CARCASS TRAIT, MEAT LIPID PROFILE AND MEAT QUALITY OF BROILER CHICKENS FED DIETS CONTAINING HIGH INCLUSION LEVEL OF HIGH QUALITY CASSAVA (*MANIHOT ESCULENTA*) PEEL MEAL

Tolulope O. Adebowale*, Mukaila B. Adekola#, Saka A. Balogun+, Loveth Onogwu*, Adeola V. Adegoke*, Oyegunle E. Oke*

*Department of Animal Nutrition, Federal University of Agriculture, PMB 2240, Alabata Abeokuta

#Department of Environmental toxicology, Federal University of Agriculture, Abeokuta

+Department of Microbiology, Federal University of Agriculture, Abeokuta

Corresponding author. Email address: adebowaleto@funaab.edu.ng

ABSTRACT

The study evaluated the carcass trait and meat quality of finisher broiler chickens fed diets containing high quality cassava peel meal (HQCP) at 50% inclusion level in replacement of maize. A total of 320 broiler chickens (Cobb500) were allocated to 4 dietary treatments on a weight equalization basis. Diet 1 = Control Diet (Corn-soybean meal based diet) containing 4.0 g kg-1 digestible Methionine (MET), 0.96g kg-1 digestible lysine, Diet 2 = A diet containing 50% replacement of maize in Diet 1 with HQCP and containing 4.0 g kg-1 digestible MET, 0.96g kg-1 digestible lysine, Diet 3 = A diet containing 50% replacement of maize in Diet 1 with HQCP and containing 4.4 g kg-1 digestible MET, 1.02 g kg-1 digestible lysine, Diet 4 = A diet containing 50% replacement of maize in Diet 1 with HQCP and containing 4.8 g kg-1 digestible MET, 1.08 g kg-1 digestible lysine. The highest slaughtered, carcass, and small intestinal weight were recorded in birds fed Diet 2 while the birds fed Diet 3 had the least abdominal fat value ($p < 0.05$). The water holding capacity and cooking loss percentage was highest in the meat of the birds fed Diet 4. The meat color of birds fed Diet 4 recorded the highest value. The very low-density lipoprotein and triglyceride concentration were least in the meat of birds fed Diet 2 ($p<0.05$). It can be concluded that supplementation of MET/lysine to diets containing HQCP improved the carcass trait and meat quality of the birds.

Keywords: Cassava waste; Amino acids, Carcass trait; Meat color, Broiler chickens

INTRODUCTION

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 (Aro and Akinjokun, 2012). 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 (Adesehinwa *et al.*, 2019). However, its use in monogastric animal diets is limited by the high level of structurally indigestible carbohydrates and high antinutrients (hydrogen cyanide, tannins and phytates) 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. It was reported that the concentration of lysine in a diet may affect the response of birds to methionine (Si *et al.*, 2004). Therefore, increasing the methionine content of a cassava peel meal based diet may require additional supplementation of lysine. This study aims to utilize processed and supplemented (methionine and lysine) cassava peel meal at high inclusion level (50% dietary replacement of corn) in the feeding regime of finisher broiler chickens. The effects on carcass trait and meat quality of the birds were evaluated.

MATERIALS AND METHODS

Experimental site

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 and lysine were obtained from reputable feed additive store.

Experimental birds and diets

Three hundred and twenty Cobb500 broiler chickens were allocated to 4 dietary treatments on a weight equalization basis. All diets were formulated to be isonitrogenous and isocaloric. A control diet based on corn and soybean meal was formulated to meet the recommended digestible methionine and lysine specification of 4.0 g/kg and 0.96g/kg, respectively (VenCobb 500 Broiler Management Guide) for the finisher phase. The corn in the control diet was replaced with cassava peel meal at 50% replacement level in three other treatments (Diet 2-4). Diets 2-4 were then formulated to contain 100%, 112.5% and 125% of the recommended digestible methionine and 100%, 106.25% and 112.5% of the recommended digestible lysine, yielding 4.0g/kg, 4.4g/kg, and 4.8g/kg digestible methionine, respectively, and 0.96g/kg, 1.02g/kg, and 1.08g/kg digestible lysine, respectively (VenCobb 500 Broiler Management Guide) for the finisher phase.

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.

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 (Uijttenboogaart & Gerrits, 1982). 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 quality and 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 (Pokoo-Aikins *et al.*, 2022).

The hydrogen index of the breast muscle was evaluated with a digital tipped meat pH probe (Meat pH Tester, Hanna, USA). The breast meat muscle was pierced to about 2.5cm depth with a and the pH meter was immediately inserted to measure the meat pH. The water-holding capacity (WHC) was evaluated using the centrifugal method as described by Zhang *et al.* (2011). A total of 15 g of ground breast samples from each replicate were weighed in a centrifuge tube and centrifuged at 40,000× g for 10 min. Subsequently, the supernatant was carefully removed, and the remaining solid portion was weighed.

