THE PHYSIOLOGICAL RESPONSE OF LAYING QUAILS TO NATURAL AND ARTIFICIAL LIGHT INTENSITY

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ABSTRACT

The current study was aimed to investigate the impact of white light of various intensity of illumination on some reproductive and hematological parameters of female quail (*Coturnix coturnix*), Where 80 one-day-old birds were used, separated into four groups distributed as follows: The 1st represented as control was exposed to natural lighting, while 2ed ,3rd ,4th was subjected to different intensity of light represented by 0.6, 25 and 45 lux, respectively, for 5 h/day, each group was divided into 4 replicates. The study continued for 8 weeks. The results indicates a notable raise in the level of FSH and LH hormone with an increase in ovarian weight, an elevate in the number of outgrowth and grown-up follicles for groups exposed to 25 and 45 lux light intensity compared to control and 0.6 lux. It was observed for the same groups an increases in the weight of the edible organs (heart, liver and gizzard). In addition, there was a clear increase in the number of RBC, WBC, lymphocytes, hemoglobin and PCV levels, while the 25 and 45 lux groups showed a decline in the level of MCV with a raise in MCH and MCHC compared with the control and 0.6 lux. It conclude that the intensity of different lighting had positive effects in improving some reproductive and blood characteristics of female quail.

Keyword: LH, FSH, blood constituent, quail

الاستجابة الفسيولوجية للسمان البياض لشدة الضوء الطبيعي والاصطناعي

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المستخلص

هدفت الدراسة الحالية إلى تقييم تأثير الضوء الأبيض لشدة الإضاءة المختلفة في بعض المعايير التناسلية والدموية لإناث السمان، حيث تم استخدام 80 طائرًا بعمر يوم واحد، قسمت إلى أربع مجاميع موزعة على النحو الحالي: المجموعة الأولى تمثلت بمجموعة السيطرة عرضت للإضاءة الطبيعية، بينما تعرضت الثانية والثالثة والرابعة لشدة مختلفة من الضوء ممثلة بـ 0.6 و 25 و 45 لوكس على التوالي لمدة 5 ساعات / يوم، وتم تقسيم كل مجموعة إلى 4 مكررات، واستمرت الدراسة لمدة 8 اسابيع. بينت النتائج زيادة معنوية في مستوى الهرمون المحفز للجريبات وهرمون الاباضة مع زيادة وزن المبيض و ارتفاع في اعداد الجريبات النامية والناضجة للمجاميع المعرضة لشدة اضاءة 25 و45 لوكس مقارنة مع السيطرة و0.6 لوكس , كما لوحظ لنفس هذه المجاميع زيادة وزن الاعضاء المأكولة (القلب, الكبد والقانصة) اضافة الى حصول ارتفاع واضح في اعداد الخلايا الدم الحمر، وخلايا الدم البيض, والخلايا اللمفية، وتركيز الهيموكلوبين وحجم الخلايا المرصوصة، في حين اظهرت مجموعتي 25 و45 لوكس انخفاض في معدل حجم الكرية مع ارتفاع في معدل هيموكلوبين الكرية وتركيز معدل هيموكلوبين الكرية مقارنة مع السيطرة والـ 0.6لوكس

الكلمات المفتاحية: هرمون الاباضة، الهرمون المحفز لنمو الجريبات، مكونات الدم، السمان

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IINTODUCTION

Different light strengths have an impact on the physical environments, as well as on several physiological mechanisms and behavioral activity of birds (4). One of the most important aspects in poultry health and wellbeing is light. As a result, the poultry industry is constantly on the lookout for modern and masterly equipment to use in chickens output in request to reduce costs, therefor changes in the illumination system, strength, period, and wavelength have a significant impact on poultry productivity(19) .The researchers concentrated on the animals affected by a light source, intensity, continuous or intermittent photoperiods, color, and wavelength, all of which are considered necessary for producing energy for animal welfare (18) .After doing research on photoreceptors in the retina, Rana and Campbell (23)discovered that UVA light improved the broiler behavior, feeding, locomotors activity and decreased in ground pecking of birds. Furthermore, the optimal period for exposure to UVB light that naturally occurs in sunlight coupled with a sufficient vitamin D3 fortified diet could encourage intestinal absorption of phosphorus and calcium by intestinal epithelial, thereby increasing bone regeneration and skeletal muscle development (3). Over the previous fifty years, studies have highlighted that photoperiodicity and physiological responses regulator sexual maturation in hens by handling photoreceptors with photo-produce activation of all levels of the reproductive axis (HPG-axis) (9).Numerous studies have been conducted to discuss the impact of various illumination ferocity on the efficacy of quail development and venereal regimen; as recorded by Matty et al(14) that 45 and 25 Luxity have perfect effects on the hematological parameters of male quails; nevertheless, there seems to be insufficient information concerning the impacts of light on quail outcomes; thus, the goal of the present research is to explore the impact of varying different illumination intensities on the reproduction and growth of laying quails.=

