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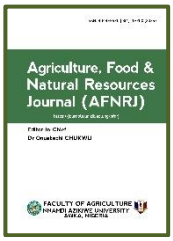

Original Article

Lipid profile and serum indices of broilers fed cassava peel meal-palm oil sludge diets as maize replacement

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ABSTRACT

The study examined the lipid profile and serum biochemical indices of broiler chickens fed diets containing cassava peel meal palm oil sludge (CPMPOS) as a mixture replacement for maize. A total of 96 day-old broiler chicks (40g initial mean weight) of the Agrited Ros 308 strain were used in this study, which lasted for eight weeks. The chicks were assigned to three dietary treatments with replaced levels of 0, 22.5, and 25% of CPMPOS mixture for maize. Each treatment was replicated four times with eight birds per replicate using a completely randomized design (CRD). Feed and water were supplied ad libitum. At the end of the feeding trial, 10mls of blood were collected from two birds per replicate from their brachial veins into non-heparinized bottles for biochemical assay. Results were subjected to one-way ANOVA. The study revealed that CPMPOS had no significant ($p>0.05$) effects on the lipid profile and serum electrolytes. The study therefore recommends the use of a 25% level of CPMPOS as a replacement for maize in broiler chicken diets without fear of compromising lipid and serum biochemical assays.

K E Y W O R D S : *Broilers, Chicken, Electrolyte, Serum, Triglyceride*

INTRODUCTION

Despite the enormous amounts of poultry meat and eggs and other livestock products produced annually in Nigeria and other developing countries, the animal protein intake in these developing countries is still low due to the high cost of the products (Abeke *et al.*, 2003). The animal protein deficiency is further aggravated by high level of population growth of which Food and Agriculture Organization - FAO (2012) projected that the world's population stands at 7.3 billion people currently, and will hit nine billion by 2050, the United Nations Department of Economic and Social Affairs (2017) released a report stating that the world population was 7.6 billion at that time, with projections to reach 9.8 billion by 2050 and in 2021, meta-

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analysis published in Nature Food projected that total global food demand is expected to increase by 35% to 56% between 2010 and 2050, highlighting the challenges in meeting future nutritional needs.

This high population has continued to put pressure on the existing animal protein, (Henchion *et al*. 2017) coupled with the high cost of producing them. Adedeji *et al.* (2015) stated that the estimated daily minimum animal protein requirements of an adult in Nigerian vary between 65 and 85g per person. However, Ebenebe and Okpoko (2017) stated that the Food and Agriculture Organization (FAO) recommended consumption of 34g of animal protein per person per day for normal growth and development although Oloyede (2005) recommended that 35g of the minimum protein requirement should be obtained from animal products. Ebenebe & Okpoko (2015) stated that figures on average animal protein intake per day in Nigeria fall short of the recommendations by Food and Agriculture Organization (FAO) which is 7g as compared to 34g recommended, the workers also suggested that it is grossly as a result of high poverty level and ignorance. Despite the fast-growing trade and importance of poultry production in Nigeria, like with every other animal production and by extension, agricultural investment, poultry production is not without its own peculiar challenges. Okagbare and Akpodiete (1999); McAinsh *et al*., (2004); and Omonona & Oni, (2004) highlighted some constraints to poultry production in Nigeria to include; high cost of feeds and veterinary services, high mortality rates, predation, high incidence of diseases, inadequate supply of day-old chicks, inadequate finance and lack of market information.

Boosting the production of broiler chicken so as to attain maximum weight at short intervals is an alternative means of alleviating the deficiency of animal protein in Nigeria. Broiler chickens are fast growing birds and efficient converters of feed to animal protein. At maturity (6 - 8 weeks), well managed broilers could attain market weight of between 1.16 and 2.00kg, (Oluyemi & Robert, 2000). The success of broiler chicken production manifests as maximum weight gain within minimum period and this could be achieved through proper nutrition and good management practices. Currently, the livestock industry is having difficulties in meeting the demand for animal feeds which accounts for about 70% of the total cost of production in animal production enterprise and this high cost of feeds increase the overall cost of production for poultry keepers which could negatively affect its economic sustainability, (Sumberg *et al.,* 2017). Oyewole *et al.,* (2024) reported that the continuous use of maize will result in perpetual increase in the price of livestock as well as livestock products. Salami *et al.,* (2003) advocated the use of alternative energy source in feed production. Abiola-Olagunju *et al.,* (2015) stated that Agro-industrial by-products such as palm kernel meal, cassava sieviate, bean seed hull, cassava peels, and oil palm slurry (OPS) are other possible non-conventional alternatives. One of such alternatives for potential replacement of maize in animal feeds is cassava peel meal (CPM). Ahaotu *et al*. (2011) stated that researchers have recently discovered that agro by-products such as cassava peels, which hitherto were discarded as waste are now used as livestock feedstuff to partially or totally substitute a proportion of conventional energy, fibre and protein sources such as maize, soya bean meal and groundnut cake; whose prices have risen. Raji *et al.* (2020) predicted that the potential for increased utilization of cassava is enormous, particularly for unutilized or underutilized fractions and residues such as cassava peels, stating that cassava peels fractions represents primary fibre source in feeding programs.

