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The Effect of 12 and 24-Hour Blue Lighting on Performance and Feeding Behaviour of Broiler Chickens

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ABSTRACT

This study was conducted to assess the effects of the 12 and 24 hours blue lighting on the performance of broiler chickens. This study used 2,700 broiler chickens that were divided into three treatments which are: control lighting (K) with conventional light used by farmers, 12-hours blue lighting (B12), and 24-hours blue lighting (B24). Each treatment was repeated three times and consisted of 300 broiler chickens each. The parameters observed were feeding behaviour including the feeding duration, feeding frequency, and broiler chickens performance. The results showed that broilers treated with the B24 and B12 lighting have longer feeding duration ($P<0.05$), lower feeding frequency ($P<0.05$), higher body weight gained ($P<0.05$), and lower feed conversion ($P<0.05$) when compared to those of chickens with K lighting. The conclusion of this study showed that continuous 24-hours blue lighting (B24) caused longer feeding duration and lower feeding frequency and the treatment of B24 and B12 lighting gave better benefits than control lighting.

Keyword: Blue Light, Broiler performance, Feeding behaviour

Introduction

Lighting is an important factor that can be used to improve the comfort of broilers (*animal welfare*). The lighting color is regarded as a powerful management tool that can be used to reduce the stress of broilers in order to obtain a physiological response in which the results will be reflected through behaviour. Various attempts of manipulation of lighting on birds such as lighting color, illumination length intensity and the wavelength of the lighting was aimed to increase productivity (Li *et al*., 2010). Chicken feeding activity depends on the presence or absence of lighting. The Chicken feeding at lighting time and almost no feeding activity in the dark. The lighting is composed of various wave lengths to stimulate the chicken eye retina, then affect the chicken behaviour (especially on the behaviour of feeding), thereby affecting the growth (Lewis and Morris, 2000).

Lighting is one of the environmental factors that have an important role on the function of chicken's organs, especially to the reproductive organs, behaviour and social interaction. Thus, the lighting functions are to help to optimize the daily body weight. Giving 24-hour lighting would increase the feeding behaviour, however, it makes the chicken waste their energy, so that a negative influence is on the increase of chicken body weight, fat storage, which eventually becomes imperfect bone formation (Kristensen *et al*., 2006). Prayitno *et al*. (1997) states that the broilers are less active under the maintenance of light blue or green, and they spent most time just for sitting and sleeping compared to the maintenance of red lighting or white one, where the broilers with red lighting color shows that the broiler is more aggressive and they flap their wings even more (*wing* stretching) and peck *litter* compared to the maintenance of white, green and blue lighting. The blue lighting has an important role in reducing stress, fear, and is soothing for broilers (Mohamed *et al.,* 2014).

Based on the description above, the researcher carries out the study dealing with broiler chickens blue lighting treatments. It were discontinuous (B12) and continuous (B24) blue lighting treatments in order to determine their effects on behaviour and production performance.

Materials and Methods

Materials

The research conducted on broiler chicken farm in the Manggungsari, Wonokerto village, Turi district, Sleman, Yogyakarta on September 1st -28th 2015. The material used in this study were 2,700 broiler chicken, commercial broiler chicken feeding, cages used is the chicken coop open systems (*opened house*) with construction, *double-deck* the tool used was a manual feeding type *Hanging*

r*ound feeders* and drinking places was *Nipple* drinker. Other equipment used were brand feed scales *Camry* with a capacity of 40 kg and chicken brandscales *Salter* with capacity of 50 kg, and cameras closed *circuit television* (CCTV) to observe the behaviour of broiler chickens for 28 days.

Method of experiment

2,700 chicken were divided into 3 treatments, each treatment consisted of a 900 chickens with three replications of 300 chickens for each test (Figure 1). The treatment in this study, were control (K) using common lamp breeder; 12-hour and 12-hour blue lighting (B12); and 24-hour blue lighting and 0 sunlight (B24). Lamps used in this research was *light emitting diode* (LED). Heater Management, solar radiation, and lighting on each cage consisted of treatment K, B12, and B24 for 28 days are listed in Table 1.

Data observed during the study was the feeding behaviour consisted of feeding duration (minutes / day), feeding frequency (times / day), body weight gained (g / bird), and *feed convertion ratio* (FCR).

