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Carcass characteristics of broiler chicken reared under different light sources

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Abstract
An experiment was carried out to investigate the effect of different light sources on the carcass characteristics, abdominal fat and carcass grading of broilers. One hundred and sixty day old broiler chicks were procured from reputed sources. The chicks brooded in battery cages for a period of one week. On 8th day the chicks were distributed randomly into four treatment groups *viz.*, Natural light (T_1) as Control, Incandescent (T_2), CFL (T_3) and LED (T4) having 40 chicks in each groups, each group having four replicates of 10 chicks each. The percent blood loss was recorded to be 4.67± 0.05, 4.62 ± 0.05, 4.67± 0.04 and 4.63± 0.05 for T_1, T_2, T_3 and T_4 groups, respectively. The percent feather loss was recorded to be 6.55 ± 0.09, 6.49 ± 0.06, 6.60 ± 0.06 and 6.53 ± 0.06 respectively, for T_1, T_2, T_3 and T_4 groups. Statistically, no significant difference was observed among the different treatment groups for blood loss, feather loss, eviscerated yield and dressing yields and giblet yields. The percent of different cut-up parts were found to be differed non-significantly among the different treatment groups. . The broilers reared under T_1 (Control), T_3 (CFL) and T_4 (LED) groups scored visual carcass score grade 1 while as the broilers reared under T_2 (Incandescent) group scored visual carcass score grade 2. The percent abdominal fat was significantly higher in T_1 (1.40 ± 0.10) followed by T_4 (1.29 ± 0.06), T_3 (1.05 ± 0.13) and T_2 (1.02 ± 0.09) groups. Therefore rearing birds under these new light sources does not affect the carcass grading and other characteristics.

Keywords: Broiler chicken, light sources, carcass characteristics

Introduction
The Indian poultry industry is growing at a faster rate during the last 3- 4 decades. The industry growing at around 8-10% annually on an average over the last few decades with annual growth rates of 5.57 percent in egg and 11.44 percent in broiler production, driven by increased domestic consumption of poultry products [1]. Poultry sector is contributing for about one percent to India's GDP and 11.70 percent to the GDP from the of livestock sector [2]. The revolution made by poultry industry in Indian is contributing to reduced malnutrition, improved health status and poverty alleviation and employment generation. Poultry has helped in fulfilling the animal protein requirement in most of the developed and developing countries of the world. Poultry meat is the fastest growing animal protein in India which are easily available everywhere. Poultry and poultry products are relatively cheaper for consumers in compared to other meat products, and have comparatively wider acceptability across regions and religions [3].

Poultry meat quality is potentially influenced by ante- and post-mortem factors, such as management practices, weather and rearing conditions, genetics of the birds, transportation, and the ability of birds to respond to environment. Most of factors influencing poultry meat quality can be controlled during the different production stages by providing better managemental practices. Environmental factors are one of the critical ante mortem factors to be controlled for the final meat quality. One of the major microclimate factors in poultry production is the light that greatly influences the growth and development, behaviour, physiological functioning, immune response, and growth rate of the birds [4, 5]. Light one of the managemental factors which stimulate secretory patterns of several hormones responsible for major proportion of growth, maturation and reproduction of the birds [6]. The behavior as well as performance of chickens and their physiological conditions before slaughtering the birds can be manipulated by using specific light colors, especially those with long wavelength, such as red, orange, yellow, green, and blue [7].

Nowadays, several new light sources are available in the markets that are using by poultry producers. The major advantages of these lamps are: high energy efficient, longer duration of life, moisture resistance, and availability in different peak wavelengths [8]. Light is a major environmental factor that can influence the poultry production to a great extent. A lot of research has been conducted on the various aspects of lights; however, literature on the effects of different light sources on slaughter traits and carcass characteristics is scanty. Despite the large number of studies on lighting programs, there is still little information on their effect on carcass yield or quality [9]. Therefore, the present study was conducted to investigate the effect of light sources on the carcass characteristics, abdominal fat and carcass grading of broiler chickens.

