Effect of heat stress for specific period on juvenile traits, feed efficiency and some heat stress parameters in different genetic groups of broilers


ICAR-Directorate of Poultry Research, Rajendranagar, Hyderabad-500 030, Telangana, India.

Received: 23-05-2017 Accepted: 24-07-2017 DOI: 10.18805/ijar.B-3441

ABSTRACT

To evaluate the effect of heat stress an experiment was conducted in which one cross (PB-1X Naked neck), two pure lines (PB-1 and Naked neck) and corresponding control populations were generated simultaneously on the same day. 120 chicks in PB-1X Naked neck (Control 120), 91 chicks in Naked neck pure (Control 82) and 81 chicks in PB-1 pure (Control 80) were generated. Temperatures were raised (up to 40°C) by providing the two halogen lamps in each of the heat stressed genetic groups from 4-6 weeks of age. Body weights were recorded at 0, 2, 4, 6 and 7 weeks of age along with conformational traits like breast angle and shank length at 6 weeks of age. 2ml of blood was collected at 6 weeks of age from all the 6 genetic groups (10 birds from each) to estimate the heat stress parameters. Feed efficiency was recorded at 6 weeks and 7 weeks of age. Significant differences were found for SOD, CAT, ALP and GPx between heat stressed and control genetic groups. Higher estimates were found in heat stressed genetic groups as compared to corresponding control groups. For juvenile body weights in stressful conditions there is significant difference between genetic groups. Lower juvenile body weights were recorded in heat stressed genetic groups as compared to control groups. Lower feed efficiency was recorded in heat stressed genetic groups as compared to corresponding control groups.

Key words: Antioxidative enzymes, Genetic groups, Heat stress, Juvenile traits, Naked neck.

INTRODUCTION

In the hotter regions of the world high ambient temperature is the main cause for potent climatic stress causing impaired antioxidant status in poultry (Wolfenson et al., 1979 and Donkoh, 1989). Many countries have laws or welfare codes that protect poultry from distress and fear (Webster and Nicol, 1988). It causes poor growth performance (Botjee and Harrison, 1985), immunosuppression (Young, 1990) and high mortality (Yahav et al 1995). Adoption to heat stress requires the physiological integration of many organs and systems such as endocrine, cardio respiratory and immune systems. Etches et al (1995) have reviewed the molecular, physiological, neuroendocrine and behavioral responses of birds to heat stress. Present research paper focuses the effect of heat stress on juvenile traits, feed efficiency, mortality and some heat stress parameters.

MATERIALS AND METHODS

Genetic Stock: Synthetic Coloured Broiler Male line (PB-1), Naked neck broiler line (NN) maintained at Directorate of Poultry Research (ICAR), Rajendranagar, Hyderabad-30 were mainly used for this purpose. Cross was made between PB-1X naked neck (PN). For these 3 genetic groups corresponding control populations were generated from the same group. All the 6 genetic groups were generated simultaneously. A total of 81 chicks in PB-1 pure (control 80), 91 chicks of naked neck (control 82) 120 chicks of PN cross (Control 120) were utilized for the present experiment.

Brooding and management: All the 6 genetic groups were brooded separately in brood-grow houses. Standard floor, brooder, feeder and water spaces were provided in these pens up to 7 weeks of age. Marex disease vaccination was done at day old age in the hatchery. Raniket disease vaccination was done at 1st week of age. The Temperature of the pen outside the brooder was increased to 38-40°C by providing the 3 Halogen lamps of 1000 watts capacity each. Temperature was measured daily 3 times by temperature and humidity sensor. R.H in the pens was 65-70%. Temperatures were raised for specific period i.e 4-6 weeks of age in the treatment groups only. Control groups were maintained under the normal shed temperatures only. Brooders were removed by 6 weeks of age. Standard broiler starter ration was provided up to 3 weeks of age, there after finisher ration was fed (4-7 weeks).

Traits measured: Juvenile body weights were recorded at 0, 2, 4, 6 and 7 weeks of age and conformation traits like breast angle and shank length were recorded at 5 weeks of age. Feed efficiency was recorded up to 6 weeks and 7 weeks of age. Percent mortality was recorded up to 7 weeks of age. At 6 weeks of age 2ml of the blood was collected from 15 birds from each genetic group and serum was separated and incubated at 14°F. The following heat stress parameters were
analysed as per the standard protocol. Alkaline Phosphatase (ALP), Glutathione peroxidase (GPx), Superoxide dismutase (SOD), RBC catalase (CAT) and Lipid peroxidase (LPO).

Statistical analysis: Statistical analysis are carried out using SPSS version 17.0 software. Data for all the genetic groups were compared using 1-way ANOVA followed by Duncan’s multiple comparison tests.

