PHYTOGENICS (LEMON AND ORANGE PEELS) INFLUENCED THE HEAMATOLOGY, SERUM BIOCHEMISTRY AND LIPID PROFILE OF BROILER CHICKENS

A. O. FAFIOLU[1,2], J. O. ALABI[1,2], C. G. GODWIN[2], I. D. DADA[1], A. A. TENIOLA[1,3] AND Z. O. BELLO[2]

[1]World Bank Africa Centre of Excellence in Agricultural Development and Sustainable Environment (CEADESE), Federal University of Agriculture, Abeokuta, P.M.B. 2240, Ogun State, Nigeria, [2]Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, P.M.B. 2240, Ogun State, Nigeria, [3]Federal College of Animal Health and Production Technology, Ibadan, P.M.B. 5029, Oyo State, Nigeria.

Correspondence: joelalabi@gmail.com; 07066486949

ABSTRACT

This study evaluated the effect of phytogenic feed additives (Lemon peel, LP and Orange peel, OP) added singly or in combination to basal diets on the haematology, serum biochemistry and lipid profile of finisher broiler chickens. 320 Marshall strain, mixed sexes, broiler chickens were given the basal diet supplemented with no additive (T1), 500g/tonne of LP (T2), OP (T3), or LP+OP (T4) in a study which lasted for 3 weeks (d 22–42). Blood samples collected at d 42 were assessed. Data generated were analyzed by ANOVA using PROC GLM of SAS (2007). Results showed that highest ($P<0.05$) PCV (30.00 %), total protein (6.89 g/L) and albumin (3.67 g/L) were observed in birds on LP+OP. Hb and RBC were not affected by the treatments imposed. Serum creatinine, uric acid and liver enzymes (AST and ALT) activity were significantly reduced with inclusion of LP and OP in broiler diets. Increase ($P<0.05$) HDL and decrease total cholesterol, LDL and triglycerides were observed in broilers fed LP and OP. The study concluded that dietary supplementation of LP and OP had positive influence on blood profile and exert cholesterol-lowering properties in broiler chickens.

Keywords: phytogenics, serum,lipids, chickens.

INTRODUCTION

The quest to satisfy the consumers' demand for safe and quality animal protein had led to growing interest in the use of phytogenic feed additives (PFA) as growth-enhancers in poultry production. The essential oils (EO) present in PFA enhance production of digestive secretions, stimulates blood circulation, exerts antioxidant properties and enhance immune status thus improving the productive capacity and general welfare of poultry birds (Brenes and Roura, 2010). Reduction of pathogenic gut microbes also minimizes the risk of food contamination during processing thereby ensuring provision of safe poultry products. Various beneficial effects of PFA exhibited depends largely on the composition and concentration of EO contained as well as dosage administered, processing methods, age and physiological status of the animal, duration of ingestion, background diet, housing and rearing conditions (Alabi *et al.*, 2016).

Lemon (*Citrus limon)* and Sweet Orange (*Citrus sinensis*) peels, which constitutes the major waste products of the food and juice extraction industry, are found to be rich in phenolic compounds such as protocatchic, catechol, cinnamic, caffein, vanillic, syringic, chrisin and coumarin; flavonoids such as quercetin, luteolin, rutin, and hesperetin as well as antioxidants (Akbarian *et al.*, 2014). Previous studies have investigated the effects of lemon peels (LP) and orange peels (OP) on growth performance, carcass yield, antioxidant enzyme activities and serum metabolites of broiler chickens with varying outcomes (Oluremi *et al.*, 2010; Akbarian *et al.*, 2014; Alzawqari *et al.*, 2016). However, the paucity of available information on the response of broiler chickens to LP and OP, fed singly and in combination, on heamatology, serum biochemistry and lipid profile necessitate the need for this study.

MATERIALS AND METHODS

Fresh lemon fruits were purchased from the local market in Abeokuta and peeled while sweet orange peels were collected from orange sellers. The peels were sundried, milled to powder and stored in air-tight bags before incorporation into

the formulated diet. The study was carried out at the Poultry Unit, Teaching and Research Farms, Federal University of Agriculture Abeokuta, Ogun State in accordance with the guidelines of the Animal Care Committee of the University. Three hundred and twenty (320) Marshall Strain, mixed sexes, broiler chicks used were randomly allocated on weight equalization basis to four dietary treatments, each having four replicate pens with 20 birds per pen. Basal diets were formulated to contain 12.51 MJ/kg ME, 23.75% CP (starter phase) and 11.43 MJ/kg ME, 21.13 % CP (finisher phase). Birds were fed one of four diets which include basal diet supplemented with no additive (TI), 500 g/t of LP (T2), OP (T3), or LP+OP (T4) for experimental period of 42 days. The birds had unrestricted access to feed offered in mash form during the study.

