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Effect of Processed Cassava Peel Meal on Blood Chemistry Characteristics of Pullets

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Authors' contributions

This work was carried out in collaboration between both authors. Author COE wrote the protocol, wrote the first draft of the manuscript and managed the literature searches, while author CNU designed the study. Both authors read and approved the final manuscript.

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ABSTRACT

A 37-week feeding trial was conducted using 108 Dominant black strain of pullets to evaluate the effect of feeding diets containing retted cassava peel meal (RCPM) on their blood chemistry characteristics. The research was carried using a completely randomized design, from June 2009 to May 2010 at a private farm in Makurdi, Benue State, Nigeria. The RCPM used in this study was prepared and included at rates of 0%, 10% and 20% to replace maize of the control diet. The birds were randomly allotted to the three dietary groups. On 12th week, the birds in group T_2 and T_3 had a significant decline (P =.05) in total protein values when compared to the birds on the control diet. In the 24thweek, the cholesterol values increased significantly (P =.05) with increasing RCPM inclusions, also at the 24th week, the serum Alanine aminotransferase (ALT) values at 20% (T_3) RCPM inclusion was significantly (P =.05) higher than values recorded in diets T_1 and T_2; but at the 37th week, values at the 10% (T_2) inclusion rate was significantly lower (P =.05) than values recorded at the 0% (T_1) and 20% (T_3)RCPM inclusions respectively. The serum albumin values in the 37th week significantly increased (P =.05) in the treatment diets (T_1 and T_2) compared to the control diet (T_1). The RCPM inclusions led to a significant decline (P =.05) in Serum aspartate

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aminotransferase (AST) values in the 24th week. It can be concluded that up to 20% RCPM can be used in pullet diets to replace maize without adverse effect on the blood chemistry characteristics of the birds.

Keywords: Cassava peels; serum chemistry; diets; pullets.

1. INTRODUCTION

Poultry products are very important protein sources for feeding the world's teeming human population because of their high nutritive value with short output period and relatively low cost of production. In an attempt to strengthen/enhance poultry products production and combat the challenge of increasing feed cost, researchers have stressed the need for utilization of cheaper, locally available and nutritionally viable alternative energy feedstuffs far removed from human and industrial interests, thereby limiting the dependence on maize for livestock production [1,2]. Cassava is the most important tropical crop providing dietary energy for over 900 million people in 105 countries; the world's fourth most important crop [3]. Cassava peel is an abundant and less expensive agro-industrial by-product, farm waste or crop residue resulting from the processing of cassava roots for human consumption which can be exploited as an alternative feed resource in the diets of monogastric stocks to high energy cereals, particularly maize. It follows that the level of the various haematological and biochemical substances in the blood can serve as an indication of an animal's general health condition [4]. According to [5], replacement of dietary maize with 50% sun-dried and 70% lye treated RCPM did not affect egg performance and blood characteristics of laying hens. Generally speaking, both the haematological and biochemical blood components are influenced by the quantity and quality of feed, and also the level of anti-nutritional elements or factors present in the feeds [6]. According to [7], blood tests can access specific enzymes which indicate the level of liver function. Diarra and Devi [8] Reviewed the feeding value of some cassava by-products, while [4] studied the effect of feeding cassava peel meal-based diet on the performance, characteristics, egg quality and some blood profile of laying chicken. However, the effect of RCPM on the blood chemistry of pullets has not been widely explored. The aim of this study was to, therefore, further investigate the effect RCPM on the blood chemistry of pullets.

2. MATERIALS AND METHODS

The study was carried out at a private farm in Makurdi, Benue State, Nigeria located $7^0 43'$N, $8^0 3'$E.

