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THE EFFECT OF LIGHTING COLOR ON SOME OF THE PRODUCTIVE TRAITS OF JAPANESE QUAIL

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Abstract

This study was conducted to determine the effect of lighting color on the productive performance of Japanese quail. A total of 180 quail chicks, one day old, 8 g average weight, randomly distributed into four treatments with three replicates (15 birds / replicate). The chicks were exposed to four colors of lighting, they were white, red, blue and green light, the intensity of illumination was 15 lux for 23 hours / day. The results showed that a significant increase ($P \leq 0.05$) on the body weight and weight gain, white light significantly outperformed ($P \leq 0.05$) on the feed consumption at first three weeks of bird life, while the blue light in the same characteristic in the last two weeks of the life of birds, the red light showed a significant improvement ($p \leq 0.05$) in the feed conversion.

Key words: lighting color, productive traits, Japanese quail.

Introduction

Commercial production of poultry which reared at a large houses, needs focused management for the success of the breeding process, environmental conditions must be regulated in the poultry houses, such as heat, humidity, ventilation and lighting, whereas, the factors have a direct impact on the health and productivity of the chicks (Olanrewaju *et al*., 2006). The bird is sensitive to the color of light is high, it has the ability to feel red, green, blue, ultraviolet, and even light spectrum (Prescott and Wathes, 1999). Via the retinal brain and light receptors (Kuenzel *et al*., 2015). Light is an important factor in regulating the physiological and behavioral processes of birds, organizes and coordinates the body's daily physiological functions, including body temperature, metabolism and hormonal secretion, affects growth, maturity and production, the effect of light on behavioral and physiological functions due to the length of illumination, intensity of light and color (Manser, 1996). Some recent studies confirm that certain colors of light have improved the productive performance of different types of poultry, such as Japanese quail, laying hens and broilers (Hakan and Ali, 2005; Cao *et al*., 2008). As the laying hens exposed to red light increased their production (Hassan *et al*., 2014), but the size of the eggs was small (Er *et al*., 2007). Whereas in other studies, there was a significant improvement in the productive performance of broilers exposed to blue and green light (Zhang *et al*., 2014). Therefore, this study was conducted to determine the effect of different light colors on the productive performance of Japanese quail.

Materials and Methods

This study was conducted from 3/21/2017 to 4/24/2017 at a private poultry field, Al-Khader District, Al-Muthanna Governorate. A total 180 Japanese quail chicks were used, one day, 8 g weight, randomly distributed to four treatments, with three replicates per treatment (15 birds per replicate). Chicks were reared at three-storey cages with dimensions of (60 × 70 × 60) cm. Part of the house was isolated, divide it into four small rooms (one for each cage), by wooden planks height of 2 m to control of the lighting colors used. Water and feed was introduced *ad libitum* using plastic feeder and waterier. The chicks were given a Starter diet from 1-21 days, then a grower diet from 22-35 days (end of experiment), table 1, shows the chemical composition of the diets.

The lighting was continuous for 23 hours during the

Table 1: The composition of the diets used and chemical analysis during the starter and grower periods.

Items	Starter diet (1-21 day)	Grower diet (22-35 days)
Maize	41.8	41.55
Wheat	25	25
Soybean meal	32	30.7
limestone	0.25	0.5
salt	0.25	0.25
oil	0.7	2
total	100%	100%
Chemical analysis		
Protein (%)	21.10	20.48
Energy (kilo calorie/ kg diet)	3080.7	3164.5
Lysine (%)	1.31	0.97
Methionine (%)	0.50	0.55
Methionine+ Cysteine (%)	0.68	0.55
Calcium (%)	0.81	2.49
Phosphorus (%)	0.43	0.32

Diet provided form Al-Fayyad feed factory.

trial period and the intensity of the lighting was 15 lux. As for the experiment treatments they were: The first treatment (control) was presented to the normal lamp in white. While the second, third and fourth treatments were red, blue and green colors, respectively. Body weight, weight gain and feed conversion were calculated according to Al-Zubaidi, (1986), the feed consumption was calculated according to Naji, (2006).

A Complete Random Design (CRD) were used, the significant differences between the averages were compared with Duncan Multiple ranges test (1955), the SAS program (SAS, 2001) was used in statistical analysis.

Results and Discussions

Table 2 and indicate that there were no significant differences in the rate of body weights and weight gain for all lighting color at the first week of birds life, at the second week, no significant differences among red, blue and green light and among white, red and blue light, at the last three weeks of life, there was a significant increase ($P \leq 0.05$) in the average live weight in green light treatment, and there were no significant differences between red and blue light, which was a significantly increased ($P \leq 0.05$) compared with white lighting.

Table 2: Effect of lighting color on weekly body weight (g) of Japanese quail (Mean± standard error).

Lighting color	Age (week)				
	1	2	3	4	5
White	0.22±29.36	0.55±54.83 b	0.96±92.02 c	1.12±138.14 c	2.03±178.06 c
Red	0.27±28.24	0.62±57.54 ab	0.89±98.54 b	1.29±147.76 b	2.40±191.83 b
Blue	0.17±27.50	0.54±56.35 ab	0.88±101.30 b	1.35±158.07 b	1.84±199.89 b
Green	0.20±29.26	0.53±64.55 a	0.90±110.78 a	1.20±174.07a	1.76±223.04 a
Sig.	N.S	*	*	*	*

N.S Non-significant differences. Different letters between the averages of the treatments mean that there were significant differences.