On d 42, one bird per replicate totaling 4 birds per treatment was selected for blood sampling. Blood samples (2mls/bird) were collected via the jugular vein using sterile needles and syringes into EDTA bottles for haematological parameters while another 2mlsof blood samples were collected into hypothermic syringe to investigate the serum chemistry and lipid profile using the standard procedures (Fafiolu *et al.*, 2014; Alzawqari *et al.*, 2016). Data generated were statistically analyzed by ANOVA using PROC GLM of Statistical Analysis Systems (SAS, 2007; version 9.1.3). Statements of statistical significance was based on $P<0.05$.

RESULTS AND DISCUSSION

Highest ($P<0.05$) PCV (30.00 %) was observed in birds fed diets supplemented with LP+OP (Table 1). This suggests that such birds have better health indices with no impairment in primary physiological functions. PCV is often used to identify and evaluate the severity of anaemia or polycythemia, and also to monitor the response to its treatment. The synergy of LP and OP enhanced the RBC production in broiler chickens. Ritchie *et al.* (1994) stated that percentages of packed cell volume of red blood cells obviously determine the health conditions in birds which supported the result. RBC and Hb were similar ($P>0.05$) in birds fed diets with or without LP and OP supplementation. Non-significant variation in RBC and Hb concentration among the treatments indicate that phytogenics used had no adverse effects on normal erythropoiesis and transportation of oxygen, chemicals and nutrients essential to life. This finding is strongly supported by Alabi *et al.* (2016). Higher ($P<0.05$) WBC counts obtained in bird fed control diets could be a pointer to the increased rate of antibodies production against the activities of pathogenic microbes. Reduced WBC counts in birds fed LP and OP probably suggests reduction of pathogenic microbes through competitive exclusion mechanism thus channels available nutrients for RBC production other than for immunoglobulin.

LP and OP produced significant ($P<0.05$) effect on all serum biochemistry parameters investigated (Table 2). Increase in serum total protein in birds fed LP+OP showed beneficial synergistic effect of phenolic compounds and flavonoids on protein metabolism and transamination process. Higher albumin was obtained in birds fed LP+OP. Albumin carries and delivers important nutrients to body cells. It also binds with toxins and free radicals thus minimize oxidation process and prevent cell damage. Creatinine and urea provide insight to diagnosis of renal damage or functionality of the kidney. Higher creatinine and urea in birds fed basal diet showed that they did not fully utilized the dietary protein and is an indication that the muscle wastage (Fafiolu *et al.*, 2014). Reduced ($P<0.05$) AST and ALT values in birds fed diets supplemented with LP+OP indicates improved liver function. ALT plays an active role in biotransformation and detoxification of various toxicants, ROS, endo- and xerobiotics. This implies that PFA enhance the integrity and productive capacity of chicken's internal organs and the biochemical activities within the cells. Akbarian *et al.* (2014) reported that elevated liver enzymes activities (AST &ALT) indicate liver damage. This findings is opposed by that of Akbarian *et al.*(2014) who reported no significant difference in Albumin, AST, ALT, Uric acid and creatinine.

Effects of LP and OP supplementation on lipid profile of broilers revealed significant difference (Table 3). Birds fed diets containing LP and OP had higher ($P<0.05$) HDL and reduced total cholesterol, triglycerides, and LDL. Lipoproteins are macromolecules of lipid and soluble complexes of proteins (apolipoproteins) that transport lipids (including cholesterol and triglycerides) through the intravascular and

extravascular body fluids. They are involved in a diversity of processes such as immune reactions, coagulation and tissue repair. HDL acts as a maintenance crew for the inner walls (endothelium) of blood vessels thus reduces the process of atherosclerosis and the risk of coronary heart diseases. In view of this, higher cholesterol-lowering effect was observed in birds fed OP. In agreement, Akbarian *et al.* (2014) reported significant decrease in serum LDL and cholesterol levels in heat-stressed broiler chickens fed diets containing citrus peels extract.

CONCLUSION

Broiler chickens fed diets fortified with lemon and orange peels,singleor mixture, showed improved RBC production, enhanced the plasma protein reserves, immune system production and prevents muscle wastage. The study concluded that dietary supplementation of LP and OP, at inclusion level of 500 g/tonne kg feed, had positive influence on blood profile and exert cholesterol-lowering properties in broiler chickens.

