weight gain of control was similar to those of 25, 50 and 75%, it was better than that of 100%. It was observed that only diet containing 100% CF negatively affected feed: gain ratio. The feed: gain ratio of control and other levels of CFC were similar (P>0.05).

Table 4: Effect of cassava flour on economic performance of local starter turkeys

Parameters	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Cost/kg of feed (₦)	134.09^{e}	146.44^{d}	158.79^{c}	171.14^{b}	183.49^{a}	4.67
Cost /kg gain (₦)	367.14^{b}	411.75^{b}	473.50^{ab}	529.22^{a}	559.42^{a}	22.89
Revenue (₦)	555.90	535.23	519.36	496.88	503.67	13.32^{NS}
Gross margin (₦)	329.12^{a}	292.54^{ab}	246.60^{ab}	205.93^{b}	198.59^{b}	18.42

^{ab} means treatment in a row with different superscripts are significantly different (p<0.05). S.E.M: Standard Error of mean. ns=not significant.

The Effects of CF on the economics of production grower turkey poult is shown in Table 6.It was observe that the economic performance of birds that consumed cassava flour further declined. The cost of feed consumed per bird increased when CF was included above 25%. It was highest in group that consumed 100% CF, but the same in control and 25%. Feed cost per gain was highest in 100%% followed by 75 and 50% compared to control, but the same in control and 25%. Revenue accrued was lower in groups whose diets were replaced by 50, 75 and 100%, while it was the same in control and 25%. The gross margin followed the same trend as the revenue.

Table 5:Effect of cassava flour on growth performance of local grower turkeys

Parameters	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Initial live weight (g/bird)	666.68	645.37	625.93	603.70	608.33	14.70^{NS}
Final live weight (g/bird)	2837.04^{a}	2767.59^{ab}	2670.11^{bc}	2589.65^{bc}	2537.04^{c}	38.96
Daily weight gain (g/bird)	38.75^{a}	37.89^{ab}	36.50^{ab}	35.46^{b}	34.44^{b}	0.58
Daily feed intake (g/bird)	143.45^{b}	147.94^{b}	142.53^{b}	148.80^{b}	164.07^{a}	67.93
Feed-to-gain ratio	3.70^{b}	3.90^{b}	3.91^{b}	4.19^{b}	4.79^{a}	0.11

^{abc,}means along the same columns with different superscripts are significantly different(P<0.05) SEM = Standard error of the means. ns= not significant.

Table 6: Effect of cassava flour on economic performance of local grower turkeys

Parameters		T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Cost/kg of feed (₦)	141.04^{e}	154.69^{d}	168.34^{c}	18199.38^{b}	195.64^{a}	5.16
Cost/kgfeed consumed (₦)	1132.99^{d}	1281.56^{cd}	1343.48^{bc}	1496.12^{b}	1797.54^{a}	111.18
Cost /kg wt gain (₦)	521.63^{d}	603.37^{cd}	657.82^{c}	752.43^{b}	936.13^{a}	39.43
Revenue (₦)	3472.58^{a}	3395.56^{ab}	3270.69^{b}	3177.03^{c}	3085.92^{c}	52.01
Gross margin (₦)	2339.55^{a}	2113.99^{ab}	1926.88^{bc}	1680.08^{c}	1288.39^{d}	101.51

^{abc} Means treatment in a row with different superscripts are significantlydifferent ($p<0.05$). SEM - standard error of means.

4. DISCUSSION

The result of this study which revealed that final live weight and daily weight gain of the starter birds though not significant but marginal decreased as the inclusion levels of CF in the diets was increased is an indication that the CF was not effectively utilized at the starter phase. The significant effect of CF observed whereby live weight and feed: gain ratio were deteriorated at the grower phase is an indication that prolong feeding of CF was detrimental to the wellbeing of the birds. This result is in line with the work of Hassan *et al.* (2012) who reported a considerable decrease in average daily weight gain when maize was replaced with cassava flour by 50%, 75% and 100% in broiler diets. The poorer feed: gain ratio in group that fed 100% CFcould be attributed to the presence of anti-nutritional factors (especially hydrogen cyanide) which is usually associated with cassava roots. According to Esonu and Udedibie (1993) the level of impact of anti-nutritional factors depends on the quantity consumed by animals. Hence the birds on 100% CF could have consumed larger quantity of hydrogen cyanide. Anti-nutritional factors are known to impart negatively on productivity of monogastric animals (Udedibie and Asoluka, 2008). The increase in feed intake was in variance with the report of (Esonu and Udedibie).

On economic point of view, poor economic showing by 75 and 100% level of replacement could be attributed to the marginal reduction of the final live weight of the birds that consumed the diets and also high feed cost recorded. Further decline in economic performance at the grower phase revealed that prolong feeding of cassava flour should not be encouraged. The result of the economic indices was in variance with that reported by tada *et al.* (2004) and Ojewola *et al.* (2006).

6. CONCLUSION

Results from the experiment confirmed that maize is a good dietary energy source in local turkey diet and is nutritionally superior to cassava flour meal. Substituting cassava flour meal for maizeup to 25%level at both starter and grower phases could be beneficial to farmers, especially when maize is scarce and costly.

