PHOTOSTIMULATION IN EGG PRODUCTION AND OVERALL PERFORMANCE OF LAYING PULLETS UNDER STEPWISE INCREMENTAL LIGHTING PROGRAMME

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Abstract

An eight week study was conducted at the teaching and research farm of Tai Solarin University of Education in Ijebu Ode Nigeria to determine the effect of 30minutes weekly stepwise increase in lighting for Isa brown point of lay pullets. Parameters assessed in this study were egg production, performance characteristics and volume of waste generated. A total of 100 Isa brown pullets of 16 weeks of age were randomly divided into 4 treatments in a completely randomized design. Each treatment is further divided into 6 replicate of 4 birds each. The 4 treatments represent the duration of exposure of the birds to light on a daily basis (12hrs, 14hrs, 16hrs and 18hrs). The birds were transferred from the floor to cage at 16weeks of age while 2 weeks was allowed for acclimatization of the birds to the new environment. At 18 weeks of age, the birds were exposed to 30minutes weekly increase in lighting until the maximum number of hours based on treatment is reached. Treatment 1 (control) is exposed to normal daylight which average 12hours while treatment 2, 3 and 4 received 14, 16 and 18hours of light daily. From the result of the study birds that were reared under 14hours of daylight were the first to come into lay at 19 weeks of age. Significant differences ($p< 0.05$) were observed in the feed intake per bird per week across the group. In week 1, the highest feed intake (530g) was obtained from birds exposed to 14hours of daylight. In week 8 however, feed intake in birds that received 12 and 14 hours of light were similar (844g) but higher than feed intake in birds that received 16hours (776g) and 18hours (792g) respectively. The mean values of body weight, weekly egg production and egg weight were all similar.

In conclusion, the performance of pullets exposed to light improved with regard to feed intake, the onset of egg laying and number of eggs producedhile other performance indicators were not affected.

Keywords: photostimulation, pullet, incremental lighting, Isa brown

Introduction

Poultry production is unique in that it offers the highest turnover rate and the quickest return on investment in the livestock industry (Taru, 2010). In Nigeria, the industry has been described as the fastest means to solving the problem of protein deficiency (Ike, 2011). Eggs are an excellent source of nutrients including high quality protein, vitamins and minerals.

They are consumed globally and their production represents an important segment of the world food industry. Light is a crucial environmental factor influencing the production, welfare and behaviour of laying hens (Olanrewaju *et al*; 2006 and Mendes *et al*; 2013).

Many physiological processes are influenced by light. Poultry perceive light through the photoreceptors that transform the energy contained in photon to biological signals. In the eyes, the energy of the photons is transformed by photosensitive pigments in the cones and rods of the retina, and transmitted through neurons to the brain where the signal is integrated in an image. It was demonstrated that photoreceptors in the hypothalamus are biological transformers that convert photon energy into neutral impulses (Etches, 1994). The pineal gland which is part of the endocrine system of the hen is situated behind the eyes, above her midbrain. This pineal gland of hen produces melatonin that helps to regulate sleep and other body functions. When the natural lighting period of day lengthen, then the pineal gland of hens responds by sending a hormone through her body to ovary to start producing eggs. And when the days shorten then the pineal gland stops sending this hormone.

Studies have been conducted to determine the conditions that are most suitable for hen to maximize their genetic capacity (Almalrous, 1997; Mendes *et al*; 2005). It has been reported earlier by Morris and Butter (1995) that the beginning of laying induced by lighting programme leads to laying more eggs during production cycle but also lower average egg mass and conversely in case of later beginning of laying. The number of egg produced, liveability and profitability can be favourably influenced by a proper lighting programme, as egg production is directly related to changes in day length to which the pullets are exposed. This study is therefore targeted at finding the effect of varied lighting duration on performance and egg laying capacity of Isa brown pullets.

Materials and method

This research was conducted at the teaching and research farm of Tai Solarin University of Education under a standard manage mental condition.

Experimental animals and management

A total of 100 Isa brown pullets of 16 weeks old were used in this study. The birds were caged at 16 weeks and allowed to acclimatize for 2 weeks before they were randomly allotted to treatment groups in a completely randomized design. All management practices required were carried out on the birds while vaccination and medication were carried out at the appropriate time. A commercial poultry diet was supplied to the birds throughout the experiment. At the 18th week of age, the birds were weighed and randomly allotted to treatments according to the light exposure. Before the allotment of the birds to treatment, all the birds were subjected to natural day light and darkness. At 18th week however, the birds were divided into 4 treatments, 6 replicates and 4 birds per replicate. The birds were separated into cages in different houses while the lighting programme commenced treatment

Experimental Design

As earlier explained, the birds were divided into 4 groups or treatment.

Treatment 1 is the control group which were reared under natural day light throughout the experimental period

Treatment 2 received 14hours of daylight starting from 18th week with 30minute weekly stepwise increase.

Treatments 3 and 4 received 16 and 18hours respectively also under 30minutes stepwise weekly increase. Light was using white energy saving bulb for the required number of hours daily.

The performance parameters measured in this study include age at first egg, feed intake, body weight gain, egg production and egg weight.

