



Research Article

Effect of Locally Processed Cassava (*Manihot Esculenta*) Root Meal on Performance Indices, Metric Characteristics of Gut and Organs of Broiler Chicken

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ABSTRACT

A 4-week feeding trial was conducted with 54 two-week-old broiler chicks which were randomly allotted to 3 dietary treatments, each treatment having 6 replicates consisting of 3 broilers in a completely randomized design to evaluate the influence of inclusion in broiler diets at 0, 7.5 and 12.5 % cassava root meal on feed intake, weight gain, feed conversion efficiency, organ weight and gut morphometry. Results showed no significant difference ($p>0.05$) in the treatments' feed intake, weight gain, and feed conversion efficiency. There was also no significant ($p>0.05$) difference in the absolute weight of organs selected for analysis, while there was a significant ($p<0.05$) difference in the right caeca length. Sun-dried cassava root meal can be incorporated into the starter diet of broilers up to 12.5% to replace conventional feed ingredients like maize without any deleterious effects on the performance and gut health.

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1. INTRODUCTION

Nigeria's Poultry production has become a popular economic enterprise with a promising future. The poultry industry contributes approximately 25% to Nigeria's agricultural Gross Domestic Product (GDP) (Makasi *et al.*, 2020). Apart from food production, farm animals like poultry play other important social, economic, and cultural roles (Soussana *et al.*, 2017). In Nigeria, maize remains the main basal feed ingredient in poultry feed. Unfortunately, domestic maize production in Nigeria is not fast-growing (Poultry World, 2020), and this has necessitated the importation of maize at high prices, with a risk of mycotoxin contamination that has exposed broilers to health challenges. The broiler production industry requires less expensive feed ingredients that are easily digestible with no risk of mycotoxin contamination. Cassava, a

tropical crop grown extensively in Nigeria, can replace maize in broiler diets (Chang'a *et al.*, 2020) because of its high energy content (Pradyawong, 2018). Cassava can survive on soils unsuitable for other arable crops (Pradyawong, 2018). The use of cassava as animal feed is not new, either in cassava root or cassava leaf meal in poultry diets (Ravindran *et al.*, 1986; Aderemi *et al.*, 2000; Ewa *et al.*, 2019). However, incorporation of cassava in broiler diets is restricted due to their unbalanced amino acid content, low protein, high fibre, and cyanogenic glucosides, which are anti-nutrients (Chauynarong *et al.*, 2009).

Many studies have been conducted to evaluate the replacement of grains with cassava meal in poultry feeds. The outcomes of these studies have shown wide variation in feeding value, nutritional problems, and productive

performance. The inclusion level of cassava root meal in broiler diets has ranged from 10% to 30% (Ewa *et al.*, 2019; Ogbuewu & Mbajorgu, 2022) and as high as 40 to 60% (Garcia & Dale, 1999; Chang'a *et al.*, 2020). These inconsistencies could be traced to different sophisticated processing methods of cassava and the introduction of other supplements, making cassava in the poultry diet relatively more expensive.

This study investigated the effect of locally processed cassava tubers used to replace maize on performance, gut metric characteristics, and some internal organs of broilers without enzyme supplementation.

2. METHOD

2.1. Processing of Cassava Roots

Fresh cassava tubers were harvested at a farm near the Teaching and Research Farm of the University of Ilesa, Ilesa, Nigeria. The cassava tubers were peeled, washed, and sliced into pieces. The sliced pieces were sun-dried on concrete floors for about 10 days with daily turning to reduce the moisture content to about 10% and cyanogenic glucosides present in cassava to the point where they could have no adverse effect on the animal (Tewe, 1991; IITA, 1994).

2.2. Experimental Diets

The dried cassava chips were milled using the locally available milling machine. Milled cassava was incorporated into experimental diets at 0, 7.5, and 12.5% levels of inclusion and subsequently referred to as diets A, B, and C, respectively (Table 1). The experimental diets were formulated as isonitrogenous (22% crude protein). The diets were further fortified with adequate minerals and vitamins.

