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## RESEARCH ARTICLE

# EFFECT OF DIETARY LICORICE EXTRACT ON SOME PHYSIOLOGICAL AND PRODUCTIVE TRAITS OF ROSS 708 BROILER CHICKEN

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**ABSTRACT**

The study was conducted in Kalar Technical Institute to investigate the effect of dietary licorice extract of Ross708 broiler chicks using (100) birds one day age and the duration of the experiment was 60 days, started from 02/15/2015 to 04/15/2015. Four treatments used in the experiment (the first treatment control 0 g licorice extract / kg feed), the second, third and fourth treatments are (1, 1.25, and1.5 gm licorice extract / kg feed) respectively. Birds were divided randomly into four groups on the four treatments, each group containing 25 birds, each group divided to the three replicates, chicks reared on the ground in the hall under same healthy conditions for broiler chickens and were supplied with regular lighting. Used Wood pens with dimensions (1Mx2M) per room and each replicates contain (8 birds). Treatment licorice extract led to a significant increase in the number of red blood cells (RBC) and packed cell volume(PCV%) and hemoglobin (Hb) concentration and the number of white blood cells (WBCs) in comparison with control. T2recordeda significant increase in the primitive body weight (the age of the first week) and to increase the final body weight. A significant decrease in weekly feed consumption and feed conversion ratio (FCR) in the birds of the second treatment. Also, treatments with licorice led to significantly ($P \leq 0.05$) improve of bird immunity against Newcastle disease as HI -ND Titers in T2, T3, and T4 in comparison with control. We conclude through the study that the dietary licorice extract led to a significant improvement in the performance of broiler chickens and increase immunity response against Newcastle disease virus.



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## INTRODUCTION

The earliest use of licorice-*Glycyrrhizaglabra* (Gg) was recorded in 2000 B.C. *Glycyrrihiza*is a Greek word meaning "sweet root". The compound glycyrrhizin is responsible for sweet flavor of licorice roots. The herb has many uses, including as a cough suppressant and anti-inflammatory for ulcers (Janke and DeArmond, 2004). It stimulates the adrenal glands and medical source has been found that it works as anti-viruses and antibacterial and anti-mutagenesis and anti-carcinogenesis (anti- carcinogenic). The high doses of this plant may lead to symptoms of unwanted side such as a lack of potassium in the blood (hypokalemia) (Caradonna *et al*., 1992). Since the powder roots of the plant licorice in which anti factors to oxidize fat with similar hormone-steroidal effectiveness (Steroid like - action) and high nutritional value, it also has other uses since ancient times (Grieve, 1995).It used as feed additives for sheep and cattle and as growth promoter (Shalaby, 1996). Glycyrrhizin sweetness extracted from licorice more than the sweetness of regular sugar (cane) with (50) times (Takino*et al*., 1979) and can chew or eat it in the form of sweets also added to the beer and alcoholic and soft drinks to give her a foam, add the well to drink Coca-Cola and Pepsi-Cola or work tea of licorice powder (Auf, 2006).The *Glycyrrhizaglabra* contains also protein and amino acid e.g. Asparagin. Polysaccharide e.g.: Glucose, Fructose, Sucrose, Maltose, Lignins, Yellow dye (Langer, 1998; Trease and Evans, 2002). The researchers found that use of licorice extract in drinking water improve some physiological, production and physicalmeat traits for broiler chickens (Al-Daraji *et al*., 2003 abc). Also, previous study carried out by Al-Daraji *et al*. (2005c) showed that the use of licorice improve reproductive efficiency of older local roosters. Recently, it utilize in semen dilution of cock (Al-Daraji, 2005) and other studies indicated

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to improve some characteristics of the semen of Awwasi rams with the orally give licorice extract (Mahdi, 2000). As well as improved feed conversion ratio and increase the weight of the body lambs and raise the reproductive efficiency of ewes have fed on the residues of licorice (Shujaa, 2001). So this study was conducted in order to:Determine the effect of the best ratio of plant roots of licorice powder (Licorice extract) in the diets of broiler chickens and to determine their impact on the physiological, productive performance and immunity response of broiler chicken.

