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Effect of Varying Levels of High-Quality Cassava Peels on Broiler Finisher Growth and Hematological Indices

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Abstract

In a completely randomized design, 150 three-week-old Abor Acre broiler birds were randomly assigned into five nutritional treatments, and each nutritional treatment was administered to thirty birds replicated three times, with ten birds each. The birds were fed for 21 days. High-quality cassava peel replaced 0%, 25%, 50%, 75%, and 100% of maize in the five treatment diets T1, T2, T3, T4, and T5, respectively. Body changes were recorded weekly, while feed consumption was recorded daily. Feed conversion ratio, daily body changes, and feed consumed per day were calculated from the records. The dietary treatments had a significant ($p<0.05$) impact on the final body weight, daily weight gain, daily feed consumption, feed cost, and feed conversion ratio. The final body weight decreased ($p<0.05$) across treatments as the level of HQCP increased in the diets, with the highest (2557.77 g/b) on the control diet without HQCP. Performance indicators showed significant ($p<0.05$) comparison across 0%–50% HQCP inclusion levels. Significant ($p<0.05$) similarity was also shown across 75%–100% HQCP inclusion levels. Samples of blood were drawn for the haematological assay. The inclusion of HQCP had a significant ($p<0.05$) impact on the parked cell volume (PCV), hemoglobin (Hb), and red blood cell (RBC), but there was no significant difference ($p<0.05$) at the 25% and 50% HQCP incorporation levels. White blood cell (WBC) and its differentials except the lymphocyte concentration were significantly ($p<0.05$) influenced by diets. The cost of producing feed decreased significantly ($p<0.05$) as the amount of HQCP in the diets increased. The results of the study indicated that HQCP would replace up to 50% of maize inclusion in broiler finisher diets without compromising the growth performance and health status of the birds.

Keywords: Broiler finisher, high quality cassava peel, blood, growth, maize

INTRODUCTION

Energy is a major requirement in poultry diets. The high demand for maize by humans and other industrial uses of maize has led to scarcity, high cost, and low supply of maize in the tropics [9]. This informed poultry producers to source cheaper alternative energy ingredients to replace maize. A good alternative that readily comes into the scene is the use of cassava products. Researchers have considered the replacement of maize with cassava in poultry diets because of its availability and high-energy content. [9] reported an energy value of 3000–32000 kcal/kg ME for cassava, whereas [16] and [8] reported 3279 kcal/kg ME and 3519 kcal/kg ME, respectively. Cassava peel meal contains 3.1-5% crude protein and 9-12% crude fiber, respectively [6]. A major concern in the use of cassava peel is that it has a high fiber content and low energy and protein contents [13].

Cassava peel meal provides less protein than maize or other cereal grains [2]. According to a number of studies, up to 20% of corn diets for broiler finishers can be substituted with cassava [1],

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whereas 30% of the corn diet for pigs can be replaced with HQCP [11]. As per [14], sufficient flesh was provided to the cocks to sustain their growth performance, and up to 15% of their diets contained meals made from cassava peels. The purpose of this study was to ascertain the potential impact of cassava peel quality on the hematological parameters and growth performance of broiler finishers.

MATERIALS AND METHODS

The experiment was conducted at the poultry unit, teaching and research farm, Ekiti State Polytechnic, and Isan Ekiti. A total of 150 three-week-old Abor Acre broiler strains were used in this study. Five distinct feed formulations were randomly assigned to each bird. Thirty birds were fed each treatment diet, which was replicated three times, and each replicate consisted of 10 birds.

The formulated diets were free of any feed additives. The birds were fed this diet for twenty-one (21) days. The fine-mash cassava peel used in this study was developed at the International Livestock Research Institute (ILRI) using highly developed innovative patented methods for processing cassava peels into feed products. These techniques combine several physical processes, including grating, dewatering, pulverizing, and sun-drying, or, in the case of industrial manufacturing, toasting on a pan heated by fire or in a flash dryerhis study, the fine particle HQCP was employed. [3]. In this study, a fine-particle HQCP was employed.

There was food and clean water available for the birds to drink without restriction. In the T1, T2, T3, T4, and T5 diets, 0%, 25%, 50%, 75%, and 100% HQCP were used instead of maize. T1 was used as the control diet because it contained no HQCP. The proximate makeup of the HQCP is presented in Table 1. Growth indices were also established. Body weight was recorded at the end of each week, and feed consumption was recorded daily. The daily feed consumption was computed by deducting the amount of leftover feed from the feed provided. The feed conversion ratio (FCR) and daily weight gain were calculated.

