

PERFORMANCE AND GUT HEALTH OF BROILER CHICKENS FED DIETS CONTAINING PROCESSED CASSAVA PEEL MEAL

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Target audience: *Nutritionists, Feed formulators, Poultry farmers, Animal Scientists*

Abstract

The rising cost of conventional feed ingredients has intensified the search for sustainable alternatives that can maintain broiler performance, reduce production costs, and promote environmental sustainability. This study investigated the performance and gut-health responses of broiler chickens to the dietary replacement of maize with processed cassava peel meal (high quality cassava peel meal, HQCP), included at 20% during the starter phase and at 100% replacement during the finisher phase. Two hundred Arbor Acres Plus broiler chickens were allotted to two dietary treatments on a weight-equalized basis. The maize-soybean meal control diet and the HQCP based diet were formulated to meet the recommended nutrient requirements of the birds. At the starter phase, birds fed the control maize-based diet recorded significantly higher body weight gain and improved feed conversion ratio (FCR) ($p < 0.05$), along with superior villus height/crypt depth ratio compared to HQCP-fed birds. No intestinal lesions were observed in either group at this stage. By the finisher phase, villus height/crypt depth ratio and final body weight did not differ significantly ($p > 0.05$) between dietary treatments. However, FCR and feed intake were lower in the maize-fed birds ($p < 0.05$). Importantly, jejunal necrosis was observed in birds receiving the HQCP-based diet, indicating residual anti-nutritional factors despite processing. In conclusion, processed cassava peel meal demonstrates potential as a sustainable alternative to maize in finisher broiler diets without compromising growth performance. Its successful utilization, however, depends on effective processing to reduce anti-nutritional factors and on strategic phase-feeding approaches to safeguard early growth.

Keywords: Cassava By-product; Performance; Gut Morphology; Broiler Chickens

Description of problem

The current high in prices of conventional feedstuffs seems to warrant intensified efforts to find sustainable alternatives to the major feed inputs (maize or soyabean) that would support performance without compromising health of birds. The production of animal feeds that would meet the nutritional requirement of monogastric animals is a great challenge because of the high cost of protein and energy feed ingredients. This has resulted in increased cost of finished feeds and an eventual hike in the cost of animal production and products. This situation has resulted in the search for alternative feed ingredients to reduce production costs without compromising animal performance, and the use

of agro-industrial by-products in poultry production has been identified (1). Cassava peels (5 -15% of tuber weight), an important by-product of cassava, when processed could be used to replace corn or wheat in animal production (2). However, its use in monogastric animal diets is limited by the high level of structurally indigestible carbohydrates and high antinutrients (hydrogen cyanide, tannin and phytate) together with low protein and amino acid (methionine) levels. These nutritional limitations of cassava peel results in poor feed intake and impaired digestibility leading to reduced performance when it is used in the feeding program of broiler chickens. The observed metabolic aberration involves the continuous depletion of the sulfur-

containing amino acids (methionine) in the circulatory system of the animal. Hence, for increased utilization of cassava peels in monogastric nutrition, the amino acid concentration must be balanced and the cyanide content of the peel must be reduced. This study aims to utilize processed cassava peel meal based diets formulated to be equal in methionine content to maize based diet in the feeding regime of broiler chickens at the starter and finisher phase. The effects on performance and gut morphology of the birds were evaluated.

Materials and Methods

Experimental site and management

This study was conducted at the Federal University of Agriculture, Abeokuta and all procedures followed the Animal Care and Use Committee of the University. Feed grade methionine was obtained from reputable feed additive store.

Experimental birds and diets

Two hundred Arbor Acres Plus broiler chickens were allocated to 2 dietary treatments on a weight equalization basis. All diets were formulated to be isonitrogenous and isocaloric. The diets were formulated to meet the recommended digestible methionine specification of 4.0 g/kg. The corn in the control diet was replaced with cassava peel meal at 20% and 100% replacement level at the starter and finisher phase, respectively.