This study was therefore designed to determine the effect of partial replacement of cassava peel meal (CPM) and palm oil sludge (POS) mixture for maize on lipid profile and serum electrolytes of broiler chickens.

MATERIALS AND METHOD

Ninety-six unsexed day-old Ross 308 strain of broiler chicks were used in this study. The chicks were purchased from Agrited Hatchery, Ibadan Nigeria and transported to the Teaching and Research Farm, Chukwuemeka Odumegwu Ojukwu University, Igbariam Campus, Anambra State, Nigeria. The study location is at latitude 623'26.4 North of the equator and longitude 6'56'38.7 East of the Greenwich Meriden, with annual rainfall ranging from 1000-1500mm. The cassava peels (TME-419 cassava variety) were sourced from Somkenechi Multipurpose Co-operative farms, a garri processing plant at Igbariam. They were collected, washed and sun-dried to a constant weight for four consecutive days. The dried mass was milled in a hammer mill and then bagged and labeled CPM. The palm oil sludge was sourced from a palm oil processing plant at Igboukwu, Aguata Local Government Area of Anambra State, it was collected and transported in jerry cans labeled POS to the experimental site and stored at room temperature before use.

The test materials (CPM and POS) were mixed at the ratio of 2.5kg cassava peel meal to 0.50 litre of palm oil sludge and the final mixture was labeled CPMPOS and replaced maize in the diet formulation at 22.5% for Treatment 2 and 25% for Treatment 3 while Treatment 1 was the control with 0% replacement level of CPMPOS. The composition of experimental diets is presented in Tables 1 and 2 for starter and finisher phases, respectively.

The birds were weighed and randomly allotted to the three (3) dietary treatments replicated four (4) times with each replicate having eight (8) birds in a completely randomized design (CRD), managed under a deep litter. The birds were managed purely on concrete floor with wood shavings on it, demarcated with wire mesh. Feed and clean water were supplied *ad libitum*.

At the end of eight weeks, one bird each was collected from each of the replicates (four birds from each treatment), and 10ml of blood was collected from each of them into non-heparinized bottles. The blood samples were kept for one hour in 20 ml tubes, then the samples centrifuged at 10,000 revolutions per minute (RPM) for 10 minutes to obtain the sera. The serum samples collected were assayed for lipid profile and serum

electrolytes at Animal Science Laboratory, University of Nigeria, Nsukka, using ferric chloride – sulphuric acid reaction (Elleston and Caraway, 1970)

Data from laboratory results obtained were subjected to one - way ANOVA using SPSS statistical software and significant means were separated using the New Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The lipid profile parameters profile of broiler chickens fed cassava peel meal - palm oil sludge (CPMPOS) mixture

The effect of replacing maize with cassava peel meal blended with palm oil sludge (CPMPOS) on lipid profile of broiler chickens is presented in table 3. Results indicated that cassava peel meal blended with palm oil sludge (CPMPOS) had no significant ($p>0.05$) effect on total cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL), and very low density lipoprotein (VLDL) across dietary treatments.

Metabolic profile of the blood, specifically the lipid profile is used in detecting sub-clinical disorders due to malnutrition and other diseases, although currently it is used in determining the effect of new feeds and supplements (Ganong, 1999; Moniel *et al.* 2005). The result of lipid parameters in this study showed no significant ($p>0.05$) mean differences among the treated broilers. The result showed a similar pattern across all parameters, having a slight increase with increased replacement level from T2 (22.5%) to T3 (25%) in the values of total cholesterol, triglycerides, high density lipoproteind (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) this agrees with the findings of Neto *et al.* (2011); Nwosu *et al.* (2022); and Richard, (2022) who carried out similar studies with different fat sources. On the other hand, Aguilar *et al.,* (2013) who conducted same studies with palm oil and Saree, *et al.* (2017) who reported no significant ($p<0.05$) difference in lipid profile of meat-type ducks fed cassava-based diets. The increase in cholesterol level with increase in CPMPOS from T2 to T3 agrees with the findings of Onibi *et al.* (2011) who reported that the serum cholesterol contents of the chickens increased with increasing levels of POS in the diets. This suggests that excessive POS inclusion in broiler chicken diets could lead to hypercholesterolemia in the birds.