REFERENCES

Akbarian, A., Golian, A., Kermanshahi, H., De Smet, S. and Michiels, J. 2014. Antioxidant enzyme activities, plasma hormone levels and serummetabolites of finishing broiler chickens reared under highambient temperature and fed lemon and orange peel extractsand *Curcumax anthorrhiza* essential oil. *Journal of Animal Physiology and Animal Nutrition,* 1-13. DOI: 10.1111/jpn.12188

Alabi,J.O.,Ojo,O.G.,Olarotimi,I.D.,Teniola,A.A., Onifade,B.A and Fafiolu,A.O.2016. Influence of Essential Oil(Crina and Nutmeg) on Performance and Blood Profile of Starting Broiler Chicken. *Proceeding of the 41st Annual Conference of Nigeria Society for Animal Production (NSAP).* Federal University of Agriculture, Abeokuta. March 20-26, 2016. Pp 875-877

Brenes, A. and Roura, E. 2010. Essential oils in poultry nutrition: Main effects and mode of action. *Animal Feed Science and Technology*, 158: 1–14.

Fafiolu, A. O., Otakoya, I. O., Adeleye, O. O., Egbeyale, L. T., Alabi, J. O. and Idowu, O. M. O. 2014. Comparing the blood profile of two strains of Broiler chickens with varying interval of post hatch feeding. *Nigeria Journal of Poultry Science,* 11: 196-203

Oluremi,O. I. A.,Ebe,A.I.,Ngi,J. and Aku,E.O.2010.Effect of naturally fermented Sweet Orange (Citrussinensis) peel meal on its Maize replacement value in Broiler diet on Performance and Carcass indices. *Proceeding of the 35rd Annual Conference of Nigeria Society for Animal Production (NSAP).* University of Ibadan, Ibadan. March 14-17, 2010. Pp449-452

Ritchie,B.W.,Harrison,G.J. and Harrison,L.R. 1994. *Avian Medicine: Principle and Application.* Wingers Publication Inc.,Lake North,Florida, USA.

SAS, 2007. SAS for Windows, 9.1.3 portable version. SAS Institute Inc., Cary, NC 27513, USA

Table 1: Haematology Parameters of Broiler Chickens fed diets supplemented with Lemon peel (LP) and Orange Peel (OP)

Parameters	T1	T2	T3	T4	SEM	P-Value
PCV (%)	19.00^{b}	20.00^{b}	20.67^{b}	30.00^{a}	1.58	0.0008
HB (g/dl)	7.00	7.20	7.45	9.40	0.42	0.1382
RBC (x10^{6}/mm^{3})	2.95	3.00	3.10	3.69	0.12	0.4789
WBC (x10^{6}/mm^{3})	16.50^{a}	14.00^{c}	13.80^{c}	14.40^{b}	3.25	<0.0001
H/L ratio	2.62	2.92	2.76	2.91	0.01	0.6947

^{abc}Means values with different superscripts are significant different P<0.05, H/L: heterophils/lymphocytes, SEM: Standard Error of Mean

Table 2: Serum Biochemistry of Broiler Chickens fed diets supplemented with LP & OP

Parameters	T1	T2	T3	T4	SEM	P-Value
Total Protein (g/L)	6.71^{a}	4.84^{b}	4.66^{b}	6.89^{a}	0.33	0.0005
Albumin (g/L)	2.93^{b}	2.33^{c}	3.05^{b}	3.67^{a}	0.14	<0.0001
Globulin (g/L)	3.78^{a}	2.51^{cb}	1.61^{c}	3.22^{ab}	0.27	0.0023
Uric Acid (mg/dL)	2.70^{a}	1.88^{b}	1.34^{c}	1.99^{b}	0.15	0.0002
Creatinine (mg/dL)	1.67^{a}	0.89^{b}	0.89^{b}	0.89^{b}	0.10	0.0023
AST (IU/L)	60.40^{a}	45.36^{b}	40.44^{c}	48.85^{b}	2.65	<0.0001
ALT (IU/L)	10.54^{a}	9.35^{b}	7.45^{c}	6.70^{d}	0.46	<0.0001

^{abdc}Means values with different superscripts are significant different P<0.05, ALT: Alanine aminotransaminase, AST: Aspartate aminotransaminase, SEM: Standard Error of Mean

Table 3: Serum lipid profile of broiler chickens fed diet with LP & OP

Parameters (mg/dl)	T1	T2	T3	T4	SEM	P-Value
Total Cholesterol	276.12^{a}	226.87^{b}	150.70^{d}	189.40^{c}	14.04	<0.0001
Triglycerides	209.43^{a}	189.57^{b}	156.76^{c}	190.25^{b}	5.75	<0.0001
HDL	60.84^{c}	76.90^{b}	86.90^{a}	66.98^{bc}	3.08	<0.0001
LDL	4.34^{a}	2.56^{b}	3.00^{ab}	3.35^{ab}	0.24	0.0005

^{abdc}Means values with different superscripts are significant different P<0.05, SEM: Standard Error of Mean