MATERIALS AND TECHNIQUSE

Quails: During the spring season, this research was carried out at the experimental field of the College of Veterinary Medicine, University of Mosul, Iraq. An overall of 80 one-day female quails have been purchased from the Department of Agriculture's Ebaa Research Unit. laying quails were selected at random to four groups, each with 20 birds and each 4 treatments were managed with 4 replicates. To avoid interfering and reflection of the different lighting sources, the laying quails were enclosed in vertically and horizontally from together on floor cages, and the ambient temperature in the room ranged between from 21oC to 28oC. The humidity usually ranges from 45 to 65 %. During the eight weeks rearing up and growth cycle, clean water supply. The Institute (NRC) recommended that the basic diet item be provided. A lux meter was devised to measuring the different intensities of illumination accessible at the apex of the bird's head in different portions of the floor cages to establish a photometric Lux detector at the head level .

Experimental styling

At the beginning at 15 days of age.laying quails were classified into four groups: G1 considered the control group, was subjected to a routine lightening period of 12 hours of light and 12 hours of darkness. The quails in the G2 considered a dim group was exposed to 0.6 Luxity, whereas the G3 as well as G4 quail groups were subjected to 45, 25 Luxity respectively for five hours every day for eight weeks. Only at the terminus of the experiment were the quail slaughtered. Some visceral such as heart, liver, gizzard, and muscle of the chest were weighted as organ weight/100 g body weight, (2). The ovary was weighted and the number of large and small follicles was counted. (6).

Blood testing

During the slaughter period, specimens of the blood were taken and split into different portions: the 1st part put in the centrifuge for 10 minutes at 3000rpm. Serum samples were preserved at -26C^0 until the follicular stimulating hormones (FSH) and luteinizing hormone (LH) level were determined using an ELISA Kit (21). Whereas the 2nd part of the blood specimen put in to with anticoagulant tubes to calculate hematological parameters for instance counting of the RBCs, WBCs by applying Natt and Herrick mixture , but Wright dye was used for calculate different

leukocytic cells (DLC) and stress index also estimate PCV, Hb, MCV, MCH, MCHC.

Statistical analysis

A one-way analysis of variance has been used to analyze the data. The Duncan Multiple Range test was used to limited the remarkable differences between average at P<0.05 (25).

RESULTS AND DISSCUTION

Result in Table (1) demonstrated the highest increases in FSH and LH, was observed when applying 25 and 45 luxity for 5 h/ day when compared with control and 0.6 lux and also between group sequentially.

Table 1.The influence of natural and different artificial light intensities on FSH and LH level

	Average ± SE	
Treatment	**FSH IU/ML**	**LH IU/ML**
Control	**2.59 ±0.05 c**	**2.30 ±0.04 c**
0.6 Luxity	**2.46 ±0.01 c**	**2.21 ±0.03 c**
45 Luxity	**3.89 ±0.04 b**	**3.91 ±0.01 b**
25 Luxity	**4.04 ±0.02 a**	**4.04 ±0.02 a**

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

Attempting to put on laying quail to 0.6 Luxity lead to in a remarkable drop in the weight of the ovary and numbers of small follicles relative with other groups, but not differ with numbers of large follicles from group that exposure to 45 luxity (Table 2).

Table 2. Influence of natural and different artificial light intensities on reproduction performance of laying quail

	Average ± SE		
Treatment	**ovary weight**	**no. of mature follicles**	**no of growing follicles**
Control	**2.93 ±0.08 a**	**4.80 ±0.37 a**	**30.60 ±2.61 a**
0.6 Luxity	**2.08 ±0.03 b**	**3.60 ±0.50 b**	**17.40 ±1.12 b**
45 Luxity	**3.24 ±0.38 a**	**4.60 ±0.24 ab**	**24.60 ±1.88 a**
25 Luxity	**3.17 ±0.21 a**	**5.40 ±0.24 a**	**27.00 ±2.72 a**

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

The result in Table (3), body weight and chest muscle weights on the last day of the experiment did not differ significantly between groups, the heart weights when the bird was applied to program of luxity at 25 and 0.6 were significantly highest than the control group. Whereas applying 45 luxity did not significantly differ relative to other groups. Although the layer quails that exposed to artificial light 45 and 0.6 led to drop significantly of liver weight relative to 25 luxity while not differ from group that exposured to natural lightening. the gizzard weight diminishes significantly in groups faced 25 luxity relatively to group of 45 luxity and group of naturally lighting, but 0.6 luxity show no difference with other groups.

