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RESEARCH ARTICLE

Effect of Different Light Intensities on the Production Performance of Broiler Chickens

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ABSTRACT

The experiment was designed to find out the effect of different light intensities on the production performance of broiler chickens. One hundred and fifty broiler chickens were randomly divided into 15 equal experimental units. Three experimental units (replicates) were randomly assigned to each of the five experimental groups. Light treatment T1 (20 lux at first week and 5 lux from 2-6 week) was given to group A, T2 (20 lux at first week and 10 lux from 2-6 week) was given to group B, T3 (20 lux at first week and 20 lux from 2-6 week) was given to group C, T4 (20 lux at first week and 30 lux from 2-6 week) was given to group D, T5 (20 lux at first week and 40 lux from 2-6 week) was given to group E. Results indicated a non-significant effect of light intensity on body weight and feed consumption whereas, feed conversion ratio (FCR) was significantly ($P<0.05$) affected by light intensities. The birds in group A showed significantly better FCR and fetched more profit. Mortality rate was the highest (13.33%) in the birds kept under group E. It can be concluded that energy savers (Compact florescent) may be used in broiler chickens production at same intensities as provided by other light sources for economical provision of light.

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INTRODUCTION

Light is an important aspect of physical environment for poultry birds. Light plays a pivotal role for vision and for the release of various hormones, which are important for production, and reproduction of birds (Scheideler, 1990). The performance of poultry have been assessed for different light intensities (Davis *et al.*, 1999), light sources (Vandenberg and Widowski, 2000), light colors (Prayitno *et al.*, 1997) and flickering frequencies (Widowski and Duncan, 1996).

Effects of light on the performance and activity of broiler chickens are highly dependent on the levels of intensity used (Kristensen *et al.*, 2006a). Whereas, no differences in broiler chickens body weight were observed in response to intensities of 3 lux and 10.75 lux (Dorminey and Nakaue, 1977), from 0.1 to 107.6 lux (Newberry *et al.*, 1986), 6.45 to 194 lux (Newberry *et al.*, 1988). However, Kristensen *et al.* (2006a) observed an increase in body weight of broiler chickens due to light intensity ranging from 5.4 to 6.45 lux and decrease in body weight when birds were kept under light intensity ranging from 107.6 to 124.7 lux.

Wathes *et al.* (1982) observed higher feed consumption at 3.2 lux relative to that occurring at 0.7, 16, or 50 lux. Similarly, an increased feed consumption was noted in broiler chickens provided 2.7 lux instead of 21.5 lux (Downs *et al.*, 2006). Newberry *et al.* (1986) reported no effect of intensities from 0.5 to 32.5lux However, a transitory decrease in feed consumption from 2 to 3 week was seen in broiler chickens subjected to 1.75 vs. 10.75 lux (Lien *et al.*, 2007).

Cherry and Barwick (1962) observed improved feed conversion as intensities were decreased from 107.5 to 1.75 lux. It has also been assumed that lower intensities may improve feed conversion because of a reduction in activity (Downs *et al.*, 2006). Buyse *et al.* (1996) reported that increasing light intensity from 5 to 51 lux has no significant effect on feed conversion ratio. Similarly, Charles *et al.* (1992) reported no influence on feed conversion when exposed to light intensity of 6 lux to 151 lux. Lien *et al.* (2008) also reported that feed conversion is not influenced by providing 1.75 vs. 162 lux.

Several reports have observed no effect of intensity on mortality (Downs *et al.*, 2006; Lien *et al.* 2008) whereas Newberry *et al.* (1988) observed an increase in mortality due to light intensity ranging from 6.45 to 194

lux. Mortality differences attributable to lighting programs are often not observed unless levels approach 10% (Lien *et al.*, 2007).

As mentioned above different scientists explored contradictory results regarding the effects of light intensity on production performance. The present study was conducted to know the impact of varying light intensity on production performance and economics of broiler chickens while using the energy savors (compact florescent) as light source.

