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Intermittent Lighting Schedule effects on Broiler Production Performance and Carcass Traits

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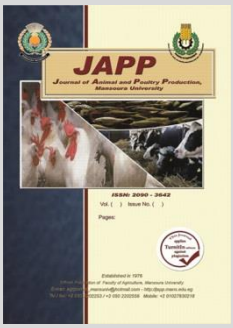

ABSTRACT

The current research aim is to examine the impact of light rhythm on development characteristics in broiler chicken before and after slaughter. One hundred and eighty-eight 11-day Ross 308 broilers were picked and reared between 11 to 42 days under an intermittent illumination schedule of either control illumination 6 hours of light: 18 hours of darkness T1 (6L:18D) or 2 hours of light: 2 hours of darkness T2(2L:2D) or 4 hours of light: 4 hours of darkness T3(4L:4D) or 6 hours of light: 6 hours of darkness T3(6L:6D). The results show that there are no significant differences for body weight and body weight gain at 23-42 days and body weight gain at 11-22days of age between treatments, but body weight in intermittent light (2L:2D) was significantly better than control group with other treatments group ($P<0.05$). The results also demonstrate that here is no significant difference between treatments for feed intake. Use of intermittent lighting schedule improved feed conversion ratio but not significantly ($P<0.05$). Also for mortality, there is no significant difference between treatments. Similarly, the chest and thigh percentage in birds reared in all photoperiods are not significantly different from each other. In addition, the dressing percentage of birds reared in the (2L:2D) treatment group is greater than measurements observed in the control or other lighting program. Therefore, we can conclude that in broiler managing, the (2L:2D) lighting schedule was preferable compared to 4L:4D, 6L:6D photoperiod and control.

Keywords: Lighting, Broiler, Production, Performance, Carcass

INTRODUCTION

Light wavelength, strength of light, and duration with distribution of photoperiods are the elements that found to be a critical management technique in broilers production.

It is possible to understand the above aspects separately, but they are considered to have interactive consequences. Really the most study has been dedicated to the effect of duration and distribution of photoperiods on broiler lighting.

Traditionally, the use of long day lengths in management schemes has been presumed to allow maximum feeding time and, as a consequence, optimum growth rate.

There are also several detailed reviews on the subject, reported by (Lewis and Morris 1999), (Morris, 1994), (Buyse *et al.* 1996b) and (Nixey, 1994) on production of laying hens, broilers, and turkeys, also on animal welfare and vision by (Martrenchar, 1999), (Prescott *et al.* 2003) too. Even some key issues still need to be answered, much is realized about the influence of lighting on poultry.

In several places, continuous or near continuous lighting is usually given for broilers. First researchers noted that there were substantially more leg problems in birds raised under continuous lighting than in birds grown under intermittent illumination, were (Buckland *et al.* 1976).

Several studies, however, have shown that different lighting program, such as increasing or irregular lighting schedules, improving body weight and feed conversion, and reducing leg problems and mortality (Buyse *et al.*, 1994; Buyse *et al.*, 1996a). Additionally, published articles are insufficient about intermittent program illumination for broiler performance.

MATERIALS AND METHODS

Experimental design and diets: A local incubation group of 1-day-old Ross 308 broilers was used in the current analysis. Under the same environmental conditions, the newborn chicks were divided and reared. All birds were given a commercial broiler starter ration and water ad libitum from 1 to 10 days of age. 144 birds were selected at 11 days of age and distributed in 12 pens with a bed floor with wood shavings. The 4 treatment groups with 3 repetitions per group were randomly divided with 12 broilers per repetition, respectively. The lighting program provided 23 h of illumination and 1 h of darkness during the first 11 days. The program (Control light) at 11 days was 18 h of light and 6 h of darkness for one treatment group, while the program of (Intermittent light) was started for the other three treatment groups, consisting of 2L: 2D treatment cycles 2, 4L: 4D treatment cycles 3 and 6L: 6D treatment cycles 4. The same treatment groups were used in each pen and each of the three pens was covered with a black mesh to prevent leakage of light. An electronic timer was used for all treatment units. From 11 days of age during the experimental phase, the chickens were kept in their specified light treatment (11 to 42 days of age).

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During the experimental phase, the birds had access to ad libitum feed and were given a 2-period feeding program that consisted of a fattening (11 to 18 days) and a finisher (19 to 42 days). Table 1 shows the measured ingredient and nutrient profile of the test diets. The production treats below were taken and calculated at 1d, 11d, 23 days and 42 days of age.

Production Traits: Body weight, Body weight gain, Feed intake, Feed conversion ratio and Mortality.

