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Photoperiod on growth and egg characteristics of the white leghorn chicken

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Abstract

One hundred and twenty (120) 16 weeks old White Leghorn layer breeds were used for the study. The objective of the study was to determine effect of photoperiod on layer chicken. The research was carried out at the Poultry Section of the Animal farm of the Department of Animal Science Education, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Mampong. Four treatments made up of 12 hours of light, 14 hours of light, 16 hours of light and 18 hours of light were used for the study. Each treatment was replicated three times with 10 birds per replicate in a Completely Randomized Design. Birds were exposed equally to common daylight and in the evenings, lights were turned on at specified periods. Growth parameters measured were initial body weight, daily feed intake, daily weight gain and final body weight. Egg traits measured were egg weight, albumen height, yolk color and yolk weight. The data collected were analyzed using General Linear Model procedure of Statistical Analysis System. Results from the study indicated that, varied photoperiod regimes had no significant ($P>0.05$) effect on initial body weight, daily feed intake but had significant ($P<0.05$) effect on daily weight gain and final body weight of growth traits. Photoperiod had no significant ($P>0.05$) effect on the egg characteristics of the white Leghorn layer bird. It was concluded from the study that, increasing photoperiod had no positive effect on growth and egg characteristics of the white Leghorn layer.

Keywords: Photoperiod; Layer chicken; Growth traits; Egg traits; White Leghorn

1. Introduction

Broiler chicken industry is an important source of animal protein in the world in comparison with cattle and pigs [1]. Small poultry holdings provide supplementary food, income and employment in Africa [2]. The role played by the poultry industry cannot be over looked in terms of poverty alleviation in most rural communities [3]. Despite these prospects, the poultry industry in Ghana is face with some challenges. This comes in various forms ranging from housing, feeding, medication, diseases and pests [4]

The growing demand for poultry and its product especially egg justifies the need to increase poultry productivity. This pressure to increase productivity coupled with the current cost of electricity is putting the poultry production in the country into danger in terms of reduction in profit of poultry industry in Ghana [5]. Lighting intensity has been reported to affect the production and feeding behavior of chicken [6]. In Zambia, increased (24 hours) photoperiod has been found to increase quail production and reproductive traits [7]. However, there is limited literature on the effect of varied photoperiod duration on the growth performance and egg quality traits in the White Leghorn layer in Ghana and hence necessitates this study. The objective of the study was to determine the effect of photoperiod on the growth and egg traits of the White Leghorn layer chicken.

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2. Location and duration of the study

The research was carried out at the Poultry Section of the Animal farm of the Department of Animal Science Education, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Mampong-Ashanti campus, Ghana. The study took a period of 6 months. Mampong-Ashanti lies in the transitional zone between the Guinea savanna zone of the north and the tropical rain forest of the south of Ghana along the Kumasi-Ejura road.

2.1. Experimental birds and treatments

One hundred and twenty (120) 16 weeks old White Leghorn layer breeds were used for the study. The treatments for the study were made up of 12 hours of light (control), 14 hours of light, 16 hours of light) and 18 hours of light. Each treatment was replicated three times with 30 birds per treatment consisting of 10 birds per replicate in a Completely Randomized Design. Birds were exposed equally to common daylight and in the evenings, light were turned on at specified periods.

2.2. Feeding and watering

Birds were offered feed and water ad-libitum. The composition of feed ingredients is as shown in table 1 below.

Table 1 Composition of feed used in the experiment.

Feed ingredient	Quantity
Maize (Kg)	53
Wheat bran (Kg)	20
Soybean (Kg)	8
Tuna fish (Kg)	7
Russian fish (Kg)	3
Oyster shell (Kg)	7.5
Dicalcium phosphate (Kg)	0.5
Vitamin premix (Kg)	0.5
Salt (Kg)	0.5
Crude Protein (%)	16

2.3. Parameters measured

Parameters measured included growth traits (initial body weight, daily feed intake, daily weight gain, final body weight gain, feed conversion ratio) and egg characteristics (egg shell thickness, yolk color, egg weight and albumen height)

2.4. Statistical Analysis

The data collected were analyzed using General Linear Model (GLM) procedure of Statistical Analysis System (SAS for Windows, version 7). The means were separated using the probability of difference (PDIF) procedure of SAS (SAS, 2008).

