The immune response of broiler chickens fed diets supplemented with Propolis and Digestarom under heat stress condition

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Summary
This research was carried out to evaluate the effect of dietary supplementation of a mixture of propolis and phytogenic (Digestarom) on immune responses against Newcastle disease and infectious bursal disease, also Heterophil/lymphocyte ratios in vaccinated broiler under thermoneutral (maintained on usual heat program) and heat stress maintained in (33 ± 2°C). total of three hundred, one-day-old broilers (Rose 308) chicks were distributed equally in two separated room, thermoneutral groups and heat stress HS groups along the duration of the experiment (42) days, then each group subdivided in to five groups (30 chicks for each) as follow: (thermoneutral group and heat stress group) fed a basal diet supplemented with propolis (2g/kg of diet), (thermoneutral group 2 and heat stress 2) fed Digestarom (150mg/kg), (thermoneutral group 3 and heat stress group 3) fed a mixture of (propolis2g/kg + Digestarom150mg/kg) and two control groups without additive. Antibody titers against Newcastle disease and infectious bursal disease were measured and Heterophil/lymphocyte ratio was estimated. In heat stress chickens the results revealed a significant decrease (P<0.05) in immune response with significant increased (P<0.05) in Heterophil/lymphocyte ratio, while higher significant (P<0.05) in antibody titers with significant decrease (P<0.05) in Heterophil/lymphocyte ratio was showed in all thermoneutral chickens but more significant in thermoneutral group 3 and heat stress group 3 groups were gave the best values in comparing with others groups. The role of Propolis or phytogenic on broiler health and immunity had already been reported, but in this study was reported the effects of their mixture on ameliorating deleterious effects of heat stress.

Keywords: Broiler, Heat stress, immune response, Propolis, phytogenic, Newcastle Disease, Infectious Bursal Disease, Heterophil/lymphocyte ratio.

Introduction
Environmental stressors especially heat stress is one of the problems affecting successful poultry productive and reproductive performance(1). Broiler chickens are homoeothermic, they perform well within a thermoneutral zone range 10 and 26°C of ambient temperature(2). All birds especially broilers seems to be more sensitive to thermal stress due to their greater metabolic activity. Ambient temperatures over thermoneutral (TN) zone of chickens have received more attention, its detrimental effects with heavy economic losses are associated with impaired feed conversion, reduced average daily weight gain, immunosuppressant increased mortality in growing birds and effect on meat quality and egg productions(3 and 4). heat stress (HS) induce immunosuppression of broiler subjected to continuous elevated temperatures(5). heat stress (HS) depressed circulating antibodies leading to reduced systemic humeral immune response and Cell-mediated immunity (6), also it affects the
developing of immune organs in young chickens, causing decreased relative weights of bursa of Fabricius, thymus and spleen (5). As well as reduced phagocytic ability of macrophages, also decreased numbers of lymphocytes and increase in the numbers of Hетrophils / lymphocyte H:L ratio (7 and 8). As it is expensive to cool poultry buildings, certain nutritional manipulations and several feed additives like propolis, Prebiotics and phytobiotics, Probiotics and some vitamins have been found to be helpful(9 and 10). Propolis (bee glue; BG), it is a natural product, which is collected by honeybees from plants has various biological and therapeutic activities with strong antioxidant properties that improve the growth performance and productivity in birds reared under high ambient temperatures (11 and 12). Phytogenic Digestarom are natural, growth promoters, plant derived substances, natural alternatives to antibiotic, which are incorporated into animal feed to improve performance, productivity and digestibility, elimination of pathogens improving feed conversion and improve immune response (13). This study was set up to determine the effects of heat stress on broiler chicks performance and immune systems, and the effect of adding mixture of dietary propolis and /or phytogenic to alleviate this negative effects.

Materials and methods

In this study, three hundred and one day old, broiler (Ross-308) taken from a commercial hatchery, Al-Zahra hatchery Al-Qadesia province were used. They were weighed 40g, at second day 10 blood samples were collected by heart puncture technique for estimating the maternal immunity against Newcastle disease (ND) and Infectious Bursal Disease (IBD) using Enzyme Linked Immunosorbent Assay (ELISA) (indirect method).

All chicks of TN(TG1,TG2,TG3,TG4 and TG5) and HS(HG1,HG2,HG3,HG4 and HG5) groups, except TG5 and HG5 were vaccinated with live ND vaccine (clone 79-Hepra) via eye drop at one day and (La Sota Iso-Vac) via drinking water at day 10, 20, and 30. Also all groups except TG5 and HG5vaccinated with attenuated IBD vaccine (IBDL-Pfizer) at day 13 via drinking water.

