Biochemical and Histopathological effects of some herbal plants in Broilers

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Abstract

One hundred chicks, one day old were divided into 10 groups. The first group was control negative and the second was control positive (infected with *E. coli O 78*). The other eight groups treated either by *Thymus vulgaris* (*1* or 2 ml/ 1 litter drinking water) or *zingiber officinale* (5 or 10 ml/ 1 litter drinking water) from the first day old till the end of the experiment. Experimental infection was done orally to 4 groups only of the 8 groups at 10 days old.

Biochemical profiles showed better results with higher doses of either *Thymus vulgaris* or *zingiber officinale* extract in comparision with lower doses of the same extract either in infected with *E.coli O78* or natural not infected chicks. The treated experimentally infected groups showed better results than compare to positive control group. These biochemical results are confirmed by the histopathological pictures that prepared by taking specimens from intestine, kidneys, liver, lung, spleen, thymus, and bursa of Fabricious.

The microscopic examination cleared pathological changes in the control positive also the infected treated groups with lower doses of any of the two extracts. On the other hand, the infected treated groups with higher extracts doses showed better improvements in the microscopic pictures than the infected treated with lower doses.

Introduction

Using synthetic drugs in poultry industry had negative side effects on both poultry and human ***(Heitzman, 1986; Khachatourians, 1998, Wary and Davies, 2000)***, many attempts have been made to use natural feed additives such as herbs and edible plants which serve not only as a medical purpose but also contain aromatic substances and essential oils which are widely used in feed industries moreover metabolic modifiers ***(Hassan et al, 2007)***.

Medicinal plants facilitate absorption of calorigenic nutrients across the gut wall by increasing its absorption capacity ***(Nelson et al, 1963)***.

Enteritis caused by *Escherichia coli* (colibacilliosis) is an important disease in the poultry industry because of increasing mortality and decreasing performance. *E. coli* is a normal inhabitant of the intestinal

tracts of animals and is harmless as long as it is kept in check by other intestinal bacteria **(**When an imbalance occurs in bacterial flora of the intestinal tract, *E. coli* may grow and cause an outbreak of colibacilliosis. Chickens of all ages are susceptible to colibacilliosis, but usually young birds are considered more susceptible ***(Barnes et al, 2003)***.

The present experiment aimed to study effects of oral doses of herbal plants (*Thymus vulgaris* and *Zingiber officinale*) on normal and experimentally infected (by *E.Coli*) broiler chickens through evaluation of biochemical profile and histopathological studies.

Materials and Methods

This experiment was conducted on one hundred (100) normal healthy Cobb broiler chicks one day old which were divided into equal 10 groups (each 10 chicks). Chicks of 8 groups only from one day old treated with *Zingeber officinale* aqueous extract (5 and 10 ml/L drinking water) or *Thymus vulgaris* aqueous extract (1 and 2 ml/lit. drinking water). The other 2 groups, one of them is control negative group 1 (orally inoculated with distilled water only) the second is control positive group 2 (orally infected with *E.Coli* serogroup O_{78} at 10 day old by a dose of **0.5** ml *E.Coli* serogroup O_{78} of broth containing 3×10^8 CFU (colony forming units of *E. Coli*) / chick) ***(Johnson et al, 2001 & Khalid 1990)***. The serogroup obtained from the Serology Unit Bank of Animal Health Research Institute in Dokki Giza. Balanced food and water were available ***(NRC, 1994)*** ad libitum. No antibacterial agents were given to all groups. Infected groups kept in a separate room from non infected and all conditions were the same. Chickens in all groups inspected daily.

Blood samples were collected from each chicken at the end of the 4^{th} and 6^{th} weeks of the experiment without anticoagulant in sterile, clean and dry screw capped centrifuge tubes for serum separation, stored in deep freezer at -20ºc for determination of biochemical parameters.

