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Haematology and Serum biochemistry of broilers fed diets containing cassava peels and cassava leaf meal

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ABSTRACT

A 7 weeks feeding trial was conducted in a completely randomized design to evaluate the haematological parameters and serum biochemistry parameters of 7-day old Abor-acre broiler chicks fed with different diets containing cassava peels and cassava leaf meal. The birds were assigned to four dietary treatments with three replicates and 15 birds per replicate. The birds in the control treatment (Treatment 1) were fed diets that did not contain cassava peel or cassava leaf meal, birds in treatment 2 were fed with diets containing cassava peel to replace maize by 20% and cassava leaf meal to replace soya bean meal by 20%, birds in treatment 3 were fed diets containings cassava leaves to replace soya bean meal by 20% and birds in treatment 4 were fed diets containing cassava peel to replace maize by 20%. The chicks were mass brooded at day old and fed with commercial broiler starter feed for one week before being randomly allotted to various dietary treatments. The birds were fed the experimental starter diet for 3 weeks and the experimental finisher diets for 4 weeks.

With the exception of lymphocytes and neutrophils, there was no significant differences (p>0.05) in the haematological parameters across the dietary treatments. All the serum biochemistry parameters were not significantly different (p>0.05) across the dietary treatments.

INTRODUCTION

Poultry producers aim at producing high quality meat and eggs at minimal cost. Maize is the conventional source of energy in poultry nutrition while soy bean meal is the conventional source of protein. These ingredients are scarce and expensive due primarily to competition for available cereals between man and animals in its use as food/feed. The rapid growth of human and livestock population has created

an increased need for food and feeds worldwide and this demands that alternative feed resources must be identified and evaluated (Odunsi *et al*, 2003).

Cassava is a staple root crop that is rich in carbohydrates, calcium, vitamins B and C and essential minerals and is considered to be a suitable alternative to corn as an energy source in poultry diets (CGIAR, 2017). Cassava production worldwide was estimated at about 278 million tonnes as of 2018 (FAO, 2018) with Africa contributing to about 56% (about 170 million tonnes of the total global production (FAOSTAT, 2019). Nigeria is the largest global producer of cassava producing about 60 million tonnes which accounts for 21.5% of the cassava produced globally (FAOSTAT, 2019).

The use of cassava as animal feed is not novel, there are several researches on its use as an alternative to maize in animal feed with favourable results (Omede *et al*, 2018; Bhuiyan and Iji, 2015; Anaeto and Adighibe, 2011). The replacement of maize with cassava flour or pellets have been reported to be economical. However, these findings appear to have been overtaken by events and recently in Nigeria cassava has been attracting interest as an industrial crop having found various uses in the starch, pharmaceutical, bread and biscuit industries. This has made the price of cassava tuber to be on the increase thereby making its use to replace maize in the diets of livestock unattractive economically (Akinfala *et al*, 2011). Agricultural wastes from cassava harvesting and processing such as cassava leaves and peels are underutilised in Nigeria because they are often left to rot away on farms and homesteads after harvesting the roots which in turn constitutes environmental nuisance (Olowoyeye *et al*, 2019; Akinfala and Tewe, 2004). Cassava peelings has been used to satisfactorily replace maize up to 40% for pigs, 15% for broilers and 27% for layers (Tewe and Egunike, 1992).

Previous studies on the use of cassava in poultry diets has been centred on the use of the flour, whole tuber whole cassava plant and peels as replacement for maize of the use of cassava leaves as replacement for soybean meal. In this study, attempt has been made to replace both maize and soybean meal with cassava peels and cassava leaves respectively in the same diet.

MATERIALS AND METHODS

The experiment was conducted at the Poultry Unit of the Teaching and Research Farm, University of Ibadan.

Experimental diets and design

Fresh cassava peels and leaves from mature cassava (sweet variety) were collected when the tubers were being harvested and processed from a farm in Eruwa in Oyo State. The cassava peels and leaves were sun-dried separately on clean cement surface. After drying, they were milled and stored inside airtight containers pending their inclusion in the experimental diet.

