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Growth Response, Carcass Characteristics and Serum Biochemistry of Finisher Broilers Fed Cassava Peel Meal as Replacement for Maize Supplemented with Exogenous Enzyme

C. I. Nwosu[1], M. U. Ibrahim[2] and A. E. Ibeziako[3]

[1]*Department of Animal/Fisheries Science and Management, Enugu State University of Science and Technology (ESUT), Agbani, Enugu State, Nigeria.*
[2]*Department of Agricultural Education, College of Education, Akwanga, Nasarawa State.*
[3] *Department of Animal/Fisheries Science and Management, Enugu State University of Science and Technology (ESUT), Agbani, Enugu State, Nigeria.*

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Corresponding Author's E-mail Address:
irenkemnwosu@gmail.com

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ABSTRACT

A twenty-eight days feeding trial was conducted to evaluate the effect of feeding graded levels of cassava peel meal as a replacement for maize supplemented with enzyme on broiler performance. One hundred and sixty finisher broilers were randomly allocated to four dietary treatments (T_1, T_2, T_3, T_4) at 0%, 25%, 50% and 75% respectively. Each group had a total of forty chicks. This was replicated 4 times with ten (10) birds per replicate in a completely randomized design. The finisher broilers showed significant ($P<0.05$) differences in final weight gain, daily weight gain and feed conversion ratio in favor of the control (T_1) and T_3 (50%) over T_2(25%) and T_2(25%) over T_4(75%). However, for carcass characteristics, T_1 (0%) was significantly ($P<0.05$) better than T_3 (50%), which in turn was superior ($P<0.05$) to T_2 (25%) and the least being T_4 (75%) in most parameters. The serum metabolites (electrolytes) of the birds fed the treatments were similar ($P>0.05$) to values for the control. The study thus showed that sundried cassava peel meal can successfully be included in place of maize at fifty (50) percent with enzyme supplementation for good performance and health status of broiler chicken.

1.0 Introduction

Maize is the most common cereal grain used as a carbohydrate source in poultry production. However, its use has been limited because of its competition for use by man, the beverage industries and other livestock production (Iji, *et al.,* 2010). It is therefore expedient that alternatives are found. Unconventional feed material like cassava peel meal has since been discovered as a replacement for maize in poultry ration (Tewe *et al.,* 1976; Salami and Odunsi, 2003; Agiang *et al.,* 2004). These unconventional feeds earlier are seen as waste because of the high cellulose content making it difficult for monogastric animals to digest and at times because of the toxins contained in them; cassava peel was no exception. To make it useable, certain actions were employed.

Firstly, cassava peel contained toxic substances such as phytates and a large number of cyanogenic glycosides; thus, researchers employed various processing methods to reduce the cyanogenic and phytate content (Oboh, 2006; Salami and Odunsi, 2003; Adegbola *et al.,* 1985). These methods include sun drying alone, soaking and sun drying.

Secondly, cassava peels like most agricultural wastes are made up of mainly polysaccharides (cellulose) which account for an estimated 66% of all global-bound carbon (Egbunike *et al.,* 2009). These are difficult to digest by Monogastrics but can be aided with enzymes to hydrolyze the cellulose. Literature show that microorganisms have the ability to produce enzymes in large quantity (Muhammad and Oloyede 2009; Salami and Odunsi 2003; Bahman 2011) and these enhance the digestibility of the feed ingredient (Abdulrashid *et al.,* 2007; Hajati *et al.,* 2009; Aguihe *et al.,* 2016). (Abdulrashid *et al.,* 2007; Iji *et al.,* 2010; Kayode 2009) reported that dietary supplementation with microbial enzyme preparations are capable of hydrolyzing endosperm cell walls and resulted in increased performance of broiler chickens receiving cereal-based diets.

In the same light, some researchers (Raji and Ndukwe 1988; Belewu and Banjo 1999) reported a positive effect of hydrolyzed cassava peel as maize replacement on the hematological parametres and serum biochemical indices. Some specifically observed improved blood parameters with enzyme supplementation on poultry chickens (Adeyemo and Sani 2013; Uchegbu and Udedibie 1998; Etuk *et al.,* 2013).

