Effect of phytobiotics inclusion on haematological and serum indices of broiler chickens

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Abstract

The effect of phytobiotics inclusion on haematological and serum indices of broiler chickens was investigated using 180 one day-old Arbor-acre broiler chicks in an eight weeks feeding trial. Six experimental diets were formulated to include the control diets (0g/kg), Ginger (5g/kg), Pawpaw leaf (5g/kg), Moringa (5g/kg), Turmeric(1g/kg) and Oxytetracycline (0.5g/kg) diet. These diets were assigned to six groups of 30 chicks replicated 3 times with 10 birds per replicate in a completely randomized design (CRD). Feed and water were given ad libitum. At the end of eight weeks, blood samples were collected from jugular vein of the birds and were analyzed for haematological and serum biochemical indices. The result of the analysis showed that dietary treatments significantly ($p < 0.05$) influenced all haematological parameters studied. Ginger had the highest value of packed cell volume (45%), haemoglobin (15.05 g/dl) and red blood cell count ($3.39 \times 10^{12} L^{-1}$) at the finisher phase. Total protein, uric acid, glucose were significant ($p < 0.05$). Serum cholesterol value was significantly ($p < 0.05$) lower in birds supplemented with ginger compared to other groups. It can be concluded that ginger at 5g/kg improved PCV, Hb and reduction of cholesterol concentration in broiler chicken.

Keywords: Ginger, turmeric, moringa, pawpaw, hematology, serum, broiler

Introduction

Antibiotics have been used for over five decades in animal production with its attendant benefits such as improved growth rate, better feed conversion and reduced mortality and morbidity in farm animals. Its future and continuous usage have come under close scrutiny in recent time due to the residue left in meat, eggs and other animal products and the increasingly reported case of microbial resistance to antibiotic drugs in humans. The ban on the routine use of antibiotics in 2006 as growth promoter in the European Union and the propensity of consumers for animal products through "natural" methods with less use of chemical agents (e.g. organic farm product) has stimulated renewed interest in possible alternatives. Possible

alternatives include probiotics, organic acids, prebiotics and phytobiotics. Plant products have been used for centuries by human as food and to treat ailments. Natural medicinal products originating from herbs and spices have also been used as feed additives for farm animals in ancient cultures for the same length of time. To differentiate between the plant products used for veterinary purposes (prophylaxis and therapy of diagnosed health problems), phytobiotics were redefined (Windisch and Kroismayr, 2006) as plant derived products added to the feed in order to improve performance of livestock. Around the world, phytobiotics have been investigated as natural sources of biologically important chemicals since efforts are being made to ban all types of IFAs (in-feed antibiotics) in

many countries. Compared with synthetic antibiotics or inorganic chemicals, these plant-derived products have proven to be natural, less toxic, residue free, and are thought to be ideal feed additives in animal production (Wang *et al.*, 1998). Blood parameters have been shown to be major indices of physiological, nutritional status of animal and health status of an animal. The objective of this study therefore was to determine the effect of phytobiotics inclusion in diet on the haematological and serum indices of broiler chickens.

Materials and Methods

The study was carried out at the Directorate of University Farms (DUFARMS) of the Federal University of Agriculture, Abeokuta, Nigeria. The area lies on latitude 7°10'N and longitude 3°2'E, it is 76m above sea level and located in the tropical rainforest vegetation zone with an average temperature of 34.7°C (Google earth, 2010). A total of 180 one day old Arbor-acre broiler birds were weighed and randomly divided into six groups, each consisting of three replicates with 10 birds per replicate. The birds were housed under same experimental conditions. Fresh leaves of Moringa and Pawpaw were harvested from the Federal University of Agriculture Abeokuta environment. The leaves harvested were spread under shade for 7 days. The dried samples were then milled using 2mm sieve and added to the formulated diet. Ginger and Turmeric were sundried for 7 days and ground manually. Six diets were formulated such that diets 1 served as the control diet while diets 2, 3, 4, contained 5g/kg of ginger, pawpaw and moringa respectively and diets 5 and 6 contained 1g/kg of turmeric and 0.5g/kg oxytetracycline. The experimental diets were offered to each of the six treatment

groups and water was made available *ad libitum*. The routine management practices were maintained and necessary vaccinations and medications were administered. Six birds per treatment were randomly selected and bled via jugular veins. 2.5 ml blood was collected into labeled sterile universal bottles containing Ethylene- Diamine-Tetra-Acetic acid (EDTA) as anticoagulant used to determine the haematological components (PCV, RBC, Hb, WBC). The parameters were determined within an hour of sample collection following standard procedures described by (Davice and Lewis, 1991).

Another 1.0 ml of blood was collected into labelled sterile sample bottles without anticoagulant and used to determine the serum (total protein, globulin, albumin, uric acid, creatinine, glucose and cholesterol). The serum indices were carried out using standard clinical chemistry procedures Olorede *et al.* (1996). Cholesterol was determined as described by Coles (1986). Data collected were subjected to completely randomized design analysis using the General Linear Model procedure of SAS (1999) to determine treatment effects. Significant mean differences were determined using a least significant difference test. The feeding trial lasted for eight weeks.