Four experimental diets (Table 2 and 3) were formulated for both the starter and the finisher phase. Diet one (T1), had neither cassava peels nor cassava leaf meal and served as the control diet. Diet two (T2), contained both cassava peels and cassava leave as 20% replacement for maize and 20% replacement for soybean meal respectively. Diet three (T3) contained only cassava leaves as 20% replacement for soya bean meal. Diet four (T4) contained only cassava peels as 20% replacement for maize.

Management of the experimental birds

180 1-day-old broiler Abhor acre chicks were purchased from a commercial hatchery in Ibadan were mass brooded for 7 days and fed a common commercial diet. The birds were randomly allotted into four dietary treatments groups with three replicates of 15 birds per replicate in a completely randomized design. Feed and water were provided ad libitum and all recommended management practices was carried out.

Collection blood samples and analysis

At day 49 of the experiment, 2 birds per replicate were randomly selected for haematological and serum tests. The birds were bled with the aid of sterile hypodermic needle and syringe via the wing vein. 10ml of blood was collected; 5ml of blood was released into sample bottles containing ethylene diamine tetra acetic acid (EDTA) as anti-coagulant and the bottles were shaken thoroughly to ensure proper mixing of the blood with EDTA to prevent coagulation. The remaining 5ml of blood samples was released into sample bottles without the anti-coagulant to harvest the serum. The bottles containing the blood samples were kept in an ice pack and taken to the laboratory for analysis.

The haematological parameters examined are; red blood cells (RBC), white blood cells (WBC), packed cell volume (PCV), haemoglobin concentration, mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV). Red blood cells and white blood cells were determined by improved Neubauer haemocytometer (Kelly, 1979). Packed cell volume was determined by Wintrobe's microhaematocrit (Kelly, 1979), haemoglobin was determined by cyanometaemoglobin methods (Mitruka and Rawnsley, 1977). Mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) were calculated from haemoglobin concentration, PVC and RBC as described by Jain (1986).

Blood samples for serum biochemistry analysis were centrifuged after clotting. The total protein was determined by biuret method (Reinhold, 1953), the albumin was determined by Bromocresol green (BCG) method as described by Peters *et al,* (1982), globulin

was calculated by subtracting the values obtained from the albumin from the total protein value. Alanine amino transferase (ALT), aspartate amino transferase (AST) and alkaline phosphatase (ALP) was determined by spectrophotometric method (Rej and Holder, 1983). Glucose was determined as described by Cooper *et al,* 1970).

Proximate analysis

Proximate composition of the test ingredients and the experimental diets were carried out using the procedure of AOAC (2000).

Statistical analysis

Data collected was subjected to analysis of variance (ANOVA) using SAS (2000). Means were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

The haematological parameters of broilers fed cassava peels and leaf meal diet is presented in Table 4. The results obtained from this study shows that the different dietary treatments had no significant ($p>0.05$) effect on all the observed haematological parameters with the exception of lymphocytes and neutrophils. The PCV values from this study were within the standard range 22-25% for apparently healthy chickens (Mitruka and Rawnsley, 1977; Schalm *et al*, 1975). The normal PCV values suggests that the birds were not anaemic. All the values for RBC in this experiment were slightly higher than those reported by Mitruka and Rawnsley (1977) except for Treatment 4 which fell within the range of 2.0 – 4.0 $10^3/mm^3$. However, they all fell within the range of 2.5 – 4.5 $10^3/mm^3$ reported by McDonald (1996). This variation is in agreement with the report of Emenalum *et al.* (2009) and Ogbuewu *et al* (2008) that the number of erythrocytes of animals in good health varies with species, age, sex, diets and clinical conditions of the animal.