The current study was intended to add further information on the effect of replacing maize with cassava peel meal supplemented with enzymes on the growth, carcass characteristics and serum biochemical parameters of broiler chickens.

2.0 Materials and Methods

The study was carried out at the Teaching and Research Farm, Poultry Unit of the Department of Animal/Fisheries Science and Management of the Faculty of Agriculture and Natural Resource Management, Enugu State University of Science and Technology.

2.1 Experimental Diets and Treatment

Four (4) experimental diets were formulated consisting of Treatment (T1) with 0% inclusion of cassava peel meal as the control while T2, T3 and T4 had 25%, 50% and 75% respectively. The dietary treatments were supplemented with exogenous enzyme. Table 1 shows the composition of the experimental diet, while Table 2 shows the proximate composition of the cassava peel meal.

Table 1: *Composition of finisher diet (5-8 weeks)*

Ingredients	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)
CPM	0.00	12.50	25.00	35.50
Maize	50.00	37.50	25.00	14.50
Soyabean meal	30.20	30.20	30.20	30.20
Fish meal (72%)	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00
Wheat offal	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Enzyme	0.10	0.10	0.10	0.10
Total	100	100	100	100
Calculated Analysis				
ME (Kcal/g)	3015.50	2975.00	2815.20	2710.45
Crude Protein (%)	22.95	22.15	21.95	19.55
Crude Fibre (%)	3.00	3.45	3.90	4.25

Table 2: Proximate composition of CPM

Nutrients	% Composition
Dry matter	86.00
Crude protein	3.84
Crude fibre	32.00
Ether Extract	2.20
Nitrogen free extract	52.96
Gross energy (kcal/g)	3.1
Ash	6.00

2.2 Experimental birds

One hundred and sixty finisher broilers were randomly allocated to four experimental diets in a completely Randomized Designed, with four (4) replicates containing (10), birds. Each treatment contains forty (40) birds. Proper brooding as well as a vaccination schedule was adopted during brooding.

2.3 Experimental Material

Fresh cassava peel meal was collected from garri processing plant in Agbani, Nkanu West Local Government Area of Enugu State. The fresh cassava peel meal were chopped, washed, soaked for a day and dried under the sun. The peels were turned regularly to prevent uneven drying and possible decay. When the cassava peel becomes crispy by sun drying, it was milled using a hammer mill to produce the cassava peel meal. Enzymes were included in the diet at the rate of 0.01 for T_2, T_3 and T_4.

2.4 Chemical Analysis

The proximate analysis of sundried cassava peel meal was carried out using the procedure described by A.O.A.C (2002).

2.5 Statistical Analysis

The data collected were subjected to analysis of variance and significantly different means were compared using Duncan's Multiple range Test as described by Obi (1990).

3.0 Result and Discussion

The nutrient composition of the experimental diet for finisher phases shown in Table 1 and the proximate composition of cassava peel meal shown in Table 2 revealed that the cassava peel meal contained 3.84% crude protein, 32.00% crude fiber, 2.20% ether extract, 6.00% ash and 52.96% NFE. Hence the nutrient (proximate) compositions of the diets are adequate and within the recommended range for broiler finishers as reported by NRC (1994) and Oluyemi and Robert (2007).

Table 3: *Performance of finisher broilers fed CPM based diet supplemented with exogenous enzyme*

Parameter	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)	SEM
Average final weight (g)	2165^a	1880^b	2085^a	1729^c	23.01
Average initial weight (g)	755.37	756.03	756.45	756.18	5.61
Total weight gained (g)	1409.63^a	1123.97^b	1328.55^a	972.82^c	12.41
Average daily weight gain (g)	50.34^a	40.14^b	47.45^a	34.74^c	2.34
Average daily feed intake (g)	102.89^b	110.05^a	14.83^a	101.20^c	8.56
Feed conversion ratio	2.04^a	2.74^b	2.42^b	2.91^c	0.03

^{abcd}Means within the same row with the same superscripts do not differ significantly (P>0.05)