Proximate determination of the experimental diets was performed following the procedure outlined in [4]. Table 2 shows the approximate makeup of the experimental diet. At six weeks of age, blood samples were obtained from two birds per replicate for hematological indices. Using a sterile hypodermic needle (23-25) gauge and syringe (1-3 ml) into a blood collection container containing ethylenediaminetetraacetic acid (EDTA), blood was drawn through the wing vein. Hemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC), and white blood cell (WBC) counts, as well as their concentrations, were measured in blood samples. The PCV was determined using a microhematocrit capillary tube and hematocrit reader. After centrifuging the blood sample in a capillary tube, the PCV was immediately determined as a percentage.

The General Linear Model [19] package for Windows's Analysis of Variance (ANOVA) was used to statistically analyze the experimental data. The Duncan Multiple Range Test was used to separate the means among the variables, and $P < 0.05$ (95% confidence interval) was considered to be significant.

Table 1. Proximate composition of high quality cassava peels HQCP.

Parameters	HQCP (Whole)	HQCP (Fine)	HQCP (Coarse)
Starch	66.70	69.00	55.00
Protein (%)	4.50	4.60	5.80
Fat (%)	1.40	1.20	1.20
Crude Fibre (%)	9.80	8.20	15.60
Crude Ash (%)	5.80	6.60	3.50
ME (KCAL/KG)	2947	3039	2495

HQCP – High Quality Cassava Peels

RESULTS AND DISCUSSION

Proximate composition of diets

As indicated in Table 3, diets were examined to determine their proximate elements.

The proximate fractions' metabolizable energy and crude protein levels showed a similar pattern with increasing HQCP in the diets. As the HQCP concentrations increased, the metabolizable energy and crude protein values of the gross experimental diet composition were determined.

Table 2. Gross composition of the experimental diets of broilers finisher fed high quality cassava peels.

	% INCLUSION LEVELS				
Ingredients	***0% HQCP***	***25% HQCP***	***50% HQCP***	***75% HQCP***	***100% HQCP***
Maize	68.00	51.00	34.00	17.00	0.00
HQCP	0.00	17.00	34.00	51.00	68.00
Soy Bean Meal	22.00	22.00	22.00	22.00	22.00
Wheat offal	4.19	4.19	4.19	4.19	4.19
Bone meal	2.20	2.20	2.20	2.20	2.20
Fish meal	3.00	3.00	3.00	3.00	3.00
Broiler premix	0.01	0.01	0.01	0.01	0.01
Table salt	0.50	0.50	0.50	0.50	0.50
Methionine	0.05	0.05	0.05	0.05	0.05
Lysine	0.05	0.05	0.05	0.05	0.05
Calculated nutrient values					
Crude protein (%)	21.15	20.05	20.01	19.98	19.94
ME (kcal/kg)	3138.02	3098.92	3059.82	3020.72	2981.62
Lysine	0.97	0.93	0.89	0.85	0.82
Methionine	0.39	0.36	0.32	0.29	0.26
Ether extract	3.13	2.51	1.90	1.29	0.68
Crude fibre	3.24	2.89	2.53	2.17	1.82
Calcium	1.05	1.04	1.04	1.03	1.02
Phosphorus	0.62	0.62	0.61	0.61	0.60

Note – ME- Metabolisable energy, HQCP – High Quality Cassava Peel

Table3. Proximate composition of the experimental diets of broilers finisher fed high quality cassava peels

PARAMETERS	**% INCLUSION LEVELS**				
	0% HQCP	***25% HQCP***	***50% HQCP***	***75% HQCP***	***100% HQCP***
Moisture (%)	11.47	10.75	9.88	8.85	7.52
Dry Matter (%)	88.53	89.25	90.12	91.15	92.48
Crude Protein (%)	20.12	20.02	20.01	19.92	19.58
Crude Fibre (%)	5.85	5.55	5.32	6.1	7.28
Ether Extract (%)	4.89	4.01	3.94	2.69	2.43
ASH (%)	4.91	5.41	5.12	5.21	5.84
NFE (%)	52.76	54.08	55.73	57.23	57.35
ME	3097.87	3039.84	3037.93	2986.60	2957.22

NFE – Nitrogen free extract, ME – Metabolizable energy

Growth Performance Characteristics of Finishers Raised on Varying Amounts of High-Quality Cassava Peels

The growth and performance characteristics of broiler chickens fed varying amounts of high-quality cassava peel inclusions are displayed in Table 4.