2.3. Experimental Animals

Fifty-four two-week-old broiler chicks were randomly allotted to 3 dietary treatments, each with 6 replicates of 3 broilers in a completely randomized design. The birds were fed the treatment diets and fresh, clean water *ad libitum* at 8.00 hours throughout the 28-day trial period. Medication programmes for broilers were strictly adhered to throughout the investigation. Records of performance were taken every week. At the end of the feeding trial, two birds were randomly selected per replicate, making up 36 birds. The selected birds were starved of feed and water for 12 hours before they were killed. After thorough bleeding, they were immersed in hot water at about 500 °C to make the removal of feathers seamless. This was followed by cutting up the birds to harvest the liver, heart, gizzard, spleen, and bile, as well as the small intestine, large intestine, left and right caeca. The weights of the internal

organs were taken using a sensitive digital scale, while the lengths of the small intestine, large intestine, left and right caeca were also taken using a ruler.

Table 1. Composition of experimental diets (%)

Ingredients	Dietary Cassava Meal (%)		
	0.00	7.50	12.50
^a Cassava root meal	0.00	7.50	12.50
Maize	47.00	39.50	34.50
Groundnut cake	16.00	16.00	16.00
Soybean meal	17.10	17.10	17.10
Wheat offal	13.25	13.25	13.25
Palm kernel cake	1.00		1.00
Fish meal	1.00	1.00	1.00
Bone meal	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00
Salt	0.25	0.25	0.25
^b Vitamin premix	0.20	0.20	0.20
Methionine	0.10	0.10	0.10
Lysine	0.10	0.10	0.10
Total	100.00	100.00	100.00
Calculated analyses			
Crude protein (%)	22.00	22.00	22.00
Metabolizable energy			
(Kcal/kg)	2,838.26	2,820.71	2,809.01
Crude Fibre (%)	4.11	4.10	4.18

^aThe proximate composition of the cassava tuber used is Dry matter (90.0 %), Crude protein (2.5 %), Crude fibre (3.5 %), Ether extract (0.5 %), Ash (3.8 %), and ME (kcal/kg) (3,200)

^b Vitamin premix contributed the following:

Vitamin A, 20,000IU; Vitamin D3, 4000IU; Vitamin E, 40mg; Vitamin K3, 4mg; Vitamin B1, 6mg; Vitamin B2, 10mg; Niacin, 90mg; Calcium panthothenate 20mg; Vitamin B6, 8mg; Vitamin B12, 0.04mg; Choline, 600mg; Folic acid, 2mg; Biotin, 0.1mg; Manganese, 600mg; Iron, 240mg; Zinc, 160mg; Copper, 17mg; Iodine, 3mg; Cobalt, 0.6mg; Selenium, 0.24mg; Antioxidant, 0.24mg.

2.4. Statistical Analysis

Data obtained were subjected to statistical analysis using the analysis of variance procedures of Statistical Analysis Software (SAS, 1999). The treatment means were presented with group standard errors of means, and where significant, were compared using the Duncan multiple range test of the same software.

3. RESULTS AND DISCUSSION

There was no significant ($p > 0.05$) difference in the feed intake of broilers in all the treatments (Table 2). This implies that including up to 12.5% of cassava in broiler rations does not affect feed acceptance. This similar feed intake could be because the experimental diets were formulated to be balanced for all nutrient requirements of broilers at the starter phase. It could be observed from

Table 2 that feed intake was higher in the control group than in the other treatment groups. According to Yadav et al. (2019), this could be due to limiting factors in cassava, which tended to reduce feed intake.

Also, in Table 3, no significant difference ($p>0.05$) was observed in the weight gain of the broilers. At the same time, Table 4 also reveals no significant difference ($p>0.05$) in the feed conversion efficiency, though the mean value was highest for birds on 12.5% cassava root meal.