3.1 Weight Gain

The final weight for the finisher broilers (Table 3) was not significantly (P>0.05) different between T_1 and T_3 but these were significantly (P<0.05) higher than T_2 and T_1, with T_2 significantly (P<0.05) better than T_4. The poor performance of birds in T_4 may be due to the low protein and high fiber percentage of cassava peel meal inclusion in the diet, which may have interfered with digestion and utilization of nutrients by the birds as observed by Esonu and Udedibie, (1993). However, the high weight gain in T_1/T_3 over T_4 might be due to as stated that enzymes tend to reduce digesta viscosity, enhance digestion and absorption of nutrients, especially fat and protein, improve apparent metabolizable energy value of the diet, decrease size of the gastrointestinal track as well as alter the population of microorganism in the gastrointestinal tract (Campbell *et al.,* 1989; Jansson *et al.*, 1990; Annison and Choc, 1991; Leeson and Proulx, 1994; Gill, 2001; Wang *et al.,* 2005); all of which are believed to enhance weight gain. This may have been optimized in T_3 because of the apparent lower content of fiber in its diet compared to T_4.

On this premise, it has been reported that cassava peel meal should not be fed alone as its protein and mineral content cannot support optimum growth, it should be fortified with micronutrients especially sulfur, phosphorus and vitamin B (Smith, 1988; Pipat lounglawan *et al.,* 2011). Accordingly, some researchers reported the use of sun drying method to effectively reduce the cyanogenic glycoside and phytate content (Tewe *et al.,* 1976; Salami et al., 2003; Onoh, 2006; Aro *et al.,* 2010) and enzymes (Abdulrashid *et al.,* 2007; Hajati *et al.,* 2009; Aguihe *et al.,* 2016) to cause release the nutrient for efficient utilization.

3.2 Feed intake

Broilers in T_2 and T_3 significantly (P<0.05) consumed more feed than those in the control (T_1), while broilers in T_4 consumed significantly (<0.05) less. The high feed intake observed for T_2 and T_3 over T_1 can be attributed to high crude fibre and low energy content of the diet compared to the control diet as it is known that chickens provided with a diet of lower nutrient density will require more feed to reach a similar weight (Ravindran, 2013; Esonu and Udedibie, 1993). On the other hand, the higher feed intake of these groups over T_4 may be because of the enzyme reduction of the anti-nutritional effect of hydrocyanic acid in the diet which had less crude fibre content compared to the diet of T_4 and this is in support of the work of White *et al.,* (1981).

3.3 Feed conversion ratio

The result (Table 3) showed that T_1 was significantly (P<0.05) better than T_3 and T_2 which did not differ significantly (P>0.05) from each other but were significantly (P<0.05) superior to T_4. The poor feed conservation ratio observed in T_4 was due to high fibre and cellulose content of the diet. Researchers have shown that broiler birds are easily affected by the fibre content of the feed (Yaakugh *et al.,* 1988; Rougiere and Carre, 2010) and agreed that the inclusion level of cassava meal should be limited. Ogbonna and Dredein, (2000) recommended an inclusion level of 5-10% depending on the quality and appropriate feed formulation. Good feed conversion in T_3/T_2 among the treated broilers may be attributed to increased availability of carbohydrates for energy utilization associated with increased energy digestibility (Mollah, *et al.*, 1983; Partridge and Wyatt, 1995) over T_4.

3.4 Carcass characteristics

Table 4: The carcass characteristics of finisher broiler chickens fed CPM based diets supplemented with exogenous enzyme.

Parameter	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)	±SEM
Live weight (g)	2165[a]	1880[b]	2085[a]	1729[c]	23.01
Dressed weight (g)	1726[a]	1396[c]	1591[b]	1219[d]	31.22
Dressing %	79.72[a]	74.26[c]	76.31[b]	70.53[d]	5.10
Breast muscle (g)	405.66[a]	287.66[c]	362.00[b]	210.00[d]	18.31
Thigh (g)	110.26[a]	89.34	95.51[b]	60.83[d]	3.60
Drumstick (g)	110.11[a]	115.43[c]	116.72[b]	71.84[d]	3.27
Liver (g)	30.21[a]	22.71[c]	26.44[b]	20.10[d]	2.04
Kidney (g)	2.16[a]	1.22[c]	1.54[b]	0.86[d]	0.25
Heart (g)	7.88[a]	5.95[c]	6.77[b]	4.73[d]	0.38
Gizzard (g)	42.66[a]	34.26[b]	31.12[c]	25.33[d]	2.16

