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Estimation of Interleukin 1β (IL-1β) in broilers reared under coloured light emitting diodes vis-à-vis incandescent supplemental lighting

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ABSTRACT

Present study was performed to estimate Interleukin 1β (IL-1β) of broiler birds' in an open-sided house under supplemental lighting programme using light emitting diodes (LEDs) and incandescent light. A total of 240 straight run commercial Cobb broiler chicks were procured, distributed in four different light treatment groups i.e. T_1; white (650nm), T_2; green (565nm) and T_3; blue (430nm) light LED (3 Watt each) and incandescent light bulbs (60 Watt each) as control (Tc) in 12 pens (4x3 factorial design) and reared from day old to 6th week of age. Matching colour curtains were placed inside each pen of shed according to light treatment requirement and each pen was completely enclosed to make it light proof. Light intensity was measured with the help of light intensity meter (Lutron®PLX-111 light meter with range 0-20000 LUX). Interleukin 1β were estimated using bioassay technology laboratory enzyme- linked immunosorbent assay (ELISA) kit from randomly collected blood from 3 birds of each replicate of each treatment at 21st and 42nd day of experiment period. Interleukin 1β value on 21st day of experiment period was highest in T_1 group (3104.68±149.27) and T_3 group (1970.42±227.02) differ significantly ($P<0.05$) over control group (Tc) (2824.89±249.69). Whereas, on 42nd day control group (Tc) was having highest value (4956.58±396.87) and T_2 (2635.40±449.51), T_3 group (1974.97±139.05) differ significantly ($P<0.05$) over control group (Tc). From the study, it can be concluded that birds under LED light treatment are having improved level of immunity and lower stress level as compared to incandescent light treatment as supplemental light.

Key words: Broiler birds, Incandescent bulb, Interleukin 1β, LEDs, Supplemental light

I.INTRODUCTION

Indian economy is basically an agrarian economy and rearing of livestock is one of the main agricultural activities, livestock sector contributed about 4.11% to the total gross domestic product and poultry farming is one of the best options available with farmers. Nowadays, the major chunk of poultry production is occurring in intensively managed open sided broiler houses under artificial lighting programme requiring a lot of artificial environmental factors which differ from natural environment in which they were evolved and one of the crucial factors is light management. It is essential for sight, including both visual perspicacity and color discrimination [1]. Being a major environmental stimulus light affect bird activity, performance and immunity and the effect of coloured light, leading to series of biochemical changes in broiler birds [2], [3], [4] and [5] is well documented.

Therefore, light management in broiler production involving aspects of light intensity, wavelength and energy efficiency can be effectively explored. Earlier conducted experiments observed that Chicken (21d of age) reared under yellow and green light treatment had higher level of IgG than those of birds reared under the white light treatments [3] whereas, [4] worked on effect of monochromatic light on immune response of broilers and reported that birds under blue light group showed a 44.0% reduction in the level of serum interleukin-1β as compared with that in the red light group at 49 days of age. The properties of light such as intensity, color and the photoperiod have certain affect on the physical activity of broiler chickens [6] and thus affect the production performance of broiler chickens. Therefore, LED light bulbs could be a better alternative light source than incandescent light bulbs for commercial poultry as it is found that the energy efficiency (only about 8-24 lumens per watt), life span (about 1200 hours) and durability of incandescent bulb is less as compared to LEDs (provides energy efficiency about 100 lumens per watt) [7] and life span is about 50000 hours without affecting the performance and welfare of broiler chickens and thus, the present study was planned with following objective:

1. To compare the stress related estimation of Interleukin 1β (IL-1β) in broilers reared under coloured light emitting diodes and incandescent supplemental lighting

II.MATERIALS AND METHODS

This study was conducted on 240 commercial Vencobb broiler chicks procured from M/s Venkey's India (Ltd.) at the Poultry Research Farm of the Department of Livestock Production Management, Guru Angad Dev Veterinary and Animal Science University, Ludhiana (Latitude: 30°54' North and Longitude : 75°48' East).