## MATERIALS AND METHODS

### Animal care

Total number of (100) chicks were randomly distributed. The experiment lasted 45 days in the poultry farm from 15/02 to 01/4/2015. The bird were reared in floor pens each pen was three square meters with one hanging tube feeder and one suspended drinker. Feed and water were offered *adlibitum* and the light program was 23L/1D.Birds were distributed equally in to four groups, each group (treatment) was equally subdivided in to three replicate per group (control, 1, 1.25 and 1.5gm. licorice extract/kg feed), each experimental unit or replicate contain 8 chicks. Birds housed on floor pens and used straw as litter (4 birds per square meter). Birds were kept in a closed house; artificial lighting and were raised under the same environmental and veterinarian conditions. During the experiment, a three-phase feeding program consists of offering a starter (0-14 days of age), grower(15-29 days ) and finisher (30-45 days of age) was provided to the broilers. Commercial feed were provided and compositions of experimental diet according to (NRC, 1994) as shown in Table (1). All birds were vaccinated against the common local diseases according to the prevention program for broiler chicken in Table (2) .Hall was sterilized by Ioden, Formalin and Vercon solutions.

### Source of licorice extract

Licorice was brought from Azizya factory a district of the province of Wasitan Iraqi company for production the aromatic substances, as well as export licorice to other countries. This material or ingredient isin form of a brown powder. Licorice extracting process include the cutting and crushing the roots then transferred to the large basins for infusion then placed inside the furnace iron rushes hot air by spray dryer devicefrom130-150C temperature, and by heating steam to extract juice as adhesive substance. Then grind this powder and packaged especially and called licorice extract (Al-Darwash *et al*, 1999; Ameen, 2006).

**Table 1. Ingredient of experimental diet according to (NRC, 1994)**

| Ingredients | Starter diet% (0-14 days) | Grower diet% (15-29 days) | Finisher diet % (30-45 days) |
|---|---|---|---|
| Soya bean meal | 40 | 35 | 29 |
| Wheat grains | 11 | 11 | 11 |
| Corn grains | 35 | 40 | 46 |
| Flour | 10 | 10 | 10 |
| Oil | 1.5 | 1.5 | 1.5 |
| Vitamin Min Premix | 2.5 | 2.5 | 2.5 |

**Calculated chemical analysis of experimental diet according to (NRC, (1994)**

| Analyzed Ingredient % | Starter diet% (0-14 days) | Grower diet% (15-29 days) | Finisher diet% (30-45days) |
|---|---|---|---|
| Crude protein (%) | 22.23 | 20.470 | 18.36 |
| Dry matter (%) | 80.25 | 80.25 | 80.25 |
| Metabolize energy (kcal/kg) | 2875.45 | 2887.20 | 2901.30 |
| Methionine (%) | 0.37 | 0.35 | 0.32 |
| Lysine (%) | 1.3 | 1.16 | 0.994 |
| Calcium (%) | 0.13 | 0.115 | 0.099 |
| Available phosphorus (%) | 0.40 | 0.38 | 0.36 |

**Table 2. Prevention program for broiler chicken**

| Birds age (Day) | Vaccine type | Inoculation method | Vaccine Source |
|---|---|---|---|
| 7 | (ND+AIV)oily | Injection | Holland (Netherland) |
| 13 | IBD Gumbo | Water | France |
| 21 | ND Lasota | Injection | Holland |
| 28 | Vitamins | Water | France |
| 38 | ND | Injection | Holland |
| 40 | Coccidian vac | Water | France |

### Hematological Parameters

Five individual blood samples were collected from each replicate for each analysis in a test tube with EDTA from the main brachial vein of the bird, to determine the PCV, Hb, RBCs, and WBCs count at 21 and 42 days of age by using blood analyzer device and according to Al-Daraji *et al*. (2008).

### Measured of body weights and Feed Conversion Ratio (FCR)

The chicks were weighted individually on weeks, 1st, 2nd, 3rd, 4th, 5th, and 6th week, for each pen. By using digital balance then calculated average body weights and FCR for each treatment.

### Immune Status

To assess immune status, antibody titers to Newcastle disease virus (NDV) were measured by hemmaglutination inhibition test (HI). Serum was collected from the birds at 3thd and 6thweek of age from each groups. Newcastle antibody levels in serum samples were analyzed according to Cunningham (1971) and Naji (2004).

