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Effect of coloured led light on carcass characteristics of broiler in Rajasthan

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Abstract
The study was conducted on 160 chabro broiler chicks, which were distributed in four different light treatment groups, i.e., Tw; white (650nm), Tg; green (565nm) and Tb; blue (430nm) light emitting diodes (LED) bulbs (3 Watt each) and incandescent light bulbs (60 Watt each) as control (Tc). At the day time open-sided house were open from 10.00 AM to 4.00 PM and the rest of the time sides of the house were covered with black colored tarpaulin sheet. Pens were light proof to avoid light interference during dark hours. The performance of broiler chickens was evaluated based on carcass characteristics. The result revealed a non-significant effect on carcass traits (dressing percentage and eviscerated weight). It could be concluded that the use of light emitting diodes (LED) light is better than incandescent light in terms of energy utilization efficiency and working life span without affecting the broiler carcass traits.

Keywords: Light emitting diodes, broiler performance, carcass characteristics and life span

Introduction
Poultry lives revolve around a regular day-and-night cycle. Proper diurnal rhythms can be developed by a proper day and night cycle (a routine of typical activities during the day). For melatonin, the production of light is also essential, and it drives things like immune function, growth rate, and reproductive hormones. "By giving that day-and-night cycle, the health of the birds, immune status, mobility, and alertness can be improved." (Ryan Johnson, 2018) [14].
Further, it has been reported that light efficacy has been an effective measure to improve poultry production (Hassan *et al.*, 2013); (Yang *et al.*, 2016) [5, 16]. Light manipulation modulates poultry's circadian rhythms, body temperature, feed intake, and digestion. Patterns of secretion of hormones related to growth, maturation, and reproduction can be altered by manipulating the color of the light (Olanrewaju *et al.*, 2006) [11].
Light is an essential factor for the chicks among all the environmental factors. Birds and mammals respond to light energy in several ways; they sense the light through their eyes (retinal photoreceptors) and photosensitive cells in the brain (extra-retinal photoreceptors). It has been observed that growth and behavior in poultry birds are associated with retinal photoreception, whereas reproduction has been linked to extra-retinal photoreceptors (Rozenboim *et al.*, 1999) [13]. The properties of light, such as intensity, color, and the photoperiod, have a certain impact on the physical activity of broiler chicks (Lewis and Morris, 1998) [9]. The colors of light (wavelength of light) have variable effects on the birds' behavior, growth, and reproduction. It was found that a short wavelength (blue-green color) appears to stimulate growth during the early period of life. As the bird approaches the time of sexual maturity, a long wavelength (red color) increases the growth. Besides, blue light has a soothing effect on birds; on the other hand, red light has been used to reduce cannibalism and feather picking. Green-blue light also enhances carcass weight as well as quality by increasing pH value and water holding capacity (Ke *et al.*, 2011) [7].
The government of India has also started the "Domestic Efficient Lighting Program" on 5 January 2015 to promote the use of LED bulbs for domestic purposes and urging people to use LED bulbs in place of incandescent bulbs, tube lights, and CFL bulbs to reduce electricity consumption to achieve GHG emission mitigation targets as per the commitment of Kyoto Protocol as the majority of electricity in India is produced using fossil fuels.
Therefore the study was conducted to evaluate the effect of coloured LED light as compared to incandescent light bulbs on carcass traits in broiler.