Serum biochemichal tests were performed using commercial test kits to determine AST activity (Colormetric Randox) England according to ***Reitman and Frankel (1957)*** & Lactate dehydrogenase activity according to ***Buhl and Jackson (1978)*** , Total protein according to ***Young (2001)***, Albumin according to ***Dumas and Biggs (1972)***, Cholesterol according to ***Flegg (1973)***, Triglycerides according to method described by ***Fredrickson et al, (1967)*** and HDL according to method described by ***Burstein et al, (1970) and Lopes- Virella et al, (1977)*** (Stanbio. Co. UK) & Glucose according to ***Young (2001)***, Uric acid according to ***Young (2001)*** and Creatinine according to ***Henary (1974)*** (Spinreact. Co. Spanish)&

and albumin globulin ratio according to ***Kaneko et al, (1997)***.

Tissues specimens were taken for histopathological purposes from kidneys, liver, lung, heart, spleen, thymus, and bursa of Fabricious at 4 and 6 weeks. The specimens were rapidly fixed in 10% buffered neutral formalin solution, dehydrated in gradual ethanol (70-100%), cleared in xylene, and embedded in paraffin. Five-micron thick paraffin sections were prepared and then routinely stained with hematoxylin and eosin (HE) dyes then mounted by Canada balsam, covered, hot air dried ***(Bancroft and Gamble, 2008)*** and then examined microscopically.

XI- Statistical analysis:

The mean values and standard errors were calculated for the obtained data and the level of significances for all means were determine using general linear model (GLM) of multiple-variant analysis (full factorial design) using *SPSS*/pc^{+} V17 statistical package for windows. Two groups were significantly different if P value was statically lower than 0.05.

Results and Discussion

Broilers industry continues to be a hugely important source of animal protein steadily. The rise in popularity of broiler meat can be attributed to its versatility and relative low cost in comparison to other meats ***(Mark et al, 2008)***.

Adding herbal plants (e.x. *Thymus vulgaris* and *Zingiber Officinale*) have potentials as growth and health promoter in chicken without adverse effects. However, the effects have not yet been well studied in chickens.

Phenolic compounds carvacrol and thymol present in *thyme* exhibit considerable antimicrobial activity ***(Basilico and Basilico, 1999; Hernandez et al, 2004)***. That effect is mainly due to the lipophilic character of the active principles, which permeate the cell membranes and mitochondria of the microorganisms and inhibit, among others, the membrane bound electron flow and therewith the energy metabolism. This leads to a collapse of the proton pump and draining of the ATP pool. High concentrations of essential oils also lead to lysis of the cell membranes and denaturation of cytoplasmic proteins. Nevertheless, there is only limited data on *in vivo* effects of thyme and thymol ***(Helander et al, 1998)***.

As shown in Fig. (2), our histopathological studies showed affected livers portal areas with intense aggregations of heterophils, lymphocytes and macrophages in the 4 week period with severe congestion and round cells infiltrations and moderate hyperplasia in the lining epithelium of the bile ducts at 6 week**.**

As shown in Fig. (4), macrophages and lymphocytes invaded the epicardium and focally displaced the cardiac muscles or heavily

infiltrated amoung the muscle fibers**.**

As shown in Fig. (5 and 6), the lymphoid organs (bursa of Fabricius and spleen) showed slight (*Zingeber officinale* -groups) and moderate (*Thymus vulgaris* -groups) hyperplasia in the lymphocytes of the lymphoid follicles and white pulp**.**

Studies of ***Craig (1999) and Ghazalah and Ali (2008)*** support our results as they confirmed that active components of herbs have a great influence on the function and reactivity of the immune system of the farm animals and may stimulate the immune function in broilers.

Our results agreed with that of ***Selitrennikoff (2001)*** who ensures that plants do not have an immune system directly comparable to that of animals. Thus, plants have evolved host defense mechanisms either by pre-existing or induced physical barriers by numerous antimicrobial compounds such as antimicrobial peptides, proteins and small molecular weight organic substances.

