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Effect of Aqueous Extract of Ginger (*Zingiber officinale*) on Blood Biochemistry Parameters of Broiler

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Abstract: This study was carried out at the Poultry of Animal Resource, College of Agriculture, University of Tikrit. The present study was conducted to explore the usage of different levels of aqueous extract of ginger at concentration of 0.4 and 0.6% respectively supplemented to drinking water on the Physiological Performance and Lipid Profile of the Broiler Chickens. One hundred and eighty of 3 weeks old broiler chicks (ROSS) raised to 6 weeks of age. The birds were distributed into 3 treatment groups with three replicates per treatment (20 birds per treatment). Aqueous extract of ginger was the rate 0.4 and 0.6% with water offered to treatments T_2 and T_3 respectively while treatment one served as control. The result of the physiological parameter showed significant difference between treatments. However glucose and uric acid level showed a significant differences ($p<0.05$) between T_2 (0.4% ginger extract) and T_3 (0.6% ginger extract) and control. The total protein, Albumin and Globulin were not differ significantly between the treatment groups. Serum HDL-cholesterol, LDL-cholesterol and VLDL-cholesterol level revealed no significant ($p>0.05$) difference between treatments but serum cholesterol level was a significantly lower in the 0.4 and 0.6% aqueous extract of ginger ($p<0.05$) than control. Findings of the research study indicated that groups receiving ginger infusion at the rate 0.4 and 0.6% of drinking water showed better physiological performance and lipid profiles in broiler.

Key words: Ginger extract, plasma, lipids, broiler

INTRODUCTION

Ginger is an underground rhizome of plant *Zingiber Officinale* belonging to the family *Zingibeaceae* and now, it is considered a common constituent of diet worldwide (Sertie' *et al*., 1991). Moreover, ginger is well known all over the world especially for its use in disorders of the gastrointestinal tract such as constipation, dyspepsia, nausea and vomiting (Tanabe *et al*., 1993). It was reported that ginger has medicinal properties against digestive disorders, rheumatism and diabetes (Afzal *et al*., 2001). Ginger extract possesses antioxidative characteristic, since it can scavenge superoxide anion and hydroxyl radicals (Krishnakantha and Lokesh, 1993). Akhani *et al*. (2004) reported that ginger pretreatment inhibited the induced hyperglycemia and hypoinsulinaemia. Other investigators (Sharma *et al*., 1996) have showed that the hypolipidemic effect of ginger.

In addition, phytochemical reports have shown that the main constituents of ginger are Gingerol, Shagaols, Zingerone and Paradol. It was reported that 6-gingerol and 6-shogaol are the major Gingerol and Shogaol present in the rhizome (Comell and McLachlan, 1972). Sharma and Shukla (1997) reported a significant blood glucose lowering effect of ginger juice in diabetic and non-diabetic animals. In addition, Ahmed and Sharma (1997) reported a significant hypoglycemic activity in rats after administration of ginger extract. Akhani *et al*. (2004) reported that ginger pretreatment inhibited streptozotocin hyperglycemia and hypoinsulinaemia. Furthermore, Bhandari and Grover (1998) reported the blood glucose and blood urea ware lowered after administration of ethanolic extract of ginger in diabetic rats. Ginger acts as a hypolipidaemic agent in cholesterol-fed rabbits (Bhandari *et al*., 1998). Akhani *et al*. (2004) reported that ginger treatment significantly decreased both serum cholesterol and triglycerides. In addition, Fuhrman *et al*. (2000) reported that ginger decreased LDL-cholesterol, VLDL-cholesterol and triglycerides levels in apolipoprotein-E deficient mice.

Furthermore, Bhandari *et al*. (1998) have reported that an ethanolic extract of ginger prevent hypercholesterolemia and development of atherosclerosis in cholesterol fed rabbits. Bhandari *et al*. (2005) found that, the ethanolic extract of ginger significantly reduced serum total cholesterol and triglycerides and increased the HDL-cholesterol levels; also, the extract can protect tissues from lipid peroxidation and exhibit a significant lipid lowering activity in diabetic rats.

Keeping in view the significant important of ginger this research study was conducted to investigate the effect of ginger on the blood biochemistry parameters of broiler.

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MATERIALS AND METHODS

The experiment was executed as a complete randomized design. One hundred and eighty of 3 weeks old broiler chicks(ROSS) to 6 weeks of age. Upon arrival chicks were randomly assigned to 9 different pens. Three treatments were applied, each treatment consisted of three replicates and 20 broilers per replicate. The experiment was conducted over a period of 42 day with performance evaluation. The Feed Conversion Ratio (FCR) for each pen was calculated from body weight gain and feed intake.