Results

Table 1: Average weekly weight of egg in gram

	Group 1	Group 2	Group 3	Group 4	SEM
Week 1	0.0	5.7	5.3	12.1	5.594
Week 2	24.5	24.5	37.9	39.5	5.475
Week 3	40.8	42.3	40.7	42.8	0.807
Week 4	43.5	42.5	43.3	43.3	0.739
Week 5	44.7	44.8	44.8	46.3	0.607
Week 6	46.3	46.2	46.8	48.0	0.701

Table 2: Average weekly body weight per bird (g)

	Group 1	Group 2	Group 3	Group 4	SEM
Week 1	1365.7	1305.5	1337.3	1318.2	36.09
Week 2	1382.7	1364.7	1386.7	1407.7	24.02
Week 3	1512.5	1510.5	1501.3	1483.7	27.11
Week 4	1482.8	1448.0	1494.0	1531.0	22.94
Week 5	1519.0	1401.0	1488.3	1424.5	32.11
Week 6	1512.5	1510.5	1501.3	1483.7	27.11

Table 3: Average feed intake per bird per week (g)

	Group 1	Group 2	Group 3	Group 4	SEM
Week 1	495.0^{c}	530.0^{a}	505.0^{b}	495.0^{c}	44.19
Week 2	603.0^{d}	608.0^{c}	620.0^{b}	640.0^{a}	29.42
Week 3	580^{d}	613.0^{b}	617.0^{a}	607.0^{c}	66.39
Week 4	678.0^{a}	661.0^{b}	618.0^{d}	659.0^{c}	28.09
Week 5	700.0^{a}	640.0^{c}	670.0^{b}	670.0^{b}	39.33
Week 6	747.0^{a}	702.0^{d}	727.0^{c}	741.0^{b}	33.20

Table 4: Performance of layers

	Group 1	Group 2	Group 3	Group 4	SEM
Age at 1st egg	145	134	139	138	
Egg Production	70.2	86.2	79.3	101.0	9.74
feed intake/bird (g)	$5194.^{a}$	5322^{b}	5272^{c}	5354^{a}	0
Body weight gain (g)	349.7^{a}	294.2^{ab}	281.8^{ab}	227.8^{b}	31.63
Feed Efficiency	147.2	143.8	142.7	142.7	1.76
Daily Faecal weight (g)	3969.3	3833.1	4015.9	4283.8	290.56

The average weekly weight of egg did not show any significant difference ($p>0.05$) as shown in table 1 from first week to 6th week of egg collection. Similarly, the average weekly body weights were not significantly different.

Values of egg weight in week 1 ranged from 0.0 in group 1 to 12.1 in group 4.

Average feed intake per bird per week from first to 6th week were significantly different as shown in table 3. In week 1 for example, feed intake was highest in week 2 with 530g while the lowest feed intake of 495g was obtained in groups 1 and 4. In week 6, feed intake for birds in treatment (control) 1 was the highest (747.09) while the least feed intake was obtained from birds under 14hours of daylight (group 2).

Table 4 above shows age at 1st egg, egg production for the entire period of study, average feed intake, average body weight gain and the average daily faecal weight. The result of age at first egg showed that birds that were exposed to 14hours of daylight in group 2 were the first to come into lay at 134 days. Birds in group 1 under the natural photo period came into lay at 145 days.

Egg production for the period of study was highest in group 4 that received 18hours of light daily with 101 egg. The least egg production was obtained in group 1 that received normal daylight.

The average total feed intake as shown in table 4 was significantly different ($p>0.05$) with the highest feed intake (5354g) coming from birds in group 4 which received 18hours of daylight. The least feed intake (5794) however came from group that received 12hours of daylight (group 1).

Body weight gain showed significant difference with the highest value (349.7) in group 1 that received 12hours of daylight. Group 4 which received 18hours of daylight only had a bodyweight gain of 227.8g which is the lowest.

Faecal production on daily basis was not different in terms of weight. But numerical value show that the highest (4283.8g) faecal weight was obtained in treatment 4 which received 18hours of daylight while treatment 2 which received 14hours of daylight had faecal weight of 3833.1g which is the lowest.

Discussion

From the results of the current study, age at 1st egg was not affected by hours of exposure to light. This result is similar to the result obtained by Lewis and Gous (2006) and Dummis and Kalabasi (2009) who reported that sexual maturity in laying hen were not affected by increased or reduced daylight. Asghan and Bhatti (1990) obtained similar finding with respect to effect of light on the onset of laying.

The result obtained for the total number of egg collected per group did not indicate statistical significant difference ($p>0.05$) but the numerical values show that more eggs were produced by birds that were exposed to 16hrs of daylight (101.0). This is closely followed by group 2 (86.2) that received 14hrs of light daily. However, the least in terms of egg production was got from the control group (70.2) which were raised under natural daylight. Chotensangasa and Santipong (2000) studied the effect of light on egg production in local chicken and found a significantly higher number of eggs produced in birds exposed to 18hours of light and 6 hours of darkness.

Increase in the day length as observed in this study seems to have negative consequences on the body weight gain of the pullets (Table 4). The highest body weight gain was found in birds that were exposed to natural daylight. It is also interesting to note that the feed intake in the control group is the least. This in essence means that while light aid feed intake, it does not necessarily improve the body weight gain. This result is in sharp contrast to what Danlami *et al* (2016) found when they concluded that birds under 18hrs of daylight had significantly higher body weight than birds under natural daylight.

Also of importance in this study is the fact that increased daylight does not necessarily increase the faecal weight (Table 4). This is because no significant difference ($p>0.05$)

was obtained in faecal weight between birds that were raised under natural daylight and those raised under artificial lighting

Conclusion

It can be concluded based on the results of this study that increase in daylight up to 14hours can improve performance in layers in terms of early onset of lay and number of eggs produced.

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