2. Materials and Methods

The present study was conducted at Experimental Poultry farm, Division of Livestock Production and Management, Faculty of Veterinary and Animal Sciences, SKUAST-Kashmir, Jammu and Kashmir, during the months of March-April, 2017. The birds were reared under deep litter system of management. One hundred and sixty day old broiler chicks were obtained from a commercial hatchery and brooded in battery cages for a week following standard managemental procedures with *ad. lib.* feeding and sufficient potable drinking water were provided. After one week the chicks were weighed by using an electronic balance and the chicks having similar body weights were distributed randomly into four light treatment groups *viz*, Natural light (T_1) as Control, Incandescent(T_2), Fluorescent(T_3) and LED (T_4) group having 40 chicks in each which were again subdivided into four replicates of 10 chicks each. The birds were reared under deep litter system with continuous lightning and uniform light intensity. The uniform light intensity were maintained adjusting the height of the bulb. The birds were reared for a period of six weeks. At the end of experiment, a total of 32 (i.e. 8 birds per treatment) healthy broiler birds were selected randomly for studying the carcass characteristics. The birds were slaughtered by halal methods after overnight fasting and blood loss were recorded. Feathers were removed and de-feathered weight was recorded to calculate the feather loss. The head and shanks were removed and carcasses were visually observed for grading as per the standard procedure (BIS Grading). The dressed yield, eviscerated yield and giblet and abdominal fat were recorded and expressed as percent pre slaughter live weight. The yield of various cut-up parts were also recorded and expressed as percent of dressed weight. The data collected were analysed as per the method of Snedecor and Cochran [10].

3. Results and Discussion

The different slaughter traits of broiler birds reared under different sources of light is depicted in Table1. The percent blood loss was recorded to be 4.67± 0.05, 4.62 ± 0.05, 4.67± 0.04 and 4.63± 0.05 for T_1, T_2, T_3 and T_4 groups, respectively which did not show any significant difference among the different treatment groups. The percent feather loss was recorded to be 6.55 ± 0.09, 6.49 ± 0.06, 6.60 ± 0.06 and 6.53 ± 0.06 respectively, for T_1, T_2, T_3 and T_4 groups. Similar observation on blood loss and feather losses were also observed by Sheikh *et al.* [11] in broiler birds fed sheep manure based diets. Sheikh *et al.* [12] while replaced the fishmeal of broilers diet with silkworm pupae meal also recorded similar values for blood loss and feather loss. There was no significant difference observed for feather loss among the treatment groups. The percent dressing yield was found to be 70.96 ± 0.32, 70.65 ± 0.29, 71.26 ± 0.22 and 70.70 ± 0.25 respectively, for T_1, T_2, T_3 and T_4 groups which shows no significant difference among the different treatment groups. The percent eviscerated yield was found to be 82.09 ± 0.13, 81.90 ± 0.13, 82.13 ± 0.15 and 82.36 ± 0.19 in T_1, T_2, T_3 and T_4 groups, respectively. Statistically again no significant differences observed among the treatment groups.

The results of the present study are in good agreement with the findings of Olenrawaju *et al.* [13] who also found no effect of light source on carcass yield. Olanrewaju *et al.* [14] also observed non significant differences in carcass yield of broilers grown to heavy weights under different light sources viz. ICD: Incandescent light (Standard); CFL: Compact Fluorescent light; LED: Light Emitting Diode; PSF-LED: Poultry Specific Filtered LED lights. Rogers *et al.* [15] also did not find any significant difference in the whole breast muscle weight of broilers reared under incandescent, cold cathode fluorescent (CCFL) and LED lamps. However, they found slightly lower breast yield in birds under CCFL group (595 g ± 17) compared to LED (615 g ± 17) and Incandescent (633 g ± 11) groups. However, Karakaya *et al.* [16] recorded lower pH and water-holding capacity, but higher cooking loss values for breast and drumstick muscles from incandescent groups than those from different monochromatic lighting groups (green, blue and green blue mix LED light).