REFERENCES

Adesehinwa, A. O. K., Dairo, F. A. S. &Olagbegi, B. S. (2008). Response of growing pigs to cassava peel based diets supplemented with avizyme1300: growth, serum and haematological indices. Bulgarian Journal of Agricultural Science, 14(5), 491-499.

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

Duncan, D. B. (1955). NewMultiple Range and Multiple F-tests. Biometrics,11, 1-14.

Ekwu, U. (2008). The effects of for age to concentrate ratios on the performance of weaner rabbits. A project report. Michael Okpara University of agriculture, Umudike. Nigeria.

Esonu, B. O. & Udedibie, A. B. I. (1993**).** The effect of replacing maize with cassava peel meal on the performance of weaned rabbits. Nigerian Journal of Animal Production 20 (1, 2): 81-85.

FAO, (2008). FAOSTAT production database. Food and AgricultureOrganization of the United Nation, downloaded from http://faostat.fao.org/site/567.

Fauquet,C. & Fargette, D. (1990). African cassava mosaic virus: Etiology, epidemiology and control.Plant Diseases, 74, 404-411.

Hassan A .M, Tamburawa, M.S., Alponsus, C. &Yusuf, J.H. (2012). Studies on growth, organs weight and haematological parameters of broiler chicken fed graded level of sun dried cassava root meal. Bayero Journal of Pure and Applied Science, 5(1), 98-102.

Job, T. A., Oluyemi, J. A., Awopeju, A. F. &Odeyemi, T. O.(1980). Optimal level of cassava (*manihot esculenta crantz*) flour in the diet of growing chick.Journal of Veterinary Medicine,27, 669-674.

Kirchgessner, M. (1985). Tierernährung: Leitfaden für Studium, Beratung und Praxis. 6. verb. Auflage, DLG-verlag, Frankfurt, Germany.

N.R.C(1984).National Research Council. Nutrient requirements of poultry. 8th ed. National Academy of Science, Washington,D.C.USA.

Nyerhovwo,J.T. (2004). Cassava and Future of Starch Electronic.Journal of Biotechnology, 7 (1), 5 – 8.

Ogbonna, J. U. (1991).Studies on cassava peels in rations of cockerels. Ph.D Thesis, University of Ibadan, Ibadan, Nigeria. PP. 254.

Ojewola, G. S., Udokainyang, A. D. &Obasi, V. (2002). Growth, carcass and economic response of local turkey poults to various levels of dietary energy. In: V.A. Aletor and G.E. Onibi (eds.). Increasing household protein consumption through livestock products. Proceeding

of the 27th Annual Conf. of Nigeria Society for Animal Production, Akure, Nigeria. PP. 167-169.

Ojewola, G.S., Opera, O.E. &Ndupu, O. (2006). The substitutional value of cassava meal, supplemented and un-supplemented with palm oil for maize in broiler diets. *J. Anim. Vet. Sci.*, 5: Pp478-482.

Shonaiya, E.B.,Williams,A.R.,&Oni, S.A. (1986). A biological and economic appraisal of broiler production up to 16 weeks.Journal of Animal Science Research, 6 (2), Pp115-125.

Smith, A.J. (1990). The Tropical Agriculturist Poultry. 1st ed. Macmillan Press Limited, London, Pp. 195-218.

Steel, R. G. D. & Torrie, J. H. (1980). Principles and proceedings statistics: A biometrical approach. 2nded. McGraw hill Books Co. Inc. New York, USA.

Sriroth, K.R, Chollakup, S., Chotineeranat, K., Piyachomkwan, S. & Oates, C.G. (2000). Processing of cassava waste for improve biomass utilization. Bioresources Technolology. 71, 63-69.

Tewe,O.O., Tada, O., Mutungamiri,A., Rukuni, T. & Maphosa,T. (2004). Evaluation of performance of broiler chicken fed on cassava flour as a direct substitute of maize. African Crop Science Journal, 12, 267-273.

Egbunike, G. N. (1992). Utilization of cassavain non-ruminant livestock feeds. Cassava aslivestock feed in Africa. Proceedings of the IITA/ILCA/University of Ibadan workshop on the potentialutilization of cassava as livestock feed in Africa. Nigeria, PP. 28-38.

Ukachukwu, S.N. (2005). Studies on the nutritive value of composite cassava pellets for poultry: Chemical composition and metabolizable energy.Livestock Researchand Rural Development,17(1), 125.

Udedibie, A.B. & Asoluka, C. O. (2008). Effect of 5 h. welting of sun dried cassava tuber meal on the HCN content and dieting value of the meal for young broiler chicks. Nigeria Journalof Animal Production, 1, 25-31.

Udedibie A. B. I., Enang, M. T, Enyenihi, G. E. & Obikaonu, H. O. (2009). Use of sun – dried cassava tuber meal, brewers' grains and palm oil to simulate maize in broiler diets. Proceedings of International Conference on Global Food Crisis, Federal University of Technology, Owerri, Nigeria. PP. 56 – 59.