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Effects of Induced Heat Stress on Haematological Values in Broiler Chicks

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ABSTRACT

Haematological changes in broiler chicks exposed to high temperatures were investigated. For this purpose, 100 day-old broiler chicks were reared and at the age of 28 days divided into three groups viz., A, B and C and kept at 28-32, 35-40 and 40-45°C, respectively. Blood samples were collected from these groups at the age of 32, 36, 40 and 44 days, and processed for different haematological parameters. The erythrocyte counts were significantly lower in group B and group C as compared to the group A. There was no effect of high temperature on hemoglobin concentration; whereas, PCV increased at higher temperatures, and both TLC and DLC significantly ($P<0.01$) decreased in group B and C.

Key Words: Heat stress; Haematology; Broiler; Chicks

INTRODUCTION

Heat stress is one of the main factors adversely affecting overall poultry production in the tropical regions. It is established that heat stress not only effects growth rate and feed efficiency but also increases death losses in the birds. The domestic fowl is homoeothermic which can live comfortably only in relatively narrow zone of thermo neutrality ranging from 14.5 to 25.5°C (Freeman, 1969). Any deviation especially in upper limit depresses both the survival rate and productivity of the broilers.

The broilers kept during summer season in Pakistan undergo a long heat stress. No study has been carried out to analyze hematological parameters in heat stressed broilers under the local environmental conditions. Therefore, the present study was proposed.

MATERIALS AND METHODS

One hundred day old broiler chicks were procured from Khyyam chicks, Faisalabad. The birds were kept under standard management conditions, till fourth weeks of age. Temperature in the brooder was maintained at 35°C and then reduced gradually to 30°C during the first week. The chicks were vaccinated against infectious bronchitis, Newcastle disease, hydro pericardium and Gumboro disease.

After 28 days, 60 birds were divided into three A, B and C equal groups and remaining 10 birds were culled, 10 birds died and 20 birds were slaughtered on day 7 and 14 for collection of blood. Group A (control) was kept at 28-32°C, group B at 35-40°C and group C at 40-45°C. Clean and fresh water and commercial broiler feed was provided *ad libitum* through out the study. Daily temperature was recorded.

Heat compartments were used to expose the birds to the desired temperatures. Each of the three compartments was made by dividing a room (12 x 16 x 11) into three equal compartments (5 x 12 x 11). A maximum/minimum thermometer was fixed to record the daily temperatures. Air conditioner was used to maintain 28-32°C, in compartment A (control). The compartment B was made to keep the temperature limit of 35-40°C, maintained with the help of an air cooler and exhaust fan. The compartment C was developed in such away that the temperature range remained between 40-45°C and for this purpose a 1000 watt-heating element along with an electric fan blower was used. Temperature phase was kept for 8 h daily from 28-44 days. All the temperature-controlling devices were attached with individual thermostats in each compartment.

To determine the hematological parameters in induced heat stress broiler chicks, blood samples with and without anticoagulant were collected from these groups on days 32, 36, 40 and 44. RBC counts were done with the help of a hematocytometer by using the technique by Natt and Herick (1952), Hemoglobin concentration was determined by Sahli`s Acid Hematin method, PCV was obtained by the microhematocrict method, Hemocytometer was used for TLC and the procedure of Sastry (1989) was adopted for DLC.

Statistical analysis. Data thus collected were analyzed by using the two factor RCBD through MSTAT-C software.

RESULTS AND DISCUSSION

The changes in RBC counts, Hb, PCV, TLC and DLC from 5^{th} to 6^{th} week of age in broiler chicks maintained at three different temperatures are shown in Table I.

Table I. Hematological values (Mean ± SE) from 5th to 6th week of age in broiler chicks maintained at three temperatures

Parameter	Group(A)	Group(B)	Group(C)
	(28-32°C)	35-40°C	40-45°C
RBC (10^6/mm^3)	2.70±0.07[a]	2.31±0.06[b]	2.23±0.05[b]
Hb(gm/dL)	9.02±0.23[a]	8.11±0.17[b]	7.85±0.18[b]
PCV (%)	26.38±0.49[a]	31.06±0.53[b]	39.10±0.44[c]
TLC (10^3/mm^3)	24.71±0.36[a]	26.29±0.41[b]	28.02±0.52[c]
Neutrophils (%)	31.95±0.83[a]	36.70±0.60[b]	41.30±0.55[c]
Lymphocytes (%)	51.20±0.74[a]	49.45±1.63[a]	42.55±0.64[b]
Monocytes (%)	11.55±0.56	10.85±0.63	11.50±0.47
Eosinophils (%)	1.90± 0.19	1.65±0.13	1.60±0.15
Basophiles (%)	1.90±0.19	1.65±0.13	1.60±0.15

Figures bearing different superscripts in a row differ significantly (P<0.01).

The results indicated that birds which were kept as control (Group A, 28-32°C), showed RBC counts significantly different as compared to birds which were kept at high temperature group B (35-40°C) and group C (40-45°C). However, RBC counts in group B and C showed no significant difference. Lowered RBC counts in group B and C than group A might be due to decreased oxygen consumption by the chicks as a result of high ambient temperature and this may be associated with a concurrent reduction in the production of red blood cells (depressed hemopoetic activity) as a consequence of lower basal metabolic rate (Huston *et al.,* 1962)

Different temperatures significantly (P<0.01) affected the level of hemoglobin concentration during the 5th and 6th week of age. There was decrease in the Hb levels in the B and C groups as compared to control. However, Hb in B and C groups did not show any difference. The study confirms the results of Deaton *et al*. (1969) and Zimmerman *et al*. (1973, 1975).

Highly significant (P<0.01) difference in PCV at different temperatures was observed during the 5th and 6th week of age in all groups. Increased PCV as observed in group B and C was might be due to hemoconcentration because of high temperature. These results are in line with the findings of Huston (1960) and Moye *et al.* (1969). TLC in broiler chicks kept on high temperatures (Group B and C) was higher as compared to the broiler chicks (Group A) which were kept at low temperature. Differences among three treatments were significant (P<0.01). Leucocytosis in broilers exposed to heat stress (Group B and C) seems to be due to an increase in neutrophils. On the other hand, lymphocytes showed an decreasing trend as compared to control group A. In general, the lymphatic organs spleen, thymus and bursa of fabricious become smaller during prolonged exposure to high temperature and there is reduction in circulating lymphocytes. Findings about high counts of neutrophils and low counts of lymphocytes in the present study were in line with the findings of Al-Hassani *et al.* (1987). Monocytes, eosinophils and basophil counts did not show any difference between control (Group A) and heat stress given groups (B and C) in broiler chicks.

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