2.1 Source and Management of Experimental Birds

One hundred and eight Dominant black pullet chicks were purchased from Global Millennium Chicks Hatchery in Ibadan, Nigeria. Birds were weighing between 32.17-32.49 g. Birds were kept in open-sided poultry house partitioned into homogenous pens, by which were sub-divided into 3 dietary treatment groups of 36 birds per treatment. Thereafter, each treatment was subdivided into 3 replicates of 18 birds in each replicate. Feed and water were offered to birds without restriction. The grower ration was offered to the birds from 8 to 19 weeks of age whereas the layer ration was offered from the19th week of age to up to the end of the study period (39 weeks of age). Vaccinations were provided adequately.

2.2 Source and Processing of Cassava Peels

Fresh cassava peels were collected from cassava *(garri)* processing centres in Agan Community of the State and then were washed thoroughly with clean water. Thereafter, cassava peels were soaked in water inside a closed metal drum for 5 days. The peels were then removed from the sticky water and drained with a plastic basket and subsequently sundried for 3-5 days.

2.3 Experimental Design and Dietary Treatments

A Completely Randomized Design was adopted in this study. The study had three dietary treatment designated as T_1, T_2 and T_3 for 0 (control), 10, and 20 proportion of RCPM in the experiment diet (grower or layer) as shown in Tables 1&2.

Table 1. Percentage composition of grower diets

Feedstuff	Diets groups		
	T_1	T_2	T_3
RCPM	0.00	10.00	20.00
Ground cake	25.00	25.00	25.00
Maize	55.00	50.00	46.00
Rice offal	16.23	11.15	5.01
Bone meal	3.00	3.00	3.10
*Premix (grower)	0.25	0.25	0.25
Lysine	0.10	0.15	0.16
Methionine	0.17	0.20	0.23
Salt	0.25	0.25	0.25
Total	100.00	100.00	100.00
Calculated analysis			
Crude protein %	17.00	17.00	16.84
Energy kcal/kg ME	2707	2674	2656
Calcium %	1.08	1.08	1.11
Phosphorus % (Total)	0.80	0.79	0.80
Methionine %	0.60	0.60	0.61
Lysine %	0.70	0.70	0.70

**Grower Bio-organics Premix at the rate of inclusion provides the following additional nutrients per kg of diet:Vitamin A 3.200i.u., Vitamin D3 640 i.u., Vitamin K 0.8 mg., Thiamine, B1 0.6 mg, Riboflavin, B2 1.6 mg., Pyridoxine, B6 0.6 mg, Niacine 6 mg, Vitamin B12 0.004 mg, Pantothenic acid 2 mg., Folic acid 0.2 mg., Biotin 0.008 mg., Choline chloride 0.08 g, Antioxidant 0.05 mg., Manganese 0.032 g., Zinc 0.02 g, Iron 0.008 g, Copper 0.002g, Iodine 0.00048 g, Selenium 0.08 mg and Cobalt 0.08 mg*

Table 2. Percentage composition of layer diets

Feedstuff	Diets groups		
	T_1	T_2	T_3
RCPM	0.00	10.00	20.00
Fish meal	2.00	2.00	3.00
Soybean meal	30.00	30.00	25.00
Maize bran	9.60	-	-
Maize	48.00	47.60	43.70
Bone meal	3.50	3.50	3.50
Limestone	6.00	6.00	4.50
Methionine	0.30	0.30	0.30
*Premix (Layer)	0.30	0.30	0.25
Salt	0.30	0.30	0.25
Total	100.00	100.00	100.00
Calculated analysis			
Crude protein %	17.51	18.20	17.40
Energy kcal/kg ME	2733	2705	2630
Calcium %	3.50	3.67	2.93
Phosphorus % (Total)	0.845	0.840	0.851
Methionine %	0.574	0.592	0.541
Lysine %	1.020	1.022	0.921

