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Effect of different photoperiods on some maintenance behavior, external and internal egg quality traits of layers

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Abstract

This study was conducted to investigate the effect of three different photoperiods (13, 16, 19 hours) on some maintenance behavior, external and internal egg quality traits of layers. One hundred and eight birds of Bovans layers at 25th week of age were used. The birds were divided randomly into three equal groups and each group subdivided into 6 replicates (6 bird/ one replicate), where the cages floor spaces were 833 cm^2 / bird. The obtained results revealed that the birds housed at 16 hours of photoperiod/day laid egg with significant ($P<0.05$) higher external quality traits, including egg length, egg width, shell weight, egg shell ratio and shell thickness than other groups. Moreover, egg weight and its surface area were significantly higher in 16 hours light than 13 hours. Similarly, the most of internal quality traits, including yolk height, albumen height, yolk weight and yolk ratio. In addition, there was an increase in the most of behavioral patterns (feeding, drinking, sitting and other comfort behavior) in16 hour's photoperiod, with significant differences. It was concluded that, there is an economical effect of housing layers at different photoperiods.

Key Word: Photoperiod, Egg quality, Behavior, Layer

Introduction

The poultry industry is one of the best available sources for the production of high biological value animal protein in the form of eggs. Increasing concern towards poultry welfare in farms has led to studying the management. Welfare of poultry is largely regulated by various intrinsic and extrinsic factors, among which photoperiod plays role in its behavior. The management of the poultry house is essential and the lighting, as managerial practices was a powerful exogenous factor in control of many physiology and behavior processes of laying birds[11]. The light duration was widely used for improvement the reproductive performances of layers[7]. Understanding the factors that affect egg quality is important for eggs production with high quality[15]. Also, the economic losses due to poor egg quality[1]. Thus, the objectives of this study were to investigate the effect of photoperiod on behavior and egg quality traits of layers.

Materials and Methods

One hundred and eight birds of bovans layers at 25th week of age were divided randomly into three equal groups under 13, 16 and 19 hours (hrs) of photoperiods from candescent light. Each group subdivided into 6 replicates (6 birds/cage),

where the cage floor space was 833 cm^2/bird. Each group was in separate room, where, all rooms of experiment had the same hygienic measurement. Basic layer's diet was provided ad libitum containing 18% crude protein, 3.5% calcium, 0.45% phosphorus and 3000 k. cal ME/ kg[14]. Behavioral patterns were performed for 8 hrs weekly/group by direct observation[20] in two observational periods; in the morning and at afternoon to avoid the effect of diurnal rhythm[4]. The observed behavioral patterns (duration) were feeding, drinking, standing, sitting, walking, preening and other comfort behavior (wing flapping, body shaking, leg/wing stretching)[8]. To assess the egg quality parameters, a total of 450 fresh eggs were randomly collected "150 eggs from each group" and egg quality was taken. Egg and shell weights were measured using the Sartorius 1202 MP balance. An electronic digital caliper was used for calculating width, length and shell thickness (mm)[5]. Egg shape index= egg width / egg length x 100[6]. As well as, egg shell% was calculated as shell weight / egg weight x 100[5]. Egg surface area $cm^2 = 3.9782W^{0.7056}$, where W = egg weight[19]. The internal quality was obtained by gently broken the egg and the contents were taken on flat surface. The measurement of internal traits (yolk weight, albumen weight, yolk height, albumen height, yolk ratio, haugh unit, albumen ratio and diameter) was according to the methods published before[5]. The data were analyzed using SAS statistical analysis package[18].

Table (1). Means (± SE) of some maintenance behavior of layers under the different photoperiods

Maintenance behavior	Photoperiods (hrs/ day)			Degree of significance
	13 hrs	16 hrs	19 hrs	
Feeding time (minutes/hr)	11.02±1.82^b	15.72±1.57^a	12.40±1.11^{ab}	*
Drinking time (minutes/hr)	1.75±0.45^b	3.75±0.80^a	2.03±0.48^b	*
Sitting time (minutes/hr)	7.65±2.02	6.30±0.95	6.03±0.86	NS
Standing time (minutes/hr)	9.39±1.32	12.02±1.06	9.36±0.92	NS
Walking time (minutes/hr)	3.48±0.15^b	4.42± 0.26^a	3.98±0.33^{ab}	*
Preening time (minutes/hr)	2.72±0.92	2.56±0.86	2.80±0.83	NS
Other comfort time (minutes/hr)	3.83±1.14	3.65±1.02	3.88±1.22	NS

Means within the same row having different superscripts are significantly different at ($P \leq 0.05$).