Our results agreed with ***Demir et al, (2008)*** who fed 1 day old male broiler chicks (Ross) a starter diet supplemented by *thyme* powder until 21 d of age and a finisher diet until 42 day which influenced significantly humeral immunity. Our serum globulin levels were increased in treated and treated infected groups in compare to control also. These results agreed with ***Navid and Mahmoud (2011)*** who used *Thyme* powder (dried thyme was supplied from local market and after fine milling, mixing) that was supplemented to 1 day following until 42 days to broiler chicks at 0.75%, 1%, 1.5%, and 2% doses. Serum globulin level increased insignificantly in all treated groups in compare to the control**.**

Biochemical shown in tables (1and 2):

Recent reports for normal chicken serum glucose levels ranging between 156-330 mg/ dl ***(Scanes, 2008).*** Serum glucose concentrations depend on a wide variety of factors and its concentrations is the net of equilibrium between rates of entry and removal of glucose in the circulation ***(Collin et al, 2003).*** One of these factors as ***Kaneko et al, (1997)*** reported is that glucose is supplied by intestinal absorption of dietary glucose or by hepatic glucose production from its precursors. Our recent study revealed hyperglycemia in all treated non infected groups with either *thymus vulgaris or zingeber officinale* extracts in compare with treated infected groups with the same doses. Our results agreed with that of Safaa and ***Nafez (2009)*** who recorded hyperglycemia with addition of dried crushed thyme by different doses to broiler chicken diet, while disagreed with ***Jamel et al (2010)*** who reported hypoglycemia in *ginger* and thyme treated groups. Hyperglycemia in

these groups may be due to increase the health condition of the intestinal tract so absorption of glucose become well by the act of both *thymus vulgaris* and *zingeber officinale* extracts.

Our results revealed increase in the serum AST activity in treated infected groups in compare to non infected treated groups. That may be due to hepatic injury during the detoxification of E.coli bacterial toxin ***(Marcel 1994).*** In our study either (*thymus vulgaris or zingeber officinale* extracts) treated infected or non infected groups showed decrease in serum AST levels in compare to control positive group that may be due to improvement of the liver physiological functions and increase the hepatic metabolic reserve as described by ***Dobicki et al (2007).*** Our results disagreed with ***AL-Homidan (2005)*** who confirm significant increases in the activities of AST in group fed 6% *zingiber* officinale.

Our results revealed significant decrease in the serum uric acid and creatinine in infected treated groups in compare to control positive. These results agreed with ***Jamel et al (2010)*** who gave aqueous extract of *ginger* at concentration of 0.4 and 0.6 % respectively in drinking water of broiler chicks (Ross). Serum uric acid levels were lowered in compare with positive control group. But, significant increased serum uric acid and creatinine in infected treated groups in compare to control negative was observed. Uric acid is a major end product of nitrogen metabolism in birds. Renal functions disorders can eventually leads to increased plasma uric acid and creatinine concentrations ***(Kaneko et al, 1997).*** Our histopathological examinations confirmed our results; round cell infiltrations among the renal tubules were encountered. The glomeruli were congested and rarely shrunken. perivascular and periglomerular aggregation of round cells were visualized, 6 weeks post infection as cleared at Fig. (1).

Our study revealed decreased serum cholesterol and triglyceride levels in all infected herbal treated groups in compare to control negative. Our results agreed with ***Ademola et al (2009)*** who ensured that the ginger exhibited better antilipidemic influence on the serum cholesterol, triacylglycerol and abdominal fat pad of the treated chickens in compare to control.

Our results are in harmony with ***Jamel et al (2010)*** who reported that Cholestrol and triglyceride serum levels of aqueous extract of *ginger* at concentration of 0.4 and 0.6 % respectively supplemented to drinking water of broiler chicks decreased significantly in compare with control group**.**

Al-Kassien (2009); Majid et al (2010) and ***Rahim et al (2011)*** ensured that addition of either dried *thyme* leaves or thyme extract at different levels to broiler chicks caused a significant reduction in the levels of blood total plasma

cholesterol and triglycerides that agreed with our study.