**Layer Bio-organics Premix at the rate of inclusion provides the following additional nutrients per kg of diet:Vitamin A 8,500,000.00 i.u., Vit. D3 1,500,000.00 i.u., Vit. E 10,000 mg.,Vit. K3 1,000 mg.,Vit. B1 1,500 mg.,Vit. B2 4,500 mg.,Niacine 15,000 mg., Pantothenic Acid, 4,500 mg., Vit. B6 3,000 mg.,Vit. B12 15.00 mg., Folic acid 600 mg., Biotin H2 500.00 mg., Choline chloride 175,000.00 mg., Cobalt 200.00 mg., Copper 3,000.00 mg., iodine 1,000 mg., Iron 200,000.00 mg., Manganese 40,000.00 mg., Selenium 200.00 mg., Zinc 30,000.00 mg., Antioxidant 1,250.00 mgr*

2.4 Procedures for Proximate Analysis of Test Ingredient and Experimental Diets

The test ingredient, retted cassava peel meal and the experimental diets were assayed for proximate analysis according to the method of [9].

2.5 Sampling and Evaluation of Blood Chemistry Parameters

The blood chemistry parameters were monitored in the 12th, 24th and 37th weeks of age of experimental birds. About 4ml of the blood sample was then collected from the jugular vein of the birds into tubes for serum chemistry determination. The total protein, serum albumin and serum cholesterol were determined using the methods of [10,11]. The serum ALP (Alkaline Phosphatase) and ALT and AST levels were also determined using the method of [12] whereas the method of [13] was used for the determination of serum urea.

2.6 Statistical Analysis

The data collected from the experiment were subjected to analysis of variance (ANOVA) and the means were separated using Duncan's Multiple Range Test as outlined by [14].

3. RESULTS AND DISCUSSION

Table 3 shows the influence of RCPM on blood chemistry parameters of pullets at weeks 12, 24 and 37. At the 24th week, RCPM at 20% level of inclusion led to a significant increase P=.05 in total protein values compared to the control diet. There was a general increase in cholesterol values as the bird's age. In week 24, the values of ALP significantly declined P=.05 at 20% inclusion level compared to the control diet. Urea values in all the weeks were not affected by the diets, though the values slightly increased at the 24th week. In the 24th week, serum ALT values at 20% RCPM inclusion was significantly P=.05 higher than values recorded in diets A and B respectively. The serum albumin values in the 37th week significantly increased P=.05 in the treatment diets compared to the control diet, while the RCPM inclusions led to a significant decline P=.05 in serum AST values in the 24th week.

Biochemical parameters are sensitive indicators for evaluating the functional integrity of organs. Serum total protein, albumin and bilirubin concentrations reflect hepatic injury and usually provide a good index of the health status of the animal. Values of total protein obtained in this study were within normal limits for poultry species, and suggest intact hepatocellular functions. Low protein values reflect chronic diseases, especially liver and kidney disorders. A positive correlation was observed to exist between increasing levels of RCPM and total protein, and this corroborates the findings of [5] who recorded increasing levels of serum protein as RCPM levels increased. [15] supplemented cassava peel meal with cashew nut reject meal in pullets and obtained higher(50.38-52.65 g/dl) serum total protein values. [16] supplemented sundried cassava peel meal with the enzyme(MAXIGRAIN^R) in broilers and obtained slightly higher (6.29-7.09 g/dl) total protein and comparable cholesterol(95.67-116.20 mmol/L) and albumin (29.10-30.36 g/dl) values. Differing values could be due to supplementations and other ingredients in the diets. The enzyme, MAXIGRAIN^R, for instance, breaks fibrous materials to generate energy and protein and makes it available to the animal, as well as, catalyzes some metabolic activities in the body of the animal that enhances the blood quality in the long run [16]. Increasing levels of cholesterol in this study indicate that hydrocyanic acid in cassava peels was eliminated to prevent hypocholesterolemic influence as glucosides can interfere with the intestinal absorption of dietary cholesterol and lipid. Urea is considered to have limited diagnostic value in poultry; it is also known to be a function of the protein quality ingested by the animal, energy deficiency and disease condition. When an animal is deficient in amino acid, the amino acid present will be deaminated, increasing urea secretion [17]. Serum AST and ALT under normal circumstances are low in the blood but might become high when the plane of nutrition is low or there is hepatocellular damage [18]. This study reveals that the overall level of serum ALP decreased with age. [5] evaluated the effect of feeding diets containing sun-dried cassava peel meal and lye-treated cassava peel meal and obtained ALT and AST ranges of 22.1-22.6iu/L and 133.2-137iu/L respectively, which were higher than values obtained in this study. Differences could be due to seasonal variations in nutrient composition which probably enhanced the ability of the birds to tolerate cyanide. Normal levels obtained in this study are an indication that the diets contained adequate levels of calcium which did not potentiate osteoclasis in laying