### Statistics Analysis

Data generated from experiment was carried out in a complete randomized design (Steel and Torrie, 1980). These data were subjected to ANOVA according to general linear model procedure of statistical analysis system software (SAS, 2001). The significant differences among means were determined by Duncan's multiple range tests (1955) with ($P \leq 0.05$) level of significance.

## RESULTS

Production trait (weekly body weight gain) of broiler at different ages was presented in Table (3) as a mean value affected different levels of dietary licorice extract.

**Table 3. Effect of different levels of licorice extract on weekly body weight gain (gm) of broiler at different age (Mean + Se)**

| Bird's age(week) | Treatments[1] | | | |
|---|---|---|---|---|
| | T1 | T2 | T3 | T4 |
| 1st | 68 ± 1.58 b | 80± 2.74 a | 78± 2.12 a | 68.4±1.14 b |
| 2nd | 201.2 ± 12.63 a | 202.8±8.17 a | 190± 2.12 b | 173 ± .2.91 c |
| 3rd | 401.2 ± 5.26 a | 401 ± 5.15 a | 400.8 ± 4.38 a | 301.6 ± 4.88 b |
| 4th | 1301.4±5.32a | 1102 ± 5.7 c | 1211 ±5.83 b | 903.4 ± 8.27 d |
| 5th | 1825 ± 17.43a | 1839± 20.83 a | 1638.2± 19.42 b | 1617.8± 32.08.c |
| 6th | 2330 ± 87.38 b | 2784±61.17 a | 2279±59.79 b | 2176±92.36 c |

[1]T1=control group, T2, T3& T4denote dietary licorice extract of1,1.25& 1.5 gm /kg feed respectively. Different letters in the same raw represent significant differences between the treatments at a level ($P \leq 0.05$).

**Table 4. Effect of different levels of dietary licorice extract on (FCR) Feed Conversion Ratio (feed intake (gm) / body weight (gm) of broiler (Mean + Se)**

| Bird's age (week) | Treatments[1] | | | |
|---|---|---|---|---|
| | T1 | T2 | T3 | T4 |
| 1st | 2.06± 0.44 a | 1.75± 0.39 b | 1.79± 0.36 b | 2.05± 0.23 a |
| 2nd | 2.80± 0.40 a | 2.2± 0.15 b | 2.31± 0.30 b | 2.51± 0.44 a |
| 3rd | 2.00± 0.38 a | 1.75 ± 0.43 a | 2.31± 0.32 b | 2.33± 0.56 b |
| 4th | 2.46± 0.31 a | 2.36± 0.68 a | 2.55± 0.46 a | 1.65± 0.55 b |
| 5th | 2.77±0.30 a | 2.5± 0.16 b | 2.91± 0.50 a | 2.76± 0.46 a |
| 6th | 2.146± 0.27 a | 1.67± 0.31 b | 1.98± 0.39 a | 2.30±0.38 a |

[1]T1=control group, T2, T3& T4denote dietary licorice extract of 1,1.25& 1.5 gm /kg feed respectively. Different letters in the same raw represent significant differences between the treatments at a level ($P \leq 0.05$).

**Table 5. Effect of different levels of dietary licorice extract on the mean of some hematological traits of broiler at 21 and 42days of age (Mean ± Se)**

| HematologicalTraits[2] | Treatments[1] | | | | |
|---|---|---|---|---|---|
| | Age(days) | T1 | T2 | T3 | T4 |
| Hb(gm/dl) | 21 | 7.4±0.62 c | 11.72±0.55a | 9.6± 0.33 b | 11.35±1.28a |
| | 42 | 11.95± 0.50b | 12.5±0.53a | 12.9± .78a | 11.91± 0.47b |
| RBC(10$^6$/mm$^3$) | 21 | 1.6± 0.44b | 2.27±0.14a | 2.11± 0.34a | 2.10 ± 0.13a |
| | 42 | 2.23± 0.35a | 2.39 ± 0.16a | 2.60± 0.22a | 2.28± 0.12a |
| WBCs | 21 | 7.27± 1.05 c | 15.8±1.41b | 19.9± 1.75a | 16.77± 1.56 b |
| (10$^3$ cells /mm$^3$) | 42 | 18.76± 1.58 b | 23.3± 1.66a | 20.09± 1.41a | 16.90± 1.75 b |
| PCV%; | 21 | 25.90 ± 3.07b | 25.4± 2.92b | 32.4±1.09a | 24.0± 3.87b |
| | 42 | 30.25±3.60 b | 30.50± 3.31b | 33.95±3.11a | 28.4± 2.4c |

