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Hematological and Serum Biochemical Indices of Finisher Broilers Fed Graded Levels of Yam Peel Meal

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Abstract

One hundred and twenty-four weeks old Marshal Broiler birds were used in a 28-day feeding trial to evaluate the effect of partial replacement of yam peel meal (YPM) for maize on the haematological and serum chemistry profile of finisher broilers. The birds were assigned to four treatment groups of 30 birds each, which were further replicated in triplicate of 10 birds per replicate in a completely randomized design (CRD). Four experimental diets containing 0, 5, 10 and 15% inclusion of YPM were formulated and offered to birds during the study. The haematological and serum biochemical indices were carried out at the end of the experiment. Results obtained showed no treatment effect ($p>0.05$) in all the parameters except for mean corpuscular haemoglobin (MCH). Total serum protein (TSP), globulin, urea, potassium and bi-carbonates also differed across the means.

Keywords: Yam peels, haematology, serum chemistry, electrolytes

Introduction

Conventional energy sources for broiler feeding are scarce, expensive and therefore make the cost of poultry feed very high. The consequence therein is the resultant high cost of poultry products thus making them unaffordable to consumers and consequently resulting to sub-optimal animal protein intake by Nigerians. Several researchers have therefore reiterated that the adoption of the non – conventional feed materials and agro waste which have little or no value to man as ingredients in livestock feeding. Yam (*Dioscorea rotundata*) peel is an agro waste that could be utilized in poultry feeding. It is cheaply available and is not competed for by man and the industries for food. However, the peel meals contain some anti-nutritional factors like tannin, phytin, saponin and trypsin inhibitor (Apata, 1990). Blood acts as a pathological reflector of the status of exposed animals to toxicants and other conditions (Olafedehan *et al.*, 2010).

The present study therefore, finds it necessary to investigate the hematological and biochemical constituents of finisher broiler chicken fed varying levels of YPM as a replacement for maize in order to establish its implications on the health status of the birds.

Materials and Methods

The yam peels were collected from the University environment. The yam peels were sun-dried, to about 10% moisture level and milled to fine particles using sieve mesh 2 mm in diameter and was used to formulate the test diets. One hundred and twenty (120) four weeks old unsexed Marshal Breed of broiler birds were divided into four groups of 30 birds with each of the group further replicated with 10 birds per replicate in a completely randomized design. The birds were assigned to four diets designated as T₁, T₂, T₃, and T₄ containing 0%, 5%, 10% and 15% yam peel meal respectively. Feed and water were supplied *ad libitum*.

At the end of the 8 weeks experiment, the blood samples were collected from the jugular vein and about 7 ml were collected from each replicate. 2 ml was transferred immediately into sterile plastic bottles containing EDTA (Ethylene - diaminetetraacetic acid) to prevent clotting and used for hematological test, while the remaining 5 ml was transferred into clean bottles without anticoagulant for serum biochemical tests. The bottles were labeled and transported to the laboratory for analysis in cold box within one hour of collection. All the haematological and serum biochemical parameters were determined using the Rondax kit (RONDAX™) as described by the manufacturer. The Mean Cell Hemoglobin (MCH), Mean Cell Volume (MCV) and Mean Cell Hemoglobin Concentration (MCHC) were calculated while Globulin concentration was determined by subtracting albumin values from the total protein values. The leukocyte or white blood count was obtained using a haemocytometer with Natt and Hendricks diluent to obtain a 1:200 blood dilution. White blood cell was differentiated into granulocytes (heterophils), lymphocytes, monocytes, eosinophils and basophils with the aid of

automated WBC differential machine. The birds initial live weights were ascertained at day 28 and their final weights measured after 4 weeks of experiment. Also measured were, feed intake, weight gain and feed conversion ratio (FCR).

Data obtained were subjected to analyses of variance using SPSS version 20. (SPSS, 2012) and the differences between the treatment means were compared using the Duncan Multiple Range Test.

Table 1: Nutrient composition of the YPM based diet for finishing broilers

Ingredients g/100g	T1	T2	T3	T4
Maize	55.00	50.00	45.00	40.00
Yam peel meal	0.00	5.00	10.00	15.00
Soya meal	5.00	5.00	5.00	5.00
Groundnut cake	17.00	16.00	17.00	17.00
Palm kernel cake	10.00	10.00	10.00	10.00
Fishmeal	4.00	4.00	4.00	4.00
Wheat offal	4.20	5.20	4.20	4.20
Bone meal	4.00	4.00	4.00	4.00
Salt	0.30	0.30	0.30	0.30
Vitamin / trace mineral premix	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated nutrient composition				
Crude protein%	20.32	20.00	20.13	20.28
Metabolizable energy Kcal/kg	2896.54	2893.34	2889.5	2880.84

Results and Discussion

The data on hematological parameters are presented in Table 2. Results obtained showed that no treatment effect was observed in all the haematological parameters evaluated except for MCH which recorded a significant difference between means. Birds on diets T2 and T4 recorded significantly higher values for MCH than T3 but were similar to the control while no differences was observed in all the treatment for MCHC. The red blood cell indices, MCV, MCH and MCHC measurements usually aid the characterization of anemic states in animals (Aiello and Mays, 1998). Therefore the within normal values obtained for the red blood cell indices indicates that they birds were not anaemic hence the inclusion of YPM up to 15% did not engender anaemia in the birds.