Table 1: Composition of experimental broiler starter diets

Ingredients	T1 (0%)	T2 (22.5%)	T3 (25%)
Maize	55.00	32.50	30.00
Palm kernel cake	3.00	3.00	3.00
Soya bean meal	29.00	29.00	29.00
CPMPOS	0.00	22.5	25.0
Wheat offal	2.00	2.00	2.00
Brewers dry grain	2.00	2.00	2.00
Fish meal	5.00	5.00	5.00
Bone Meal	3.00	3.00	3.00
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Mineral-vitamin premix	0.25	0.25	0.25
Total	100	100	100
Calculated crude protein (%)	21.88	21.73	21.93
Calculated metabolizable energy (Kcal/kg)	2799	2800	2796

Min-Vit.Premix supplied the following per kilogram of diet: Mn, 120 mg: Zn, 100 mg; Cu, 10 mg; I, 2.5 mg; Ca, 135 mg; Fe, 75 mg; Se. 0.15 me.

Table 2: Composition of the experimental broiler finisher diets

Ingredients	T1 (0%)	T2 (22.5%)	T3 (25%)
Maize	60.00	37.50	35.00
Palm kernel cake	3.00	3.00	3.00
Soya bean meal	22.00	22.00	22.00
CPMPOS	0.00	22.50	25.00
Wheat offal	2.00	2.00	2.00
Brewers dry grain	4.00	4.00	4.00
Fish meal	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Mineral-vitamin premix	0.25	0.25	0.25
Total	100	100	100
Calculated crude protein	18.84	18.69	18.45
Calculated metabolizable energy (kcal/kg)	3001	3003	3005

Mineral-Vit. Premix supplied the following per kilogram of diet: Mn, 120 mg: Zn, 100 mg; Cu, 10 mg; I, 2.5 mg; Ca, 135 mg; Fe, 75 mg; Se. 0.15 me.

Table 3: Lipid profile of broiler finisher chickens fed replacement levels of cassava peel meal blended with palm oil sludge (CPMPOS) for maize

Parameters	T1 (0% CPMPOS)	T2 (22.5% CPMPOS)	T3 (25% CPMPOS)	SEM
Total Cholesterol	129.62	112.55	162.79	11.94
Triglycerides	183.2	138.4	166.4	9.16
HDL	74.94	71.33	94.36	4.91
LDL	18.04	13.54	35.15	8.05
VLDL	36.64	27.68	33.53	1.83

HDL = High density lipoprotein, LDL = Low density lipoprotein, VLDL = Very low density lipoprotein, CPMPOS = cassava peel meal mixed with palm oil sludge (at 2.5kg:0.5 litres).

Serum electrolytes of broiler chickens fed cassava peel meal - palm oil sludge (CPMPOS) mixture

The effect of varying levels of cassava peel meal blended with palm oil sludge (CPMPOS) on the serum electrolytes of broiler finisher chickens is presented in Table 4. The result showed that dietary treatments had no significant ($p>0.05$) effects on the serum electrolytes like sodium ($Na^{\pm}$), chloride (Cl^{-}), phosphorus (P), calcium ($Ca^{2\pm}$), and potassium ($K^{\pm}$). The values of serum electrolytes in this study were similar to the normal values which are 8.5 to 10.2 mg/dL for calcium, 135 to 145 mEq/L for sodium, 3.5 to 5.0 mEq/L for potassium, 2.4 to 4.1 mg/dL for phosphate and 96 to 106 mEq/L for chloride, reported by Lalhriatpuii and Haldar, (2012) indicating that the test ingredient did not affect the metabolism of the broiler chickens. This findings agrees with the report of Nwosu *et al.* (2022) who fed cassava peel meal to broiler birds as replacement for maize supplemented with exogenous enzyme. In this study, the levels of sodium ($Na^{\pm}$), Chloride Cl^{-}), and calcium ($Ca^{2\pm}$) decreased slightly across dietary treatments, while phosphorus (P) and potassium ($K^{\pm}$) levels increased slightly but all within the acceptable threshold as reported by Lalhriatpuii and Haldar, (2012)

Table 4: Serum electrolytes of broilers fed diets containing cassava peel meal blended with palm oil sludge (CPMPOS)

	T1 (0% CPMPOS)	T2 (22.5% CPMPOS)	T3 (25% CPMPOS)	SEM
Sodium (Na)	148.96	150.28	144.13	2.49
Chlorine (Cl)	95.38	102.54	101.37	2.01
Phosphorus (P)	14.00	10.27	11.33	0.79
Calcium (Ca)	7.54	6.88	6.77	0.34
Potassium (K)	5.51	5.47	6.38	0.38

CONCLUSION AND RECOMMENDATIONS

The study concludes that the method of processing of cassava peel did not have any negative effects on the birds. The study showed that the different replacement levels of CPMPOS for maize in the diets had no adverse effects on the serum biochemical indices and lipid profile of broiler chickens. The study recommended the replacement level 25% of CPMPOS for maize in broiler chickens diets without fear of compromising their serum chemistry and lipid profile.

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Authors' Contributions

Authors NCP and MSN managed data collection, interpretation of data, writing of manuscript, review of manuscripts and wrote the first draft of the manuscript. Authors EFC and OJ managed the literature searches and the development of methodology, author OLE managed, data analysis, and the development of the model. All authors read and approved the final manuscript.

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