CARCASS YIELD AND RELATIVE ORGAN WEIGHT OF ARBOR ACRE BROILER CHICKENS FED VARYING LEVELS OF HIGH-QUALITY CASSAVA PEELS AS REPLACEMENT FOR MAIZE

[1]Ajayi F. E., [2]Akinsuyi M. A., [2]Oyeniyi F. G., and Ajayi E. A
[1]*Agricultural Technology Department, Ekiti State Polytechnic, Isan Ekiti, Nigeria.*
[1]*Animal Science Department of Landmark University, Omu-Aran, Nigeria*
[2]*Agricultural Technology Department, Ekiti State Polytechnic, Isan Ekiti, Nigeria.*
*Corresponding author: ebunoluwa380@gmail.com, feajayi@ekspoly.edu.ng, ajayi.florence@lmu.edu.ng, 07062934093

ABSTRACT
This study investigated the effects of replacing maize with High-Quality Cassava Peels (HQCP) at varying levels on the carcass characteristics and relative organ weights of Arbor Acre Broiler Chickens. A total of 150 day-old broiler chicks were allotted into five dietary treatments with inclusion of HQCP replacing maize at 0%, 25%, 50%, 75%, and 100% respectively, in a completely randomized design. Each treatment group had three replicates of 10 birds. Results showed that birds fed diets with 25% HQCP had comparable carcass yields to the control group, while further inclusion led to reduced growth performance and carcass quality. Organ weights, particularly the kidney and heart, increased significantly with addition of HQCP levels, suggesting physiological stress or adaptive responses to diet composition. These findings suggested that HQCP can be used to partially replace maize in broiler diets without compromising performance, however, complete replacement may adversely affect growth and health parameters.

Keywords: Maize, High Quality Cassava Peels (HQCP), Arbor acre Broiler, and Carcass

DESCRIPTION OF PROBLEM

The rising cost, higher rate of foreign exchange, and increasing competition between human and animals for conventional feed ingredients such as maize have posed a major setback to sustainable livestock production, especially in developing countries (1). Maize, which is a primary source of energy in animal diets, is also a major staple food for human consumption and industrial use. This dual demand has intensified the need to explore alternative, cost-effective, and locally available feed resources that do not compete with human food supply. According to (2), agro-industrial by-products could be utilized as feed ingredients-, to reduce feed cost and enhance the growth of poultry industry. One of such agro-industrial by-products with potentials to replace maize in livestock feed is the cassava peels.

Cassava (*Manihot esculenta*) is a widely cultivated root crop in tropical regions, and it peels have demonstrated to be a major source of energy. Cassava peels, a major by-product of cassava processing, are often discarded or underutilized and causes environmental nuisance. Most of the products produced from cassava are usually without its peels which contribute up to 13% of the cassava tuber (3). However, with recent advancements in processing techniques, cassava peels can be upgraded to High-Quality Cassava Peels (HQCP) through drying, fermentation, and detoxification, thereby reducing anti-nutritional factors such as cyanogenic glycosides, and phytate (4). This study explores the effects of replacing maize with HQCP at varying inclusion levels on the carcass traits of Arbor acre broiler chickens.

MATERIALS AND METHODS

Experimental Site

This trial was conducted at the Poultry Unit of Teaching and Research Farm of Ekiti State Polytechnic Isan-Ekiti, Ekiti State. Nigeria.

Test Materials

High Quality Cassava Peels (HQCP), was sourced from International Livestock Research Institute (ILRI), located within the campus of the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. The detailed method of HQCP production was documented by (5).

Experimental Birds and Management

A total of 150 day-old Arbor Acre broiler chicks were sourced from a reputable hatchery in Ibadan, Oyo State. Nigeria. The birds were uniformly managed to acclimatized for a-week prior to the start of the experiment. At the end of this period (day 7), all chicks were individually weighed and randomly distributed into five dietary treatment groups. The control group (T1) received a diet devoid of high-quality cassava peels (HQCP). Treatments T2, T3, T4, and T5 were fed diets with inclusion of HQCP at 25%, 50%, 75%, and 100; respectively. Each treatment group consisted of 30 birds, arranged in three replicates having 10 birds each in a completely randomized design. Feed and water were provided ad libitum throughout the trial. All birds were managed under standard husbandry conditions, including routine vaccinations. A floor space allowance of 0.3 m² per bird was maintained. The composition of the experimental diets is presented in Table 1.

Data Collection

The carcass analysis was done according to methods of (6). At the end of the experiment, three birds were randomly selected from each treatment and were fasted for 12hours for carcass trait evaluation. Live body weight of birds were recorded prior slaughter. Thereafter, bled weight, plucked weight, eviscerated weight, each cup-up parts were recorded and expressed as percentage of live weight.