The plasma proteins are synthesized in the liver which is the main site for protein synthesis from amino acids that absorbed well by healthy gastrointestinal tract and immune system ***(Kaneko et al, 1997)***. Our present study revealed significant increase of the plasma protein in all groups in compare to both control positive and negative. Our results agreed with ***Majid et al (2010)*** who reported hyperprotenemia in chicks treated with thyme powder in compare to control group. Also ***Safaa and Nafez (2009)*** *and* ***Al-Kassien (2009)*** reported that feeding chicks with ration containing thyme had increased serum total proteins significantly, but ***AL -Homidan (2005)*** reported significant decreases in total protein in chicken group fed 6% *zingiber* officinale and slight or significant decrease in group fed 6% *zingiber* officinale for albumin concentration.

Moreover, our present study revealed significant decrease in tolal protein and albumin of infected treated groups in compare to treated groups with the same doses.

The hypoproteinemia may be due to breakdown of plasma protein, increase the renal excreation and impair protein synthesisas a result of liver disorders caused by colibacillosis ***(Dooley et al, 1988).***

Our histopathological studies confirm our biochemichal results as the slides of these infected groups showed heterophils in the portal areas in the liver. Perihepatitis and thickened hepatic capsule revealed small areas of coagulative necrosis, surrounded by lymphocytes, heterophils and extravasated erythrocytes were recorded. The connective tissue infiltrated with round cells of lymphocytes and macrophages, post infection as shown in Fig (2 and 3).

Recommendation: From the obtained data it can be concluded that2 ml *Thymus vulgaris* extract or 10 ml *Zingeber officinale* extract / 1 litter drinking water from one day old age of the chick the best to use in the field.

Table (1): Some Serum biochemical profiles (mean ±S.E) at 4 weeks old chicks experimentally infected with E. coli O78 and treated with either Thymus vulgaris or Zingeber officinale .