WHC was expressed as the percentage of water loss (Equation (1)):

$$\text{WHC (\%)} = \frac{\text{initial sample weight - sample weight after centrifugation}}{\text{initial sample weight}} \times 100$$

The cranial portion of the pectoralis muscle was divided, weighed (about 100 g), placed in separate zip-lock bags, and refrigerated at 4 ºC for 48 hours. A paper towel was used to dry the samples before the initial weights were taken. The samples were individually drained, paper towel dried, and reweighed after storage. Drip loss was calculated as the difference between final and initial weights and expressed as a percentage of the initial weight. The cranial section of breast meat was cut, weighed at approximately 90 g, and packaged in a zip-lock bag. The sample was cooked in a boiling water bath until the internal temperature reached 75 ºC. Cooked samples were cooled for 1h in a refrigerator at 4 ºC to allow the temperature to equilibrate prior to weighing. Excess liquid was removed from the meat by patting with a paper towel. Subsequently, the cooked sample was weighed.

Cooking yield is calculated as the ratio of cooked weight to raw weight and expressed as a percentage (Hussnain *et al.*, 2020). Weight of sample before freezing minus sample weight after thawing] x 100/weight of sample before freezing was used to compute the percentage thaw loss (Henrikson *et al.*, 2018).

Meat Lipid Analysis

Total lipid in the muscle samples was extracted following the previous method (Liu *et al.*, 2012). About 1 g each of muscle samples from each replicate was homogenised with 12 mL of chloroform-methanol 2 : 1 (v/v) and filtered directly into a 50-mL volumetric flask using a glass microfiber filter. After rehomogenisation and refiltration, the muscle filtrates were diluted to a final volume of 50 mL with chloroform-methanol 2 : 1 (v/v). In addition to increase the concentration of lipid extract of the muscle samples, the chloroform-methanol was removed by rotary evaporator (Virtis, Gardiner, NY, USA) following centrifugation (1000g for 10 min) and filtration, and finally the dried extract was dissolved in 5 mL of chloroform-methanol 2 : 1 (v/v). Cholesterol, low density lipoprotein, very low density lipoprotein, high density lipoprotein, and triglyceride concentrations in the total lipid extracts were determined using commercial analytical kits (Randox diagnostic kit; GPO-PAP Method; Antrim, orthern Ireland) and automatic blood biochemical analyser (Roche Cobas Miras, Basel, Switzerland)

RESULTS AND DISCUSSION

The results suggest significant differences among the treatments for carcass trait. The highest slaughtered and carcass weight was recorded in birds fed Diet 2 (4:0.96PM) while the birds fed the control diet (CON) showed the least slaughtered weight among the treatments ($P<0.05$). The breast meat of the finisher broiler chickens fed Diet 3 (4.4:1.02PM) had the highest weight while the birds fed Diet 4 had the least breast meat weight ($p < 0.05$). This agrees with the report that suggests that processed cassava peel meal has no detrimental effect on carcass trait of growing birds Oladimeji *et al.* (2020). The thigh weight was least in the birds fed the control diet and highest in the birds fed Diet 2. The abdominal fat was least in birds fed Diet 3 (4.4:1.02PM) and highest in birds fed the control diet and Diet 1 (4:0.96CON). This could imply that processed cassava peel meal may have no discernible impact on the acceptability of broiler chicken meat by consumers because abdominal fat content of meat significantly influence consumer's perception on a meat (Emmanuel *et al.*, 2018). Dietary treatments had no significant effect on the liver, empty gizzard, full gizzard, heart and spleen weight of finisher broiler chickens fed the different dietary treatments ($P<0.05$). However, the dietary treatments seems to affect the small intestinal weight. The birds fed Diet 2 had the highest small intestinal weight while the small intestinal weight of birds fed Diet 1 was observed to be lowest ($P<0.05$). Ogbuewu & Mbajiorgu (2023) reported that an increase in the length and weight of the various segments of the small intestine of broilers could be a strategy to handle the fibre contained in the diets. There are significant dietary effects on the meat quality with the exception of water absorption capacity and refrigeration loss. The meat of broiler chicken fed the control diet (CON) had the least water holding capacity while the broiler chickens fed Diet 4 (4.8:1.08PM) had the highest water holding capacity. The meat cooking loss of chickens fed Diet 4 was highest while the lowest cooking loss was recorded in meat of broiler chickens fed Diet 3. The control diet fed broiler chickens had meat containing the highest cholesterol, LDL (low density lipoprotein), HDL (High density lipoprotein), VLDL (Very low density lipoprotein) and triglyceride concentration ($P<0.05$) while the meat of broiler chickens fed Diet 2 (diet without additional methionine and lysine supplementation) had the lowest cholesterol, triglyceride, LDL and VLDL concentration ($P<0.05$). The lowest HDL concentration was observed in the meat of broiler chickens fed Diet 3. Previous studies have indicated that diets containing cassava peels has potentials in the metabolism of lipids and cholesterol contents of meat type animals (Aro & Akinjokun, 2012).

CONCLUSION

In conclusion, it seems that processed cassava peel meal-based diets have no negative influence on meat quality, meat color and meat lipid composition of broiler chickens. Importantly, it seems that additional supplementation of methionine and lysine have important implication on carcass yield and abdominal fat deposition of birds fed diets containing high inclusion level of processed cassava peel meal. It is recommended that further studies should elucidate micro-nutrient composition of meat derived from birds fed processed cassava peel meal-based diets.

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