Feeding behaviour. Behavioral observations are made by observing the chicken feeding that has been marked using black paint on the back as much as 10% of the population of as many as 30 individuals per treatment. Chicken behaviour was observed at the age of 7, 14, 21 and 28 days. feeding behaviour was observed for 24 hours with a group of observation time at 1:00 to 6:00, 07:00 to 12:00, 13:00 to 18:00, and 19.00-24.00. Feeding behaviour was measured by recording the feeding duration, Neves *et al*. (2010) reported the feeding duration is measured by measuring how long the chickens do *feeding bout* that time feeding the chickens began to be calculated as part of chicken feed is in place and stops counted when the chicken leaves the feed. chicken feeding duration is calculated in units of time (minutes). chicken feeding frequency is counted how many times the chickens do *feeding bout* in the feed. Frequency is calculated every hour.

Body weight gained (g / bird). Body weight gained data obtained from the difference between the body weight on the day of harvest (28 days) with a weight of DOC.

Feed intake (g / bird). Feed intake is obtained by calculating the difference between the feed given to feed the remainder after 28 days.

Feed conversion. Feed conversion is calculated from the quotient between the consumption of chicken feed to weight gain in the

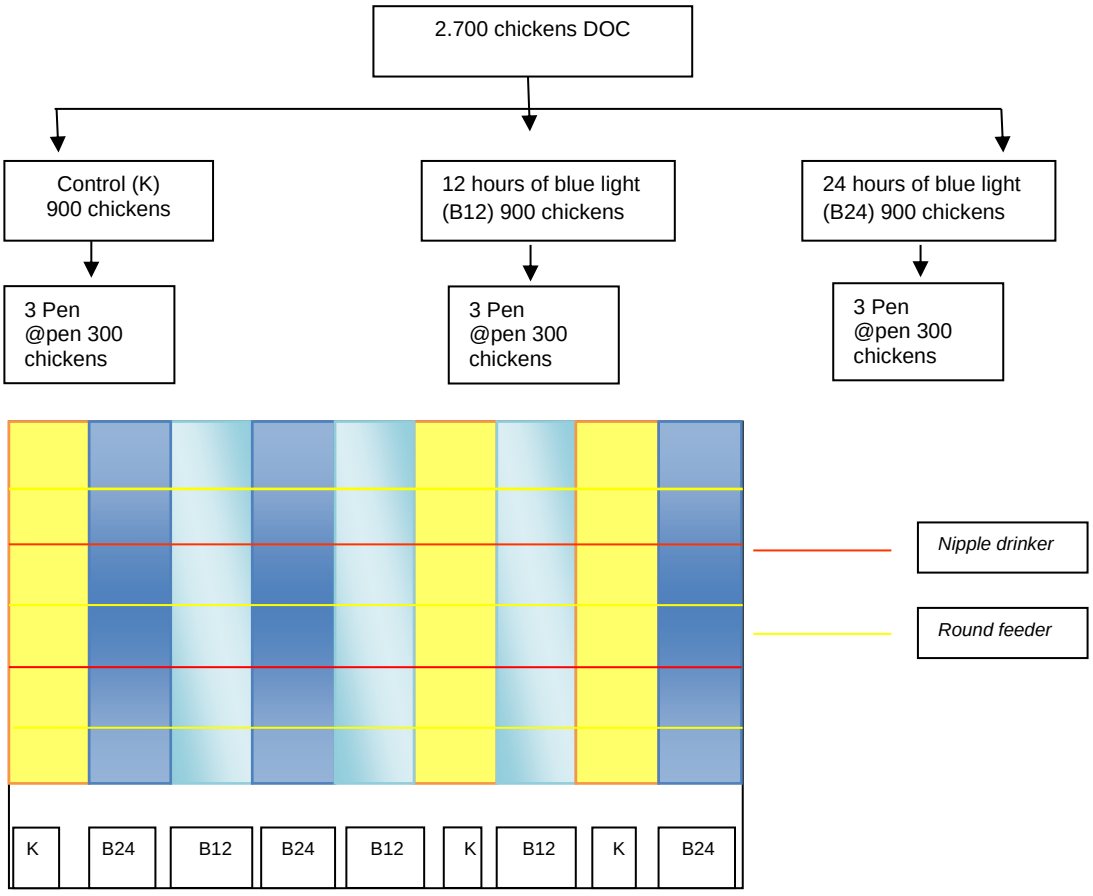

Figure 1. Schematic of research.

