

EFFECT OF ORAL ADMINISTRATION OF GARLIC, GINGER AND ROSELLE EXTRACTS ON THE HAEMATOLOGICAL CHARACTERISTICS AND BIOCHEMICAL PROFILE OF BROILER CHICKEN

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Abstract

A total of 200 unsexed day-old Arbor Acre broiler chicks were used to determine the effect of orally-administered garlic (*Allium sativum*), ginger (*Zingiber officinale*) and roselle (*Hibiscus sabdariffa*) calyx extracts on the haematology and serum biochemistry of broiler chicken. The treatments were: 100 % water with no plant extracts (T₁); 4 g of roselle per 1 litre of water (T₂); 4 g of roselle and 4 g of ginger per 1 litre of water (T₃); 4 g of roselle and 2 g of garlic per 1 litre of water (T₄) and 4 g of roselle, 4 g of ginger and 2 g of garlic per 1 litre of water (T₅). The birds were randomly allotted to the five treatments; each treatment was replicated four times containing 10 birds per replicate in a completely randomized design (CRD) model. Feed and water were supplied to the birds *ad libitum* for 56 days. At the end of the feeding trial, two birds per replicate were randomly selected, kept off feed for 12 hours and blood samples collected through their branchial wing veins, using hypodermic needles and syringes. Blood samples of 5 ml were collected from each bird into two different sample bottles: one containing EDTA anticoagulant for haematological analyses while, the other containing no EDTA for serum biochemical analyses. Results showed that roselle extract in combination with either garlic or ginger improved the PCV and stabilized the WBC, though with no significant effect ($P > 0.05$) on haemoglobin concentration and RBC. Also, it significantly ($P < 0.05$) increased the concentration of the liver enzymes, ALT and ALP, and the total bilirubin level. Hence, oral administration of 4 g roselle + 4 g ginger + 2 g garlic per litre of drinking water optimized the haematological characteristics and serum biochemical profile of broiler chicken.

Keywords: Garlic, ginger, roselle extracts, haematology, serum biochemistry, broiler chicken.

Introduction

Various phytochemical feed additives or phytochemicals have been used by different researchers, extensively in poultry nutrition, because of their appetite stimulating, antimicrobial, antioxidant, immunomodulatory and growth promoting activities. Some of these include oregano extract, clove extract, cinnamon extract, red pepper extract, ginger extract, garlic extract, turmeric extract, *Moringa* leaf extract and Roselle (*Hibiscus sabdariffa* L.) calyx and flower extracts (Barreto *et al.*, 2008; Al-Nasrawi, 2013; Alabi *et al.*, 2017). Dried red calyx of *Hibiscus Sabdariffa* is used as traditional medicine for its diuretic, hypocholesterolemic antihypertensive and mucolytic effects (Promphob *et al.*, 2006 cited in Azara *et al.*, 2013). It is composed of anthocyanin (red pigment presented in the flowers), aids digestion, promotes kidney function, improves cardiovascular health and helps reduce fever (Fasoyiro *et al.*, 2005). 100 g of fresh calyx contains 49 Calories, 84.5 % H₂O, 1.9 g protein, 0.1 g fat, 12.3 g total carbohydrate, 2.3 g fibre, 1.2 g ash, 1.72 mg Ca, 57 mg P, 2.9 mg Fe, 300 µg β-carotene equivalent and 14 mg ascorbic acid (Duke and Atchley, 1984). It also contains tannins (17 %), saponins (0.96 %), phenols (1.10 %), glycosides (0.13 %), alkaloids (2.14 %), flavonoids (20.08 %), protocatechuric acid, and anthocyanins (Okereke *et al.*, 2015). When orally administered to broiler chicken, highest weight gain and optimal FCR were obtained by boiling 4 g of the calyx in 1 L of water for 30 minutes (Awodola-Peters *et al.*, 2015a). It is believed that a more potent additive could be obtained by combining this extract with extracts of garlic or ginger or their mixtures. Hence, this study was designed to determine the effect of oral administration of garlic, ginger and roselle extracts on the haemato-biochemical profile of broiler chicken.

Materials and Methods

This study was conducted at the Poultry Unit of the Department of Animal Production Teaching and Research Farm, Federal University of Technology, Minna, Niger State. Minna is located within latitude 9° 30' North and longitude 6° 33' East of the equator. The mean annual rainfall is between 1200 - 1300 mm, while temperature varies between 38°C to 47°C. The characteristic vegetation in Minna is Southern Guinea Savanna Zone (Post Graduate School Prospectus, Federal University of Technology, Minna, 2012).