Statistical Analysis

Data generated were subjected to one-way analysis of variance using (7). Means separation was done using (8).

Table 1: Gross Composition of Experimental Diet at Starter and Finisher Phase

Ingredients	Control 0%	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	59.00	44.25	29.50	14.75	0.00
HQCP	0.00	14.75	29.50	44.25	59.00
Soyabean	31.00	31.00	31.00	31.00	31.00
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
Premix	0.01	0.01	0.01	0.01	0.01
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
Total	100.00	100.00	100.00	100.00	100.00
Crude protein	21.63	21.82	21.88	21.86	21.67
Crude fibre	7.85	7.55	7.32	6.10	8.48
ME (Kcal/g)	3168.18	3182.60	3186.32	3186.43	3197.23

HQCP- High Quality Cassava Peels; ME- Metabolizable Energy

RESULTS AND DISCUSSION

The effects of dietary replacement of maize with high-quality cassava peels (HQCP) on carcass parameters of broiler chickens are presented in Table 2. Significant differences ($p < 0.05$) were observed among the parameters measured except for breast, neck, and shank respectively.

Live weight was significantly higher in birds fed the control diet (T1: 2131.90 g) and those with 25% HQCP inclusion (T2: 2211.60 g), however, there was no statistical difference between them. In addition, live weight decreased notably with increasing levels of HQCP beyond 25%, particularly in T5 (100% HQCP), which recorded the lowest weight (1109.00 g). This suggests that complete replacement of maize with HQCP significantly impaired weight gain. The reduction in weight at higher HQCP levels may be attributed to decreased dietary energy level or reduced digestibility of nutrients in HQCP, as also reported by (9).

Dressing percentage, followed a declining trend with increasing HQCP levels. Birds on the control diet (T1) recorded the highest dressing percentage (79.14%), which was significantly higher than that of T5 (73.50%). Birds in T2 to T4 showed intermediate values without significant differences. The reduced dressing yield at higher HQCP inclusion levels may result from limited muscle accretion and possibly higher non-carcass components in the body.

Among the primal cuts, birds in T1 and T2 had higher back and drumstick yields, while T5 showed the lowest values. Thigh muscle yield was highest in T1 (11.59%) and decreased progressively with increasing HQCP inclusion, with T5 recording the least (9.67%). These reductions in major meat cuts reflect a likely decline in protein deposition efficiency at higher levels of HQCP (10).

TABLE 2: RELATIVE CARCASS WEIGHT OF BROILERS

PARAMETERS	T1	T2	T3	T4	T5	SEM
L/Wt	2131.90^{a}	2211.60^{a}	1879.70^{b}	1695.42^{b}	1109.00^{c}	107.83
Plucked Wt	95.15^{c}	96.77^{b}	97.66^{ab}	96.88^{ab}	98.26^{a}	0.32
Dressing percentage	79.14^{a}	76.73^{ab}	75.23^{ab}	76.20^{ab}	73.50^{b}	0.66
Breast	21.89	23.02	20.21	22.55	22.90	0.45
Back	19.10^{a}	18.06^{a}	16.68^{b}	18.64^{a}	15.89^{b}	0.35
Drumstick	11.57^{a}	11.52^{a}	10.70^{b}	11.24^{a}	10.01^{c}	0.17
Shank	5.40	5.05	5.20	4.79	4.77	0.10
Thigh	11.59^{a}	10.65^{c}	11.21^{b}	10.67^{c}	9.67^{d}	0.17
Wing	8.13^{b}	8.20^{b}	8.03^{ab}	9.00^{a}	8.44^{ab}	0.11
Neck	3.68	3.86	3.44	3.70	3.45	0.06

L/WT= Live Weight

The effects of dietary replacement of maize with high-quality cassava peels (HQCP) on the relative organ weights of arbor acre broiler chickens are shown in Table 3. All organs weight showed significant ($p < 0.05$) difference except the lungs. The relative weight of the proventriculus was significantly higher in birds fed T1 and T5 diets, (0.30% and 0.33) respectively. These values were significantly greater than those observed in other treatments. The increased proventriculus weight at the extreme ends (T1 and T5) may reflect an adaptive response to differing dietary fibre and energy content, particularly in T5. (11), reported that increased fibre content might cause hypertrophy of the proventriculus to enhance feed digestion. Heart weight was significantly higher in birds fed 100% HQCP (T5: 0.31%), followed by uniform values in T1–T3 (0.24–0.25%), while the lowest was in T4 (0.19%). The increase observed in T5 may indicate higher circulatory demands due to metabolic stress or suboptimal energy supply. This aligns with findings of (12) that nutrient imbalance or low dietary energy can elevate cardiovascular workload in poultry. Kidney weight showed a marked increase with dietary inclusion of higher HQCP levels. T5 recorded the highest value (1.36%), which was significantly different from the other groups, especially T2 (0.24%) and T1 (0.40%). (13) in their findings stated that anti-nutritional factors such as hydrogen cyanide, present in cassava products might cause enlarged kidney due to increased excretory burden of detoxification.

