HAEMATOLOGICAL AND BIOCHEMICAL INDICES OF BROILER CHICKENS FED GINGER (*ZINGIBER OFFICINALE*) BASED DIETS

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ABSTRACT

An experiment was conducted using 150 day-old broiler chicks (Anak 2000 strain) to determine the effect of feeding graded levels of ginger-based diets on their haematology and serum biochemical indices. Five (5) experimental diets containing 0, 2, 4, 6 and 8% ginger designated as T_1, T_2, T_3, T_4 and T_5 respectively, were formulated and fed to the birds for a period of 8 weeks. Diet T_1 served as the control. Haematology and serum biochemical assays were carried out at the end of the experiment. Proximate analysis of the test ingredient (ginger) showed that it is composed of crude protein (5.84%), crude fibre (2.9%), ether extract (1.35%), ash (1.79%) and nitrogen free extract (88.10%). Results showed that the serum cholesterol content of the birds (range of 105.72 to 123.61mg/dl) significantly ($P< 0.05$) declined with increasing percentage inclusion of ginger in the diets, while creatinine and urea contents increased simultaneously with increased percentage ginger inclusion. Birds on T_5 had significantly ($P<0.05$) highest serum cholesterol, glucose and creatinine content, but least in serum total protein and globulin content. All haematological indices of the birds were not significantly ($P>0.05$) affected by dietary treatments. The research confirmed the hypo-cholesterol action of ginger on broiler chickens. It was concluded that ginger can be included up to 6% in the diet of broiler chickens without compromising their physiological status.

Keywords: Chickens, ginger, Haematology, Serum Biochemistry

INTRODUCTION

Following the ban on the use of antibiotic growth promoters due to their perceived danger of causing drug-resistance in animals as well as in man (Botsoglou and Fletouris, 2001; Moser, *et al.*,2003), the quest for use of naturally occurring substances has gained prominence in the livestock industry. Previous studies (Oyekunle and Owonikoko, 2002; Descheper *et al.*, 2003; Bamidele and Adejumo, 2012) have focused on the implicit advantages of spices, herbs, enzymes, acids and hormones on immune function, growth and physiology of farm animals. To this end, phytogenic feed additives like ginger, garlic, curry, thyme, fennel, *etc* have been incorporated into the diets of farm animals to enhance both their productivity and quality of their products. Nasiroleslami and Torki (2010) reported that the inclusion of ginger essential oil in the diets of laying hens improved their egg shell weight and thickness. Bamidele and Adejumo (2012) in their study using garlic and ginger mixture in the diet of pullets reported optimum performances in terms of total cholesterol

and LDL cholesterol at 1% garlic and 0.5% ginger mixture. Similarly, Mohamed *et al.* (2012) showed from their research that the body weight, weight gain and feed conversion ratio of broiler birds were enhanced at 0.1 and 0.2% inclusion of ginger in their diet. According to Martins *et al.* (2001), in Mohamed *et al.* (2012), "plant active principles are chemical compounds present in the plant that confer on them therapeutic activity or beneficial effects". Active principles in ginger (*Zingiber officinale*) have been identified to include shogaol, gingerol, zingiberene and zingirone (Malhotra and Singh, 2003). Ginger has been valued since ancient times as a spice and ethno-medicinal herb. This herb has been reported to possess anti-oxidative, anti-inflammatory, anti-emetic and hypolipidemic properties (Katiyar *et al.*, 1996; Zhang *et al.*, 2009). Cryo-protective, anti-ulcerogenic, anti-bacterial and anti-viral effects of ginger have been demonstrated in rats, rabbits and broiler chickens (al-Yahya *et al.*1989; Denyar *et al.*, 1994; Mohamed *et al.*, 2012). Given the foregoing benefits on the use of ginger, it becomes imperative to research into the use of this plant product in broiler diets, by evaluating its effect on the physiological status of the birds. The objectives of this study were to evaluate the haematological and biochemical characteristics of broiler chickens fed different levels of ginger diets.

Materials and Methods

The study was carried out at the Poultry Unit of the Teaching and Research Farm, University of Calabar, Nigeria. One hundred and fifty (150) broiler day-old chicks (*Anak 2000*) were purchased from a reputable hatchery and used for the study. Fresh ginger rhizomes were procured, washed and sun-dried for 7 days before being ground for experimental diet formulation. Five (5) experimental diets were formulated containing ginger at 0, 2, 4, 6 and 8% designated as T_1, T_2, T_3, T_4 and T_5, respectively. Treatment 1 (T_1) served as the control with 0% ginger inclusion. Proximate composition (Table 1) of ginger and the experimental diets were analyzed according to A.O.A.C. (1990) procedures. Each treatment group had 3 replicates with 10 birds per replicate. They were raised in a deep litter house. Feed and water were given *ad libitum*. Vaccine and drugs were administered accordingly.

