

**ENHANCEMENT OF IMMUNOCOMPETENCE  
AND ENVIRONMENTAL STRESS  
TOLERANCE IN POULTRY**

By

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B.Sc. Agric. Sc. (Animal and Poultry Production), Ain Shams University, 2011

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## ABSTRACT

**Mona Ahmed Mohamed Hemida: Enhancement of Immunocompetence and Environmental Stress Tolerance in Poultry, Department of Poultry Production, Faculty of Agriculture, Ain Shams University, 2016.**

Five hundred and ten broiler breeder eggs were obtained from Cobb-500 broiler breeder flock at 48 WOA.

At the embryonic day 16 (E16), eggs were randomly divided into two equal main groups, each of 240 eggs. The first group of eggs was set under the normal incubation conditions and served as control ( $T_0$ ), while the second group ( $T_1$ ) was subjected to  $39.5^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$  in another automatic incubator where the incubation temperature was raised for only 5 h/day (d) from (E16-E18).

On the 4<sup>th</sup> day of age (DOA), 90 chicks from each of the main two groups ( $T_0$  and  $T_1$ ) were randomly subdivided into two sub-groups, each of 45 chicks. One of each sub-group was exposed to a thermal conditioning at  $38.0 \pm 0.1^{\circ}\text{C}$  and 42.0% RH for 5h/d in another controlled chamber through the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> DOA, while the other sub-group was kept under the optimal brooding conditions, resulting finally in four sub-groups;  $T_0T_0$ ,  $T_1T_0$ ,  $T_0T_1$  and  $T_1T_1$ .

The egg temperature, hatchability and embryonic mortality percentages; post-hatch performance and muscles traits; some blood and histomorphometric measurements of pectoral muscles and immune lymphoid organs were investigated.

Embryonic TC decreased embryo weight, breast muscles relative weights at E18 and late embryonic mortality as well as embryonic heat production compared to control group. At 42 DOA, all TC groups, particularly  $T_1T_1$  had higher ( $P \leq 0.01$ ) growth performance and carcass traits, as well plasma total proteins, globulin, calcium and phosphorus values than the non TC group ( $T_0T_0$ ). Likewise, bursa and thymus relative

weights were increased significantly in TC groups. Converse trends were exhibited for values of Hb, PCV% and plasma MDA. With pre and postnatal TC, whether singly or in combination, IGF-I level was increased;  $T_4$  was reduced, while  $T_3$  level did not significantly change at 42 DOA. Highly significant elevation was obtained in both rectal temperature and respiration rate at 6 DOA, and disappeared at later ages. hsp70 expression was enhanced at E18 for  $T_1$  and at 42 DOA for  $T_1T_1$  more than  $T_0T_1$  and  $T_1T_0$ , while  $T_0T_0$  had the poorest hsp70 expression. Chicks of  $T_1T_0$  and  $T_1T_1$  had increased the number and dimensions of myocytes in major pectoralis muscles. The worst histomorphometric measurements of bursal sections were associated with  $T_0T_0$  compared with TC groups, especially  $T_1T_1$ . Thymus sections showed lower changes due to TC, while the lowest changes among all groups including control one was observed for spleen sections, indicating that bursa is the most sensitive lymphoid organ to heat stress and spleen is the least sensitive.

In conclusion, pre and/or postnatal TC treatments are practical application to enhance the thermotolerance acquisition and immunocompetence of broiler chicks, and therefore productive and physiological responses under the conditions of heat stress. Moreover, superior benefit could be achieved by the combination of both procedures as established by  $T_1T_1$  group.

**Key words:** Thermal conditioning, broiler, embryo, growth, hormones, thermotolerance, hsp70, lymphoid organ, histomorphometric.

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