Preparation of cassava peel meal

The high quality cassava peel meal was prepared as follows. A freshly harvested cassava was peeled and grated. The grated peels was then dewatered for 24hrs (placed in woven bags) using an hydraulic press. Then, pulverized and sieved to pass through 3mm mesh (separation of coarse fraction), the resultant material was dried locally in the sun or using a flash dryer, and stored in plastic woven bags until needed.

Growth performance

Feed intake and gain in weights were measured at weekly intervals. Feed intake was computed as the difference between the feed offered and leftovers. Feed:gain ratio was calculated as the ratio of feed consumed to bodyweight (BW) gain.

Intestinal Morphology

The small intestine was opened, the intestinal contents were removed and weighed, and the length of the intestine was measured immediately after killing the bird (2 birds per replicate). The tissue samples (3 cm) were obtained from the middle part of the jejunum washed with 10% formalin, and fixed in PBS for 24 to 48 h. Histomorphology of the jejunum, Villus height (VH), villus width (VW), crypt depth (CD), and the ratios of VH:VW and VH:CD were determined at a magnification of 10× by using a light microscope.

Results and Discussion

At the starter phase, the highest body weight gain with improved feed conversion ratio (FCR) ($P<0.05$) and increased intestinal villus height/crypt depth ratio was found in birds fed the maize-based diet ($P<0.05$). Intestinal necrosis and lesions were not observed on the jejunal tissue of the birds in both treatment groups. These findings are consistent with earlier reports that maize-based diets support optimal nutrient digestibility and intestinal morphology during early growth stages in broilers, as maize provides balanced energy and lower fiber fractions compared to cassava by-products (1,2).

At the finisher phase, the villi height and villi height:crypt depth ratio, as well as the final body weight, were not significantly different among the dietary treatments ($P>0.05$). However, a lower FCR and feed intake were observed in the birds fed the control maize-based diet ($P<0.05$). This result suggests that while maize continues to promote efficient feed utilization, cassava peel meal can sustain comparable growth performance at later stages. Similar trends have been reported where processed cassava products partially or completely replaced maize without negatively affecting broiler performance at the finisher stage (3,4).

Notably, intestinal necrosis was observed in the jejunal tissue of the birds fed the cassava peel meal-based diet, suggesting that residual cyanogenic glycosides or anti-nutritional factors in cassava peels, even after processing, may exert adverse effects on intestinal health (5,6). Despite this, the absence of significant differences in final body weight and villus morphology indicates that broilers may adapt to cassava-based diets during the finisher phase. A lower mortality rate was

observed in the group fed the cassava-peel meal based diet. The study was conducted during the hot weather condition suggesting Overall, this study found that total replacement of maize with processed cassava peel meal holds potential as an alternative to maize at the finisher

phase of broiler chicken production, provided that proper detoxification and fortification methods are applied. This aligns with previous work emphasizing the economic and nutritional advantages of cassava as a locally available energy source in poultry nutrition (7).

Table 1: Effect of dietary treatments on growth performance of broiler chickens

Parameters	Maize-based	Cassava-based	SEM	P<0.05
Starter phase				
Initial body weight (kg)	0.042	0.042	-	-
Final body weight (kg)	0.941 ^a	0.905 ^b	8.09	0.04
Average body weight gain (kg)	0.899 ^a	0.863 ^b	12.21	0.03
Feed intake (kg)	1345	1349	5.89	0.07
Feed conversion ratio	1.43 ^b	1.49 ^a	6.77	0.03
Finisher Phase				
Initial body weight gain (kg)	0.941 ^a	0.905 ^b	8.09	0.04
Final body weight gain (kg)	2.67	2.61	3.67	0.05
Average feed intake (kg)	3.59 ^b	3.67 ^b	4.07	0.03
Body weight gain (kg)	1.73	1.71	3.45	0.05
Feed conversion ratio (kg)	2.07 ^b	2.14 ^a	0.06	0.03
Mortality rate	8.00 ^a	3.00 ^b	2.00	0.03