MATERIALS AND METHODS

The present study was conducted to observe the impact of various light intensities on production performance of broiler chickens. One hundred and fifty broiler chicks were randomly divided into 15 equal experimental units. Three experimental units (replicates) were randomly assigned to each of the five experimental groups. Light treatment T1 (20 lux at first week and 5 lux from 2-6week) was given to group A, T2. (20 lux at first week and 10 lux from 2-6 week) was given to group B, T3 (20 lux at first week and 20 lux from 2-6week) was given to group C, T4 (20 lux at first week and 30 lux from 2-6week) was given to group D and T5 (20 lux at first week and 40 lux from 2-6week) was given to group E. The birds were provided commercial feed according to their age specifications and all the birds were fed *ad libitum*. The body weight of birds was recorded individually at start of experiment and at the end of every week. For this purpose, all the birds from each replicate were weighed with the help of an electrical weighting balance. From the individual weights, the mean weight of all the groups was calculated separately. Birds were offered feed daily (*ad libitum*) and feed consumption was calculated at the end of each week. Record of weekly feed consumption and weight gain was used to compute the feed conservation ration of each experimental group (FCR = feed consumed/ live weight). A complete record of mortality in each group was maintained throughout the experimental period. The economics of the study was also calculated based on weight gain, feed consumption and cost of electricity (Table 2).

The data thus collected were subjected to statistical analysis for the interpretation of results using one way analysis of variance technique with completely randomized design. Treatment means were compared by Duncan Multiple Range test (Steel *et al.*, 1996).

RESULTS AND DISCUSSION

Weight gain redundant

No significant difference was observed in body weight gain within all experimental groups; although the highest value was recorded for group A (Table 1). Cherry and Barwick (1962) also found no adverse effect of light intensities on body weight from 1 to 107.6 lux. Similarly Newberry *et al.* (1988) found no influence light intensity treatments (180 and 6 lux) on body weight. Results of the present study are in accordance with the finding of (Denbow *et al.*, 1990; Hullet *et al.*, 1992) who reported that there is no effect of light intensity on body weight gain. Whereas, some research reports indicated that the body weight of broiler chickens were greater under intensities of 10.75 to 54 lux, relative to 63 to 1290 lux (Skoglund and Palmer, 1962; Wathes *et al.*, 1982). Similarly, Downs *et al.* (2006) also found a transitory effect of light intensity on body weight. They observed that broiler chickens reared at 2.7 lux gained more than broiler chickens reared at 21.5 lux intensity. Most of the reports showed a better weight gain at low light intensities as compared to high intensities. Although in the present study the results were non significant but the birds kept under lower light intensity showed slightly higher weight gain than those kept under higher light intensities which indicated that increasing the range of light intensity may significantly affect the body weight.

Feed consumption and Feed Conversion Ratio

The data revealed that light intensity has non significant effects on feed consumption of broiler chickens (Table 1). Results of experiment are in line with the studies of Scheideler, (1990) who observed that light intensities ranging from 4 to 20 lux did not affect feed consumption in broiler chickens. Similarly, Charles *et al.* (1992) found no effect of light intensity of 5 to 150 lux, on feed consumption. Kristensen *et al. (*2006a) also reported no adverse effects on feed consumption in broiler chickens receiving light intensity ranging 5 to 100 lux. Whereas, Lien *et al.* (2008) found that feed consumption increased proportionally by providing 1.75 vs. 162 lux of light intensity. The contradiction in the results may be attributed to a wide range of light intensity applied in the study because in the present study range of light intensity was 5-40 lux whereas Kristensen *et al.* (2006b) applied the light intensity range of 5-100 lux. However from the above results it can be concluded that light intensity ranging from 5 to 40 lux have a little or no effect on feed consumption. Hence the electricity can be saved by providing lower light intensity (5 lux) instead of providing 40 lux light intensity without any adverse affect on the feed consumption.

The mean values of FCR of broiler chickens kept under different light treatment showed significant difference ($P<0.05$) among various treatment groups (Table 1). The data revealed that group A showed significantly better feed conversion ration as compared to group B, C, D and E. The results of present study are in line with the finding of Cherry and Barwick (1962) who observed an improved feed conversion as intensities were decreased from 107.5 to 1.75 lux. Findings of present study also support that assumption of Newberry *et al.* (1986) and Downs *et al.* (2006) who stated that lower intensities may improve feed conversion because of a reduction in activity and stimulating muscular growth. However, Buyse *et al.* (1996) reported that increasing light intensity from 5 to 51 lux has no significant effect on feed conversion ratio. Similarly, Charles *et al.* (1992) envisaged no influence on feed conversion when exposed to light intensity of 6 to 151 lux. Lien *et al.* (2008) also reported that feed conversion was not influenced by providing 1.75 vs. 162 lux. The contradiction in the findings of present study may be due floor space, because increasing the light intensity and providing more space may affect the activity and muscular growth, where as this affect may not be observed in cage rearing with

Table 1: Weight gain, feed consumption, feed conversion ratio, mortality and economics of broiler chickens kept under various light intensities