Among the various cut up parts, the percent breast weight was recorded as 37.34± 0.84, 38.26± 0.83, 38.13± 0.29 and 37.83± 0.42 in T_1, T_2, T_3 and T_4 groups, respectively with no significant difference among treatment groups. The percent breast recorded in the present study was higher than those observed by Olanrewaju *et al.* [14] in broilers grown to heavy weights under different light sources viz. ICD: Incandescent light (Standard); CFL: Compact Fluorescent light; LED: Light Emitting Diode; PSF-LED: Poultry Specific Filtered LED lights.However, they also observed non significant differences in breast yields. The percent thigh weight was recorded as 15.16 ± 0.40, 14.16 ± 0.43, 14.63 ± 0.13 and 14.56 ± 0.28 and that of drumsticks was 12.62 ± 0.27, 12.65 ± 0.20, 12.98 ± 0.18 and 12.87± 0.35 respectively, for T_1, T_2, T_3 and T_4 groups which did not differed significantly among the treatment groups. The percent wings weight was 12.05 ± 0.24, 12.53 ± 0.27, 12.81 ± 0.15 and 12.52 ± 0.43; percent back weight was 16.72 ± 0.41, 16.31 ± 0.51, 15.95 ± 0.49 and 15.70 ± 0.25, percent neck weight was 5.34± 0.32, 5.22± 0.31, 5.27 ± 0.19 and 5.69 ± 0.18 for T_1, T_2, T_3 and T_4 groups, respectively which was again did not differed significantly among the treatment groups. The percent giblet yield was recorded as 7.89 ± 0.11, 7.94 ± 0.08, 7.99 ± 0.09 and 7.92 ± 0.09 in T_1, T_2, T_3 and T_4 groups, respectively. Statistically no significant difference was observed among the groups. The percent abdominal fat was significantly higher in T_1 (1.40 ± 0.10) followed by T_4 (1.29 ± 0.06), T_3 (1.05 ± 0.13) and T_2 (1.02 ± 0.09) groups. The broilers reared under T_1 (Control), T_3 (CFL) and T_4 (LED) groups scored visual carcass score grade 1 while as the broilers reared under T_2 (Incandescent) group scored visual carcass score grade 2. Olanrewaju *et al.* [14] recorded non significant but higher fat yield than the findings of the present study in broilers grown to heavy weights under different light sources viz. ICD: Incandescent light (Standard); CFL: Compact Fluorescent light; LED: Light Emitting Diode; PSF-LED: Poultry Specific Filtered LED lights.

The significant ($P \leq 0.05$) differences found in the visual carcass score, with LED, CFL and control groups scoring '1' and incandescent group scoring '2' were due to increased stress levels also evidenced by significantly ($P \leq 0.05$) higher plasma corticosterone levels and H:L ratio in INC group. The birds under incandescent light were also observed to exhibit less comfort behavior and more aggression. Therefore more of this stressful behavior could have led to aggression and fighting among themselves resulting in down grading of carcass. Prayitno *et al.* [17] also suggested that discomfort reduced the quality of meat bird. In the present study significantly ($P \leq 0.05$) higher abdominal fat (1.40 ± 0.10%) was recorded in the control group because of less physical activity of the birds during darkness thereby conserving more energy for conversion into fat and also more feed consumption by this treatment group leading to more fat deposition. However, Abreu *et al*. [18] found no effect of curtain color and lighting programme on the abdominal fat of broilers.

Table 1: Carcass characteristics of broiler birds reared under different sources of light

Parameter (%)	T_1 (Control)	T_2(Incandescent)	T_3 (CFL)	T_4 (LED)
Blood Loss	4.67±0.05	4.62±0.05	4.67±0.04	4.63±0.05
Feather Loss	6.55±0.09	6.49±0.06	6.60±0.06	6.53±0.06
Eviscerated Yield	82.09±0.13	81.90±0.13	82.13±0.15	82.36±0.19
Dressing Yield	70.96±0.32	70.65±0.29	71.26±0.22	70.70±0.25
Giblet	7.89±0.11	7.94±0.08	7.99±0.09	7.92±0.09
Abdominal fat	1.40 ± 0.10^{b}	1.02 ± 0.09^{a}	1.05 ± 0.13^{a}	1.29 ± 0.06^{ab}
Visual Carcass Score	1	2	1	1
Cut up parts (% dressed weight)				
Breast (%)	37.34±0.84	38.26±0.83	38.13±0.29	37.83±0.42
Thigh (%)	15.16±0.40	14.16±0.43	14.63±0.13	14.56±0.28
Drumstick (%)	12.62±0.27	12.65±0.20	12.98±0.18	12.87±0.35
Wings (%)	12.05±0.24	12.53±0.27	12.81±0.15	12.52±0.43
Back (%)	16.72±0.41	16.31±0.51	15.95±0.49	15.70±0.25
Neck (%)	5.34±0.32	5.22±0.31	5.27±0.19	5.69±0.18
Giblet (%)	7.89±0.11	7.94±0.08	7.99±0.09	7.92±0.09
Abdominal fat (%)	1.40 ± 0.10^{b}	1.02 ± 0.09^{a}	1.05 ± 0.13^{a}	1.29 ± 0.06^{ab}

Means across rows bearing different superscripts differ significantly ($P \leq 0.05$)

Carcass of bird reared under LED light (Grade A)

Carcass of bird reared under natural light (Grade A)

Carcass of bird reared under CFL light (Grade A)

Carcass of bird reared under INC light (Grade B)

4. Conclusion

From the present study it can be concluded that there was no significant effect of all the three light sources on the carcass characteristics, abdominal fat and giblet yield of broilers. However, incandescent light source resulted in the production of Grade 2 carcasses and therefore can be replaced with modern energy efficient light sources such as CFL and LED which resulted in better visual score of the carcasses.

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