Table 1: Proximate composition of experimental diets and ginger

Composition (%)	T1	T2	T3	T4	T5	Ginger
Crude protein	22.6	23.2	22.33	22.09	23.07	5.84
Ether extract	4.5	3.94	5.46	5.34	4.03	1.35
Crude fibre	4.24	4.17	4.05	4.18	4.15	2.92
Ash	10.22	9.94	8.82	9.1	8.6	1.79
NFE	41.56	59.74	59.34	59.29	60.33	88.1

NFE = Nitrogen free extract

On the 56th day of the experiment, three birds were randomly picked from each treatment replicate for the purpose of blood collection. The birds were starved for 12 hours and blood samples were collected with the aid of needle and syringe from the wing vein of the selected birds. Replicate blood samples from each selected chicken were immediately transferred into a set of sterile bottles, with and without anti-coagulant (EDTA) for assessment of haematological and serum biochemical indices of the birds respectively.

Haematological parameters like red and white blood cells were determined using haemocytometer method, Packed Cell Volume (PCV) and Haemoglobin Concentrations using Winthrobe's microhaematocrit and cyanohaemoglobin methods respectively (Ghai, 1993). Serum biochemical assays were carried out using the procedure described by Coles (1986) and Wotton (1964).

The study applied a completely randomized design. The data was subjected to one-way Analysis of Variance using SAS (2010). Significant differences between means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS

Proximate composition of the test ingredient (ginger) and experimental diets are as presented in Table 1. Results showed that ginger contains crude protein of 5.84%, ether extract of 1.35%, crude fibre of 2.9%, ash of 1.79% and nitrogen free extract of 88.10%.

Results of the serum biochemical characteristics of the birds are shown in Table 2. Significant ($P<0.05$) differences were recorded among dietary treatments in all parameters except albumin and calcium. Total protein content of birds fed T_1, T_3 and T_4 (range 2.79 – 2.83 g/ dl) were slightly higher than those fed T_2 (2.74 g/dl). Birds fed T_5 exhibited the least value (2.09g/dl) of total protein content. Globulin value for birds fed T_2, T_3 and T_4 were statistically ($P>0.05$) similar to those of the control group (T_1 0.90 – 0.92 g/dl). Birds fed T_5 were however significantly ($P<0.05$) lower in serum globulin content (0.69 g/dl) than the others. Nevertheless, glucose content was highest for birds fed T_5 diet (2.08g/dl), though not different from those on T_1 and T_2.

Creatinine content of the birds increased with percentage increment in dietary test ingredient. Birds on T_5 recorded the highest value (2.54 mg/dl). Urea content also increased marginally with increasing quantity of ginger in the diets. Birds on T_1, T_2, T_3 differed significantly ($P<0.05$) from those fed T4 and T_5 in relation to calcium, albumin and serum cholesterol values. Serum cholesterol values of the birds differed significantly ($P<0.05$) among dietary treatments, with birds on T_1, T_2 and T_3 being superior to those on T_4 and T_5.

Table 3 shows the haematological characteristics of the birds. There were no significant differences ($P>0.05$) among treatment groups in all the haematological indices.

Table 2: Serum biochemical characteristics of broiler chickens (at 8 weeks) fed graded levels of ginger

Parameter/unit	T1	T2	T3	T4	T5	SEM
Total protein (g/dl)	2.83^{a}	2.74^{ab}	2.80^{a}	2.79^{a}	2.09^{c}	0.12
Cholesterol (mg/dl)	123.61^{a}	119.25^{a}	120.10^{a}	112.45^{b}	105.72^{b}	2.25
Albumin (g/dl)	1.87	1.81	1.85	1.84	1.38	0.08
Glucose (g/dl)	1.87^{a}	1.95^{a}	1.83^{b}	1.85^{ab}	2.08	0.03
Globulin (g/dl)	0.93^{a}	0.90^{a}	0.92^{a}	0.92^{a}	0.69^{b}	0.03
Creatinine (mg/dl)	0.51^{b}	0.85^{b}	0.85^{b}	1.35^{b}	2.54^{a}	0.31
Urea (mg/dl)	24.45^{b}	31.50^{b}	30.50^{b}	38.91^{a}	47.50^{a}	3.35
Calcium (mg/dl)	11.9	11.85	11.81	11.93	11.88	0.27

^{ab}Means on the same row with different superscripts are significantly different (P<0.05)

Table 3: Haematological characteristics of broiler chickens (8 weeks) fed ginger based diets