Procedure of indirect ELISA test (Snybotic – USA), this test was done according to the manufacturer's instructions ProFLOK® NDV ELISA Kit (Snybotic-USA) (14). Blood samples were collected from the bird’s wing vein of 10 broiler chicken in -each group at 20, and 40 of age. The blood samples (about 3 ml/bird) were collected in tubes and kept at 4°C overnight, serum were separated by centrifugation at 3000 rpm for 5 minutes.

The chicks were distributed in two separated room (150 chick) for each TN and HS, each room then being subdivided in to five partitions by plastic obstructions, representing. Five treated groups (30 chicks for each group) were put in floor pens provided with wood-shavings litter and lightening period of 23 h. /day throughout the experimental period. All experimented chickens fed a corn-soybean meal basal diet and water ad libitum. The temperature in TN was set at 33°C at one day and gradually decreased 2-3°C per week until 21°C, Chicks in HS were kept at constant temperature 33 ± 2°C until 42 days was designated as heat stressed group. Each group treated as follow: (TG1 and HG1) fed a basal diet supplemented with propolis (2g/kg of diet), (TG2 and HG2) fed Digestarom (150mg/kg). (TG3 and HG3) fed a mixture of (propolis 2g/kg + Digestarom®150mg/kg). (TG4 and HG4) Control positive group fed a corn-soybean meal basal diet without supplementation. (TG5 and HG5) Control negative (neither vaccinated nor supplemented) group.

Collected sera were stored at −20 C until further analysis for estimating ND and IBD immune response. Furthermore blood smears was done day 40 for calculating H/L ratios at 42 days. Obtained cell counts were used for calculation of the relative proportion of Hетrophils to lymphocytes (H/L ratio) (15).
Statistical analysis system was adopted to assess the effect of different factors in the studied parameters, using the least significant difference LSD (P<0.05). Multilevel testing to compare the averages of this study, version ratio was calculated(16).

**Result and Discussion**

The mean values of maternal immunity revealed good antibodies titer against ND and IBD about 6939.201±121; 9065±141.8 respectively. Maternal antibodies are transferred from hens to the chicks via the egg yolk (passive immunity) (17). The level of maternal antibody decay and its half life time is important information for designing a suitable vaccination program; the estimated half life time of ND maternal antibody level is 6.3 days (18).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean ± S</th>
<th>Normal group</th>
<th>Heat stress</th>
<th>LSD value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>3943.4±161.7</td>
<td>B a</td>
<td>2943.4±153.3</td>
<td>467.82</td>
</tr>
<tr>
<td>G2</td>
<td>3485.9±162.7</td>
<td>C a</td>
<td>2425.9±103.8</td>
<td>405.26</td>
</tr>
<tr>
<td>G3</td>
<td>5033.1±101.9</td>
<td>A a</td>
<td>3533.1±237.3</td>
<td>542.4</td>
</tr>
<tr>
<td>G4</td>
<td>2537.2±130.1</td>
<td>D a</td>
<td>1737.2±96.3</td>
<td>339.9</td>
</tr>
<tr>
<td>G5</td>
<td>214.3±11.3</td>
<td>E a</td>
<td>102.7±35.3</td>
<td>NS</td>
</tr>
<tr>
<td>LSD value</td>
<td>359.93</td>
<td></td>
<td>402.38</td>
<td></td>
</tr>
</tbody>
</table>
Number of samples: 10 from each group. Means having different capital letters (in columns) and small letters (in rows) are significant difference (P<0.05). LSD: less significant differences.

**G1**: basal diet contain propolis, **G2**: basal diet contain Digestarom, **G3**: basal diet contain propolis and Digestarom mixture, **G4**: basal diet not contain any feed additive (ve+), **G5**: basal diet do not contain any feed additive and not contain any vaccine (ve-).

**Figure (1)**: Means of antibody titer against NDV within each of control and stressed for all treatments at 40 d with different capital letters significantly different (P<0.05). Means for each treatment with different small letters significantly different (P<0.05).

**Figure (2)**: Means of antibody titer against IBDV within each of control and stressed for all treatments at 40 d with different capital letters significantly different (P<0.05). Means for each treatment with different small letters significantly different (P<0.05).