Nutritional treatments had significant ($p<0.05$) impacts on growth performance indicators. However, the quantity of HQCP in the diet had no effect on mortality ($p > 0.05$). Although there was no statistically significant difference between the 0%, 25%, and 50% HQCP dietary treatments, the final body weight, daily weight increase, and daily feed intake were significantly ($p<0.05$) higher in diets with 0% HQCP than in other treatment diets.

According to the study's results, performance indicators showed a significant ($p<0.05$) comparison across the 0%–50% HQCP inclusion levels. Significant ($p<0.05$) similarity was also observed across the 75%–100% HQCP inclusion levels. Beyond the 50% HQCP inclusion threshold, growth performance indices showed a significant decline, suggesting that HQCP may negatively impact growth performance at a higher level of HQCP inclusion. In this study, it was established that, as the percentage of HQCP in the diets increased from 0% to 100%, the cost of producing a unit kg of feed declined across treatments.

When compared to other treatments, the trial diet containing 0% HQCP resulted in birds with higher final body weight, daily weight gain, and daily feed intake. The fact that diets 2 and 3 had better and statistically similar feed conversion ratios (FCR) than diet 1 suggests that replacing up to 50% of the maize in broiler finisher diets with high-quality cassava peel meal could be beneficial for raising broiler finishers.

This finding is in line with the results of [17], who reported that well-processed cassava has the potential to replace 50% of maize in poultry feed. In this study, the 50% replacement of maize resulted in 34% HQCP in the diet. Therefore, 34% by weight of HQCP is acceptable for broiler finisher diets. Mortality did not result from HQCP inclusion in the diet. Thus, the cost of broiler feed could be reduced by the use of HQCP in the production of broiler finisher feed.

Haematological Indices

Table 5 shows the blood indices for the finisher phase.

Table 4. Growth and performance characteristics of broiler chickens fed with varying amounts of high-quality cassava peel

PARAMETERS	**% INCLUSION LEVELS**						
	0% HQCP	***25% HQCP***	***50% HQCP***	***75% HQCP***	***100% HQCP***	***SEM***	***p-value***
Av. Initial body weight (g/bird)	918.65	801.29	652.29	714.67	701.46	44.34	0.3794
Av. Final body weight (g/bird)	2557.77 ^{a}	2338.79 ^{ab}	2234.97^{b}	1786.98^{c}	1516.33^{d}	106.12	<.0001
Av. Daily weight gain (g/bird)	78.05 ^{a}	73.21 ^{a}	75.37 ^{a}	51.06 ^{b}	38.80 ^{b}	4.60	0.0010
Av. Daily Feed Intake (g/bird)	120.19 ^{a}	86.74 ^{b}	88.65^{b}	82.09 ^{b}	91.43 ^{b}	4.55	0.0285
FCR	1.56^{b}	1.19 ^{b}	1.18 ^{b}	1.64 ^{b}	2.40^{a}	0.14	0.0084
Mortality (%)	5.00	3.33	1.67	1.67	3.33	0.65	0.8254
Fc/kg feed (₦)	368.18 ^{a}	346.05 ^{b}	323.92 ^{c}	301.80 ^{d}	279.68 ^{e}	8.36	0.0001

Means within rows with different superscripts differ significantly (P < 0.05). HQCP: High Quality Cassava Peel, Av.: Average, FCR: Feed Conversion Ratio, Fc: Feed Cost and SEM: Standard Error of Mean

Table 5. Haematological characteristics of broiler finisher chickens given different amounts of high quality cassava peels in their diets.