[abcd]Means within the same row with the same superscripts do not differ significantly (P>0.05)

In all the carcass characteristics (dressing percentage, breast muscle, thigh, drumstick, liver, kidney, heart, gizzard) shown in Table 4, the control (T_1) were significantly (P<0.05) higher than all the treated (T_2-T_4). T_3 was significantly (P<0.05) heavier than T_2 which in turn was significantly (P<0.05) heavier than T_4 in most of the parameters. The low values obtained in most of the parameters for broilers fed on 75% (T_4) cassava peel meal could be attributed to the higher dietary fibre. This corroborates the report of Zaczek *et al.,* (2003) that fibre in the diet of broiler chickens has a negative effect on body weight. On the other hand, the superior carcass characteristics of broilers in T_3 and T_2 over T_4 was probably due to better utilization of nutrients which reflected in their body weights and in turn higher degree of carcass meatiness (Bartov, 1998; Agunbiade, 2000).

3.5 Serum Biochemistry

Table 5: Serum biochemistry of finisher broiler chickens fed CPM based diets supplemented with exogenous enzyme

Parameter	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)	
Aspartate transaminase (AST) U/I	50	51	52	50	*
Alanine transaminase (ALT)U/I	11	11	12	14	*
Alkaline phosphatase (ALP)U/I	701	728	799	778	*
ALT:AST	0.24	0.25	0.26	0.34	*
Potassium (K^+) Mmol/L	3.5	3.7	3.9	4.1	*
Sodium (Na^+) Mmol/L	125	125	125	129	*
Bicarbonate (HCO_3) Mmol/L	27	26	26	28	*
Chloride (Cl) Mmol/L	98	99	98	98	*
Cholesterol Mmol/L	4.5	4.1	4.3	4.2	*
Urea Mmol/L	3.3	3.0	3.1	3.1	*
Creatinine Mmol/L	35	38	40	44	*

NS: means on the same row not significantly (P>0.05) different from each other.

The serum biochemical values in Table 5 for the broilers showed no significant (P>0.05) mean differences between the control and the treated broilers in all parameters studied. Further, there were no significant (P>0.05) mean differences among the treated broilers.

The similar values of the serum electrolytes to normal values reported by (Lalhriatpuii and Sudipto, 2012) indicated that the feeding of cassava peel meal did not affect the metabolism of the broilers at any level. The enzyme inclusion may have enhanced nutrient utilization and metabolism in the body of the chickens. This is in support of the work of (Etuk *et al.,* 2013) who found improvement in the blood parameters of chickens with the inclusion of enzymes. (Abdulrashid *et al.,* 2007; Iji *et al.,* 2010) suggested that dietary supplementation with microbial enzyme preparations are capable of hydrolyzing endosperm cell walls which causes increased performance of broiler chickens receiving cereal-based diets.

It is instructive to note that the ALT: AST ratio of less than 1 in this study was suggestive of the normal metabolism of the internal organs of the broilers unlike (Adeyemo and Sani 2013) who suggested possible distortion in the internal organs of the broilers studied since the ALT:AST ratio was greater than 1 in the treated feeds using the marker enzymes ; Aspartate aminotransferase (AST) and Alanine aminotransferase.

Furthermore, the serum urea levels in the current study were lower than the values reported by (Adeyemo and Sani 2013) at all levels. This may indicate normal functioning of the urea cycle thus ruling out renal dysfunction which is attributable to impairment in the urea cycle (Uchegbu and Udedibie 1998). This was indicative of the beneficial effect of the inclusion of the exogenous enzyme in this study. (Etuk *et al.,* 2013) reported reduction in blood uric acid as a result of enzyme supplementation and suggested that the enzyme preparation may have increased nutrient metabolism, particularly protein anabolism of chickens therefore promoting the growth of chickens.

4.0 Conclusion and Application

The results presented revealed that cassava peal meal may not wholly replace maize in the diet of Finisher broilers even with supplementation with enzyme for better hydrolysis of the cellulose and reduction of the anti-nutritional factors contained thereof, however, at 50% replacement level, the performance is comparable to control.

It is concluded therefore that cassava peel meal can reduce the dependence on the use of maize as growth, carcass and health promoters in the diet of broilers at 50% replacement level.

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