The significant increase in the average body weight and weight gain of the treatments in which the green and blue lights were used, may be the photoreceptors in the hypothalamus region feel directly with blue and green light (Liu *et al*., 2010), as the green light stimulates early growth and blue light on late growth, it has the ability to stimulate the secretion of testosterone and increase muscle growth and thus increase body weight (El-Husseiny *et al*., 2000), agreed with Cao *et al*., (2008) note that the broilers raised under the influence of blue and green lights improved the growth rate, which was reflected in the body weight.

Table 4, showed that a significant difference ($P \leq 0.05$) in the white light compared to the rest of the light colors, the significant superiority continued at the second and third weeks, while there were no significant differences between the other light colors (red, blue and green), as for the last two weeks, the blue light was a significant increased ($P \leq 0.05$) compare with the green light, which significantly outperformed ($P \leq 0.05$) compare with white and red light.

These results were agreed with Senaratna *et al*., (2011), noted that the feed consumption were raised under the white light at the first three weeks compared to other the colors of light (red, green and blue), agreed with Rierson, (2011), which indicated that there was an increase in the amount of feed consumption for birds raised under the influence of white light compared to other light colors. The superiority of birds raised under the blue light in the fourth and fifth weeks of feed consumption is attributed to the fact that it makes birds quieter as they spend more time feeding (Prayitno and Omed, 1997).

Table 5, shows no significant differences between all lighting color at the first week of bird age, at the second week, the blue light showed a significant improvement ($P \leq 0.05$) on the food conversion factor compared to the rest of the light colors, while at the third week, the significant improvement was ($P \leq 0.05$) in the red light, as for the last two weeks, the significant improvement was in the white light.

From table 5, note that at the second week of birds life, the chickens reared under the blue light recorded the best

Table 3: Effect of lighting color on weekly weight gain (g) of Japanese quail (Mean± standard error).

Lighting color	Age (week)					Total
	1	2	3	4	5	
White	0.11 ± 20.36	0.30 ± 28.57 b	0.43 ± 37.19 c	0.54 ± 46.12 c	0.41 ± 39.92 c	0.23 ± 169.06 c
Red	0.12 ± 18.24	0.29 ± 29.93 ab	0.39 ± 40.20 bc	0.48 ± 51.21 b	0.36 ± 43.07 b	0.26 ± 182.65 b
Blue	0.16 ± 18.50	0.3 ± 30.04 ab	0.42 ± 41.06 b	0.47 ± 52.47 b	0.36 ± 43.82 b	0.29 ± 185.89 b
Green	0.11 ± 20.36	0.26 ± 34.19 a	0.40 ± 49.32 a	0.44 ± 60.41 a	0.33 ± 49.76 a	0.34 ± 214.04 a
Sig.	N.S	*	*	*	*	*

N.S Non-significant differences. Different letters between the averages of the treatments mean that there were significant differences.

Table 4: Effect of lighting color on weekly feed consumption (g) of Japanese quail (Mean± standard error).

Lighting color	Age (week)					Total
	1	2	3	4	5	
White	0.30 ± 43.16 a	0.66 ± 75.31 a	0.84 ± 108.50 a	1.22 ± 126.76 c	1.23 ± 128.76 c	4.81 ± 482.49 a
Red	0.40 ± 35.42 c	0.65 ± 65.25 b	0.83 ± 92.06 b	1.14 ± 127.56 c	1.18 ± 129.49 c	5.03 ± 449.78 d
Blue	0.36 ± 34.60 c	0.72 ± 63.71 b	0.90 ± 93.21 b	0.96 ± 140.59 a	1.13 ± 143.90 a	4.46 ± 476.01 b
Green	0.30 ± 39.05 b	0.67 ± 65.19 b	0.95 ± 90.15 b	1.26 ± 131.71 b	1.25 ± 135.84 b	4.21 ± 461.94 c
Sig.	*	*	*	*	*	*

Different letters between the averages of the treatments mean that there were significant differences.

Table 5: Effect of lighting color on weekly feed conversion (g diet/ g weight gain) of Japanese quail (Mean± standard error).

Lighting color	Age (week)					Total
	1	2	3	4	5	
White	0.01 ± 2.11	0.03 ± 2.19 b	0.03 ± 2.38 c	0.03 ± 2.41 a	0.01 ± 2.73 a	0.05 ± 2.36 b
Red	0.02 ± 2.12	0.02 ± 2.17 b	0.02 ± 2.20 a	0.03 ± 2.39 a	0.02 ± 2.76 a	0.07 ± 2.32 a
Blue	0.02 ± 2.10	0.03 ± 2.14 a	0.02 ± 2.29 b	0.02 ± 2.57 c	0.03 ± 2.92 c	0.06 ± 2.42 c
Green	0.02 ± 2.12	0.02 ± 2.18 b	0.03 ± 2.27 b	0.03 ± 2.51 b	0.02 ± 2.82 b	0.03 ± 2.38 b
Sig.	N.S	*	*	*	*	*

N.S Non-significant differences. Different letters between the averages of the treatments mean that there were significant differences.

rate of feed conversion efficiency, this is due to decrease in energy exchange by birds due to their lack of movement under the influence of illumination color (Abreu *et al*., 2011), at the following three weeks of birds life, the birds reared under the influence of white and red light scored the best rates in food conversion efficiency, agreed with Senaratna *et al*., (2011), the reason was due to an inverse relationship between the amount of feed consumed and the efficiency of food conversion (Fraga and Thanh, 1979).

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