Table 1. Composition and analysis of diets in grower, and finisher periods of the experiment

Ingredients	Periods	
	Grower	Finisher
Protein concentrate	8	5
Soybean meal 46%	33	29.5
Wheat	20	30
Wheat bran	0	0
Sunflower oil	3.5	4
Corn	35.5	31.5
Calculated analysis		
Crude protein	23	21
Metabolisable energy kcal/kg	3000	3200
L-Lysine (%)	1.4	1.3
Methionine (%)	0.65	0.6
Calcium (%)	1	0.9
Av. phosphorus (%)	0.45	0.4
Methionine + cystine (%)	1	0.95

The age for marketing will be 42 days. Slaughter comes at the age of 42 days. From each replicated, two birds have been randomly selected, carcass, breast and thigh weights was registered on slaughtered birds. At the time of feed withdrawal, carcass yield will be measured as a percentage of live body weight. it was fed all diets in pellet form.

Furthermore, the experiments were carried out at the University of Sulaimani and all the experimental procedures were accepted by the College of Agricultural and Animal Sciences.

Statistical analyses

All data were subjected to repeated analysis of measures, with each replicated mean as the unit of Experimentation. All knowledge was analyzed with the xlstat program (XLSTAT-PRO, version 7.5).

For the differentiation of various means between procedures, one-way ANOVA followed by a multiple comparison test from Duncan was used. When data are considered to be statistically significant, with $p<0.05$.

RESULTS AND DISCUSSION

Production traits:

In table (2) showed that in 11-22day of broilers age body weight was significantly heavier in the group that received the intermittent program compared to control($P<0.05$). Even though intermittent light program T2 (2L:2D) and the other intermittent light program T4(6L:6D) have the same period of darkness, the body weigh was heavier of the chickens reared under T2 light program.

The broilers consume satisfaction in the light cycle in the intermittent light program and then don't extend much energy during the dark period, causing greater body weight gain (Ingram and Hatten, 2000).

However, body weight at 23-42d of age was not affected by intermittent lighting program, between all treatments there were no significant difference in the body weight ($P<0.05$). Furthermore, (G. Rahimi *et al.* 2005) said, the different photoperiods affected boiler growth performance, the average body weight was better in broiler how were reared under intermittent light schedules compared to control group of broiler.

Table 2. Effect of different Intermittent Lighting Schedules on body weight and body weight gain (g)

Light	periods			
	weight		Weight gain	
	11-22d	23-42	11-22d	23-42
Control	935.286^{ab} ±11.258	2646.0^{a} ±237.5	709.35^{a} ±8.68	1710.71^{a} ±247.61
2:2	979.889^{a} ±24.704	2878.33^{a} ±41.874	741.58^{a} ±23.37	1898.44^{a} ±21.23
4:4	924.0^{b} ±4.619	2666.67^{a} ±93.142	695.02^{a} ±4.63	1742.33^{a} ±95.27
6:6	954.33^{ab} ±15.421	2836.33^{a} ±46.030	720.02^{a} ±13.0	1882.33^{a} ±34.03

mean ± SEM. Means are significantly different (P<0.05) in a column with different litter superscripts.

Results of this experiment are shown in (Table 2). At 11-42 d of age there wasn't significant difference between treatments for body weight gain. Body weight gains of chickens reared under intermittent light were higher than the control group at 11-22 and 23-42 of the experiment, but these differences were not significant ($P>0.05$).

There was no difference ($P < 0.05$) in feed intake between control and intermittent light chickens in all phases of the experiment. In some experiments feed intake of intermittent light chickens were higher than the control groups in 3-6 weeks of age (Ohtani and Leeson, 2000). These results are agreeing with our outcome, feed intake almost in all periods in intermittent light groups was higher that control group. From another study (Ohtani and Tanaka, 1998), intermittent light chickens rushed to the feeder and ate enthusiastically at one moment just after the lighting cycle began, while control chickens showed little consuming excitement. They also concluded that chicken's upper digestive tract may have been empty during the time of darkness in intermittent light, and the birds were instantly able again to consume when light came on.

Feed conversion was influenced by lighting schedule, feed conversion was lower for the intermittent lighting compare to group of a control lighting program (Table 3), but there was not significant difference between them.

In contrast with (Buyse *et al.* 1996) Who recorded that intermittent light caused decreased feed intake in birds and resulted in higher productivity of broiler, this made decreasing in feed conversion compared to the control group. Intermittent lighting in this study improved feed conversion. This discovery is in line with those made by (Cave, 1980), (Malone *et al*. 1980), (Simmons, 1982), (Ketelaars *et al.* 1986) and (Buyse *et al.* 1994).

Mortality was a comparable standard rate for each treatment and there was no significant difference among treatments for this characteristic. This outcome is in

accordance with other researchers' results (Buyse *et al.* 1994; Renden *et al.* 1991; Malone *et al*. 1980). Whereas the use of intermittent light in broiler chicks decreased mortality in another study (Classen and Riddle, 1989).