Table 3. Effects of cassava peel meal levels in diets on blood chemistry characteristics of pullets

Weeks	12 Diets			24 Diets			37 Diets		
Parameter	**1(0)%**	**2(10)%**	**3(20)%**	**1(0)%**	**2(10)%**	**3(20)%**	**1(0)%**	**2(10)%**	**3(20)%**
Total Protein (g/dl)	3.38±0.21^{a}	2.91±0.12^{b}	2.98±0.21^{ab}	3.52±0.28^{a}	3.78±0.34^{ab}	4.30±0.18^{b}	4.61±0.41	4.24±0.25	3.92±0.31
Serum Cholesterol(mg/dl)	95.00±4.74	102.22±8.74	108.89±9.97	82.50±16.72^{a}	120.00±25.50^{b}	172.50±21.61^{c}	123.68 ±15.06	147.37±19.34	131.53±10.85
Serum Urea (mg/dl)	1.00±0.18	0.88±0.21	0.88±0.11	0.33 ±0.18	0.44±0.16	0.45±0.20	0.56±0.18	0.44±0.18	0.67±0.25
Alkaline Phosphatase(ALP) (iu/L)	125.39±8.78	116.54±3.23	130.00±5.06	60.44±0.27^{a}	59.35±0.79^{ab}	58.77±0.51^{b}	116.91±10.65^{a}	105.44±13.25^{a}	72.80±7.58^{b}
Serum Alanine Amino Transferase (ALT) (iu/L)	2.98±0.87	3.84±1.30	3.49±1.16	3.49±0.75^{a}	3.40±1.51^{a}	8.63±1.92^{b}	13.78±0.39^{a}	10.02±1.01^{b}	16.51±3.19^{a}
Serum Albumin (g/dl)	1.20±0.05	1.19±0.08	1.30±0.08	1.53±0.15	1.70±0.17	1.61±0.12	1.41±0.07^{a}	1.68±0.10^{b}	1.70±0.20^{b}
Serum Aspartate Amino Transferase(AST) (iμ/L)	68.52±1.59	66.17±3.29	64.60±0.42	84.54±2.32^{a}	77.09±3.56^{b}	80.42±1.27^{b}	102.28±1.81	101.05±5.00	101.91±3.48

a,b,c: Means in the same row with different superscripts differ significantly (P<0.05)

birds. ALT is a good mirror for the overall body enzymatic and metabolic process in birds and is valued as an index of liver disease [19]. Though normal ALT values for poultry species were recorded in this study, it was observed that the values increased with the ageing of the birds. Serum albumin values were not significantly P=.05 influenced by diets except in the 37th week when the levels significantly P=.05 increased with RCPM inclusions. Sogunle et al. [15] observed increased serum albumin levels with a corresponding increase in RCPM inclusions. However, fluctuations in serum levels of AST are difficult to interpret because of the wide distribution of this enzyme in avian tissue.

4. CONCLUSION

It is concluded that RCPM can be included up to a level of 20% to replace maize in the diets of pullets without any adverse effects on their blood chemistry characteristics. A maximum of this level of inclusion is recommended to farmers because of its availability, safety and cost.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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