Results and Discussion

The results of haematological indices of broiler chickens fed diets containing phytobiotics are presented in Table 3. Packed cell volume, haemoglobin, red blood cell, white blood cell are significantly different ($p < 0.05$). The packed cell volume ranged from 30.00-45.00%. Birds fed diet

Table 1: Gross Composition of Starter Diets (0-4weeks)

Ingredient %	Dietary Treatments					
	1	2	3	4	5	6
Maize	51.00	51.00	51.00	51.00	51.00	51.00
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00
Soyabean meal	27.00	27.00	27.00	27.00	27.00	27.00
Groundnut cake	8.00	8.00	8.00	8.00	8.00	8.00
Wheat offal	6.00	5.50	5.50	5.50	5.90	5.95
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	0.30	0.30	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Ginger	-	0.50	-	-	-	-
Pawpaw leaf	-	-	0.50	-	-	-
Moringa	-	-	-	0.50	-	-
Turmeric	-	-	-	-	0.10	-
Oxytetracycline	-	-	-	-	-	0.05
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis(%)						
Crude protein	23.49	23.45	23.55	23.53	23.48	23.49
Crude fibre	3.63	3.70	3.65	3.70	3.63	3.63
Metabolizable energy(k cal/kg)	2890.2	2882.27	2882.27	2902.24	2888.68	2890.20
Fat	3.63	3.64	4.16	3.62	3.62	3.63
Calcium	1.67	1.67	1.67	1.67	1.67	1.67
Phosphorus	0.86	0.86	0.86	0.86	0.86	0.86
Lysine	1.35	1.35	1.35	1.35	1.35	1.35
Methionine	0.68	0.68	0.68	0.68	0.68	0.68

*1 kg premix contains Vit. A: 4000,000 IU, Vit. D3: 800,000 IU, Vit. E: 8000 mg, Vit. K3: 900 mg, Vit. B: 30,000 mg, Vit. B3: 2000 Vit. B6: 1100 mg, Vit. B12: 6 mg, Panthotenic acid: 3,000 mg, Folic acid:3000 mg, Biotin: 20 mg, Manganese: 80,000 mg, Iron: 40,000 mg, Zinc: 60 g, Copper: 2 g, Cobalt: 80 mg, Iodine:1000 Selenium(1%150 mg, Choline: 160 g and Antioxidant: 100,000 mg.

containing ginger had significantly higher PCV values ($p < 0.05$) compared with birds in other treatment groups. PCV values were within the range for broiler chickens (Wikivet, 2012). Haemoglobin ranged from 10.45-15.05 (g/dl). Phytobiotics used in this study had no adverse effect on haemoglobin concentration because these values were within the range of 7-18 g/dl reported for normal birds (Miturka *et al.*, 1977). Inclusion of ginger rather enhanced blood haemoglobin values of the birds compared to other treatments. This may be attributed to more minerals and vitamins

made available by inclusion of ginger. Broiler chicken fed diets containing oxytetracycline had the least value haemoglobin (10.45g/dl) while the highest value (15.05g/dl) was found in bird fed diets containing ginger. Red blood cell values obtained in this study ranged from 2.36-3.39 and these values were within (1.80-3.81) reported by (Nworgu *et al.*, 2003). Red blood cell are responsible for the transportation of oxygen and CO₂ in the blood as well as manufacture of haemoglobin hence higher value of ginger indicate a greater potential for this function

Table 2: Gross Composition of Finisher Diets (5-8weeks)

Ingredient %	Dietary Treatments					
	1	2	3	4	5	6
Maize	57.10	57.10	57.10	57.10	57.10	57.10
Fish Meal	2.00	2.00	2.00	2.00	2.00	2.00
Soyabean meal	23.00	23.00	23.00	23.00	23.00	23.00
Groundnut cake	4.00	4.00	4.00	4.00	4.00	4.00
Wheat offal	10.00	9.50	9.50	9.50	9.90	9.95
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Ginger	-	0.50	-	-	-	-
Paw paw leaf	-	-	0.50	-	-	-
Moringa	-	-	-	0.50	-	-
Turmeric	-	-	-	-	0.10	-
Oxytetracycline	-	-	-	-	-	0.05
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis (%)						
Crude protein	20.59	20.58	20.65	20.17	20.58	20.59
Crude fibre	3.67	3.66	3.65	3.74	3.67	3.67
Metabolizable energy(kcal/kg)	2932	2930	2924	2944	2930	2932
Fat	3.66	3.96	3.96	3.65	3.66	3.66
Calcium	1.44	1.44	1.44	1.44	1.44	1.44
Phosphorus	0.66	0.66	0.66	0.66	0.66	0.66
Lysine	1.15	1.15	1.15	1.15	1.15	1.15
Methionine	0.64	0.64	0.64	0.64	0.64	0.64