Table 3. Effect of different Intermittent Lighting Schedules on feed intake and feed conversion ratio (g)

Light	periods			
	Feed intake		Feed conversion ratio	
	11-22d	23-42	11-22d	23-42
Control	992.19^{a} ±6.9	2497.63^{a} ±210.05	1.339^{a} ±0.009	1.497^{a} ±0.136
2:2	1012.28^{a} ±27.91	2537.22^{a} ±85.31	1.365^{a} ±0.013	1.336^{a} ±0.038
4:4	982.52^{a} ±20.75	2652.8^{a} ±138.75	1.414^{a} ±0.028	1.525^{a} ±0.056
6:6	973.11^{a} ±25.48	2758.59^{a} ±24.27	1.352^{a} ±0.042	1.467^{a} ±0.031

mean ± SEM. Means are significantly different (P<0.05) in a column with different litter superscripts

Slaughter traits:

Differences in the performance of slaughter were observed among the four photoperiod treatments (Table 4). As shown, no significant differences in thigh percentage and chest percentage were detected among the four treatments (P>0.05). However, the dressing percentage of broilers in the group T2(2L:2D) intermittent light was the largest, and was significantly higher than corresponding dressing percentage in control light (P<0.05).

Table 4. Effect of different Intermittent Lighting Schedules on dressing, chest and thigh percentage

Light	Traits		
	Dressing (%)	Chest (%)	Thigh (%)
control	71.01^{b}±0.821	42.878^{a}±1.739	27.418^{a}±1.044
2:2	73.6^{a}±0.823	40.301^{a}±0.572	26.352^{a}±0.429
4:4	72.74^{ab}±0.352	41.400^{a}±1.364	26.039^{a}±0.533
6:6	72.78^{ab}±0.530	41.328^{a}±1.014	25.416^{a}±0.833

mean ± SEM. Means are significantly different (P<0.05) in a column with different litter superscripts.

The eviscerated carcass weight of broilers in the 4L:4D photoperiodic intermittent light category was also higher and significant(P<0.05) than the eviscerated carcass weights in the 2L:2D photoperiod and in control light, according to (Yang *et al.* 2016). We are in agreement with what they found, no significant differences in breast muscle ratio was detected among intermittent light and control group (P>0.05).

Similar to (G. Rahimi *et al.* 2005), we can suggest that, one: since physical activity during darkness is very low, and the expenditure of activity on energy is considered, this may contribute to a decrease in physical activity with intermittent light schedules and enhanced efficiency in production. While electricity cost is lowered, room temperature is reduced in the intermittent light schedules (about three degrees Celsius). Two: From a practical point of view, the intermittent light model can be used in tropical and subtropical areas as an effective management technique for broiler production during the hot season. It should be noted that the intermittent light schedules can be used only in windowless houses, otherwise it can be used at night.

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تأثيرات جدول الإضاءة المتقطعة على أداء إنتاج دجاج التسمين وسمات الذبيحة

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يهدف البحث الحالى الى دراسة تأثير ايقاع الضوء على خصائص النمو فى دجاج التسمين قبل الذبح وبعده. لذلك الغرض تم تربية مئة وثمانية وثمانون من فراخ روس (٣٠٨) لمدة (٤٢) يوما بين (١١ الى ٤٢) يوما وفقا لجدول اضاءة متقطع اما المعاملة الاولى ١٨ ساعات من الضوء: ٦ ساعة من الظلام (١٨ض:٦ظ) او المعاملة الثانية (٢ض: ٢ظ) او المعاملة الثالثة (٤ض:٤ظ) او المعاملة الرابعة (٦ض:٦ظ). النتائج تظهر انه لم يكن هناك فرق معنوى فى وزن الجسم وزيادة الوزنية عند (٢٣ الى ٤٢) يوما وزيادة وزن الجسم فى عمر (١١ الى 22) يوما بين المعاملات ، ولكن وزن الجسم فى ضوء المتقطع (١١ الى ٢٢) يوما كان الفرق معنويا وافضل بكثير من جميع المعاملات بما فيها المعاملة الاولى (١٨ض:٦ظ) (P<٠,٠٥). كذلك لم يكن هناك فرق كبير بين المعاملات فى تناول العلف. النتائج تظهر ايضا ان استخدام جدول الاضاءة المتقطع ادى الى تحسين نسبة تحويل الغذائى ولكن ليس تأثيرا معنويا. ايضا بالنسبة للوفيات ، لم يكن الفرق معنويا تحت مستوى (P<٠,٠٥). وبالمثل ، فان نسبة الصدر والفخذ فى الطيور التى تمت تربيتها فى جميع الفترات الضوئية لم تكن تختلف اختلافا معنويا عن بعضها البعض (P<٠,٠٥). بالاضافة الى ذلك ، كانت نسبة التصافى للطيور التى تمت تربيتها فى معاملة الثانية (٢ض: ٢ظ) تختلف اختلافا معنويا (P<٠,٠٥) عن البرامج الضاءة الاخرى من بينها (١٨ض:٦ظ). لذلك وصلنا الى نتيجة انه فى ادارة دجاج التسمين ، كان جدول الاضاءة (٢ض:٢ظ) افضل مقارنة بالفترة الضوئية (١٨ض:٦ظ) و (٤ض:٤ظ) و (٦ض:٦ظ).