Table 2: Effect of dietary treatments on jejunal morphology of broiler chickens

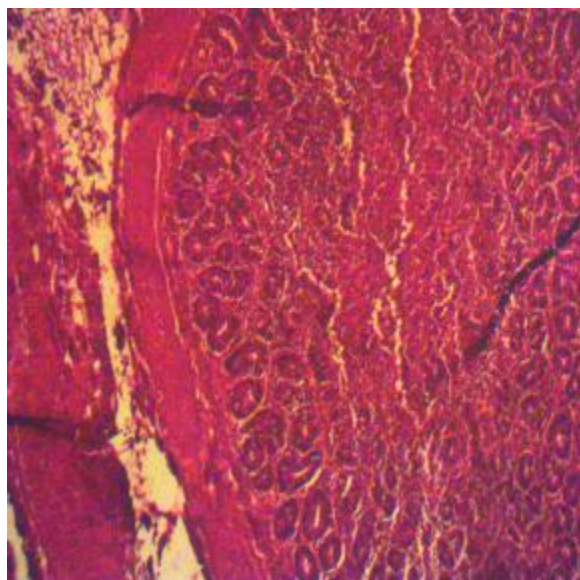
Parameters	Maize-based	Cassava-based	SEM	P<0.05
Starter Phase				
Villus height (µm)	763.56 ^a	713.78 ^b	30.23	0.04
Villus width (µm)	109.09 ^a	93.77 ^b	9.99	0.03
Crypt depth (µm)	85.90	84.78	5.67	0.05
Crypt width (µm)	67.78 ^a	58.98 ^b	7.87	0.04
Villus height: Crypt depth ratio	8.89 ^a	8.42 ^b	0.24	0.04
Finisher phase				
Villus height (µm)	1112.00	1099.87	6.89	0.06
Villus width (µm)	185.56	179.787	10.88	0.05
Crypt width (µm)	289.98 ^a	282.88 ^b	10.10	0.04
Crypt depth (µm)	451.75	449.88	12.23	0.06
Villus height: Crypt depth ratio	2.46	2.45	0.05	0.06

Conclusion and Application

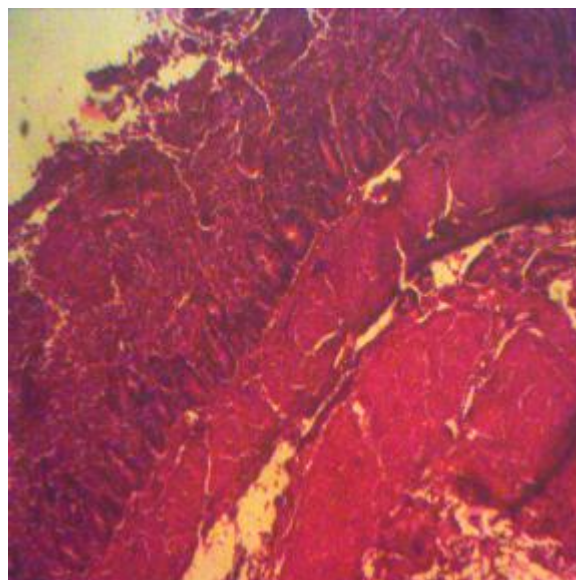
This study demonstrated that maize-based diets supported superior growth performance, feed efficiency, and intestinal villus morphology in broiler chickens during the starter phase. However, by the finisher phase, processed cassava peel meal was able to sustain comparable body weight and intestinal villus structure,

although a higher incidence of intestinal necrosis was observed. Processed cassava peel meal-based diets, included at 100% replacement level of maize, particularly at the finisher stage, provides poultry producers with a sustainable feeding option that promotes feed security, and reduces pressure on maize demand.

Figure 1. The histopathology slide of intestinal tissue (jejunal) of finisher broiler chickens fed diets containing high quality cassava peel meal



No observable lesion on the control-fed birds



Intestinal necrosis on the birds fed the HQCP-based diet

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