Chicks were fed a corn-soyabean based starter and finisher diets, fortified with minerals and vitamins (Table 1). The basal diet was mixed as a single batch to reduce diet variability after which the respective feed additive were added to create the different treatments. The concentrations in the ginger extract calculated for (Harborn, 1973) (v/v).

Table 1: Composition of the broiler diet (for 100 kg feed)

Ingredients	Starter	Finisher
Corn	48.20	58.70
Wheat	8.00	7.50
Soybean meal (40%)	28.50	20.50
Protein concentration (50%)	10.00	10.00
Vegetable oil	4.00	2.50
Salt	1.00	0.50
Vit + Min mix*	0.30	0.30
Total	100.00%	100.00%
Calculated composition**		
ME (kcal/kg)	3079.00	3102.60
Crude protein	22.06	19.37
Lys.	1.21	1.03
Meth + Cyc.	0.82	0.75
Ca (%)	1.2	0.95
P (%)	0.44	0.42

*Vitamins and minerals mixture provide per kilogram of diet: Vitamin A (as all-trans-retinly acetate); 12000 IU; vitamin E; 10 IU; k3 3 mg; Vit. D3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate, 10 mg; niacin, 20 mg; choline chloride, 500 mg; vitamin B12, 10 Ug; vitamin B6, 105 mg; thiamine (as thiamine mononitrate), 2.2 mg; folicacid, 1 mg; D-biotin, 50 ug. Trace mineral (milligrams perkilogram of diet): Mn, 55; Zn, 50; Fe, 30; Cu, 10; Se, 1 and Ethoxyquin 3 mg. **Calculated composition was according to NRC (1994)

The treatments were as follows:

Treatment 1: Control (no additive)

Treatment 2: Add 0.4% from aqueous extract of ginger to water drinking.

Treatment 3: Add 0.6% from aqueous extract of ginger to water drinking.

At the end of the treatments, three birds from each replicate (9 per treatment), were slaughtered Blood samples collected from six birds(2 birds for replicate) randomly picked up for slaughter from each treatment group were allowed to clot and centrifuged for 20 min at 1500 rpm to separate the serum. The serum samples were stored at -20^{0}C for the analysis of serum glucose (Coles, 1986), total protein (Wotton, 1964), uric acid (Trinder, 1969), total cholesterol, HDL cholesterol, LDL cholesterol, albumin, globulin and triglycerides (Franey and Elias, 1986).

All data were analyzed using the CRD (Completely Randomized Design) of (SAS, 1992). Duncan's multiple range tests were used to compare differences among treatment means (Duncan, 1955).

RESULTS

The result in Table 2 showed significant difference ($p<0.05$) between treatments indicating that ginger extract eater influenced the values of the parameters. However blood glucose and uric acid level showed a significant differences ($p<0.05$) between T_2 and T_3 and control. The total protein, Albumin and Globulin were not significantly reduced ($p>0.05$) in the blood of the broiler before adding the ginger extract to drinking water between the treatment groups.

The mean serum cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol and VLDL-cholesterol of broilers as influenced by dietary inclusion of ginger extract are presented in Table 3. Analyses of variance of data on serum HDL-cholesterol and VLDL-cholesterol level revealed no significant ($p>0.05$) difference between treatments. However, the results showed a low significantly ($p<0.05$) in LDL-cholesterol between treatments. The serum biochemical parameters in all treatment groups were lower as compared to control.

Table 2: Effect of aqueous extract of Ginger to blood biochemistry parameters of broiler

Parameters	T_1 (Control)	T_2 (0.4% ginger extract)	T_3 (0.6% ginger extract)
Glucose (mg/dl)	348.53±11.42^{a}	272.50±12.38^{b}	259.43±12.48^{b}
Total protein (g/dl)	7.14±0.33^{a}	7.28±0.17^{a}	7.04±0.22^{a}
Albumin (g/dl)	4.20±0.32^{a}	4.11±0.22^{a}	4.47±0.29^{a}
Globulin (g/dl)	2.94±0.54^{a}	3.17±0.37^{a}	2.57±0.20^{a}
Uric acid (mg/dl)	57.55±4.05^{a}	53.21±2.17^{b}	52.12±2.48^{b}

^{ab}Means within same row with different superscripts are significantly different ($p<0.05$)

Table 3: Effect of aqueous extract of Ginger to lipid profile parameters of broiler