RESULTS AND DISCUSSION

Juvenile body weights: Juvenile body weights recorded are presented in the Table 1. 0 day body weights were significantly different among the 6 genetic groups. This body weight was highest in PN stress group (33.40g) and was least in PB-1 control. At 2 week of age was also body weight was significantly different among 6 genetic groups. This was also highest in PN control and was least in NN control. 4 week body weight was significantly different among the 6 genetic groups. Highest body weight was recorded in PN stress group and was least in NN stress. 5 week body weight was significantly different among the genetic groups. This was highest in PB-1 control and it was least in NN stress. 6week body weight also showed significant difference among the genetic groups. This was highest in PB-1 control and it was least in NN stress. 7week body weight was significantly different among the genetic groups.

Conformation traits: Shank length and breast angle recorded at 5 weeks of age was presented in Table 2. Shank length was significantly different among the 6 genetic groups. Shank length was highest in PB-1 control group. Breast angle also differs significantly among the genetic groups. This was also highest in PB-1 control group.

Heat stress parameters: Estimates of heat stress parameters were presented in Table 3. Lipid peroxidase values (n mol MDA/mg protein) were higher in heat stressed genetic groups as compared to control groups. Heat stress also caused oxidative stress, increased red blood cell susceptibility to peroxidation, as indicated by increased MDA concentration. There was non significant difference among the 6 genetic groups. RBC catalase (Units/mg of protein) was higher in PB-1 stress group as compared to control groups. For this estimate in other genetic groups no definite trend was observed. For this estimate significant difference was found among the six genetic groups. Glutathione peroxidase (Units/mg of protein) higher estimates were observed in Heat stressed genetic groups as compared to control groups. There was significant difference among the 6 genetic groups. Alkaline phosphatase (units/L of serum) estimates were higher and was least in NN stress. 5 week body weight was significantly different among the genetic groups. This was highest in PB-1 control and was least in NN stress. 6week body weight also showed significant difference among the genetic groups. This was highest in PB-1 control and it was least in NN stress. 7week body weight was significantly different among the genetic groups. This was highest in PB-1 control and was least in NN stress.
Table 4: Feed efficiency and mortality in treatment and control groups.

<table>
<thead>
<tr>
<th>Genetic Group</th>
<th>FCR(6WK)</th>
<th>FCR(7WK)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN Stress</td>
<td>2.286</td>
<td>2.534</td>
<td>10.40</td>
</tr>
<tr>
<td>NN control</td>
<td>2.196</td>
<td>2.746</td>
<td>12.50</td>
</tr>
<tr>
<td>PB-1 Stress</td>
<td>2.275</td>
<td>2.551</td>
<td>9.09</td>
</tr>
<tr>
<td>PB-1 control</td>
<td>2.029</td>
<td>2.331</td>
<td>3.71</td>
</tr>
<tr>
<td>PN Stress</td>
<td>1.899</td>
<td>2.150</td>
<td>5.97</td>
</tr>
<tr>
<td>PN control</td>
<td>1.854</td>
<td>3.169</td>
<td>1.97</td>
</tr>
</tbody>
</table>

*PN- PB-1x Naked Neck; NN- Naked Neck*

in heat stressed genetic groups as compared to control groups except in Naked neck cross. There was significant difference among the 6 genetic groups. Superoxide dismutase (Units/mg of protein) estimates were higher in heat stressed genetic groups as compared to control groups except in Naked neck. There was significant difference among the 6 genetic groups. Increase in antioxidative enzymes in heat stressed birds also found by McArdle and Jackson (2000). Increase in antioxidative enzyme activities have been considered as protective response against oxidative stress (Mates et al 1990, Devi et al., 2000, Thomas, 2000). Living organisms are able to adapt to oxidative stress by inducing synthesis of antioxidative enzymes and damage removal/repair enzymes (Davies, 1995).

**Feed efficiency and Mortality**

Feed efficiency up to 6 and 7 weeks of age and mortality up to 7 weeks in different genetic groups were presented in Table 4. Feed efficiency was better in control groups as compared to heat stressed genetic group. Mortality was higher in all heat stressed genetic groups as compared to control groups except in Naked neck.

**CONCLUSION**

These results indicated that in Naked neck (NN) and PB-1X Naked neck (PN) cross lower values of the heat stress parameters were recorded as compared to other genetic groups. Significantly higher juvenile body weights were obtained in these two genetic groups as compared to other genetic groups. High feed efficiency and low mortality were obtained in these genetic groups as compared to PB-1. Since Naked neck gene expression is evident these two genetic groups for this reason these two genetic groups were relatively resistant to heat stress as compared to other genetic groups. Further study in this direction is needed to establish the heat stress parameters in these genetic groups.

**REFERENCES**