PARAMETERS	% INCLUSION LEVELS					SEM	p-value
	0% HQCP	25% HQCP	50% HQCP	75% HQCP	100% HQCP		
PCV (%)	39.62^{a}	31.93^{b}	32.77^{b}	40.00^{a}	32.14^{b}	1.26	0.0008
Hb (g/dL)	13.25^{a}	10.68^{b}	10.96^{b}	13.38^{a}	10.75^{b}	0.44	0.0144
RBC ($x10^{6}$/uL)	2.42^{a}	1.31^{b}	2.05^{ab}	1.14^{b}	1.63^{ab}	0.18	0.0816
WBC ($x10^{3}$/ul)	1.11^{a}	4.55^{d}	4.37^{e}	10.11^{b}	7.44^{c}	928.72	<.0001
Lymphocyte (%)	29.90	30.00	32.53	31.25	30.21	0.41	0.1697
Monocytes (%)	12.37^{d}	12.50^{d}	15.66^{b}	13.75^{c}	16.67^{a}	0.58	0.0002
Heterophils (%)	51.25^{b}	55.00^{a}	44.58^{c}	51.25^{b}	48.96^{b}	1.16	0.0022
Basophils (%)	2.06^{a}	0.00^{b}	2.41^{a}	1.25^{a}	2.08^{a}	0.31	0.0197
Eosinophils (%)	5.16^{a}	2.50^{b}	4.82^{a}	2.50^{b}	2.08^{b}	0.44	0.0011

Means within rows with different superscripts differ significantly (P < 0.05).

The results showed significant ($p<0.05$) differences for all hematological indices evaluated, except for lymphocyte concentration. The significant ($p<0.05$) differences for every hematological parameter in this study are consistent with the findings of [12]. There was no significant change ($p > 0.05$) in the lymphocytes of birds across the dietary treatments. The hemoglobin (Hb g/dl), basophil (%), heterophil (%), and Parked Cell Volume (PCV%) of broilers fed diets containing 0% HQCP were statistically identical to those of birds fed diets containing 75% HQCP.

The better PCV on these treatments might be due to the fact that the processing method resulted in a reduction of the anti-nutritional factor (cyanide) in the cassava peel [17]. The red blood cell (RBC) count ($x10^{6}$/ul) of birds in this study was not statistically different on diets with 0%, 50%, and 100% HQCP. Birds on the 50% and 100% HQCP diets also showed statistically similar RBC counts. White blood cell (WBC) count, which differed significantly across treatments, did not follow a particular trend. The higher values recorded for PCV (40.00%), WBC (10.11 x 10^{3}/ul), and Hb (13.38% g/dl) on diets with 75% HQCP could account for the low mortality reported for birds on the treatment. The RBC count range (1.14 - 2.42 $x10^{6}$/ul), PCV (31.93-40.00%), and Hb (10.68-13.38 g/dl) were within the 2.78 $x10^{6}$/ul, 36.83%, and 12.13 g/dl reported, respectively, for RBC, PCV, and Hb of domestic birds by [18]. The RBC (1.14-2.42 $x10^{6}$/ul) and PCV (31.93-40.00%) values were also within the RBC (2.15-33.69 $x10^{6}$/ul) and PCV (28.33-36.00%) reported for broiler finisher-fed diets supplemented with garlic bulb meal by [15], but were lower than 2.5-3.5 x106/l and 22-35% RBC and PCV reported for normal chicken. [7]. The RBC count (1.14-2.42 10^{6}/ul) was lower than the RBC count (4.21-4.84 × 106/ml) reported for avian species by [10]. However, the Hb (10.68-13.38 g/dl) were higher than the Hb (7.66-12.06 g/dl) of [15], but within 11.80-12.00 g/dl Hb that was reported for normal chicken. [7].

The WBC differentials in this study were monocytes (12.37-16.67%), Eosinophil (2.08–5.16%), Basophil (0.00–2.41%), and Lymphocytes (29.90–32.53%). The lymphocyte percentage increased as the amount of HQCP in the diets increased from 0% to 50%, and then decreased from 50% to 100. In this study, the percentage of monocytes (12.37–16.67%) was higher than the range of 2.00–3.67% reported by [5] and within the 16 percent reported for broilers by [20]. While basophils (0.00-2.48%) were greater than the range (0.00-1.00%) reported for broilers by [5], the range of values recorded for eosinophils (2.08-5.16%) was within the range (1.67-5.00%).

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CONCLUSION

The results of the investigation concluded that the ability of broiler chickens to grow was adversely affected when they were fed higher quantities of high-quality cassava peels. In addition, the blood parameters showed that the birds did not have any significant health issues.

Recommendation

It is advised that up to 50% of corn in the diets of broiler finishers could be substituted with HQCP without having a significant negative impact on blood parameters or growth performance. Hence, instead of maize, HQCP can be added to broiler finisher diets in amounts ranging from 0% to 50%.

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