[1]T1=control group, T2, T3& T4denote dietary licorice extract of 1,1.25& 1.5 gm /kg feed respectively. Different letters in the same raw represent significant differences between the treatments at a level ($P \leq 0.05$).

**Table 6. Effect of different levels of dietary licorice extracton antibodies against the Newcastle disease virus (NDV) assessed by Hem inhibition test (HI) in the serum at 3rd& 6th weeks of age of broiler chicken. (Geometric mean[1]±Se)**

| Trait | Age (week) | [2]T1 (control) | T2 | T3 | T4* |
|---|---|---|---|---|---|
| Immune status(Titers)HI Test against ND | 3rd | D | C | B | A |
| | | 3.37± 0.31 | 5.47± 0.48 | 7.22± 0.26 | 11.47± 0.75 |
| | 6th | C | B | B | A |
| | | 4.43± 0.41 | 5.8± 0.63 | 6.1±0.33 | 9.5± 0.46 |

1Geometric mean = (the average of the Logs 10)
2T1=control group, T2, T3& T4 denote dietary licorice extract of 1,1.25& 1.5 gm /kg feed respectively.
*Means in a same row without common letter differ significantly ($P \leq 0.05$).

The significant ($P \leq 0.05$) increase in weekly body weight gain (gm) were observed in T2&T3 at 1st week of age compared with T1& T4. While, there was no significant difference between T2&T3 and between T1&T4 at the same age. Also, no significant differences were observed among T1, T2 &T3, on the other hand, between T1 &T2 at the 2nd and 3rd& 5th week of age respectively. Also, results showed that the lowest body weight ($P \leq 0.05$) was recorded from 2nd to 6th week in chicks fed with T4 (1.5gm dietary licorice extract / kg feed) than the control,T2&T3.The best results of body weight throughout experiment were observed in T2 especially at 6th week of age which indicated that there were significant($P \leq 0.05$) increase of body weight in T2 as compared with other treatments and control group .Feed conversion ratio (FCR) is shown in Table(4).Results revealed that the best FCR throughout study were realized in T2 compared with other treatments, but no significant differences were observed between T1&T2 at 1st 2nd,5th& 6th week of age. Furthermore, the T2 group had lowest significant ($P \leq 0.05$) value in feed intake or FCR compared with other treatments at 5th&6thweek of age. No significant differences between T3 &T4 at 3rd,5th&6th week of broiler's age regarding this trait, on the other hands, T4 recorded lowest value($P \leq 0.05$) in FCR at 4th week compared with other treatment and control group. The effects of dietary licorice extract with different levels on the some hematological traits of broiler at 21 & 42 days of age as shown in table(5),results indicated that there were significant differences among the experimental groups and control group regarding these traits. The concentration of Hb, RBC & WBCs of treated chicks were significantly($P \leq 0.05$) increased as compared with control group, except no significant differences were observed between T1&T4 in Hb&WBC at 42 days of age and between T2&T3 at the same age. No significant differences ($P \leq 0.05$) among T2,T3&T4 in RBC count at 21days of age. On the other hands, no significant differences were observed among treatments and control group at 42 days of age regarding the latter trait. As shown in Table(5) T3 was recorded the highest significant ($P \leq 0.05$) value of PCV% at 21&42 days of age as compared with T2,T4 and control group. No significant differences among T1,T2 and T3 and between T1&T2 regarding this trait at 21 and 42 days of broiler's age respectively, and T4 was recorded lowest value than other treatment and control group regarding this trait. The data of immunity status or response trait as antibodies against the Newcastle disease virus (NDV) assessed by Hem inhibition (HI) test in the serum of the birds in different treatments at 3rd&6th weeks of broiler's age are shown in Table (6).The results revealed that dietary licorice extract increased ($P \leq 0.05$) birds immunological response in T2, T3&T4 as compared with control group. While T4 had higher value ($P \leq 0.05$) in immunological response throughout the study as compared with other treatments.