Materials and Methods

The present study was conducted on 160 day old unsexed, apparently healthy chabro broiler chicks at Poultry Farm and Department of Livestock Production Management, College of Veterinary and Animal Science University of veterinary and animal science, Bikaner, the Rajasthan University of Veterinary and Animal Sciences, Bikaner (Rajasthan) for 42 days. This experiment was conducted in the open-sided broiler house comprised of 8 pens. Four treatments viz. three different colored LED bulbs (3 Watt each) Tw; white (650nm), Tg; green (565nm) and Tb; blue (430nm) and incandescent light bulbs (60 Watt each) as control (Tc) was used in the experiment with two replicate (20 chicks/replicate) in each treatment. Colored curtains were placed inside each pen of the house according to the treatment and each pen was completely enclosed to prevent the crossing of light from one treatment to another treatment group. Daytime, the open sided house was open from 10.00 AM to 4.00 PM and rest of the time sides of the house were covered with a black colored tarpaulin sheet. 23 hour (light): 1 hour (dark) photoperiod was given to broiler birds using both natural and artificial light throughout the experiment period. Light intensity was measured by light intensity meter (Range 0-20000 Lux) and maintained at 25 lux in the first week and then reduces successively at a rate of 5 lux per week by increasing the height of bulbs from the bird's eye level. Brooders were used for brooding chicks up to one week of age. During the trial following parameters were recorded:

Eviscerated yield (%)

The dressed birds were eviscerated by giving a median cut in the abdomen and removing the crop, gullet, trachea, and viscera. The lungs were scrapped off. The heart, liver, pancreas, spleen, and gizzard were separated from the gastrointestinal tract. The giblets (heart, liver, and gizzard) were cleaned and retained along with the carcass to record eviscerated weight and expressed as a percentage of pre-slaughter weight.

$$\text{Eviscerated weight (\%)} = \frac{\text{Eviserated weight (gm)}}{\text{live weight. (gm)}} \text{ X } 100$$

Dressed weight (%)

The birds were weighed immediately before slaughter. The slaughtering was done by severing the jugular vein, and 5 minutes of bleeding time was allowed for each bird.

Dressed weight was calculated as:

$$\text{Dressed Weight (\%)} \frac{\text{Live wt.} - \text{Wt. of blood, feather, shank and head (gm)}}{\text{Live weight. (gm)}} \times 100$$

Statistical Analysis

Data collected during the investigation were subjected to statistical analysis by adopting appropriate variance analysis methods as described by (Snedecor and Cochran 1989) [15]. Wherever the variance ratio (F-values) were found significant at 5 percent and 1 percent levels of probability, the significance of mean differences was tested by Duncan's New Multiple Range Test (Duncan's Range Test) as modified by Kramer (Kramer 1956) [6].

Results and Discussion

Dressed and Eviscerated weight

The percent means of dressed weight and eviscerated weight for various treatment groups were recorded at 71.57 and 61.12 in T_1, 74.00 and 64.14 in T_2, 72.86 and 61.05 in T_3, 71.74 and 63.72 in T_4, respectively, and presented in Table 1 and Figure 1. The statistical analysis of data revealed a non-significant effect of supplementation of colored LED on dressed weight percent and eviscerated weight percent. The highest dressed weight percent and eviscerated weight percent were recorded in T_2, which were numerically higher than the rest of the groups. The lowest eviscerated weight was recorded for T_1, i.e., control.

The results obtained in the current study regarding dressed weight are in accordance with (Kumar *et al*., 2017) [8]; (Fazli *et al*., 2019) [4] .They reported that no significant effect difference was found on dressed weight. However, the result findings are contrary to the finding of (Ahmed *et al*., 2019) [1], who found that significant ($P \leq 0.05$) effect of dressing percentage under an LED light.

The present study's findings are similar and in agreement with (Cao *et al*., 2012) [2]. They reported that no significant effect ($P \leq 0.5$) difference was found on eviscerated weight.