*1 kg premix contains Vit. A: 10,000,000 IU, Vit. D3: 2,500,000 IU, Vit. E: 20,000 mg, Vit. K3: 3000 mg, Vit. B: 30,000 mg, Vit. B3: 3000 mg, Vit. B2: 7000 mg, Vit. B6: 5000 mg, Vit. B12: 25 mg, Panthotenic acid: 10,000 mg, Folic acid: 800 mg, Biotin: 50 mg, Manganese: 80,000 mg, Iron: 40,000 mg, Zinc: 60,000 mg, Copper: 8000 mg, Cobalt: 250 mg, Iodine: 1000 mg, Selenium (1%): 150 mg, Choline: 200,000 mg and Antioxidant: 100,000 mg.

and better state of health (Olugbemi *et al.*, 2010). Table 4 shows the results of serum indices of broiler chickens fed diets

containing phytobiotics. Albumin and globulin were not significantly different ($P>0.05$). Total protein, uric acid,

Table 3. Effect of phytobiotics on the haematology of finisher broiler chicken (5-8weeks)

Parameter	Dietary Treatments						SEM
	1	2	3	4	5	6	
PCV(%)	33.00 ^{bc}	45.00 ^a	34.00 ^{bc}	36.50 ^b	30.00 ^{bc}	31.50 ^c	1.46
Hb(g/dl)	11.15 ^{bc}	15.05 ^a	11.43 ^{bc}	12.10 ^b	11.70 ^{bc}	10.45 ^c	1.34
RBC($\times 10^{12}/L$)	2.50 ^{bc}	3.39 ^a	2.58 ^{bc}	2.77 ^b	2.68 ^{bc}	2.36 ^c	0.51
WBC($\times 10^3/L$)	2.85 ^{bc}	3.55 ^{ab}	4.50 ^a	1.50 ^c	2.75 ^{bc}	3.25 ^{ab}	0.62
MCH(g/dl)	44.30	44.45	44.11	43.87	30.09	44.29	2.30

^{a,b,c} Means in the same row with different superscripts differ significantly ($P<0.05$)

Oxytet- Oxytetracycline

creatinine, glucose and cholesterol as shown in Table 4 are significantly different. Birds fed diets containing ginger had high significant ($p < 0.05$) value of total protein and bird fed diets containing pawpaw leaf had least significant value of 19.67 g/l.

There were no significant difference in albumin and globulin which is in agreement with Farinu *et al.* (2004) who reported that supplementation of ginger at the rate of 5, 10 and 15 g/kg did not affect total protein and albumin in the serum of broiler chickens. Serum cholesterol were significantly lowered for birds supplemented within 5g/kg compared to the control group. The reduced concentration of cholesterol in the serum of ginger-supplemented broilers indicated that ginger possesses antihypercholesterolemic activity. This is consistent with the well-observed effect of ginger on lowering blood cholesterol level (Fuhrman *et al.*, 2000; Andallu *et al.*, 2003)

Turmeric rhizome powder increase total cholesterol (135 mg/dl) which agrees with Emadi *et al.* (2007) who reported that the use of turmeric rhizome powder in broiler's diet could significantly increase total cholesterol.

Conclusion

The study concluded that 5g/kg of ginger

inclusion in broiler finisher diets enhanced packed cell volume, haemoglobin and red blood cell, total protein better than the other groups and has greater influence as an anti-hypercholesteromic agent.

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Table 4 Effect of phytobiotics on serum parameters of finisher broiler chicken (5-8 weeks)

Parameters	Dietary Treatments						SEM
	1	2	3	4	5	6	
Total protein(g/l)	21.00 ^{ab}	23.67 ^a	19.67 ^c	20.67 ^c	22.00 ^{ab}	22.50 ^{ab}	0.375
Globulin(g/l)	11.67	12.67	11.17	10.67	11.50	11.67	0.242
Albumin(g/l)	9.33	11.00	8.50	10.00	10.50	10.83	0.164
Uric acid(mg/dl)	5.67 ^{ab}	5.70 ^{ab}	5.35 ^{bc}	5.20 ^c	5.57 ^b	5.90 ^a	0.676
Creatinine(mg/dl)	1.17 ^a	0.70 ^c	1.00 ^{ab}	0.93 ^b	1.00 ^{ab}	1.00 ^{ab}	0.379
Glucose(mg/dl)	47.67 ^c	57.00 ^a	51.67 ^{bc}	51.00 ^{bc}	53.33 ^b	56.50 ^{ab}	0.929
Cholesterol(mg/dl)	105.67 ^d	99.50 ^c	118.00 ^c	106.00 ^d	135.00 ^a	120.00 ^b	4.569

a,b,c,d,e Means on the same row with different superscripts differ significantly ($P < 0.05$)

Oxytet- Oxytetracycline

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