The test ingredients, roselle, ginger and garlic, as well as the other feed ingredients, were purchased at the Kure Central Market, Minna. Roselle was oven dried, ground into smooth powder and stored in an air tight container. The ginger and garlic were peeled, oven dried for a period of 24 hrs (a day) at a temperature of 106 °C and also ground into smooth powder and stored separately in air tight containers. Starter phase ration, which contained 24 % CP and an energy level of about 3000 Kcal/Kg ME and finisher phase ration which contained 20 % CP and an energy level of about 3000 Kcal/Kg ME were made available to the birds (Table 1). Five experimental treatments were administered to the birds from starter phase (2 - 4 weeks) to finisher phase (5 - 8 weeks). T₁ was the control treatment containing 100 % water and no plant extracts; T₂ was 4 g of roselle per 1 litre of water; T₃ was 4 g of roselle and 4 g of ginger per 1 litre of water; T₄ was 4 g of roselle and 2 g of garlic per 1 litre of water and T₅ was 4 g of roselle, 4 g of ginger and 2 g of garlic per 1 litre of water. The treatments were prepared daily by adding all the required ingredients in water, boiling them for 30 minutes and sieving after cooling, before serving the drinks to the birds.

Table 1 Composition of the experimental diets fed to the birds at both the starter and finisher phases

Ingredients (%)	Starter phase	Finisher phase
Maize	48.90	49.90
Groundnut cake	37.00	31.00
Maize offal	5.00	10.00
Fish meal	2.00	2.00
Bone meal	3.00	3.00
Limestone	1.00	1.00
Palm oil	2.00	2.00
Lysine	0.25	0.25
Methionine	0.25	0.25
Salt	0.30	0.30
*Premix	0.30	0.30
Total	100	100
CALCULATED VALUES		
ME (kcal/kg)	2912	2888
Crude protein (%)	23.79	20.73

*Premix per kg supplied: vitamin A 12,500,000.00IU, vitamin D₃ 2,500,000.00IU, vitamin E 40,000.00mg, vitamin K₃ 2,000.00mg, vitamin B₁ 3,000.0 mg, vitamin B₂ 5,500.00mg, Niacin 55,000.00mg, pantothenate 11,500.00mg, vitamin B₆ 5,000.00mg, vitamin B₁₂ 25.00mg, chlorine chloride 500,000.00mg, folic acid 1,000.00mg, biotin 80.00mg, manganese 120,000.00mg, iron 100,000.00mg, zinc 80,000.00mg, copper 8,500.00mg, iodine 1,500.00mg, cobalt 300.00mg, selenium 120.00mg, anti-oxidant 120,000.00mg

A total 200 unsexed day-old broiler chicks were purchased from Chi Farms Ibadan, Oyo State. The birds were acclimatized for a week before they were randomly allotted to the five treatments (T₁- T₅), with four replicates per treatment, and each replicate made up of 10 birds. The birds were housed in pens and reared intensively using the deep litter system. They were then fed the experimental diets and served drinking water according to the treatments *ad libitum*. Charcoal pots served as source of heat, with the birds closely monitored morning and evening. The birds were also vaccinated using the appropriate vaccination schedule as recommended by the Nigerian Institute of Animal Science (NIAS) for this region.

On the 56th day of the experiment, blood samples were collected randomly from two birds per replicate. The birds were kept off-feed for about 12 hours before the blood collection. Blood samples were collected via the branchial wing vein using sterile hypodermic needles and syringes (Onu and Aniebo 2011). Blood samples for haematological parameters were collected into well-labelled and sterilized bottles containing anti-coagulant (EDTA - ethylene diamine tetra-acetic acid). The analysis was carried out using the Abacus 380 haematological machine. Blood samples for biochemical indices were collected into the other sample bottles without the anti-coagulant, and the analysis carried out using the clinical procedures as outlined by Jain (2000). All data collected were subjected to one way analysis of variance (ANOVA) of the completely randomized design model, using Statistical Analysis System. Where differences occurred ($P < 0.05$), the means were separated using the Duncan Multiple Range Test (SAS, 2011).

Results and Discussion

Results of the effect of roselle, garlic and ginger extracts on the haematology and serum biochemistry of broiler chickens are presented in Table 2 and Table 3 respectively. Results indicate that the packed cell volume (PCV) for the birds administered the roselle calyx extracts alone (T_2) was significantly ($P < 0.05$) lower than those administered roselle calyx combined with ginger and garlic extracts, though not significantly ($P < 0.05$) different from the Control diet. White blood cell count were significantly ($P < 0.05$) higher for treatment T_4 and T_5 than for treatment T_2 and T_3 , though not significantly ($P > 0.5$) different from the Control diet. This result is similar to what was obtained by Al-Nasrawi (2013) when he evaluated roselle flower as a feed additive at 0.25, 0.50, 0.75 and 1.0 % inclusion levels in the diet of broiler chickens. PCV, RBC and WBC were increased significantly ($P < 0.05$) as the level of roselle increased in the diet. Awodola-Peters *et al.*, (2015b) determined the effect of anthocyanin and