Table 1: Effect of Coloured LED light on carcass characteristics (dressing weight % and eviscerated weight %) of broiler chicks

Treatments	Dressing weight %	Eviscerated weight %
T_1	71.57± 0.78	61.12±0.40
T_2	74.00±0.30	64.14±1.21
T_3	72.86±0.15	61.05±1.009
T_4	71.74±0.94	63.72±1.16

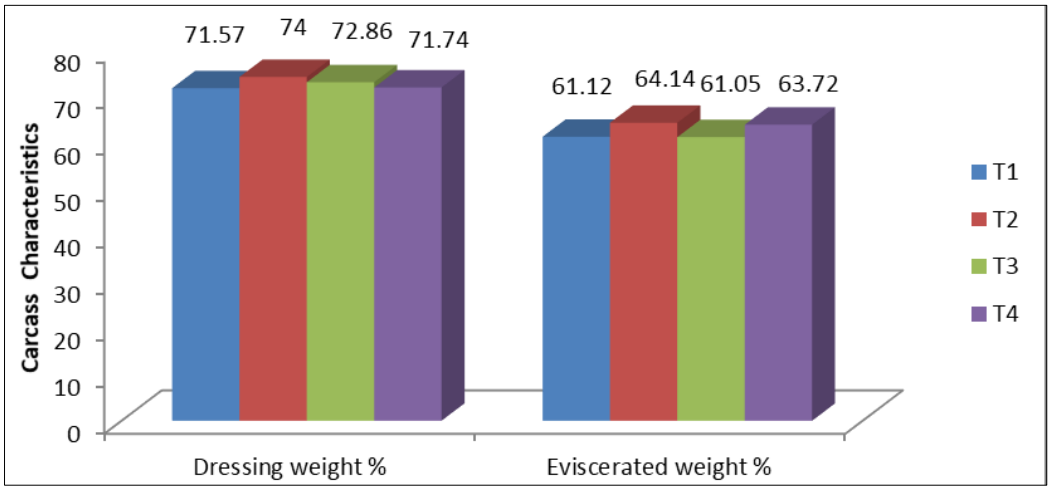

Fig 1: Effect of Coloured LED light on carcass characteristics (dressing weight %, eviscerate weight %) of broiler chicks

Organ weight Percent

The mean values of weight percent of liver, heart, gizzard, and giblets based on the effect of colored light are presented in table 2 and illustrated in fig. 2.

The statistical analysis of data given shows a statistically non-significant effect (P>0.05) of colored led light on liver, heart, gizzard, and giblet weight over the control group. Heart and gizzard weight percent, heart and giblet weight of all the light treatment groups were statistically similar. Maximum liver percentage and heart percentage were noticed in the T_4 group, while minimum and non-significantly liver and heart percentage was noticed in control group T_1. The highest gizzard and giblet percentage was recorded in the T_2 group and T_4 group, respectively, but lower in the T_1 group.

Heart Percentage

The average weight percentage of the heart at the 6th week of age was 0.47, 0.51, 0.52, and 0.53 for groups T_1, T_2, T_3, and T_4, respectively, with the highest in the T_4 group but not significantly. The results are in agreement with the finding of (Pan *et al*., 2015) [12]; (Yang *et al*.,2016) [17],who observed a non-significant (P>0.05) effect on heart percentage among all treatments. Though the result findings are contrary to (Mosa et al., 2014) [10]; (Ahmed et al., 2019) [1], they positively affect heart percentage under Green LED light.

Liver Percentage

The average weight percentage of the liver at the 6th week of age was 1.63, 1.59, 1.78, and 1.81 for groups T_1, T_2, T_3, and T_4, respectively, with the highest in the T_4 group.

The results are in agreement with the finding of (Mosa *et al*., 2014) [10]; (Pan *et al*.,2015) [12]; (Yang *et al*., 2016) [17], who observed the non-significant (P>0.05) effect for liver percentage among all treatments. However, the result findings are contrary to the finding of (Ahmed *et al*., 2019) [1], who found that significant (P≤0.05) effect on the liver percentage under the LED light.

Gizzard Percentage

The average weight percentage of gizzard at the 6th week of age was 1.82, 2.0, 1.72, and 1.95 for groups T_1, T_2, T_3, and T_4, respectively, with the highest in the T_4 group. The results are in agreement with the finding of (Mosa *et al*., 2014) [10], who observed the non-significant (P>0.05) effect for gizzard percentage among all treatments. However, the result findings are contrary to the finding of (Ahmed *et al*., 2019) [1], who found that significant (P≤0.05) effect of gizzard percentage under the LED light.