TABLE 3: ORGAN WEIGHTS OF BROILERS FED HQCP AS REPLACEMENT OF MAIZE

PARAMETERS	T1	T2	T3	T4	T5	SEM
Proventiculus	0.30^{a}	0.21^{c}	0.26^{b}	0.23^{bc}	0.33^{a}	0.01
Heart	0.24^{b}	0.24^{b}	0.25^{b}	0.19^{c}	0.31^{a}	0.01
Liver	0.97^{b}	1.02^{b}	1.08^{b}	1.00^{b}	1.36^{a}	0.05
Lungs	0.31	0.33	0.36	0.31	0.37	0.02
Spleen	0.04^{b}	0.02^{c}	0.04^{b}	0.05^{a}	0.00^{d}	0.00
Kidney	0.40^{c}	0.24^{d}	0.41^{c}	0.99^{b}	1.36^{a}	0.12
Gizzard	1.17^{a}	1.02^{ab}	0.92^{b}	1.01^{ab}	1.03^{ab}	0.03

L/WT= Live Weight

CONCLUSION AND APPLICATION

The use of high-quality cassava peels as an alternative source of energy in broiler diets offers a promising strategy to reduce dependence on maize, which is often costly and in competition with human food. The results obtained from this study indicated that replacing maize with HQCP up to 25% does not negatively impact carcass traits, and relative organ weight in Arbor Acre broiler chicken. However, increasing the inclusion level beyond 25% led to significant declined in live weight, dressing percentage, and prime cut. There were also signs of organ enlargement. These suggest that HQCP has good nutritional value, complete replacement for maize may limit nutrient utilization and impose metabolic strain in broiler birds. Further studies should be carried out to include the incorporation of enzymes to HQCP at higher levels of replacement.

REFERENCES

1. Benjamin, J., Idowu, O., Babalola, O. K., Oziegbe, E. V., Oyedokun, D. O., Akinyemi, A. M., and Adebayo, A. (2024). Cereal production in Africa: the threat of certain pests and weeds in a changing climate—a review. *Agriculture and Food Security*, *13*(1), 18.
2. FAO (Food and Agriculture Organization of the United Nations). (2018a). Africa Sustainable Livestock 2050 (Ethiopia: Integrated snapshot). Cattle sector. CA0712EN/1/09.18.
3. Sengar, R. S. (2022). Cassava processing and its food application: A review. *Pharmaceutical Innovation Journal*, *2*, 415-422.
4. Tonukari, N. J., Anigboro, A. A., Avwioroko, O. J., Egbune, E. O., Ezedom, T., Ajoh, A. I., and Aganbi, E. (2023). Biochemical properties and biotechnological applications of cassava peels. *Biotechnology and Molecular Biological Review*, *14*(1), 1-8.
5. Amole, T. A., Anandan, S. and Okike, I. (2019). A guide to the production of High-Quality Cassava Peels® mash as a feed for livestock. ILRI Manual 35. Nairobi, Kenya: International Livestock Research Institute (ILRI).
6. Solomon, F. E., Essien, C. A., and Eyoh, G. D. (2022). Effect of *Xylopia aethiopica* on growth and carcass characteristics of broiler chickens. *Nigerian Journal of Animal Science and Technology (NJAST)*, *5*(3), 10-21.
7. IBM Corp. (2017). *IBM SPSS Statistics for Windows* (Version 25.0) [Computer software]. Armonk, NY: IBM Corp.
8. Duncan, D. B. (1955). Multiple range and Multiple F-Test. Biometrics 11:1-42
9. Mwangi, E. (2023). *Cassava Utilization in Kilifi and Taita Taveta Counties and Effects of Inclusion of Processed Cassava Peels in Broiler Diets on Performance* (Doctoral dissertation, University of Nairobi).
10. Asante, E. (2022). *Environmentally sustainable cassava processing in Ghana: Trade-offs between the different United Nations Sustainable Development Goals* (Doctoral dissertation).
11. Fishah, R. I., Azab, M., Saad, R., Nafeaa, A., and Khedr, N. (2024). Effect of feeding low energy and protein diets on expression of some growth-related genes and intestinal morphology in hubbard broilers. *Assiut Veterinary Medical Journal*, *70*(183), 118-135.
12. Korver, D. R. (2023). Current challenges in poultry nutrition, health, and welfare. *Animal*, *17*, 100755.
13. Kazemi, M. (2025). Recycling Agricultural Waste: Sustainable Solutions for Enhancing Livestock Nutrition. *Veterinary Medicine and Science*, *11*(3), e70321.