**Summary**

The main aims of the present study were to determine the influence of soluble *β-*glucanon immune response of broiler chickens reared under heat stress .In order to determine the influence, one hundred and twenty broiler chicks one day old (Breed: Ross, Belgium Origin) were taken from a commercial hatchery (Al-Baraka hatchery-Diyala-Kanaan) and divided into two main groups; group under heat stress and a control group. Each group was divided into two subgroups G1, G2, G3 and G4 containing thirty chicks. The experiment was conducted for six weeks. The stressed group was exposed to heat stress (35ºC±1ºC) starting from the third week of age until the end of the experiment. Group 1 and Group 3 were supplemented *ad libitum* with 225µg/ml of soluble *β*-glucan in drinking water from day 1 to the end of the experiment , while G2 and G4 were kept as control.

The present study was based on the preparation of soluble *β*-glucan extracted from the cell wall of *Saccharomyces cerevisiae*; and the immune response was evaluated by specific parameters which included the phagocytic assay by carbon clearance ability, *in vivo* study the lymphoproliferative response to phytohemagglutinin to determine cell-mediated immunity.

In addition, evaluating the Heterophil / Lymphocyte ratio as a measure of stress, and determination of the serum antibody titer post vaccination with the Newcastle Disease Vaccine by ELISA test. Also histological evaluation and Immunohistochemical detection of macrophages by using monoclonal antibodies (mouse anti-chicken macrophage KUL-01).

At day one of age blood samples were collected to determine the maternal serum antibody titers for Newcastle Disease Vaccine by ELISA test. At 10 and 20 days of age, subgroups G1, G2, G3 and G4 were vaccinated with ND vaccine in drinking water. Blood samples were collected on days 7, 14 and 21 after the first vaccination to determine the serum antibody titer by ELISA test.

The result showed that there was no significant differences (P>0.05) among all groups at 1 day old in maternal antibody titer, but there were significant differences (P < 0.05) among all groups at 7 ,14 and 21 days old.

At 7,14 21,28, and 35 days old, blood samples were taken for evaluation the Heterophil / Lymphocyte ratio. The result showed that there were no significant differences among the non-stressed and stressed groups at 7 and 14 days old (before heat stress) while there was a significant difference (P˂0. 05) within heat stressed treated groups which showed an elevation in H/L ratio at 21,28 and 35 days old. Also there was a significant difference (*P* < 0.05) between groups that have been treated with *β*-glucan G1, G3 at 21, 28 and 32 days old compared with the control non treated non stressed group G4 at same periods.

The phagocytic activity was examined on days 14 and 24 of age by quantitating the *in vivo* carbon clearance. The result showed that there was a significant difference (P < 0.05) among groups that have been treated with *β*-glucan and the non-treated groups at 14 days old (before the heat stress). Also there were significant differences (P < 0.05) among G1 and G3 with G2 and G4 groups at 24 days old .

*In vivo* cell-mediated immunity response to PHA was carried out on days 17 and 27 of age. The result showed that there were significant differences (P < 0.05) among all groups , heat stressed treated G1 and heat stressed non treated group G2, also in the non stressed treated G3 and non stressed non treated G4 group.

At days 14 and 24 of age small intestine and bursal tissues were taken for preparation the paraffin embedded tissue blocks for histological evaluation and Immunohistochemical detection of macrophages by using monoclonal antibodies (mouse anti-chicken macrophage KUL-01).The results of immunohistochemical analysis have demonstrated that the positive staining for duodenal and bursal macrophages labled with KUL-01 mouse anti-chicken monocyte- macrophages monoclonal antibody. Sections of duodenum and bursa at 14 days old treated with 225µg/ml of soluble *β*-glucan in drinking water showed positive result red-brown staining macrophages in tissues of G1 and G3 compared to the duodenal and bursal tissues of G2 and G4 groups which appear no stained cells. The same results were demonstrated on 24 days old duodenal and bursal sections of heat stressed or non stressed treated groups which showed positive stained macrophages in G1 and G3 compared to the non treated groups G2 and G4 which showed no stained cells.

The histological result of duodenal and bursal sections of G1 on 14 days old, treated with 225µg/ml of soluble *β*-glucan in drinking water showed infiltration of polymorph nuclear lymphocyte in the duodenum, and the bursa showed moderate hyperplasia of lymphoid follicle, G3 duodenal section showed lymphoid tissue hyperplasia in sub epithelial layer and hyperplasia of goblet cells, while G4 appeared normal . At 24 days old, G1 duodenal section showed hyper cellular of lamina properia and inflammatory cells mainly heterophil between villi and in the lumen, while the bursa showed slight hyperplasia of lymphoid tissue. G2 stressed non treated the duodenum showed severe destruction in mucosal epithelia with sloughing. G3 showed duodenal cellular infiltration in the sub mucosa , while bursa showed lymphoid hyperplasia. G4 sections showed normal appearance.

Accordingly the result obtained from this study indicated that *β*–glucan enhances the cellular and humoral response.

Further, it has immuomodulatory effects on broiler chickens under heat stress.