Parameters	T_1 (Control)	T_2 (0.4% ginger extract)	T_3 (0.6% ginger extract)
Cholesterol (mg/dl)	143.70±5.30^{a}	105.53±7.93^{b}	105.42±10.15^{b}
Triglyceride (mg/dl)	108.32±13.78^{a}	105.53±12.87^{ab}	101.05±15.79^{b}
HDL-Cholesterol (mg/dl)	68.53±5.21^{a}	69.23±3.72^{a}	71.32±2.15^{a}
LDL-Cholesterol (mg/dl)	54.50±4.05^{a}	28.23±2.72^{a}	17.50±1.77^{a}
VLDL-Cholesterol (mg/dl)	20.66±2.75^{a}	21.10±2.57^{a}	23.70±2.90^{a}

^{ab}Means within same row with different superscripts are significantly different ($p<0.05$)

But, serum cholesterol level showed significant difference ($p<0.05$) between the treatments. Linear decrease in thigh serum cholesterol and triglycerides was observed in treatment T_2 and T_3 from 0.4 and 0.6% ginger extract. The mean thigh serum cholesterol of these groups were significantly ($p<0.05$) lower than control.

DISCUSSION

In this work we have studied the effect of aqueous extract of ginger on blood glucose and lipid profile in the broiler through 42 days of treatment. To examine these effects the levels of plasma glucose, cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol and uric acid were determined.

In the present study we found that, ginger, extract to the broiler reduced the plasma glucose and uric acid. These results are in agreement with the study of Akhani *et al.* (2004), who found that a ginger extract significantly decreased the blood glucose level and increased the insulin level. Kar *et al.* (1999) reported that, the inorganic part of a medicinal plant contains mainly mineral elements, which are responsible for the hypoglycemic activity. In support of this view, a number of essential minerals (Ca, Zn, K, Mn and Cr), are known to be associated with the mechanisms of insulin release and its activity in different animals and in human beings (Castro, 1998).

In the present study, the ginger extract caused reduction in the levels of plasma cholesterol, triglycerides, LDL-Cholesterol and VLDL-Cholesterol but HDL-cholesterol level statistically increased. On the other hand, the treatment with ginger extract followed by induction of diabetes caused reduction in the plasma levels of cholesterol and LDL-cholesterol and increased the level of plasma HDL-cholesterol, but plasma triglycerides statistically did not change. These findings are in agreement with previous studies as Bhandari *et al.* (2005) revealed that ethanolic extract of ginger produced significant decrease in serum total cholesterol and triglycerides levels and increased HDL-cholesterol level as compared to rats and the extract exhibit a significant lipid lowering activity and protect the tissues from lipid peroxidation.

Furthermore, Fuhrman *et al.* (2000) reported that ethanolic extract of ginger reduced plasma cholesterol and inhibited LDL oxidation in atherosclerotic, apolipoprotein E-deficient mice. It was concluded that (E)-8 beta, 17-epoxyllabed-12-ene-15, 16-dial, a compound isolated from ginger, interfered with cholesterol biosynthesis in liver homogenates of hypercholesterolaemic mice causing its reduction (Tanabe *et al.*, 1993).

Srinivasan and Sambaiah (1991) reported that feeding rats with ginger significantly elevated the activity of hepatic cholesterol 7-alpha-hydroxylase which is a rate-limiting enzyme in the biosynthesis of the bile acids and stimulates the conversion of cholesterol to bile acids leading to the excretion of cholesterol from the body. In support of this view, the study of Bhandari *et al.* (1998) revealed that posttreatment with ginger extract to the cholesterol-fed rabbits for 70 days resulted in less marked hyperlipidaemic when compared to the pathogenic rats. Furthermore, Neess *et al.* (1996) reported that the reduction of cellular cholesterol biosynthesis is associated with increased activity of the LDL receptor, which in turn leads to enhanced removal of LDL from plasma, resulting in reduced plasma cholesterol concentration.

In the study of Bruan and Severson (1992) it was concluded that deficiency of lipoprotein lipase activity may contribute significantly to the elevation of triglycerides in diabetes. Furthermore, Lopes-Virella (1983) reported that treatment of diabetes with insulin served to lower plasma triglycerides levels by returning lipoprotein lipase levels to normal. In the present study the decreasing levels of plasma triglycerides following the treatment with ginger extract may due to the stimulating effect ginger extract on insulin. In addition, Ajith *et al.* (2007) reported that the presence of polyphenols and flavonoids in ginger extract might be responsible for the antioxidant nephroprotective activities.

Based upon this study, it can be concluded that aqueous extract of ginger can be included beneficially up to 0.4 and 0.6% in the broiler drinking water for reducing blood glucose and serum cholesterol level.

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