

# Effects of Induced Heat Stress on some Biochemical Values in Broiler Chicks

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## ABSTRACT

Effect of heat stress on serum glucose, serum total proteins, serum electrolytes, alkaline phosphatase (ALP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) was studied in broiler chicks. Different groups i.e. A (control), B and C of chicks were given heat stress at 28-32, 35-40 and 40-45°C, respectively. The birds exposed to high temperatures (group A and B) showed increased level of blood glucose compared with group A. However, there was non-significant difference in blood glucose level between chicks kept at 35-40°C and 40-45°C. A decrease in the amount of protein was found in group C as compared to control. The amount of Na<sup>+</sup> and K<sup>+</sup> remained unchanged. The level of ALP remained similar with slight variation. The level of AST and ALT was not affected by age in all groups. However, environmental temperatures have significant affect on the concentration of serum AST and serum ALT.

**Key Words:** Broiler; Chick; Heat stress

## INTRODUCTION

In tropical regions, there is great concern of high temperatures affecting overall poultry production. It is established that heat stress not only affects growth rate and feed efficiency but also increases death losses in the birds. The long summer months in our country adversely affect the broiler productivity and survival rate. Blood electrolytes balance is altered during heat stress (Mitchell & Siegel, 1979). During summer season, in our country, the broilers undergo a long heat stress. No study has been carried out to analyze the biochemical parameters in heat stressed broilers, therefore, a project was designed to study the effect of induced heat stress on biochemical parameters in broilers. This study will provide basic information to design further experiments to find means of alleviation of heat stress under the local environmental conditions.

## MATERIALS AND METHODS

One hundred day-old broiler chicks were procured from Khyyam chicks, Faisalabad. The trial was conducted at University of agriculture, Faisalabad. The birds were kept under standard management conditions, till fourth week 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 infections 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 at 28 days, 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 temperatures were 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 control compartment. The compartment B was made to keep the temperature limit of 35-40°C, this temperature was maintained with the help of an air cooler and exhaust fan. The compartment C was developed in such a way 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 biochemical parameters in induced heat stress broiler chicks, blood samples with and without anticoagulant were collected from these groups on day 32, 36, 40 and 44. Serum glucose was determined by o-Toluidine-Acetic Colorimetric Method using the Cromatest reagent kits B260 B221. Serum total proteins were estimated by the Gornall Colorimetric Method using the Cromatest reagent kits B259 and B214. Serum electrolytes (Na<sup>+</sup> and K<sup>+</sup>) were determined by the Corning flame photometer. Serum ALP activity was measured by Bessey-Lowry, one point-colorimetric method using the Cromatest reagent kits E519, E507 and E502. AST and ALT activity was determined according to the Reitman-Frankel (1957) Colorimetric method using the cromatest reagent kits E551, E552, E553, E504 and E505.

**Statistical analysis.** Data thus collected was analyzed by using the two factors RCBD through MSTAT-C software.

## RESULTS AND DISCUSSION

The changes in blood glucose level, serum proteins, serum sodium, serum potassium, alkaline phosphatase (ALP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) from 5<sup>th</sup> to 6<sup>th</sup> week of age in broiler chicks maintained at three different temperatures are shown in Table I.

Birds exposed to heat showed increased ( $P<0.01$ ) level of blood glucose as compared to the birds kept on 28-32°C. However, there was no difference in blood glucose levels in chicks kept at 35-40°C or 40-45°C. Results on the same lines were declared by Hazelwood (1965). He reported that

Hassani *et al.* (1987) observed similar findings. They reported increase in temperature affects the activity of ALP.

The levels of AST and ALT in the 5<sup>th</sup> and 6<sup>th</sup> week were not affected by age in experimental groups (A, B and C). However, environmental temperatures have significant ( $P<0.01$ ) effects on the concentration of serum AST and ALT. The rise in concentration of ALT and AST was more in group C as compared to group B. The results are in close conformity with findings of Polonis (1982) and Al-Hassani *et al.* (1987). They observed significantly ( $P<0.01$ ) increased levels of AST and ALT at different high environmental temperatures.

**Table I. Biochemical values (Mean  $\pm$  SE) from 5<sup>th</sup> to 6<sup>th</sup> week of age in broiler chicks maintained at three temperatures**

Parameter	Group A (28-32°C)	Group B (35-40°C)	Group C (40-45°C)
Blood glucose (mg/dL)	261.65 $\pm$ 5.37 <sup>a</sup>	286.65 $\pm$ 7.14 <sup>b</sup>	305.95 $\pm$ 3.23 <sup>b</sup>
Total protein (g/dL)	4.01 $\pm$ 0.13 <sup>a</sup>	3.57 $\pm$ 0.11 <sup>ab</sup>	3.33 $\pm$ 0.10 <sup>b</sup>
Sodium (mEq/L)	144.35 $\pm$ 1.97 <sup>a</sup>	120.35 $\pm$ 1.87 <sup>b</sup>	111.90 $\pm$ 1.73 <sup>c</sup>
Potassium (mEq/L)	5.48 $\pm$ 0.12 <sup>a</sup>	4.20 $\pm$ 0.50 <sup>b</sup>	3.99 $\pm$ 0.14 <sup>b</sup>
ALP (Kau)	80.80 $\pm$ 2.18 <sup>a</sup>	72.40 $\pm$ 2.24 <sup>b</sup>	55.95 $\pm$ 2.02 <sup>c</sup>
AST (IU/L)	23.90 $\pm$ 1.06 <sup>a</sup>	36.85 $\pm$ 1.41 <sup>b</sup>	55.80 $\pm$ 2.40 <sup>c</sup>
ALT (IU/L)	72.40 $\pm$ 2.47 <sup>a</sup>	79.65 $\pm$ 1.87 <sup>ab</sup>	81.90 $\pm$ 1.88 <sup>b</sup>

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

blood glucose level increases under the effect of heat stress. The serum concentration of total proteins showed significant ( $P<0.01$ ) variation when birds were exposed to high temperature (Group B and C). A noticeable decrease ( $P<0.01$ ) in the amount of protein was found in group C as compared to the control. These results are in line with the findings of Huston and Subha (1969), who reported that high protein levels were found at low temperatures than at high temperature.

The amounts of Na<sup>+</sup> and K<sup>+</sup> during the 5<sup>th</sup> and 6<sup>th</sup> weeks were observed unchanged in broilers within each group. However, significant ( $P<0.01$ ) variation was observed in birds under different temperatures. Birds at high temperatures (Group B and C) showed significantly ( $P<0.01$ ) lowered levels of Na<sup>+</sup> and K<sup>+</sup> as compared to control (Group A). Similar results were found by Mitchell and Siegel (1973) and Cheveille (1979). They stated that the blood electrolytes level of chickens is altered during heat stress.

Significant ( $P<0.01$ ) lowered activity of ALP was found during the 5<sup>th</sup> and 6<sup>th</sup> week of age in heat stress treated broiler chicks. Makined and Eatunmbi (1985) and Al-

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