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Carcass Trait and Meat Color of Broiler Chickens Fed Diets Containing Rice Bran Meal

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Abstract
The rising cost of maize, the principal energy source in poultry diets, necessitates the evaluation of alternative feedstuffs that can support growth performance and carcass quality while reducing feed costs. This study investigated the effects of partial replacement of maize with rice bran on growth performance, carcass traits, and meat quality of broiler chickens. A total of 200 Arbor Acres Plus broiler chicks were randomly assigned to two dietary treatments on a weight-equalization basis. Treatment 1 served as the maize-based control diet, while in Treatment 2, 10% of maize in T1 was replaced with rice bran at the starter phase and 30% at the finisher phase. Results showed no significant differences in live weight, slaughter weight, defeathered weight, and whole carcass yield between the control and rice bran-fed groups ($p>0.05$), indicating that maize replacement did not compromise growth or dressing percentage. However, significant differences were observed in certain cut-up parts. Birds fed rice bran had higher breast ($p<0.05$) and back weights, while control-fed birds had higher neck and chest weights ($p<0.05$). Meat color was also influenced by rice bran inclusion, with significant increases in redness (a, a*) and yellowness (b, b*) compared to the control, suggesting enhanced pigmentation, while lightness (L, L*) remained unaffected. In conclusion, dietary inclusion of rice bran (10% and 30% replacement at starter and finisher phase, respectively) effectively replaced part of the maize without adverse effects on carcass yield, while improving breast meat yield and meat color attributes.

Keywords: broiler chickens, rice bran, feed resource, carcass traits, meat color

Description of the problem

Feed cost remains the major constraint in poultry production, accounting for up to 70% of total expenses, with maize serving as the primary energy source in broiler diets (1). However, the rising demand for maize for human food, animal feed, and industrial purposes has created stiff competition, driving up prices and limiting its availability (2). This has necessitated the search for alternative, sustainable feed resources that can reduce production costs without compromising performance or product quality.

Rice bran, a by-product of rice milling, is abundant in rice-producing regions and contains moderate levels of energy, protein, essential fatty acids, and bioactive compounds such as antioxidants and pigments (3–5). These attributes make it a promising dietary ingredient for poultry. Moreover, its potential to enhance meat pigmentation and carcass quality offers added value to producers and consumers (6). Nonetheless, the relatively high fiber content and susceptibility to rancidity have restricted its extensive use in broiler feeding (4). Advances in feed processing and formulation now provide opportunities for its safe incorporation at practical inclusion levels (7).

Reports on the performance of broilers fed rice bran diets have been mixed, with some studies showing positive effects on growth and carcass yield (8,9), while others highlight limitations due to nutrient dilution at high inclusion levels (10). Therefore, there is a need for further evaluation of rice bran as a partial maize substitute in broiler diets under practical feeding conditions. The present study investigated the effect of replacing maize with rice bran at 10% inclusion during the starter phase and 30% during the finisher phase on carcass yield, meat color, and related performance traits in broiler chickens.

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.

Experimental birds and diets

The experiment was conducted using 200 day-old Arbor Acres Plus broiler chicks. On arrival, the birds were weighed and randomly assigned to two dietary treatments on a weight-equalization basis. Each treatment consisted of five replicates with 20 birds per replicate, housed in deep-litter pens under standard management conditions. Birds were provided with *ad libitum* access to feed and clean drinking water throughout the study. Routine vaccination and health management practices were observed.

Dietary treatments and feed preparation

Two experimental diets were formulated: T1 (Control): A maize–soybean meal–based diet. T2 (Rice bran diet): At the starter phase, 10% of maize in the control diet was replaced with rice bran, while at the finisher phase, 30% of maize was replaced. Rice bran was first soaked in clean water for three days to reduce anti-nutritional factors, sundried to safe moisture content, and milled. Proximate composition of the processed rice bran was determined following (11) procedures to generate nutrient values used in diet formulation. All diets were formulated to meet or exceed the nutrient requirements of broilers as recommended (12), with particular attention to metabolizable energy and digestible amino acids.