Table 3. Influence of natural and different artificial light intensities on relative organ weights of laying quail

	Average (g/100 g.bw) ± SE				
Treatment	**body weight g**	**Heart weight**	**Liver weight**	**Gizzard weight**	**Chest weight**
Control	**233 ±4.04 a**	**0.62 ±0.13 b**	**2.94±0.05 b**	**1.83 ±0.09 a**	**21.62±0.07 a**
0.6 Luxity	**229 ±10.01 a**	**0.97 ±0.13 a**	**2.54±0.05 b**	**1.65 ±0.03 ab**	**23.12±0.80 a**
45 Luxity	**249 ±13.70 a**	**0.91±0.04 ab**	**2.64±0.19 b**	**1.76 ±0.09 a**	**20.86±0.85 a**
25 Luxity	**254 ±6.87 a**	**0.98 ±0.06 a**	**3.25±0.24 a**	**1.41 ±0.07 b**	**22.59±0.78 a**

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

The current research revealed highly significant variations in the red blood count, packed cell volume and hemoglobin level for 45 and 25 luxity related to the control group. While the laying quails that exposure to 0.6 luxity did not significantly changes from remaining groups except there is decline in number of WBC as compared with normal control group (Table 4).

Table 4. Influence of natural and different synthetic light intensities on blood component of laying quail

Treatment	Average ± SE RBC x 10^6 /mm^3	WBCx10^3 /mm^3	PCV %	Hb g/dl
Control	2.43 ±0.15 b	4.59±0.22 b	37.20±0.48 b	6.53±0.18 b
0.6 Luxity	3.12 ±0.25 ab	3.76±0.18 c	36.80±0.48 ab	7.40±0.53 ab
45 Luxity	3.59 ±0.53 a	6.40±0.11 a	41.20±0.48 a	12.58±0.97 a
25 Luxity	3.58 ±0.25 a	6.07±0.22 a	42.80±1.49 a	11.97±0.48 a

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

The data in Table (5) show significant decreases in the mean corpuscular volume in collections of bird exposition to 0.6 and 45 luxity in comparison with collection exhibition natural circadian cycle, while not deference from 25 luxity group. In the same table the result clarified significant upsurge in the MCH and MCHC value in quails subjected to luxity 45 and 25 relatively to 0.6 lux and control animals.

Table 5. The influence of natural and different artificial light intensities on erythrocyte indices of laying quail

Treatment	Average ± SE MCV fl	MCH pg	MCHC g/100ml
Control	155.34±11.04 a	189.49±13.39 b	122.01±2.78 b
0.6 Luxity	121.14±10.14 b	165.39±5.06 b	140.14±11.52 b
45 Luxity	116.76±8.08 b	248.42±19.96 a	212.24±3.49 a
25 Luxity	131.31±11.70 ab	253.88±18.95 a	194.44±4.83 a

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

The impact application luxity at 25 show highly significant differed from 0.6 lux group in percentage of lymphocyte, whereas no any difference with other artificial and natural lighting groups. But other DLC cells indicated no variant between groups (Table 6).

Table 6. The influence of natural and different artificial light intensities on DLC and stress index of laying quail

Treatment	Average ± SE Lymphocyte %	Heterophils %	Basophils %	Eosinophils %	Monocyte %	Stress index
Control	66.20±4.39ab	18.00±2.04a	0.20±0.20a	0.60±0.24a	15.00±3.61a	0.27±0.04a
0.6 Luxity	58.40±4.94b	21.00±2.89a	0.80±0.80a	0.20±0.20a	19.60±4.01a	0.37±0.09a
45 Luxity	68.60±2.50ab	16.60±2.18a	0.20±0.20a	0.80±0.37a	13.80±1.28a	0.24±0.04a
25 Luxity	70.40±1.56a	17.00±1.41a	0.40±0.24a	0.40±0.24a	11.80±1.31a	0.23±0.02a

The data is offered as an average ± SE. crucial divergence between collection at P<0.05 are indicated by little different letters in the column.