2.1 Experiment details: The day old sexed chicks were randomly distributed to 4 treatment groups each having 3 replicates. The housing treatments were T_1; white (650nm), T_2; green (565nm) and T_3; blue (430nm) light LED (3 Watt each) and incandescent light bulbs (60 Watt each) as control (Tc) in 12 pens (4x 3 factorial designs). At the day time, open-sided house was open from 10.00 AM to 4.00 PM and rest of the time sides of the house was covered with the black coloured tarpaulin sheet. Matching colour curtains were placed inside each pen of shed according to light treatment requirement and each pen was completely enclosed to make it light proof. Light intensity was measured by light intensity meter (Lutron®PLX-111 light meter with range 0-20000 LUX) and maintained at 25 Lux in first week and then reduces successively @ 5 Lux per week by increasing the height of bulbs from the bird eye level. The entire experimental period was divided into 3 phases namely starter (0-2 weeks), grower (3-4 weeks) and finisher (5-6 weeks). The starter, grower and finisher rations were formulated containing 22, 20 and 18 % crude protein and 2896, 2932 and 2979 Kcal ME/Kg of feed, respectively. The feed and water was available ad-libitum to chicks.

2.2 Observations recorded: For the estimation of Interleukin 1β (IL-1β) nine birds (3 from each replicate) from each treatment were randomly picked up for blood sampling at 21st and 42nd day. Chicken interleukin 1β (IL-1β) was estimated using Bioassay technology laboratory® Enzyme- linked immunosorbent assay (ELISA) kit.

2.3 Data on various biochemical parameters and behavioural study in relation to different treatments were subjected to one way analysis of variance (ANOVA) utilizing GLM procedure of SAS (SAS® 9.3) software and the difference among various treatments were examined by tukey's test.

III.RESULT AND DISCUSSION

The data on Interleukin 1β (IL-1β) (Table) indicated that IL-1β value on 3rd week was highest in T_1 group (3104.68±149.27) and T_3 group (1970.42±227.02) differ significantly (P<0.05) over control group (Tc) (2824.89±249.69). Whereas, on 6th week control group was having highest value (4956.58±396.87) and T_2 (2635.40±449.51), T_3 group (1974.97±139.05) differ significantly (P<0.05) over control group (Tc) thus increasing the level of immunity and lowering the stress level which ultimately, improves the overall growth performance of broiler birds reared under supplemental lighting programme using light emitting diodes (LEDs) over incandescent light (control) group. The results finding were similar in accordance with the results of [4], [8] and [9] who reported that birds under blue light group showed a 44.0% reduction in the level of serum interleukin-1β as compared with that in the red light group at 49days of age.

Table: Effect of different treatment groups on interleukin 1β (IL-1β)

Parameter	3rd week	6th week
T_c	2824.89^{ab}±249.69	4956.58^{a}±396.87
T_1	3104.68^{a}±149.27	3288.72^{ab}±628.55
T_2	2558.79^{abc}±145.76	2635.40^{b}±449.51
T_3	1970.42^{c}±227.02	1974.97^{b}±139.05

Means with different superscripts in a column differ significantly (P<0.05)

IV.CONCLUSION

From this study, it can be concluded that LED light bulbs are the need of hour and they are the best option available which can be effectively and significantly explored in the field of poultry industry to reduce the energy expenditure by reducing the electricity consumption drastically as compared to incandescent light bulbs. LED light bulbs could be a better alternative light source than incandescent light bulbs for commercial poultry facilities in lowering the stress level and improving the level of immunity without affecting the overall performance of broiler chickens.

V. ACKNOWLEDGEMENT

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VI.ETHICAL PERMISSION

Permission to conduct experimental trial was granted by Institutional animal ethics committee vide letter no. GADVASU/2015/IAEC/27/013.

VII.CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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