3. Results and discussions

Varied photoperiod regimes had no significant ($P>0.05$) effect on initial body weight (IBWT) of the birds. This could be attributed to the use of birds of similar ($P>0.05$) age and weight at the beginning of the experiment and hence the difference expected was not supposed to be significant. This study is in harmony with the study of [8], who reported no significant difference for initial body weight when birds were exposed to 6L:18D, 8L:16D, 10L:14D, 12L:12D and 14L:10D photoperiod regime in China.

Table 1 Different Photoperiod regimes on Growth Parameters of Layer Chicken

Parameter	12H	14H	16H	18H	SE	P
IBWT (g)	826.70	826.70	826.70	826.70	10.50	0.89
DFI (g)	77.62	75.05	76.95	79.81	2.13	0.27
DWTGN (g)	32.22 ^a	26.83 ^b	26.51 ^b	27.30 ^b	1.78	0.04
FBWT (g)	1503 ^a	1397 ^b	1383 ^b	1380 ^b	32.60	0.03

IBWT = initial body weight, DFI= daily feed intake, DWTGN= daily weight gain, FBWT= final body weight gain, H= hours of light exposure, SE= standard error, P=probability. Means bearing different superscripts in the same row are significantly (P<0.05 different).

There was no significant (P>0.05) difference between treatment means for daily feed intake (DFI) of the birds though birds exposed to 18H recorded the highest mean value of performance. Reports have shown that, birds are active in the day and also in the night, especially when they are able to see feed; this enhances their ability to feed in the night to boost their feed intake [6]. This finding is in agreement with the reports of the study conducted by [9], who compared the performance of Pekin ducks under 24L:0D and 16L:8D and concluded that even though, birds exposed to long hours of light had the opportunity to feed at night and had higher mean performance in terms of feed intake, their comparison to their counterparts in 16 hours light were not statistically different. However, this report disagrees with the findings of [7], who reported that daily feed intake increased with increasing level of hours of exposure to light in the Japanese quail. Even though, there is similarity in the treatment allocation in the two experiments, there is a vast difference between the species of bird used in both study which might accounted for the differences in the reports for the parameter measured.

Different photoperiod regimes had significant (P<0.05) effect on the mean performance in terms of daily weight gain (DWTGN) of the birds. Birds raised under 12H performed better than birds raised on 14H, 16H and 18H. Even though, birds exposed to longer photoperiod were expected to increase in feed intake and hence body weight [6], this was not the case in this observation. Birds could be exposed to longer hours of light, but that is not a guarantee of their ability to feed and hence increase weight [10]. This report disagrees with the finding of [9], who reported that, there was no significant difference between ducks raised under varied photoperiod regimes for daily weight gain. Again, the results from this study disagrees with the findings of [9] who reported no significant difference between treatment means for daily weight gain in broilers after raising the birds in varying photoperiod regimes (13L, 18L and 23L).

Varied photoperiod regimes had significant (P<0.05) effect on the final body weight gain (FBWT) of the birds. Birds raised under 12H performed better than birds raised under 14H, 16H, and 18H. There was a negative correlation between final body weight and the length of exposure of birds to light. Thus, the final body weight in the birds declined with increased photoperiod. This could be attributed to the variation in the weight gain which consequently affected the final body weight. Birds raised under 12H light gained much weight daily than birds on 14, 16 and 18H and hence the tilt of the final body weight in favor of birds raised under 12H light. This present report disagrees with the report that, varying photoperiod regimes had no significant effect on the final body weight in the Pekin ducks [9]. The distinction in findings could be attributed to differences in species of bird and also varied duration of exposure of light. Longer period of exposure to light in animal production has been reported not to be productive as limited lighting has been shown to improve upon animal growth performance as against longer duration of exposure [10].

