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EFFECT OF LICORICE (*Glycyrrhiza glabra*) EXTRACT ON GROWTH PERFORMANCE, CARCASS PARAMETERS AND HEMATOLOGY OF BROILERS

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To study the influence of licorice *(Glycyrrhiza glabra*) extracts on broiler performance, carcass quality parameters and blood profile in broiler. One hundred eighty, day-old broiler chicks were divided in eighteen experimental units (ten chicks each). Six treatments, namely positive control, Feed +Antibiotic (T_1), negative control (T_2) i.e., basal diet without antibiotic growth promoter, Feed +Licorice Extract 10ml/L (T_3), Feed +Licorice Extract 15ml/L (T_4), Feed +Licorice Extract 20ml/L (T_5) and Feed +Licorice Extract 25ml/L (T_6) were basal diet along-with water supplemented with licorice root extract @ 10, 15, 20 and 25 ml/L, respectively. Weekly body weight, feed consumption and mortality (if any) was recorded while feed conversion ratios were calculated for starter, finisher and overall duration. At the completion of trial, one bird/replicate was randomly selected and slaughtered for estimation of carcass parameters. Blood samples were also collected for hemoglobin, hematocrit and serum analysis at the end of study. Data were analyzed with SAS software using general linear model procedure and to compare means Tukey's test was used. A significant increasing trend for feed intake (3428.50), weight gain (2039.34), breast meat yield (279.16), and dressing percentage (58.16) was witnessed with increasing level of licorice root extract compared with controls. Decreasing trend for feed conversion ratio (1.68) and hematocrit (29.34) was observed with increasing licorice root extract. Hemoglobin (14.93) increased with increasing licorice extract but decreased significantly (11.90) at 25 ml/L extract level. It may be concluded that use of licorice root aqueous extract administered in drinking water showed favorable effect on growth and carcass yield in broilers.

Keywords: broiler, carcass parameters, Licorice root extract, production performance.

INTRODUCTION

Improved growth performance has been observed in broilers by the use of antibiotics growth promoters in feed for decades (Dibner and Richards, 2005) however, use of suboptimal doses of antibiotics for the purpose of growth promoters for long term, has been reported to induce antibiotic resistance in various bacterial species (Sacakli *et al*., 2013). Because of increasing worldwide food safety concerns especially related with drug residues in poultry and poultry products, use of antibiotics growth promoters (AGPs) has been banned in poultry feed in European Union since 2006 (European Commission, 2003). These trade regulations highlight new responsibilities for researchers to find safe alternates to AGPs (Patterson and Burkholder, 2003).

Medicinal plants' extracts have been tested to substitute AGPs in poultry production (Windisch *et al*., 2008). Herbal extracts from different plants are under testing for their antimicrobial/growth stimulating abilities. Licorice (*Glycyrrhiza glabra*) is one of the herbal medicine alternatives used worldwide from ancient times (Wang *et al*., 2015). Licorice belongs to family Leguminosae, is frequently grown in Asia and possesses medicinal properties viz. anti-microbial, anti-oxidative (Fukai *et al*., 2002), anti-infective (Nowakowska, 2006) anti-viral (Fiore, 2007), anti-helicobacter (Fukai *et al*., 2002a), anti-fungal (Sato *et al*., 2000) and immunity supportive properties (Fujioka *et al*., 2003).

Licorice also has glucosides having structural homology to steroid hormones present naturally in the body (Kerstens and Dullaart, 1999). Licoriceroot contains glycyrrhizin a compound which is 50 times sweeter than sucrose which can be used as weight loss therapy it also enhances production of stress hormones like hydrocortisone that attributes anti-inflammatory andanti-stress action especially after steroid therapy by adrenal cortex stimulation. Stress induced hypotension reversion by glycyrrhizic acid showing mineralorticoid like mainly due to stimulation of adrenal gland and reducing effects of stress. Glycyrrhizin's structural similarity to corticosteroids which not only show the adrenal hormones but it also stimulates production of adrenal cortex

hormones; which is a candidate drug to enhance cortisone action (Kathleen and Kelly, 2009).

Licorice root extract has boosting effect in poultry also by improving immunity in broiler birds against diseases (Fujioka *et al*., 2003). Salary *et al*. (2014) reported improved growth performance of broilers by supplementing licorice root extract. Jagadeeswaran and Selvasubramanian (2014) reported that HI titre against Newcastle disease was improved in birds received standardized licorice root powder.

Licorice root extract was studied in poultry feed and shown improved performance of broiler birds, but drinking water supplementation is at infancy stage and still needs to be explored. Hypothesis of current study was, therefore, that inclusion of aqueous licorice root extract may improve the production performance, carcass characters and blood hemotology/chemistry of broilers. Current experiment was conducted with the objective to study the effects of licorice root extract on growth performance, carcass characteristics and blood/serum traits in broilers.