Giblet Percentage

The average weight percentage of the giblet at the 6th week of age was 3.92, 4.11, 4.02, and 4.29 for groups T_1, T_2, T_3, and T_4, respectively, with the highest in the T_4 group. The results are in agreement with the finding of (Kumar *et al*., 2017) [8]; (Fazli *et al*., 2019) [8], who observed the non-significant (P>0.05) effect for giblet yield percentage among all treatments. However, the result findings are contrary to the finding of Ahmed *et al*. (2019), who found that significant (P≤0.05) effect of giblet percentage under the LED light.

Table 2: Effect of Coloured LED light on carcass traits (heart%, liver%, gizzard% and giblet %) of broiler chicks

Treatments	Heart %	Liver %	Gizzard %	Giblet %
T_1	0.47±0.023	1.63±0.074	1.82±0.123	3.92±0.205
T_2	0.51±0.037	1.59±0.037	2.00±0.182	4.11±0.188
T_3	0.52±0.018	1.78±0.248	1.72±0.145	4.02±0.346
T_4	0.53±0.034	1.81±0.116	1.95±0.098	4.29±0.178

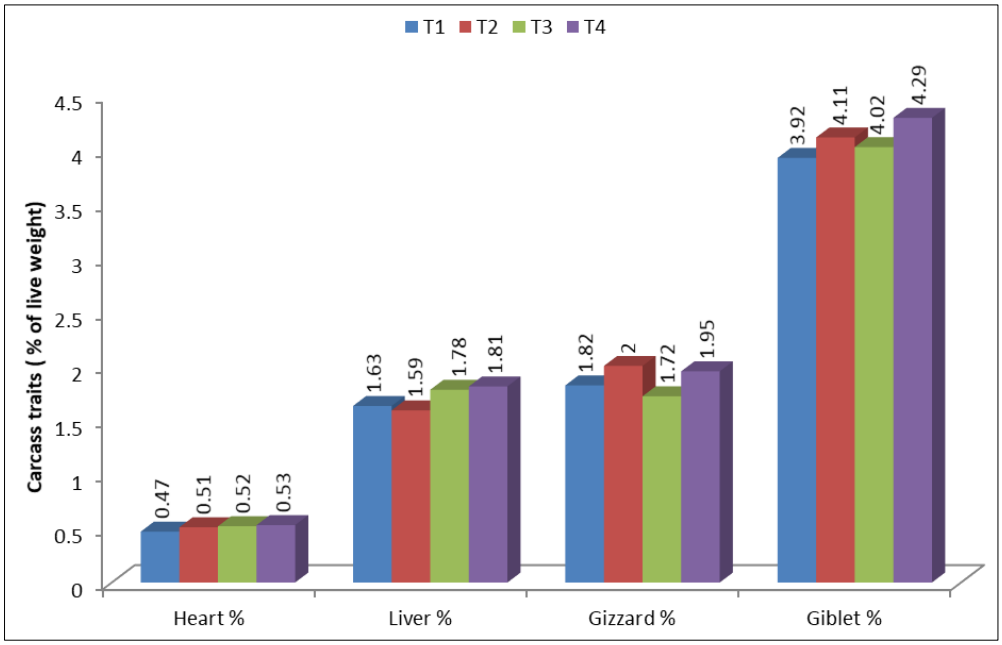

Fig 9: Effect of Coloured LED light on carcass traits (heart %, liver%, gizzard %, and giblet %) of broiler chicks

Conclusion

It can be concluded that the Non-Significant effect was observed on carcass traits (dressing percentage and eviscerated weight) of broilers reared in coloured LED light as compare to incandescent light bulbs.

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Conflict Of Interest

The authors declare that there is no conflict of interest.

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