Groupp / Parameter	Gr 1 Control negative	Gr 2 Control postive	Gr 3 Zingeber officinae 5 ml	Gr 4 Zingeber officinale 5 ml+ infected	Gr 5 Zingeber officinale 10 ml	Gr 6 Zingeber officinale 10 ml+ infected	Gr 7 Thyme valgaris 1 ml	Gr 8 Thyme valgaris 1 ml+ infected	Gr 9 Thyme valgaris 2 ml	Gr 10 Thyme valgaris 2 ml+ infected
AST U/L	**195 ±3.16^{f}**	**275 ±3.31^{a}**	**182 ±1.51^{g}**	**268 ±1.58^{b}**	**175 ±2.00^{h}**	**245 ±1.58^{d}**	**160 ±1.581^{i}**	**262 ±1.58^{c}**	**155 ±2.000^{j}**	**201 ±2.82^{e}**
Glucoe mg/dl	**220 ±9.13^{d}**	**210 ±10.6^{e}**	**251 ±7.78^{b}**	**223 ±13.5^{d}**	**259 ±6.20^{a}**	**234±3. 674^{c}**	**257±5. 568^{a}**	**238±5. 431^{c}**	**260±3. 536^{a}**	**242±5. 148^{bc}**
LDH U/L	**482± 1581^{f}**	**580± 1.880^{a}**	**450 ±2.00^{g}**	**565±1. 275^{b}**	**430± 1.454^{h}**	**530± 2.000^{d}**	**421± 1.414^{i}**	**545± 2.345^{c}**	**401± 1.581^{j}**	**511± 1.581^{e}**
Cholestrol mg/dl	**162± 4.9^{ab}**	**165± 4.472^{a}**	**122± 3.391^{e}**	**160± 3.937^{b}**	**99± 2.828^{f}**	**148± 2.916^{c}**	**82± 3.162^{g}**	**151± 2.236^{c}**	**75± 2.828^{h}**	**143± 2.345^{d}**
HDLc mg/dl	**43.3±0 .436^{d}**	**37.8± 0.354^{h}**	**45.9± 0.292^{b}**	**38.2±0. 894^{h}**	**44.1±0. 696^{c}**	**39.6±0 .791^{g}**	**46.3±0. 485^{b}**	**42.5±0. 524^{e}**	**47.8±0. 700^{a}**	**41.11± 0.728^{f}**
Triglycerides mg/dl	**112.4± 1.227^{c}**	**90± 1.190^{h}**	**115± 0.758^{b}**	**103.8± 1.471^{g}**	**114.8± 0.485^{b}**	**105.2± 0.919^{f}**	**115.3± 0.906^{b}**	**110.2± 1.490^{d}**	**116.8± 0.381^{a}**	**108.7± 0.534^{e}**
Total protein gm/dl	**3.82± 0.075^{h}**	**3.35± 0.052^{i}**	**5.22± 0.032^{d}**	**4.98± 0.028^{e}**	**5.87 ±0.038^{c}**	**4.04± 0.027^{g}**	**6.72± 0.032^{b}**	**4.72± 0.032^{f}**	**6.85± 0.027^{a}**	**3.99± 0.064^{g}**
Albumin gm/dl	**0.99± 0.027^{i}**	**0.85± 0.029^{j}**	**1.62± 0.027^{d}**	**1.44± 0.024^{e}**	**1.92± 0.039^{b}**	**1.22± 0.032^{g}**	**1.73± 0.026^{c}**	**1.35± 0.016^{f}**	**1.97± 0.030^{a}**	**1.04± 0.020^{h}**
Golobulin gm/dl	**2.83± 0.095^{g}**	**2.5± 0.041^{h}**	**3.6± 0.026^{d}**	**3.54± 0.032^{d}**	**3.95± 0.007^{c}**	**2.82± 0.042^{g}**	**4.99± 0.044^{a}**	**3.37± 0.041^{e}**	**4.88± 0.047^{b}**	**2.95± 0.083^{f}**
A/G Ratio	**0.35± 0.02^{e}**	**0.34± 0.012^{e}**	**0.45± 0.009^{b}**	**0.407± 0.009^{d}**	**0.486± 0.001^{a}**	**0.433± 0.016^{c}**	**0.347± 0.008^{e}**	**0.401± 0.009^{d}**	**0.404± 0.009^{d}**	**0.353± 0.017^{e}**
Creatinine mg/dl	**0.38± 0.022^{cd}**	**0.58± 0.032^{a}**	**0.36± 0.029^{d}**	**0.55± 0.035^{a}**	**0.28± 0.029^{e}**	**0.49± 0.016^{b}**	**0.31± 0.016^{e}**	**0.48± 0.016^{b}**	**0.21± 0.016^{f}**	**0.41± 0.029^{c}**
Uric acid mg/dl	**3.68± 0.045^{h}**	**8.2± 0.164^{a}**	**3.21± 0.026^{j}**	**6.2± 0.029^{b}**	**4.01± 0.016^{g}**	**5.22± 0.016^{d}**	**3.55± 0.016^{i}**	**5.89± 0.016^{c}**	**4.22± 0.016^{f}**	**5.12± 0.022^{e}**

The same latter in the same raw is insignificant at P<(00.05)

Table (2) *Some Serum biochemical profiles (mean ±S.E) at 6 weeks old chicks experimentally infected with E. coli O78 and treated with either Thymus vulgaris or Zingeber officinale.*