MATERIALS AND METHODS

This research was carried out at Poultry Research farm, University of Agriculture, Faisalabad, Sub-Campus Toba Tek Singh. One hundred eighty, day-old broiler chicks (Cobb strain) were randomly distributed into 18 experimental units (10 chicks each). Experimental units were placed in individual pen for 35 days trial period and were kept under similar environmental and management conditions. The birds were given various treatments as shown in Table 1. Licorice roots were collected, dried in shade and grinded. Fifty gram licorice root powder was mixed in one liter of water, boiled for three hours at 80 °C for extract preparation. Animal welfare regulations were taken in to account while rearing birds during this experiment up to 35th day.

Body weight and feed consumption were recorded weekly while weight gain and FCR were calculated at starter (1-21 days), finisher (22-35 days) and overall (1-35 days) duration. At the end of trial (35th day), carcass characteristics were recorded by slaughtering one bird/replicate. Blood samples were collected for hemoglobin, hematocrit, total cholesterol, triglyceride, high and low density lipoprotein estimation. Data were analyzed using general linear model procedure of SAS and means were compared using Tukey's test. (Steel *et al.*, 1997)

RESULTS AND DISCUSSION

Results of the current study showed an increasing trend in feed consumption with increasing level of licorice root extract supplemented in drinking water during starter, finisher and overall trial period (Table 2). Statistical analysis revealed that starter and overall period feed intakes were significantly ($p<0.01$) higher when compared with positive and negative controls. However, finisher period feed intake differed non-significantly from control. Similarly, weight gain increased in dose dependent manner i.e. higher the level of licorice root extract higher the weight gain in all starter, finisher and over

Table 1. Experimental design of the trail.

Group		Replicates	Birds/group	Treatment
T1	Positive control	3	10	Feed +Antibiotic
T2	Negative control	3	10	Feed without antibiotic
T3	Treatment	3	10	Feed +Licorice Extract 10ml/L
T4	Treatment	3	10	Feed +Licorice Extract 15ml/L
T5	Treatment	3	10	Feed +Licorice Extract 20ml/L
T6	Treatment	3	10	Feed +Licorice Extract 25ml/L

Table 2. Growth performance of birds fed licorice root extract during starter, finisher and overall phase of broiler.

Treatments	T1	T2	T3	T4	T5	T6
Starter phase (1-21 days)						
Feed intake (g)	1262.03^{cd}	1235.17^{d}	1280.0^{bc}	1305.17^{ab}	1318.33^{a}	1333.33^{a}
Weight gain (g)	849.82^{e}	846.17^{e}	867.67^{d}	878.69^{c}	889.32^{b}	901.47^{a}
Feed conversion ratio	1.49	1.46	1.48	1.49	1.48	1.48
Finisher phase (22-35 days)						
Feed intake (g)	1983.60	1948.63	2008.20	2056.67	2087.53	2095.17
Weight gain (g)	983.90^{d}	912.79^{e}	999.53^{d}	1060.11^{c}	1101.55^{b}	1137.87^{a}
Feed conversion ratio	2.02^{ab}	2.14^{a}	2.01^{ab}	1.94^{ab}	1.90^{b}	1.84^{b}
Overall period (1-35 days)						
Feed intake (g)	3245.63^{ab}	3183.80^{b}	3288.20^{ab}	3361.83^{ab}	3405.87^{a}	3428.50^{a}
Weight gain (g)	1833.72^{e}	1758.96^{f}	1867.2^{d}	1938.8^{c}	1990.87^{b}	2039.34^{a}
Feed conversion ratio	1.77^{ab}	1.81^{a}	1.76^{ab}	1.73^{ab}	1.71^{ab}	1.68^{b}
Mortality Rate (No.)	13.33	16.67	10.00	6.67	6.67	3.33

^{abcde} Means without a common superscript differ significantly ($p<0.05$) within a row.

trial periods (Table 2). Significantly ($p<0.01$) higher body weight gains were observed in treated groups when compared with positive and negative controls. Feed conversion ratios were found to be statistically non-significant during starter and finisher period while significant in overall production period. The trends during starter and finisher periods were non-specific indicating that birds having better feed intakes have better weight gain and showed better FCR. In overall period feed conversion ratios presented (Table 2) that increasing licorice root extract levels in diet responded in significantly better feed conversion ratios than positive and negative controls.

Significantly higher dressing percentage ($p<0.05$) and breast meat yields ($p<0.05$) were observed while thigh meat yield did not differ significantly in birds receiving licorice root extract. Relative giblet weights i.e. liver, gizzard and heart did not significantly differ from positive and negative controls (Table 3). Abdominal fat pad weight was not statistically affected indicating that addition of licorice root extract has no influence on abdominal fat accumulation in broilers. Blood hematology parameters hemoglobin and hematocrit revealed significantly higher hemoglobin and hematocrit values indicating better health conditions of birds given licorice root extract (Table 4). Blood biochemistry parameters like total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein differed non-significantly from control groups (Table 4).