Carcass Characteristics

On the last day of the finisher phase, five broiler chickens per replicate (40 per treatment) was selected at random, humanely slaughtered following appropriate measures (accordance to the standards of Ministry of Agriculture, Nigeria), defeathered, and eviscerated following standard commercial procedures. The body weight and dressed weights were measured, while the dressing percentage was calculated. The cut parts, which include breast, thighs, and drumsticks were weighed and recorded as relative weights (percentage of BW). The organs, which include kidney, liver, and the spleen were collected, weighed, and calculated as percentages of respective BW.

Meat color analysis

The surface color of breast meat was determined using a colorimeter (Minolta Chroma Meter CR-400, Minolta Italia S.p.A., Milano, Italy). The instrument was calibrated against white reference tiles prior to use. Commission Internationale de I'Eclairage (CIE) L* (lightness), a* (redness), and b* (yellowness) values were recorded.

Results and Discussion

Table 1 shows that inclusion of rice bran at 10% in the starter phase and 30% in the finisher phase did not significantly affect live weight, slaughter weight, defeathered weight, or whole carcass yield compared with the maize-based control diet ($p > 0.05$). This indicates that partial replacement of maize with rice bran maintained overall growth performance and dressing percentage. Similar findings were reported in earlier studies where rice bran was used as a substitute for maize in broiler diets (8,10). However, significant differences were observed in some cut-up parts. Birds fed the rice bran diet showed higher breast ($p < 0.05$), drumstick, wing, and back weights, while those on the control diet had higher chest and neck weights ($p < 0.05$). The improvement in breast yield is particularly important, as breast meat is the most economically valuable portion of the broiler carcass (13). Enhanced muscle deposition may be linked to bioactive compounds in rice bran, such as γ-oryzanol and antioxidants, which support nutrient utilization and muscle development (5).

Table 1: Effect of dietary treatments on carcass traits of broiler chickens

	Maize-group	Rice-bran group	SEM	P<0.05
Live weight, g	2172.00	2126.00	34.00	0.05
Slaughtered weight, SW, g	2121.00	2077.00	25.00	0.05
Carcass weight, g	1640.00	1610.00	20.88	0.06
Breast, g	583.61[b]	617.03[a]	25.45	0.04
Thigh, g	101.28	105.30	10.89	0.05

Drumstick, g	221.87[b]	234.55[a]	5.07	0.04
Heart, g kg^{-1} SW	10.03	11.98	2.09	0.07
Abdominal Fat, g kg^{-1} SW	23.12	13.68	1.96	0.07

As shown in Table 2, meat color was significantly influenced by dietary treatment. Birds fed rice bran had higher redness (a, a*) and yellowness (b, b*) values ($p < 0.05$), while lightness (L, L*) remained unaffected ($p > 0.05$). The increase in pigmentation suggests deposition of natural antioxidants and carotenoids from rice bran into muscle tissue (6,7). This can enhance consumer acceptability of broiler meat, as deeper red and yellow tones are often associated with freshness and quality (14).

Table 2: Effect of dietary treatments on meat color of broiler chickens

	Maize-group	Rice-bran group	SEM	P<0.05
Lightness (L)	43.79	42.78	1.22	0.05
Redness(a)	7.11[b]	8.81[a]	1.34	0.03
Yellowness(b)	5.03[b]	6.37[a]	1.55	0.04
Lightness(L*)	50.89	49.86	1.33	0.05
Redness(a*)	7.61[b]	9.57[a]	2.01	0.04
Yellowness(b*)	6.14[b]	8.95[a]	1.88	0.04

Conclusion and Application

The present study demonstrated that partial replacement of maize with processed rice bran at 10% during the starter phase and 30% during the finisher phase did not adversely affect broiler growth performance, carcass yield, or dressing percentage. Importantly, rice bran inclusion (10% and 30% inclusion level at the starter and finisher phase, respectively) improved breast meat yield and enhanced meat redness and yellowness, which are desirable consumer quality traits.

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