Table 2: Haematological indices of finisher broilers fed YPM as a replacement of maize in their rations

Parameters	T1	T2	T3	T4	SEM
Hb (g/dl)	12.10	12.33	11.40	11.70	0.23
PCV (%)	38.00	38.33	35.67	35.33	1.14
RBC (X10 ¹² /l)	12.03	12.20	11.67	11.40	0.21
MCV (fl)	131.47	131.80	131.13	131.47	0.40
MCH (pg)	20.07 ^{ab}	20.47 ^a	19.53 ^b	20.53 ^a	0.14
MCHC (%)	32.00	30.70	31.43	31.43	0.32
ESR (mm/h)	50.00	50.00	36.67	50.00	2.84
WBC (X10 ⁹ /l)	11.03	11.30	10.73	11.03	0.11
WBC differentials (%)					
Heterophil	52.67	52.67	52.67	52.67	0.50
Eosinophil	1.33	1.67	1.33	1.33	0.15
Basophil	0.00	0.00	0.00	0.00	0.00
Lymphocyte	44.67	44.33	44.67	44.67	0.48
Monocyte	1.33	1.33	1.33	1.33	0.14

abcd: Means with different superscript on the same horizontal row are significantly different (p<0.05).

No significant difference was observed in all the treatments for WBC and its differential counts. This suggest that YPM did not reduced the ability of the birds to fight infections and defend the body against invasions from micro organisms neither did it cause any allergic reactions in the birds. They were also within the literature limits reported for normal chicken (Mitruka and Rawnsley, 1977). Results of all the haematological indices reported fell within normal range reported for chicken.

Data representing the serum biochemical indices of broilers fed YPM are shown in Table 3. The Total Serum Protein (TSP) results obtained showed that birds on diets T2 and T4 recorded similar values with the control but were higher than T3. Generally, the TSP values recorded in all the treatment were much higher than the 3 – 3.6 g/dl reported by Funmilayo and Ayodele (2010) when maize was partially replaced with yam peel meal in the diet of finisher broilers but were close to the range reported by Iheukwumere and Herbert (2003) for water restricted broilers. TSP level in the blood may increase as a result of dehydration in the birds.

The globulin fraction followed similar trend as the TSP while no significant differences were observed for albumin. The reduction of globulin fraction beyond T2 suggests that the test diets did not cause infection or inflammation due to the diets. This is because globulin increases as a result of infection or inflammation in the liver. Harper (1975) reported that increase in serum globulin is a signal for infection since this fraction is the principal site for circulating antibodies (immunoglobulin).

Table 3: Serum biochemistry indices of broilers fed YPM as a replacement for maize in broiler finisher rations

	T1	T2	T3	T4	SEM
Parameters					
Total serum protein (g/dl)	56.67 ^{ab}	59.33 ^a	51.33 ^b	54.33 ^{ab}	1.21
Albumin (g/dl)	20.67	21.33	20.00	20.17	0.28
Globulin (g/dl)	36.00 ^{ab}	38.00 ^a	31.33 ^b	33.67 ^{ab}	1.05
Albumin/globulin ratio	3.13	4.63	4.63	3.47	0.53
Urea (mmol/l)	7.73 ^{ab}	8.13 ^a	7.20 ^b	7.43 ^{ab}	0.15
Creatinine (mmol/l)	21.00	22.00	21.33	21.67	0.29
Cholesterol (mmol/l)	8.80	8.43	8.37	8.43	0.87
Sodium (mmol/l)	41.00	41.67	40.00	40.00	0.35
Potassium (mmol/l)	1.13 ^a	1.17 ^a	1.00 ^{ab}	0.93 ^b	0.38
Bicarbonates (mmol/l)	10.83 ^{ab}	10.93 ^a	10.40 ^b	10.50 ^{ab}	0.08
Chloride (mmol/l)	21.33	22.67	20.00	20.00	0.58
ALP (iu/l)	1.27	1.27	1.20	1.29	0.02
SGOT (iu/l)	11.70	11.40	11.07	11.23	0.12
SGPT (iu/l)	6.77	6.37	6.37	6.49	0.07

abcd: Means with different superscript on the same horizontal row are significantly different @ (p<0.05).

Serum urea values showed that diet T1, T2 had similar (P>0.05) urea values as T4 which was however higher (P<0.05) than that of T3. It has been observed that serum urea, TSP and creatinine contents depend on both the quality and quantity of protein supplied in the diet (Iyayi and Tewe, 1998). Therefore, the similarities of the serum urea values in most of the test diets with the control indicates that YPM inclusion in the test diets did not dilute the protein content of the broiler rations neither did it affect protein utilization by the birds.

The serum electrolytes recorded in this experiment did not differ between treatment means except for potassium (K) and the bicarbonates (HCO₃). Slight differences were observed in the K values recorded with birds on diets T1 – T2 having similar (p>0.05) values to T3 but superior (P<0.05) to the value recorded for T4. Again, the range of 0.93 – 1.17mmol/l recorded in this study were also below the reference range of 1.7 – 4.2 mmol/l reported for normal chicken (Clinical Diagnostic Division 1990). Elements such as Na and K are known to regulate acid base balance and osmotic pressure. Birds on diet T3 recorded lower (p<0.05) bicarbonate value than groups T2 and but similar (p>0.05) to those of T1 and T4. No significant differences (p>0.05) were observed for the serum chloride values in this experiment. However, they were below the range of values reported for normal chicken (Mitruka and Rawnsley, 1977). High levels of chloride can cause metabolic acidosis (low blood pH and bicarbonates concentration) (Mc Nab *et al.*, 1981).

Conclusion and Recommendation

YPM could be included in broiler finisher rations up to 15% inclusion levels without deleterious effect on the haematology and serum chemical indices of the broiler birds.

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