Parameters	Light treatment groups				
	A (5 lux)	B (10 lux)	C (20 lux)	D (30 lux)	E (40 lux)
Initial body Weight (g)	44	43.5	43	43.8	42.5
Final body weight (g)	2064.1±42.93	1924.7±62.1	1924.8± 25.4	1927.8± 51.7	1985.4± 47.1
Weight gain (g)	2020.1±42.9	1881.2±62.1	1881.8± 25.4	1885.03± 51.7	1942.97± 47.1
Feed consumption (g)	3943±111	4093±163.2	4162±17.2	4185.1±18.1	4391.1±27.2
Feed Conversition ratio (FCR)	1.95^{b}±0.015	2.17^{a}±0.046	2.20^{a}±0.031	2.21^{a}±0.023	2.25^{a}±0.040
Mortality (%)	6.66	3.33	3.33	6.66	13.33
Profit (Rs)	36.18	18.74	16.92	16.2	17.3

Values (mean±SE) bearing different superscripts in a row differ significantly (P<0.05). In each group, 20 lux of light was provided during 0-1 week. From 2-6 weeks light intensity in each group was variable.

Table 2: Economics of raising broiler chickens kept under various light intensities

Parameters	Light treatment groups				
	A (5 lux)	B (10 lux)	C (20 lux)	D (30 lux)	E (40 lux)
Cost of chick (Rs)	52	52	52	52	52
Management cost/bird(Rs): Housing (3), equipment (2), labor (4), litter (3), brooding fuel (6)	18	18	18	18	18
Feed consumption (kg)	3.94	4.09	4.16	4.18	4.39
Feed cost/kg(Rs)	22	22	22	22	22
Feed cost/bird(Rs): (3*4)	86.68	89.98	91.52	91.96	96.58
Cost of electricity/bird (Rs) for light treatment	0.14	0.28	0.56	0.84	1.12
Vaccination and disinfection Cost/bird(Rs)	9	9	9	9	9
Total cost/bird (Rs): (1+2+5+6+7)	165.82	169.26	171.08	171.8	176.7
Live weight/bird (kg)	2.02	1.88	1.88	1.88	1.94
Sale price/kg (Rs)	100	100	100	100	100
Net price /bird(Rs): (9*10)	202	188	188	188	194
Profit/bird (Rs): (11-9)	36.18	18.74	16.92	16.2	17.3

In each group, 20 lux of light was provided during 0-1 week. From 2-6 weeks light intensity in each group was variable.

variable light intensities and further research is required to solve this contradiction. However, from the above discussion it can be concluded that providing light intensity (5 lux) from 2 to 6 weeks to broiler chicks may be a better practice to improve the feed conversion ratio because most of the scientist either reported beneficial effect of lowering light intensity or no effect of light intensity on the feed conversion ratio.

Mortality

The total numbers of birds died during the study were 11 and the highest mortality (13.33%) was observed in group E (Table 1). Mortality differences attributable to lighting programs are often not observed unless levels approach 10% Lien *et al.* (2007). Percentage mortality in group E in the present study was more than 10%. The Results are in accordance with Newberry *et al.* (1988) who observed an increase in mortality due to light intensity ranging from 6.45 to 194 lux. Blair *et al.* (1993), Oksuk *et al.* (1998) and Buyse *et al.* (1996) also found similar results. However, Downs *et al.* (2006) using 10 lux versus 2.7 lux, Kristensen *et al.* (2006a) comparing 5 to 100 lux and Lien *et al.* (2007) comparing 1.75 vs 162 lux found no effect of light intensity on mortality. The contradiction in the results may due to a combined effect of light intensity with other management factors and needs more research, it may be assumed that increased light intensity may cause stress in the broiler chicks which further led towards mortality.

Economics

The cost of production per broiler chicken was Rs. 165.82 (Group A) which increased progressively to Rs. 176.7 (Group E) in various groups kept under various light intensities. Treatment A gave maximum profit Rs. 36.18 per bird and ranked first while minimum profit obtained from treatment D (Table 2).

Conclusion

The results of the present study revealed that the birds kept under light intensity of 5 lux from 2 to 6 week showed better production performance and fetched more profit than the birds kept under higher intensities of light. In the present study the light intensities were provided by using compact fluorescent light source and lower light intensity showed better effect on the production performance of broiler chickens kept under group A. Therefore, it can also be concluded that energy savers (Compact florescent) may be used in broiler chickens production at same intensities as provided by other light sources for economical provision of light.

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