Table 1 Effect of roselle (*Hibiscus sabdariffa*) calyx, ginger (*Zingiber officinale*) and garlic (*Allium sativum*) extracts on the haematological parameters of broiler chickens

Parameters	T_1	T_2	T_3	T_4	T_5	$\pm$ SEM
Packed Cell Volume (%)	37.60 ^a	32.25 ^b	38.60 ^a	38.15 ^a	37.10 ^a	0.88*
Haemoglobin (g/L)	13.50	11.20	13.90	13.05	12.20	0.42 ^{NS}
Red Blood Cell ($\times 10^9/L$)	3.45	4.45	3.50	3.20	4.20	0.22 ^{NS}
White Blood Cell ($\times 10^6/L$)	29.30 ^a	24.65 ^b	23.86 ^b	27.05 ^{ab}	25.30 ^{ab}	0.77*

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

NS: not significant, SEM: standard error of mean, T_1 : Normal water (Control), T_2 : Roselle extracts (*Zobo*) (4grams) drinks, T_3 : Roselle extracts (*Zobo*) (4grams) + Ginger (4 grams) drinks, T_4 : Roselle extracts (*Zobo*) (4grams) + Garlic (2 grams) drinks, T_5 : Roselle extracts (*Zobo*) (4grams) + Ginger (4 grams) + Garlic (2 grams).

Table 2 Effect of roselle (*Hibiscus sabdariffa*) calyx, ginger (*Zingiber officinale*) and garlic (*Allium sativum*) extracts on the serum biochemical parameters of broiler chickens

Parameters	T_1	T_2	T_3	T_4	T_5	$\pm$ SEM
Total bilirubin	14.70 ^b	17.16 ^{ab}	15.95 ^{ab}	12.60 ^b	17.50 ^a	0.72*
Conjugated bilirubin	11.14	11.60	10.55	11.80	13.75	0.49NS
Alkaline phosphatase	45.50 ^c	58.00 ^{ab}	62.10 ^a	53.50 ^{bc}	65.00 ^a	2.41*
AST (SGOT)	26.00	30.00	29.00	31.00	32.00	1.19NS
ALT (SGPT)	37.50 ^b	52.00 ^a	50.00 ^a	52.50 ^a	54.00 ^a	2.23*
Total protein	2.25	3.00	2.15	2.45	2.45	0.20NS

^{a,b,c} Means with different superscript differ significantly ($P < 0.05$).

NS: not significant, SEM: standard error of mean, T_1 : Normal water (Control), T_2 : Roselle extracts (*Zobo*) (4grams) drinks, T_3 : Roselle extracts (*Zobo*) (4grams) + Ginger (4 grams) drinks, T_4 : Roselle extracts (*Zobo*) (4grams) + Garlic (2 grams) drinks, T_5 : Roselle extracts (*Zobo*) (4grams) + Ginger (4 grams) + Garlic (2 grams) drinks, AST: Aspartate amino transferase, ALT: Alanine amino transferase.

ascorbic acid (vitamin C) in graded levels of the red variety of roselle calyx extract on haematological indices and serum biochemistry of broiler chickens and found that PCV, RBC and haemoglobin concentration showed no significant difference in the values obtained among the treatment means. However, there was statistical difference in the values obtained for WBC and neutrophils. The authors concluded that anthocyanin and ascorbic acid present in the aqueous extract boosted immunity and fought infections, hence the significant values of the WBC. This could be true in this study. After all, anthocyanin and protocatechiuc acid, have been proved to have diuretic and cholertic effects, decreasing the viscosity of the blood, reducing blood pressure and stimulating intestinal peristalsis (Ali and Salih, 1991). Also, roselle calyx, ginger and garlic extracts had effect ($p < 0.05$) on the total bilirubin level where T_5 , T_3 and T_2 had significantly ($P < 0.05$) higher bilirubin level than the other treatments. Similar trend was also observed for alkaline phosphatase and ALT among the treatments. This result is similar to what was obtained by Awodola-Peters *et al.*, (2015b). Though total protein, albumin and AST showed no significant ($P > 0.05$) difference, globulin and ALT were significantly ($P < 0.05$) different among the treatments, indicating improvement in the immune status of the birds.

Conclusion and Recommendations

Oral administration of 4 g roselle + 4 g ginger + 2 g garlic per litre of drinking water, after boiling for 30 minutes, optimized the haematoogical characteristics and serum biochemical profile of broiler chicken. Hence, it is recommended to broiler chicken farmers to enable them attain optimum health of their birds.

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