Group / Parameter	Gr 1 Contrl negate	Gr 2 Contol postie	Gr 3 Zingebr officina le 5 ml	Gr 4 Zingebr officina le 5 ml +infecd	Gr 5 Zingebr officinale 10 ml	Gr 6 Zingebr officina le 10 ml+ infected	Gr 7 Thyme valgari s 1 ml	Gr 8 Thyme valgari s 1 ml+ infectd	Gr 9 Thye valgar is 2 ml	Gr 10 Thyme valgas 2 ml+ infectd
AST U/L	199± 1.581^{f}	314± 2.916^{a}	192± 1.581^{g}	290± 1.581^{b}	181± 1.581^{h}	258± 1.581^{d}	171± 1.581^{i}	266± 2.236^{c}	200± 1.581^{f}	235± 2.000^{e}
Glucose mg/dl	230± 5.916^{f}	228± 5.477^{f}	257± 5.788^{bc}	234± 6.964^{f}	263± 8.124^{ab}	241± 6.000^{e}	260± 3.674^{b}	247± 3.808^{de}	268± 3.873^{a}	252± 2.345^{cd}
LDH U/L	555± 1.581^{e}	610± 1.930^{a}	530± 2.000^{f}	600± 2.106^{b}	485± 1.581^{g}	583± 2.345^{c}	470± 2.266^{h}	599± 1.581^{b}	460± 1.581^{i}	570± 1.581^{d}
Cholestrol mg/dl	168± 4.848^{a}	170± 2.916^{a}	131± 3.391^{e}	162± 3.873^{b}	120± 2.236^{f}	152± 3.808^{c}	98± 5.431^{g}	159± 3.24^{b}	95± 4.359^{g}	147± 3.391^{d}
HDLc mg/dl	44.2± 0.515^{d}	37.9± 0.704^{g}	45.3± 0.485^{c}	39.7± 0.485^{f}	44.21±0.44 7^{d}	41.3± 1.173^{e}	49.5± 0.663^{b}	42.1± 0.485^{e}	57.4± 0.686^{a}	41.31 ± 0.361^{e}
Triglycerides mg/dl	115.± 0.87^{d}	92.3± 0.99^{i}	119.8± 1.070^{c}	104.1± 0.707^{h}	116.3± 0.797^{d}	107.3± 0.682^{g}	125.± 0.68^{b}	113.2 ± 0.77^{e}	138.2 ± 0.52^{a}	110.1 ± 1.259^{f}
Total protein gm/dl	3.42± 0.65^{h}	3.11± 0.035^{i}	4.99± 0.060^{c}	4.75± 0.048^{d}	5.03± 0.024^{bc}	3.82± 0.028^{f}	5.08± 0.016^{ab}	4.51± 0.032^{e}	5.12± 0.039^{a}	3.75± 0.039^{g}
Albumin gm/dl	1.69± 0.026^{g}	1.65± 0.025^{h}	1.91± 0.029^{d}	1.89± 0.026^{d}	2.09± 0.029^{b}	1.77± 0.024^{f}	1.97± 0.020^{c}	1.82± 0.016^{e}	2.14± 0.019^{a}	1.7± 0.032^{g}
Golobulin gm/dl	1.37± 0.061^{f}	1.46± 0.03^{g}	3.08± 0.053^{a}	2.86± 0.070^{c}	2.94± 0.022^{b}	2.04± 0.039^{e}	3.11± 0.01^{a}	2.69± 0.03^{d}	2.98± 0.03^{b}	2.05± 0.06^{e}
A/G Ratio	0.978 ± 0.03^{b}	1.131 ± 0.03^{a}	0.621± 0.015^{h}	0.661± 0.024^{fg}	0.711± 0.014^{e}	0.864± 0.026^{c}	0.63± 0.009^{hg}	0.677 ± 0.013^{f}	0.718 ± 0.01^{e}	0.830 ± 0.04^{d}
Creatinine mg/dl	0.44± 0.022^{ed}	0.54± 0.022^{a}	0.39± 0.029^{f}	0.51± 0.029^{b}	0.32± 0.026^{h}	0.48± 0.016^{c}	0.35± 0.02^{g}	0.46± 0.016^{cd}	0.25± 0.016^{i}	0.42± 0.025^{e}
Uric acid mg/dl	4.27± 0.029^{g}	5.11± 0.031^{a}	3.99± 0.029^{h}	5.09± 0.032^{a}	4.38± 0.016^{f}	4.75± 0.034^{c}	4.01± 0.016^{h}	4.99± 0.029^{b}	4.5± 0.034^{e}	4.66± 0.022^{d}