The values for WBC obtained in this experiment fell within normal limits as reported by Mitruka and Rawnsley (1977). Since deferential leucocytes are used as indicators of stress response and sensitive biomarkers crucial to immune functions (Adeyemo and Sani, 2013), this implies that the birds were not immunologically challenged. The values for haemoglobin across the treatments were within normal limits of 7.0 – 13.0 g/dl and 6.5 – 9.4 g/dl reported by Mitruka and Rawnsley (1977) and Ameen *et al,* (2007) respectively. These values were also in agreement with reports from other researchers (Aderemi and Alabi, 2013; Ebunike *et al*, 2009). The normal values obtained indicate effective transportation of oxygen, carbohydrates and other feed nutrients in the body (Okorie *et al,* 2011). The values for monocyte, neutrophils, basophil and eosinophil were within normal range reported by Nowaczewski and Kontecka (2012). Since high monocyte, neutrophils, basophil and eosinophil values are an indication of active infection, the results shows that the birds have no bacterial or viral infection.

Table 5 shows the serum biochemistry parameters of broilers fed cassava peels and leaf meal diets. All the serum biochemistry parameters were not significantly different across dietary treatments. Total serum protein has been reported as an indicator of protein retained in the animal body (Esonu *et al*, 2001). The total protein values obtained in this experiment was higher than the values of 2.59 -3.46 g/dl reported by Silva *et al* (2009). However, it was within the range of 3.25 – 7.61 g/dl reported by Rajurker *et al* (2009) and 4.02 – 8.36 g/dl by Mitruka and Rawnsley (1977). These results implies that the dietary protein was adequate across the treatments. The stability in total protein values irrespective of the treatments suggests that the diets are adequate for the chickens (Ebunike *et al*, 2009). The albumin fraction of the total protein was consistently higher than globulin across the treatments, this is an indication that the birds are healthy as serum globulin in an infected animal is increased because it is the principal site for circulating antibodies i.e., immunoglobulins (Harper, 1982).

Alanine amino transferase (ALT) is a good mirror for the overall body enzymatic and metabolic process in birds and is valued as an index of liver disease (Aderemi and Alabi, 2013). Low value of ALT is an indication that there is no liver damage.

Table 1: Proximate composition of test ingredients

Component (%)	Cassava leaf	Cassava peel
Dry Matter	91.40	90.27
Crude Protein	25.37	2.53
Ether Extract	11.77	0.70
Ash	8.47	3.17
Crude Fibre	10.63	9.03
Total Carbohydrate	73.00	74.83
Cyanide	0.1	0.2

Table 2: Gross composition and Proximate composition of experimental starter diets

Ingredients (%)	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Maize	50.00	40.00	50.00	40.00
Soya bean meal	35.00	28.00	28.00	35.00
Cassava peel	-	10.00	-	10.00
Cassava leaf	-	6.00	6.00	-
*Others	15	15	15	15
Total	100.00	100.00	100.00	100.00
Calculated Values				
Crude protein	22.90	21.29	21.65	22.66
ME (kcal/kg)	2974	2791	2931	2835
Crude fibre (%)	3.92	3.28	3.45	3.78
Calcium	0.92	1.10	1.01	.95
Phosphorus (%)	0.70	0.69	0.68	0.74
Determined/Proximate values				
Dry Matter (%)	90.09	90.70	90.40	90.90
Crude Protein (%)	22.70	22.30	22.70	22.80
Ether Extract (%)	14.50	15.10	15.30	14.90
Ash (%)	6.53	6.20	6.00	5.80
Crude Fibre (%)	10.30	9.80	9.00	9.00
Total Carbohydrate (%)	40.40	38.50	38.50	37.00
Cyanide (%)	--	--	--	--

*Wheat offals (7.23); Di calcium phosphate (1.5); Oyster shell (0.5); Palm oil (2.5); Premix (0.25); Table salt (0.25); DL-Methionine (0.15); L-Lysine (0.06); Avatec (0.06); Fish meal (2.5)

Table 3: Gross composition and Proximate composition of experimental finisher diets