## DISCUSSION

The positive results obtained in the production traits and characteristics of the blood and immune status or response may be due to licorice as an appetite stimulator, encourage digestion and works to increase the blood flow rate in the mucous membranes of the digestive tract, thereby increasing the consumption of feed materials and efficient utilization of feed (Grieve, 1995). Kumagi *et al*. (1967) reported that both of Glycyrrhzin and Glycyrrhetic acid one of licorice compounds has steroid- like action, where it is known that steroid hormones are constructive(anabolic)hormones, which lead to increased protein synthesis and reduce its decomposition and thus increase the rate of growth, as well as it increases the components of muscle and bone growth and lead to calcium survival of the body and increase the basal metabolic rate (Sturki, 2000) On the other hand, the Glycyrrhizin compound stimulates the production of corticoster one such as cortisol (a hormone secreted by the adrenal cortex, one of the glucocorticoids) produced when body needed, also it can metabolize when its product more than body need (Langer, 1998). Also, the Glycyrrhzin and its metabolize product Glycyrrheticacidactsasanti- viral and fungi (Pompei *et al.,* 1980; Utsunomiya *et al.,* 1999), also working to induce interferon activity through stimulation the T-Cells (Abe *et al*., 1982). The positive changes that took place in the number of red blood cells (RBC), white blood cells (WBCs) Packed cell volume (PCV%) and Hbconcentration in licorice treatments may be a reflection of the positive changes that have occurred in the productive performance of birds treated with licorice extract. Al-Daraji *et al*. (2003b) noticed that the licorice extract treatment led to a significant increase ($P \leq 0.05$) in feed conversion ratio (FCR), rate of weight gain, rate of the final weight and dressing percentage with significant decrease ($P < 0.05$) in feed consumption rate and the proportion of mortality. Because improvement in the growth and metabolism rate required for fundamental changes in the effective elements in the blood components (Sturkie, 2000). Cook and Samman (1996) and Craig (1999) reported that Flavonoids compounds, one of licorice components lead important biologicalroles, it strengthens the health and reduce the risk of disease and prolong the effectiveness of oxidative stress are highly effective by protecting many important representative materials such as Low density lipoprotein (LDL), and red blood cells against various stress factors oxidizing through mechanical rid of free radicals, and inhibiting the oxidation of fat cell membranes (Furhrman *et al*.,1997; Harguchi *et al*., 1998;Vaya *et al*.,1997). It has been found that the *Glycyrrhizaglabra* (Gg) contain $Ca^{++}$, glucose, fructose, vit E, vit C and many other substances e.g.: $Zn^{++}$, sucrose, amino acid (Grieve, 1995). All these substances stimulate activity of cells (AL-Dujaily *et al*., 2006). Moreover, AL-Dujaily, *et al*. (2006) reported that using of Gg lead to decrease the free radicals of cells. These free radicals have interfering effect of cell activity (Balen *et al*., 1997). Furthermore it has been found that Gg also contain sugar like glucose, fructose, sucrose and maltose (Trease and Evans, 2002). These sugars considered as source of energy for all cells. In addition to that, Gg contain protein and amino acids (Langer, 1998), which sustain and maintain cell osmolality, viability and in turn integrity of cell membrane. Moreover the Gg contain $Ca^{++}$. It has been known that $Ca^{++}$ found in Gg prevent the degradation of cAMP by inhibition phosphate diestrase enzyme (Gamick *et al*., 1982) Sturkie (2000) reported that the factors affecting the number of red blood cells also affect the PCV%Hb concentration and platelet count, so the behavior of these traitsaresimilar. Moussa et al. (2002) concluded that the relatively high content of some food ingredients and mineral elements in the licorice powder

compared to a lot of medicinal herbs licorice has supply one of the important medicinal herbs, it provides minerals and nutrition necessary to maintenance the physiological activities in the body. Mahdi (2000) found that the treatment of licorice extract led to significantly ($p < 0.01$) increase in body weight of lambs.

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