The same latter in the same raw is insignificant at P< (00.05)

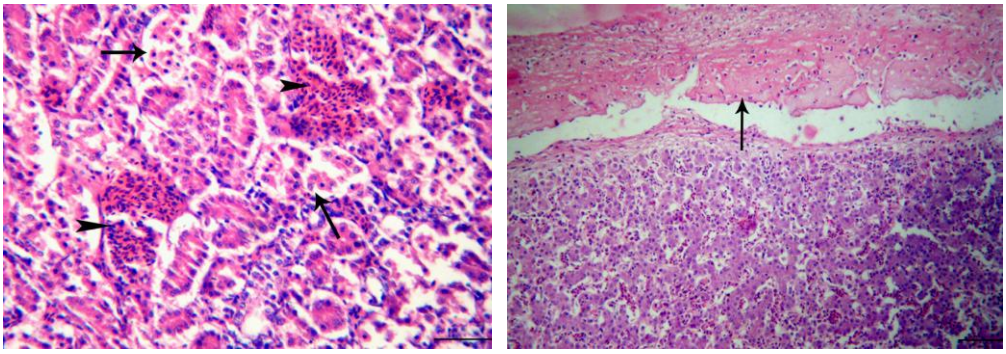

Fig. (1): Kidney of gp (2) showing coagulative necrosis in the renal tubular epithelium (arrows) and hemorrhage among these tubules (arrowheads), HE **(Bar = 100 µm)**.

Fig. (2): Liver of gp (2) showing Perihepatitis of serofibrinous exudate and few leukocytes infiltration (arrow), HE **(Bar = 100 µm)**.

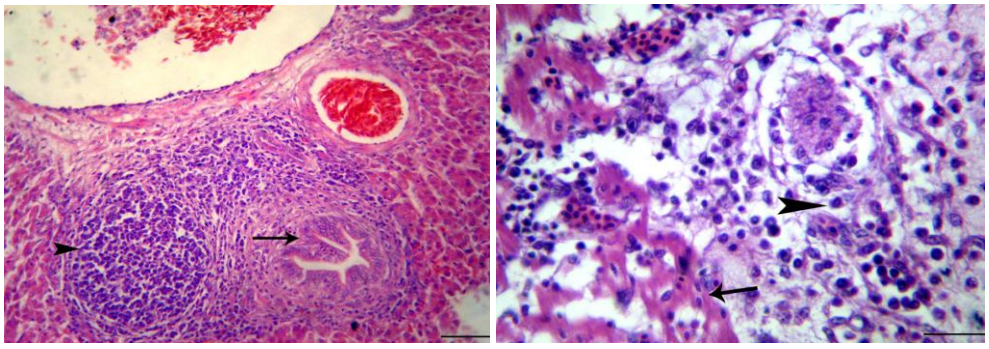

Fig. (3): Liver of gp (2) showing portal area with hyperplasia in the biliary epithelium and round cells aggregation, HE **(Bar = 100 µm)**.