**Table 2**: Effects of different treatments and group in antibody titer against infectious bursal disease at 40 days old.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean ± SE</th>
<th>LSD value</th>
<th>Heat stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>3543.4±162.5</td>
<td>374.44</td>
<td>2543.4±73.3</td>
</tr>
<tr>
<td>G2</td>
<td>2785.9±131</td>
<td>516.6</td>
<td>1965.9±208.2</td>
</tr>
<tr>
<td>G3</td>
<td>4233.1±185.8</td>
<td>540.27</td>
<td>2833.1±177.9</td>
</tr>
<tr>
<td>G4</td>
<td>2087.2±149.3</td>
<td>400.5</td>
<td>1837.2±118.4</td>
</tr>
<tr>
<td>G5</td>
<td>141.6±31.8</td>
<td>392.22</td>
<td>105±25.9</td>
</tr>
</tbody>
</table>

Number of samples: 10 from each group. Means having different capital letters (in columns) and small letters (in rows) are significant difference (P<0.05). LSD: less significant differences.
protection in heat stressed chickens as they comparing to TG4 2087.2±149.3.

The results indicates the positive effects of Propolis and/or phytogenic in elevating the Abs titer against IBD, also the mixture of prop+ Digestarom® showed the best result compared to each additive alone, and the efficiency of propolis was better than phytogenic. The influence of the heat stress on the broiler bursa of Fabricius and spleen, and other lymphoid organs indicated by atrophy and reduction in bursa weight, these results agree with (5), whom reported the heat stress of influence on spleen and thymus caused atrophy and reduction in bursa weight known as the main immune organ leading to depressed of defense mechanism against microorganisms and immunosuppression. This could have been a result of the reduction in feed intake, thereby providing less nutrients for the proper development of these organs. Also, (21) reported that addition of propolis to the diets increased relative weight of bursa of Fabricius and spleen of broiler chickens and improve the immune response, also relate to the ability of Propolis to stimulate and improve immunological function.

Heterophil/Lymphocyte ratio (H/L) ratio at 40 days old broiler under heat stress.

Table (3) and Fig.3, summarized the level of H/L ratio in broiler at the end of experiment in different treated groups. Reduction in the numbers of lymphocytes and monocytes and increase in the numbers of Hetrophils have been reported for stressed broilers are agreed with, (7), whom reported the dietary application of natural antioxidants is considered an appropriate practical strategy to reduce the deleterious consequences of stressors in animals (11). In this study, an increased Heterophil/lymphocyte ratio was found in heat-stressed chicks without supplementation.

Table, 3: Effects of different treatments and group in H/L at 40 days old

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean ± SE</th>
<th>LSD value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal group</td>
<td>Heat stress</td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>0.424±0.08</td>
<td>0.464±0.07</td>
</tr>
<tr>
<td>G2</td>
<td>0.464±0.01</td>
<td>0.504±0.01</td>
</tr>
<tr>
<td>G3</td>
<td>0.394±0.01</td>
<td>0.434±0.03</td>
</tr>
<tr>
<td>G4</td>
<td>0.494±0.01</td>
<td>0.602±0.01</td>
</tr>
<tr>
<td>G5</td>
<td>0.492±0.02</td>
<td>0.612±0.02</td>
</tr>
<tr>
<td>LSD value</td>
<td>0.064</td>
<td>0.053</td>
</tr>
</tbody>
</table>

Figure 3: Means of H/L ratio within each of control and stressed for all treatments with different capital letters are significantly different (P<0.05). Means for each treatment with different small letters are significantly different (P<0.05).
TN groups revealed significant decrease (P<0.05) in the H/L ratio in G3, G1, G2 with values (0.394±0.01; 0.424±0.08; 0.464±0.01) respectively, compared to G4,G5 (0.494±0.01; 0.492±0.023), this may be due to immunostimulatory effect of propolis or phytogenic or the combination of them which lead to increase proliferation of lymphocyte test these results agree with (7) whom reported and this in line (22) with on the other hand, The HS groups, revealed significant increase (P<0.05) in heat control groups G4,G5(0.602±0.01; 0.612±0.02) respectively in comparing with other heat treated groups G3,G1,G2.(0.434±0.03; 0.464±0.070; 504±0.01). The heat stress resulted in elevation of H/L ratio, but the mixed supplement or propolis or phytogenic alone ameliorating the negative impact of heat stress and decrease the elevation in H/L ratio induced by HS. This agree with (23) decrease in Heterophil count is also a positive indication of improved action of dietary antioxidants against heat stress, as indicated in our study stimulation of immune system and reduction of inflammatory reaction of chickens in significant increases in the serum lymphocytes and significant decreases in the numbers of Hetrophils compared with those of the controls groups or HS groups.

References

The Iraqi Journal of Veterinary Medicine, 42(2):33-40.

The study evaluated the immune response of broilers fed with a combination of vitamin E and digestion enzyme under moderate heat stress.

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