Feed intake increased with increasing level of licorice root extract supplemented with drinking water during starter, finisher as well as overall trial period. Results showed similar trend as was reported by Safari and Zahedi (2016), Rezaei *et al*. (2014), Salary *et al*. (2014) and Myandoab & Mansoub (2012), who reported higher feed intake in broilers fed diet having 2 g/kg, 0.4%, 0.2-0.4% or 200 ppm *Glycyrrhiza glabra* extract, respectively. Contrary results were reported by Moradi *et al*. (2014) and Sedghi *et al*. (2010) who reported that feed consumption had no effect of licorice extract.

Similarly, weight gains also increased in dose dependent manner. Similar results were reported by Safari and Zahedi (2016), Rezaei *et al*. (2014), Salary *et al*. (2014), Myandoab and Mansoub (2012); and Daraji (2012), who observed higher body weight gain in broilers fed diets/water having 2 g/kg, 0.4%, 0.2-0.4%, 200 ppm or 450 mg/liter licorice extract, respectively. However, Moradi *et al*. (2014) and Sedghi *et al*. (2010) observed contrary results and reported that body weight gain in broilers was not affected significantly by addition of licorice extract.

Feed conversion ratios were found to be statistically non-significant during starter and finisher period while significant feed conversion ratios were observed in overall production period. Review of literature failed to provide supporting findings for better feed conversion ratio however, Safari and Zahedi (2016), Moradi *et al*. (2014) and Rezaei *et al*. (2014) reported that supplementation of licorice root extract failed to show significant effect on feed conversion ratios in broilers.

Dressing percentage and breast meat yield differed significantly while giblet weights and abdominal fat did not differ significantly among various treatments. Al-Daraji (2012) and Myandoab and Mansoub (2012) reported similar findings i.e. dressing percentage was higher in birds fed licorice extract. Non-significant results were reported by Moradi *et al*. (2014) while Rezaei *et al*. (2014) reported lowered abdominal fat, liver and pancreas weights. Reduced abdominal fat was reported by Salary *et al*. (2014) and

Table 3. Slaughter data of broiler birds received different levels of licorice root extract.

Slaughter Parameters (%)	T1	T2	T3	T4	T5	T6
Dressing Percentage	56.04±0.80^{ab}	55.44±0.77^{b}	56.19±0.21^{ab}	56.82±0.30^{ab}	56.87±0.58^{ab}	58.16±0.38^{a}
Breast meat yield	241.86±11.1^{ab}	229.52±20.4^{b}	246.94±8.90^{ab}	259.28±9.30^{ab}	266.48±10.9^{ab}	279.16±4.50^{a}
Thigh meat yield	131.72±10.4	125.00±9.10	134.49±7.00	141.21±7.60	145.13±5.20	152.04±6.50
Heart weight	6.96±0.01	6.61±0.003	7.11±0.03	7.46±0.03	7.67±0.02	8.03±0.02
Gizzard weight	30.49±0.06	28.94±0.14	31.13±0.09	32.69±0.16	33.60±0.03	35.20±0.10
Liver weight	34.25±0.10	32.50±0.09	34.97±0.14	36.72±0.07	37.74±0.11	39.54±0.12
Abdominal Fat Pad	14.62±0.01	13.87±0.02	14.93±0.02	15.67±0.01	16.11±0.02	16.87±0.03

^{abc}Means without a common superscript differ significantly ($p<0.05$), within a row.

Table 4. Hematology and serum biochemistry parameters of broiler birds received different levels of licorice root extract.

Treatments	T1	T2	T3	T4	T5	T6
Triglycerides mg/dL	29.37±17.32	41.93±13.25	13.17±3.37	83.00±44.86	61.03±3.46	31.07±9.92
Cholesterol mg/dL	17.67±1.45	8.67±7.17	8.33±4.58	14.00±2.65	19.33±2.08	14.33±5.36
HDL mg/dL	33.67±1.86	36.67±2.03	35.33±1.45	33.33±0.88	31.67±1.20	36.67±1.86
LDL mg/dL	54.67±0.88	63.33±2.33	61.00±4.0	53.33±1.67	56.00±2.52	56.00±1.53
Hemoglobin (g/dL)	12.00^{bc}	13.90^{ab}	12.70^{bc}	14.93^{a}	13.03^{abc}	11.90^{c}
Hematocrit (%)	29.30^{b}	33.18^{ab}	31.91^{ab}	35.04^{a}	32.05^{ab}	29.34^{b}

^{abc} Means without a common superscript differ significantly ($p<0.05$), within a row.

Sedghi*et al*. (2010) by supplementation of licorice root extracts in broilers. Licorice root extract supplementation showed higher gizzard and liver weights which contradict to the findings of current study (Myandoab and Mansoub, 2012). Blood parameters revealed significantly higher hemoglobin and hematocrit while blood biochemistry parameters like total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein differed non-significantly from control. Salary *et al*. (2014), Myandoab and Mansoub (2012); and Sedghi *et al*. (2010) showed similar finding that licorice root extract supplementation tends to lower lipid profile but non-significantly.

***Conclusion*:** Licorice root extract can be safely supplemented in drinking water of broilers to improve growth performance, dressing percentage and carcass yield.

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