Parameter/unit	T1	T2	T3	T4	T5	SEM
PCV (%)	25.5	27.5	25.5	26	23.75	0.49
Hb (g/dl)	8.1	9.15	8.6	8.25	7.25	0.26
WBC (x10 /l)	2.85	3.25	2.95	4.25	2.35	0.34
RBC (X10 /L)	2.8	3	2.7	2.75	2.45	0.08
MCH (pg)	28.93	30.5	31.27	30.04	29.61	0.32
Plt (x10 /l)	368	283	215	210.5	484.5	40.95
MCV (fl)	91.07	91.66	92.82	94.82	90.83	0.87
MCHC (%)	31.77	33.27	33.68	31.74	32.59	0.33

PCV = Packed Cell Volume
WBC = White Blood Cell
RBC = Red Blood Cell
Hb = Haemoglobin
MCH = Mean Corpuscular Haemoglobin
Plt = Platelet
MCV = Mean Corpuscular Volume
SEM = Standard Error of Mean
MCHC = Mean Corpuscular Haemoglobin Concentration

DISCUSSION

The crude protein content of ginger used in the present study (5.85%) is comparable with 5.85% earlier reported by Ademola *et al.* (2009). Similarly, ether extract, crude fibre and nitrogen free extract values recorded in this experiment (1.35, 2.92 and 88.10% respectively) are in agreement with the values (1.35, 2.93 and 87.39% respectively) earlier reported by the authors. Ash content of the ginger in this study (1.79%) was however, lower than 2.29% reported by Ademola *et al.* (2009). The values for serum biochemical parameters recorded in this research were within normal ranges for broiler chickens (Mitruka and Rawnsley, 1977). This implies that the birds fed ginger diets were not compromised healthwise and the haematopoietic processes were not adversely affected by dietary treatments.

Inclusion of ginger up to 8% in the diet of the chickens significantly ($P<0.05$) lowered their serum total protein relative to the control. Birds fed diet T_5 recorded the lowest total protein and globulin values, suggesting inferiority of the diet in protein balance in comparison with the other treatment diets. More so, Eggum (1980) reported that "the lower the serum total protein value, the less the quality of protein of the test feed stuff."

Statistical similarity among T_1, T_2 ,T_3 and T_4 in the total protein content signifies the adequacy of the diets for the chicks. Nasiroleslami and Torki (2010) reported an insignificant effect ginger essential oil on the total protein of laying hens. Equally, Mohamed *et al.* (2012) who fed diets containing 0.1 and 0.2 % ginger to broilers observed no difference among ginger treated groups and the control, with respect to their serum total protein, in contrast to the present research finding. Birds on T_3 and T_4 had significantly ($P<0.05$) lower serum glucose values than the other groups. This finding is in agreement with the reports of Al-Homidan (2005), Ademola *et al.* (2009) and Mohamed *et al.* (2012) who observed significant decrease in blood serum glucose of chickens fed diets containing up to 6% ginger.

In line with the findings of the present research, several authors have reported significant decrease in serum cholesterol content of chicken fed diets containing up to 6% ginger (Ademola *et al.*, 2009; Bamidele and Adejumo, 2012; Mohamed *et al.*2012). The significant increment in serum urea value with increment in ginger inclusion level suggests a catabolism of muscle tissues (Adeyemo and Sani, 2013). This means that above 4% ginger inclusion, the bird's body tissue reserves were compromised for survival.

Levels of dietary test ingredient inclusion did not significantly ($P<0.05$) affect all the haematological parameters studied. Packed Cell Volume (PCV) of bird's fed T_1 T_2 T_3 and T_4 were within the normal range (26 – 45.20%) for adult chicken as stipulated by Mitruka and Rawnsley (1977). Correspondingly, the White Blood Cell (WBC) counts were within the normal range (Mitruka and Rawnsley, 1977) indicating that there was no adverse immune response due to the test ingredient. Bamidele and Adejumo (2012) recorded PCV and haemoglobin ranges of 18-27.50 and 5.98-9.22 g/dl respectively, which agrees with the present study findings. The non-significant effect of

feeding ginger diets on haematological indices of broiler chickens recorded in this research is in tandem with the observation of Ademola *et al.* (2004). Slight variation among treatment groups in haemoglobin count obtained in this experiment affirms the fact that diets affect the blood profile of chickens (Adeyemo and Sani, 2013).

CONCLUSION

This research established that ginger can be included up to 6% in the diets of broiler chickens without compromising their biochemical and physiological status. Furthermore, the research confirmed the hypo-cholesterol inducing action of ginger, given the corresponding reduction in serum cholesterol levels with increasing ginger content of the diets.

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