Table 1. Radiation management (lighting program)

Time illumination (l*ighting* program)	Treatment		
	K	B12	B24
06:00 18:00	CM	CM	CM
18:00 to 06:00	LED P	LED B	LED B

CM: sunlight *(Natural light);*LED P; white LED lamp*(LED white);*LED B; 5 watt blue LED lights*(LED5 watt* blue); K = control *(control),*B12 = 12 hours of blue light*(12 hours of light* blue),B24 = 24 hours of blue light*(24 hours of blue* light).
Heating is carried out at the age of 1-11 days with heating gasolek*(gasolec* brooders).

same period. How to calculate the feed conversion are:

$$\text{Feed conversion} = \frac{\text{Konsumsi pakan (g)}}{\text{Bobot badan (g)}}$$

Data analysis

The experimental design used in this study is completely randomized design Pattern Unidirectional, analyzed by ANOVA using *software,* SPSS if significantly different test then continued with Duncan's new multiple range test (Duncan Multiple).

Results and Discussion

Treatment effect of feeding behaviour (feeding duration)

Feeding length in the control treatment the first week was 81.00 minutes / day (Table 2). Feeding duration on discontinuous blue lighting treatment was 111.00 minutes / day (P<0.05) longer than control lighting and feeding duration of the continuous blue lighting is 125.33 minutes / day (P<0.05) longer than the control treatment and discontinuous blue lighting. This is because the lighting color with short wavelengths (blue and green) providing a soothing effect on the chickens (Lewis and Morris, 2000), so the chickens do not have a lot of activities. Lighting with different wavelengths have different stimulatory effects on the retina, which can lead to changes in behaviour that ultimately affect the growth (Lewis and Morris, 2000).

Blue lighting can create a cozy atmosphere in chicken feed so that it makes the energy efficient to use (Rozenboim *et al.,* 2004). Age also affects eating behaviour of broilers, as shown in Figure 1 where no meal duration significantly increased at week 3 and 4 compared to the first and the second week. This may be due to a rapid growth rate according to age broiler chickens. Sultana *et al.* (2013) states lighting color and age affect the behaviour of eating, drinking, sitting, standing, and walking on the broiler.

Treatment effect of feeding behaviour (frequency of feeding)

Treatment is the use of blue lighting that significantly (P<0.05) affect the feeding frequency of chicken in the first week to the fourth week (Table 3).

Feeding frequency of chicken in the first week control treatment was 37.06 times / day. Feeding frequency of chicken in blue lighting discontinuous treatment (B12) is 36.70 times / day that was significantly lower than the control and treatment of feeding frequency on blue lighting continuously (B24) is 35.83 / min which was significantly lower than control and B12. This indicates that the use of blue lighting on maintenance can reduce the feeding requency chicken. Blue lighting has lower wavelength (450 nm) causing decreased vision of the chicken, affecting the level of feeding frequency of broiler chickens. Senaratna *et al*. (2012) reported that blue lighting can reduce the activity compared to white lighting and red lighting for each color of light has a wavelength specific differences.

Treatment effect on the performance of broiler

Feed intake. The observation of feed intake in the control treatment, 12-hour and 24-hour blue lighting showed that no treatment effect on the average feed consumption (Table 4) both in the first week to the fourth week. Based on

Table 2. The mean duration of broiler chicken meal (min / day)

Treatment	Week 1	Week 2	Week 3	Week 4
K	81.00±1.00^{a}	110.33±1.52^{a}	140.33±1.52^{a}	255.33±1.52^{a}
B12	111.00±1.00^{b}	124.66±1.52^{b}	161.33±1.52^{b}	277.33±1.52^{b}
B24	125.33±1.52^{c}	137.66±1.52^{c}	165.00±2.64^{b}	290.33±1.52^{c}

K = control, B12 = 12 hours of blue light, B24 = 24 hours of blue light.
^{a,b,c,} Different superscripts at the same column indicate significant differences (P<0.05).

Table 3. The Average of broiler chicken feeding frequency (times / day)

Treatment	Week 1	Week 2	Week 3	Week 4
K	37.06±0.355^{b}	38.53±0.26^{b}	38.50±0.23^{c}	38.84±0.52^{b}
B12	36.70±0.57^{ab}	36.53±0.26^{a}	36.83±0.70^{b}	36.51±0.56^{a}
B24	35.83±0.55^{a}	35.87±0.50^{a}	35.50±0.23^{a}	35.58±0.50^{a}

K = control, B12 = 12 hours of blue light, B24 = 24 hours of blue light.
^{a,b,c,} Different superscripts at the same column indicate significant differences (P<0.05).