Table 3. Weight gain (in kg) of broiler chicken fed dietary cassava root meal

Week	Dietary Cassava Meal (%)			
	0.00	7.50	12.50	SEM
1	0.28	0.26	0.26	0.01
2	0.33	0.33	0.28	0.02
3	0.42	0.49	0.35	0.01
4	0.60	0.59	0.54	0.01

Means are not significantly different ($p > 0.05$); SEM = Standard Error of Mean

Table 4. Performance Characteristics of Broiler Chicken fed Dietary Cassava Root Meal

Parameters (kg)	Dietary Cassava Meal (%)			
	0.00	7.50	12.50	SEM
Initial body weight	0.28	0.26	0.26	0.01
Final body	0.60	0.33	0.28	0.01
Feed intake	0.60	0.49	0.35	0.01
Weight gain feed conversion	0.32	0.59	0.54	0.01
Efficiency	1.88	1.70	1.79	0.11

Means are not significantly different ($p > 0.05$); SEM = Standard Error of Mean

Although inclusion of cassava root in the diets of broilers did not elicit any significant difference in their performance characteristics, it could be observed that lower feed intake as a result of high fibre in cassava roots resulted in decreased body weight and weight gain in the young birds (Tang *et al.*, 2012; Zanu *et al.*, 2017).

The inclusion of cassava root meal in the broiler diet led to a significant linear reduction in live and bled weights ($p<0.05$) (Table 5). In other words, broilers placed on cassava root meal diets had lower live and bled weights than those on the control diet. This may be due to a high level of fiber content in cassava root meal, which consequently resulted in reduced protein digestibility and suppressed the broilers' growth (Akintala *et al.*, 2002; Sultana *et al.*, 2012). No significant difference occurred in the birds' absolute weight of selected organs, but the mean values in Table 5 revealed that liver, heart, gizzard, spleen, and bile weights were highest for birds on a 12.5% cassava root meal-based diet.

Table 5. Absolute weight of selected organs of the broiler chickens fed diets containing cassava root meal.

Parameters (kg)	Dietary Cassava Meal (%)			
	0.00	7.50	12.50	SEM
Live weight	0.69 ^a	0.56 ^b	0.41 ^b	0.02
Bled weight	0.65 ^a	0.48 ^b	0.35 ^b	0.02
Organs (g)				
Liver	12.27	12.15	13.55	0.53
Kidney	1.58	1.63	1.42	0.10
Lungs	1.63	1.77	1.72	0.10
Heart	3.30	3.48	3.65	0.19
Gizzard	24.10	24.07	24.98	1.16
Spleen	0.57	0.63	1.00	0.07
Bile	0.62	0.92	0.90	0.06

Ab = means in rows followed by different superscripts differ significantly ($P < 0.05$); SEM = Standard Error of Mean

There were no significant ($p>0.05$) differences in the length of the small intestine, large intestine, and left caecum (Table 6). The highest mean values were recorded for the length of the small intestine, left and right caeca, for broilers on a 12.5% cassava root meal diet. Diets containing 7.5 and 12.5% cassava root meal inclusion increased the length of the right caecum significantly ($p<0.05$). The increase in cecal length is supported by the finding of Jha and Mishra (2021), who reported that the length of the caecum increased to adapt to increased inclusion of dietary fibre levels in diets.

Table 6. Performance Characteristics of Broiler Chicken fed Dietary Cassava Root Meal

Parameters (kg)	Dietary Cassava Meal (%)			
	0.00	7.50	12.50	SEM
Small intestine	39.67	47.18	55.22	3.47
Large intestine	7.72	6.43	7.72	0.47
Left caecum	10.17	10.77	10.38	0.22
Right caecum	11.08 ^b	13.13 ^b	14.67 ^a	0.43

Means are not significantly different ($p > 0.05$); SEM = Standard Error of Mean

4. CONCLUSIONS

From the study, it can be concluded that locally processed cassava root meal can partially replace conventional feed ingredients like maize in broiler starter diet up to 12.5% without any deleterious effects on the performance and health status of the birds.

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