Ingredients (%)	Treatment 1	Treatment 2	Treatment 3	Treatment 4
Maize	50.00	40.00	50.00	40.00
Soya bean meal	30.00	24.00	24.00	30.00
Cassava peel	-	10.00	-	10.00
Cassava leaf	-	7.00	7.00	-
*Others	20	20	20	20
Total	100.00	100.00	100.00	100.00
Calculated Values				
Crude protein	20.87	19.24	19.61	20.50
ME (kcal/kg)	3023.71	2846.91	2986.51	2884.11
Crude fibre (%)	4.83	4.35	4.51	4.87
Calcium	0.89	0.95	0.97	0.88
Phosphorus (%)	0.61	0.62	0.61	0.64
Determined/Proximate values				
Dry Matter	91.30	90.30	90.80	90.50
Crude Protein	20.80	19.70	19.30	20.50
Ether Extract	11.30	11.10	10.80	12.20
Ash	5.80	5.30	5.20	5.40
Crude Fibre	11.30	12.10	11.00	12.20
Total Carbohydrate	49.20	49.10	48.50	49.20
Cyanide	--	--	--	--

Wheat offals (11.24); Di calcium phosphate (1.5); Oyster shell (1.0); Palm oil (2.5); Premix (0.25); Table salt (0.25); DL-Methionine (0.10); L-Lysine (0.06); Avatec (0.06); Fish meal (1.5)

Table 4: Haematological parameters of broilers fed cassava peels and leaf meal diet

Component (%)	Treatment 1	Treatment 2	Treatment 3	Treatment 4	SEM
Packed cell volume (%)	25.11	25.78	26.56	26.00	0.30
Red blood cells (10^3/mm^3)	4.04	4.19	4.02	3.93	0.05
White blood cells (10^3/mm^3)	18.56	20.52	19.27	19.01	0.41
Haemoglobin (g/100ml)	8.37	8.59	8.85	8.67	0.10
Lymphocytes (%)	67.11[a]	71.69[a]	69.67[a]	58.89[b]	2.81
Platelets	148667	151556	158333	147000	2498.66
Neutrophils (%)	28.56[a]	23.00[b]	25.22[b]	35.56[a]	2.74
Monocytes (%)	1.67	2.44	1.89	2.11	0.16
Eosinophils (%)	3.67	3.00	2.67	2.89	0.21
Basophils (%)	0.11	0.44	0.33	0.22	0.07
MCH (*pg*)	21.88	20.68	22.32	22.40	0.40
MCHC (g/dl)	33.34	33.33	33.34	33.40	0.02
MCV (*fl*)	64.66	61.32	66.93	62.10	1.28

a,b: Mean within rows having different superscripts are significantly different ($p<0.05$)
MCH = Mean corpuscular haemoglobin
MCHC = Mean corpuscular haemoglobin concentration
MCV = Mean corpuscular volume

Table 5: Serum biochemistry parameters of broilers fed cassava peels and leaf meal diet

Parameters	Treatment 1	Treatment 2	Treatment 3	Treatment 4	SEM
Total protein (g/dl)	5.44	5.39	5.28	5.44	0.04
Albumin (g/dl)	3.10	2.91	2.99	3.36	0.09
Globulin (g/dl)	2.32	2.47	2.29	2.08	0.08
ALT (iu/l)	9.67	7.95	8.14	9.51	0.45
ASP (iu/l)	150.26	133.68	142.17	149.33	3.84
ALP (iu/l)	52.69	67.32	56.15	30.09	7.80
Glucose (mg/dl)	288.56	239.93	262.19	259.41	9.99

a,b: Mean within rows having different superscripts are significantly different ($p<0.05$)
ALT = Alanine amino transferase
AST = Aspertate amino transferase
ALP = Alkaline phosphatase

CONCLUSION

The analysed data from this study revealed that cassava peel and cassava leaf can replace maize and soybean meal respectively in broiler diets without any deleterious effect on haematological parameters and serum biochemistry parameters of broilers

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