Table 4. Feeding of broiler chicken (g / bird)

Treatment	Week 1	Week 2	Week 3	Week 4
K	165	593.33	1292	2101.33
B12	165	555	1243.33	2101.5
B24	165	560	1238	2101.33

K = control *(control),*B12 = 12-hour blue lighting B24 =24-hour blue lighting .

Table 4 and Figure 2, the feed consumption of broiler chickens in the second week and third week of the control group had the highest amount of feed consumption of 593.33 and 1.292 g / head, the group of 12-hour blue lighting has a number of feed consumption in the second and third week 555 and 1243 g / head while the group of 24-hour blue lighting has a number of feed consumption in the second and the third week at 560 and 1238 g / head. The high number of feed consumption in the control group is due to the high activity of broiler chickens in this group compared to the group of 12-hours and 24-hours blue lighting which are more quiet and have more sleep after meal so that a positive impact on body weight gained. Cleaner for feed consumed is converted into meat, Moraes *et al*. (2007), states that the lighting program affect the behaviour of broilers and concluded that the variations in feed consumption is in line with the availability of light.

In the fourth week of feed consumption, there is no different, this is because the provision of continuous blue light (24 hours) or discontinuous (12 hours) increased the activity of feeding and drinking. Giving light continuously for 24 hours will enhance the feeding and drinking behaviour thus improving body weight gain and increases the formation of feathers.

Body weight gain. The observation on the effect of blue light treatment 24 hours, 12 hours of blue light and control of the mean body weight (Table 5).

During 28 days, it showed there was significant differences (P<0.05). The body weight gain of broiler chickens 24hour blue lighting treatment is higher than blue lighting treatment and 12 hours respectively in the control 1571.64; 1513.01; 1364.92 g / head. High body weight in the group of 24-hour blue lighting is due to the effect of blue lighting that makes the chicken more quiet and have less activity after meal so the excess energy can be converted into feeding. Zhang *et al.* (2012) stated that the blue color is the color that is most optimal performance of Broiler production Lohmann strain the blue, green and yellow lighting are *continuous lighting* on a 28-day maintenance. Prayitno *et al*. (1997) also added that the blue lighting can create a cozy and quiet atmosphere in chicken feeding so that it will make the energy more efficient to use.

Feed conversion. The result of the calculation of feed conversion of broilers at 24-hour treatment of blue lighting, blue lighting, and 12-hour control for 28 days (Table 6) showed significant differences (p<0.05).

Feed conversion at 24 hours treatment of blue lighting is the lowest compared to the 12-hour blue light and control, respectively, are 1.34; 1.39 and 1.54. The influence of different wavelengths of lighting give rise changes in weight and improved feed efficiency. The blue lighting for 24 hours showed consumption will also produce higher weight gain. Prayitno *et al.* (1997) suggests that a low rate of cross-feeding due to the influence of the color of blue lighting that causes reduced activity in broiler chickens. Blue lighting is different by giving the treatment for 24 hours *and* 12 hours in broiler chickens, it is rear for 28 days to give something efficient on broiler chicken industry, with the same amount of consumption can result in higher weight gain compared to the controls.

Table 5. The increased body weight of broilers (g / bird)

Deuteronomy (replicates)	Controls	B12	B24
1	1361.10	1510.20	1568.97
2	1365.43	1514.23	1573.63
3	1366.23	1514.60	1572.63
The mean	1364.92± 19.71[a]	1513.01±49.84[b]	1571.64± 49.84[c]

K = control, B12 =12-hour blue lighting, B24 =24-hour blue lighting.
[a, b, c,] Different superscript on the same line indicate significant differences (P <0.05).

Table 6. Feed conversion

Deuteronomy(replicates)	Controls	B12	B24
1	1.54	1.39	1.34
2	1.54	1.38	1.33
3	1.54	1.39	1.34
Mean	1.54 ± 0:02[a]	1.39 ±0:05[b]	1.34 ± 0:02[c]

K = control, B12 =12-hour blue lighting, B24 =24-hour blue lighting.
[a, b, c,] Different superscript on the same line indicate significant differences (P <0.05).

Conclusions

The use of the blue lighting is continuously making changes in feeding behaviour that is feeding into longer duration and low feeding frequency. Performance of broiler chickens on 12-hour treatment blue lighting is better than 24-hour blue lighting treatment (1513 g /head: 1571 g / head).

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