Illumination possesses a vital role in poultry reproductive performance as synthetic light is broadly utilized in poultry factory to elevate production characters (28). It is noticed from the results that an increase in the level of the hormones FSH and LH for groups exposed to different levels of illumination (25 lux, 45 lux) compared with the control and this corresponds to what was mentioned by Raziq et al (22) until the exposure of laying hens to different levels of lighting caused an expressive increase in the level of reproductive hormones represented by FSH and LH. This increase can be attributed to the effect of lighting on the level of GnRH hormone which regulate the level of FSH and LH, as the 12 h/day illumination program for laying hens led to an increase in the level of both hormones with an improvement in GnRH gene expression (8). There are many factors that affect sexual maturity in laying hens, including the length and intensity of lighting (11). In contrast to mammals, poultry does not use melatonin to transmit light information, but rather obtains it directly through photosensation located within the base of hypothalamus (20). The photoresponse occurs when illumination falls on the eye and is reflected in the form of nerve signals to the hypothalamus, causing the pituitary hormone FSH and LH to secrete, which in turn causes an improvement in production performance (24). The current study showed that the exposure of quail females to 25 and 45 lux led to a raised in the weight of the ovary and the number of outgrowth and mature follicles, and

this increase is attributed to the high level of the FSH and LH. The long wavelengths work on penetrating the skin and the skull, pituitary glands, which dominance the excretion of sex hormones, such as FSH, LH, and estradiol. The LH regulates ovulation, while the FSH plays an important role in the maturation of ovarian follicles (26). This results showed an increase in the weight of the edible organs when applying the lighting program with intensity of 25 and 45 lux in comparison to the control group and 0.6 lux. , as the long period of illumination leads to an increase in the consumption of feed and water, and thus increases the growth rate and body weight (13).Illumination is an essential climatic laborer that hits the cranium of broilers at retinal sensation and travels by neurons to the pineal gland, activating them and regulating hypothalamic functions including assimilation (5), where illumination is renowned to impact growth characters, immune levels and metabolism demeanor and efficiency of birds (17) as the eye cortex and visional cortex anatomically appear to be a major portion in the broiler brain. Physiologically, growth hormone is released in rejoinder to the photoperiod, and these results were confirming by the results of Zhang *et al* (30) they referred to the effect of white, red, green and blue lighting and found that GHRH proteins in the hypothalamus and growth hormone in plasma increased in broilers by 6.83-31.36%. Yu *et al* (29) they reported that thyroxin and growth hormones were notable increased in birds exposed to the adequate acuity of green and blue lights and this hormone play critical role in weight gain. Regarding the effect of lighting on some blood parameters. The data of this experiment indicate an increase in the number of RBC, the level of PCV ,hemoglobin ,white cells and lymphocytes at the intensity of illumination of 25 and 45 lux compared with the control group and 0.6 lux and this corresponds to what was indicated by Okyere *et al* (16) until the exposure of laying hens to 16 hours of illumination per day, which led to an elevate in the number of red cells, white cell and the level of PCV, as Mohamed *et al* (15) indicated that exposure of broilers for 45 days to a monochromatic light of 20 lux led to an increase in the numbers of red blood cells, Hb and PCV. These results are consistent with those indicated by Hassan (10) if illumination for 17 hours in poultry led to an increase in lymphocytes, heterophiles, white cell, red cell, PCV and stress index. This increase can be participated to the improvement in the ecosystem and the oxidative state of the bird, as it was proven that the photoperiod affects the microorganisms present in the bird's intestines (12) and that the gut microbiota affects the functions of the organs and the immune system of birds (27). The illuminating system affects the chickens' assimilation, which in turn is accountable for maximizing maturation performance and maintaining ordinary physiological processes and functions (7). It was also observed through the results of this research that there was a decrease in the level of MCV for quail exposed to the intensity of 45 lux and this is due to the presence of an inverse relationship with an increase in the number of red cells, while the increase in the level of MCHC when exposed to the intensity of illumination of 25 and 24 lux is attributed to the presence of an inverse relationship with an increase in hemoglobin level (1).

CNOCLUSION

It is noted through the results obtained in this research to the positive role of white light of 25 and 24 lux on some reproductive characteristics and blood parameters of female quail.

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CONFLICT OF INTEREST

The researcher indicates that there is no conflict of interest.

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