Table 2. Effect of different photoperiods on the external egg quality traits of layers

Traits	Photoperiods (hrs/ day)			Degree of significance
	13 hrs	16 hrs	19 hrs	
Egg weight (g)	53.18±0.47^b	54.27±0.90^{ab}	55.29±0.55^a	*
Egg length (mm)	53.54±0.43^b	54.65±0.34^a	52.13± 0.25^c	**
Egg width (mm)	40.43±0.34^b	41.06±0.21^a	39.32±0.12^c	**
Egg shape index	75.51±0.4	75.09±0.5	74.86±0.3	NS
Shell weight (g)	6.76±0.08^b	7.32±0.14^a	6.80±0.10^b	**
Eggshell ratio (%)	12.67±0.07^{ab}	13.45±0.10^a	12.30±0.07^b	**
Shell thickness (mm)	0.37± 0.008^b	0.42±0.004^a	0.39±0.003^{ab}	**
Egg surface area (cm^2)	65.53±0.47^b	66.49±0.49^{ab}	67.35±0.33^a	*

Means within the same row having different superscripts are significantly different at ($P \leq 0.05$).
External and internal egg quality traits, as shown in Table (2 &3) were significantly affected by changing in different photoperiods.

Table 3. Effect of different photoperiods on the internal egg quality traits of layers

Traits	Photoperiods (hrs/ day)			Degree of significance
	13 hrs	16 hrs	19 hrs	
Yolk height (mm)	17.71±0.23[a]	18.42±0.61[a]	15.40±0.20[b]	**
Albumen height (mm)	8.51±0.13[a]	8.61±0.21[a]	6.98±0.12[b]	**
Yolk diameter (mm)	36.50±0.33[ab]	37.03±0.53[a]	35.71±0.32[b]	*
Yolk weight (g)	16.38±0.23[b]	18.18±0.88[a]	18.35±0.44[a]	**
Yolk ratio	30.75±1.08[b]	33.35±1.01[a]	33.18±1. 13[a]	**
Albumen weight (g)	29.75±0.53	29.11±0.47	29.88±0.86	NS
Albumen ratio	55.88±0.74[a]	53.71±0.67[b]	54.13±1.81[ab]	**
Haugh unit	93.72±0.46[ab]	94.08 ±0.45[a]	84.71±0.34[b]	**

Means within the same row having different superscripts are significantly different at ($P \leq 0.05$).

Results

Means ± standard error (SE) of some maintenance behavior at different photoperiods are shown in Table 1. It clearly shows that different photoperiod had significant effect on feeding, drinking and walking behavior.

Discussion

Lighting is a powerful exogenous factor in control of physiological and behavioral processes. The photoperiod is a factor that influences in the behavior and egg quality of laying hens. In addition, behavior is an indicator for the assessment of bird's welfare. Hens housed at 16 hrs of photoperiod were significant ($P<0.05$) higher in durations of feeding, drinking and walking behavior than other groups[2]. In contrary, the reduction of photoperiod caused significantly lower locomotion[9]. Results revealed that, photoperiod had a non-significant effects ($P>0.05$) on sitting, standing, preening and other comfort behaviour[16]. In present study, the most of external egg quality traits were significantly affected by different photoperiods, where 16 hrs of photoperiod had significant higher than other groups. While, egg shell index which did not significantly affected by photoperiods. These results were agreed with previous publications [12,17], who mentioned that some egg characteristics could be improved by the increase in photoperiod. Never less, the increase in photoperiod led into decrease in egg weight[13]. Results as mentioned in Table (3) revealed the significant increase of the most of internal egg quality in 16 hrs, which may be due to the correlation between internal and external quality[10]. Yolk height, albumen height, yolk diameter, yolk weight, yolk ratio and haugh unit were significantly higher at 16 hrs than at 13 and 19 hrs of photoperiods. The previous findings[3] were similarly to our investigation, who noted increase the weight of albumen and yolk with the increase in photoperiod. On the contrary, albumen ratio was significantly lower at 16 hrs of photoperiod, which may be attributed to the correlation between albumen ratio and egg weight[5]. However, there was no significant difference in albumen weight among the experimental groups. It was concluded that, difference in photoperiod of layers associated with significantly difference in external and internal egg quality traits and its behavior.

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