Table 2 Different Photoperiod regimes on Egg traits of Layer Chicken

Parameters	12H	14H	16H	18H	SE	P
EGGWT (g)	49.5	49.9	50.0	50.09	45.24	0.91
ALBHT (mm)	7.44	7.22	7.10	7.77	0.64	0.76
YLKC	4.0	3.63	3.59	3.74	0.38	0.59
YLKWT (g)	15.79	15.78	15.59	16.76	0.93	0.62
SHLTH (mm)	0.41	0.42	0.42	0.44	0.03	0.19

EGGWT = egg weight, ALBHT =albumen height, YLKC = yolk colour, YLKWT = yolk weight, H = hours of light exposure SE= standard error, P=probability

There was no significant ($P>0.05$) difference between treatment means for egg weight in the present study. The weight of eggs increased slightly with increased photoperiod regimes. The present study is partially in harmony with the findings of [7] who reported that, even though there were significant difference between birds exposed to varied photoperiods for egg weight, the weight of the eggs increased slightly with the increase in photoperiod in the Japanese quail. Similarly, there was no differences observed when layer chickens were exposed to varied lighting periods at different ages [12].

There was no significant ($P>0.5$) difference between treatment means for albumen height (ALBHT). Even though there was no difference between treatment means, birds exposed to 18H recorded the highest statistical mean value compared with birds on the remaining treatments (12, 16 and 18H). Higher albumen height recorded in this study gives an indication of the egg protein quality as higher albumen height indicates higher protein levels of the egg in chickens [4]. This presupposes that, varied photoperiod regimes had no effect on the protein quality in the layer chicken. The report from this study is in agreement with the findings of [14] who reported no significant difference between Guinea fowl raised under 12, 14, 16 and 18 hours of light. Even though the Guinea fowl is different from the layer chicken in specie, the photoperiod used in the two studies were similar and hence the similarity in performance.

There was no significant ($P>0.5$) difference between treatment means for yolk color (YLKC) even though, birds exposed to 12H recorded the highest average value of performance. The color of the yolk in birds has greater influence on the marketability of the eggs as consumers prefer deep yellow eggs to other colors [13]. Deep yellow egg yolks were recorded for birds raised under the four treatments which indicates a similar performance in terms of yolk color for the varied photoperiod durations. This indicates that, photoperiod has no influence on the yolk color in the layer chicken. This study is in harmony with the findings, that varied photoperiod regimes had no effect on the yolk color in the local Guinea fowl in Ghana [14]. The similarities are as a result of the similar durations of exposure of the birds to light.

With respect to yolk weight (YLKWT), there was no significant ($P>0.5$) difference between treatment means. Though there was no significant difference between treatment means, birds exposed to 18H had the highest statistical mean value compared to the other treatments. This is an indication that, different photoperiod regimes had no influence on the weight of yolk in the layer chicken. The yolk weight recorded in this study from the four treatments were higher and have greater importance from the nutritional context in terms of cholesterol levels; yolk size increases with cholesterol level [4]. The report from this study is in agreement with the findings of [14] who reported no significant difference for yolk weight between Guinea fowls raised under 12, 14, 16 and 18 hours of light

There was no significant ($P>0.05$) difference between treatment means for shell thickness (SHLTH) even though birds raised under 18H recorded the highest mean value of performance. Photoperiod has been reported to have no effect on the shell thickness of the white Leghorn layer in China [12]. Shell thickness increased with increased photoperiod on birds. Thick shell reduces permeability of water vapor which increases hatchability of the eggs laid [1]

4. Conclusion

From the study conducted, it was concluded that, increasing duration of photoperiod does not have positive impact on the growth and egg characteristics of the white Leghorn layer.

Recommendation

It is recommended to farmers to raise birds under 12 hours of light to reduce cost of production and enhance their growth and reproductive performance of layer chicken.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have declared that, no conflict of interests exist.

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