Fig. (4): *Heart of gp (2) showing displacement of the epicardium and the adjacent cardiac muscles (arrow) with round cells (arrowhead), HE (Bar = 100 µm).*

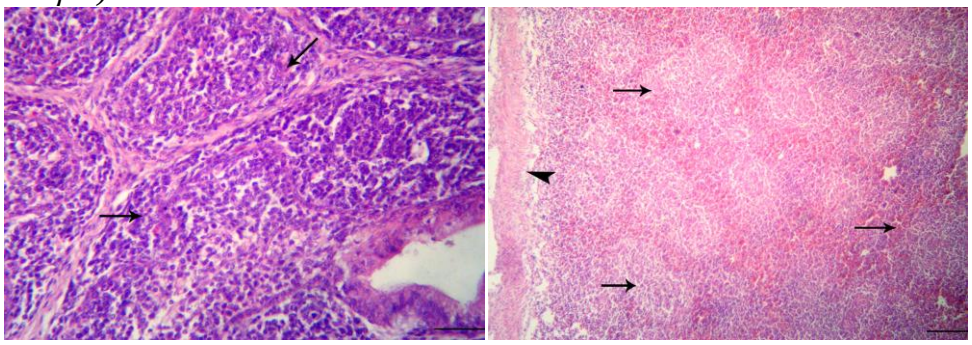

Fig. (5): Bursa of Fabricius of gp (6) showing moderate hyperplasia in the lymphocytes of the lymphoid follicles (arrows), HE **(Bar = 100 µm)**.

Fig. (6): Spleen of gp (8) showing mild hyperplasia in the lymphocytes of white pulp (arrows) with atrophied red pulp and thick splenic capsule (arrowhead), HE **(Bar = 100 µm)**.

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الملخص العربى

التأثيرات البيوكيميائية و الهستوباثولوجية لبعض النباتات العشبية فى بدارى التسمين

مستخلص الزعتر أو الزنجبيل له تأثير فعال على مظاهر النمو الطبيعى فى فراخ التسمين و المناعة و يمكن أن يكون له تأثيرعلى نمو الفراخ المصابة معمليا بالميكروب القولوني عترةO78 .
فى دراستنا استهدفنا دراسة تأثير كل من مستخلص الزعتر أو الزنجبيل كل من بدارى التسمين الصحيحة أو المعدية معمليا بالميكروب القولونى عترة O78 على مظاهر النمو و صورة الدم و أيضا المناعة المتقدمة.
اجرينا الدراسة الفعلية على ١٠٠ فرخ عمر اليوم الواحد وتم تقسيمهم إلى ١٠ مجموعة الأولى منها ضابطة سالبة و الثانية ضابطة موجب معدية بالعترة البكتيرية فقط.
الثمانى مجموعات الأخرى عولجت من عمر يوم أما بالزعتر (١ أو ٢مللى/لتر ماء شرب) أو الزنجبيل (٥ أو ١٠ مللى/لتر ماء شرب). تم عدوى أربعة مجموعات فقط من الثمانية بالعترة الميكروبية عند عمر ١٠ يوم.
قمنا بعد ذلك بقياس بعض التغيرات البيوكيميائية عند عمر ٤ و ٦ أسابيع و بعض التغيرات الهستوباثولوجية كانت النتائج كالأتى:-
بالنسبة لعينات المصل عموما اظهرت الجرعات العالية من كلا المستخلصين تحسنا ملحوظا فى المؤشرات البيوكيميائية مقارنة بالجرعات الأقل سواء كانت غير معدية أو معدية. أيضا المجموعات المعدية و المعالجة بأى من المستخلصين أظهرت تحسنا ملحوظا بالمقارنة بالمجموعة الضابطة المعدية فقط.
قمنا أيضا بأخذ عينات من (الكبد و القلب و الكلى و الأمعاء و الطحال و البرسا و الرئة) للفحص الباثولوجى و التى دعمت بقوة جميع النتائج السابقة حيث اظهرت بعض التغيرات المرضية الظاهرة فى المجموعات المعدية فقط و المعدية و العالجة بالجرعات الصغيرة من كلا المستخلصين و تحسن فى تلك المعدية و المعالجة بالجرعات العلية من كل من الزعتر أو الزنجبيلز ايضا المعالجة فقط بالجرعات العالية أفضل من المعالجة فقط بالجرعات الأقل.