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EFFECT OF MELATONIN ADMINISTRATION WITH DIFFERENT LIGHT COLORS ON THE PRODUCTION OF LOCAL CHICKENS

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Abstract

This study aims to observe the effect of melatonin implantation and exposure to different light colors and their interaction on productive in local Iraqi chicken. This study was conducted at the poultry farm of the Department of Animal Production / College of Agriculture/ University of Baghdad/ Abu Ghraib, on 252 birds (180 females and 72 males). The birds were divided into three sections (white, red and green) each section contains two lines, one of which has been planted melatonin under the skin of the neck of birds and the other has not been planted hormone. The results of the study showed significant improvement in productive traits such as egg proportion rate, egg weight, cumulative eggs number, egg mass and feed conversion rate. That the implantation of melatonin under the skin of the neck has significantly increased the weight of the egg and egg mass and Significant improvement in food conversion rate. We notice a significant increase at exposure to red and green light, a high percentage of egg production H.H%, egg weight, cumulative eggs number and significant decrease in food conversion rate.

Keywords : Melatonin, Iraqi chicken, light colors.

Introduction

The poultry sector is one of the most important sectors of animal production, characterized by high growth rates and good food conversion transactions, as well as the short production cycle and the increasing consumer demand for poultry products. The livestock sector, especially poultry, has been the focus of attention for the last 15 years. This sector has been a cornerstone in supporting the global economy, requiring large numbers of labor (Ravindran, 2013). As well as its importance in increasing the economy and providing protein sources of meat and eggs to meet human needs and meet its needs (FAO, 2012). It is based on that (The Reproduction of the Conditions of Production) (Althusser, 1971), Studies in this field have been of great importance. Several attempts have been made, including regulating the levels of melatonin and the work of the pineal gland in birds. The reproductive process regulates the levels of its hormones and the production of reproductive cells in several factors concentrated through the influence of the hypothalamus (Hotzel *et al.*, 2003; Sogorescu *et al.*, 2011; Rani and Kumar, 2014). Among the most important of these factors changes in light colors, with a lot of changes in the functions of the reproductive glands occur as a result of exposure to the color red or green light, Believes Lewis and Morris (2000) that the red light affects the hypothalamus degree greater than the rest of the colors, and then stimulate the hypothalamus to increase egg production, and that this effect is due to increasing the wavelength of light red and orange compared with the green light and blue, Improved reproductive performance of birds (Solangi *et al.*, 2004).

The effect of light is to regulate the concentration of melatonin in the body and regulates its production and secretion. It promotes the production of eggs in chickens and regulates the age of puberty (Lewis *et al.*, 2006). Melatonin can improve feed intake in chickens and promote growth, Improved production and reproductive performance of birds, with a high concentration of β17-estradiol hormone and enhanced gene expression of melatonin receptors (MT2). This finding indicates that an improvement in the rate of egg-induced melatonin was due to increased serum estradiol and reduced GnIHR (gonadotropin inhibitory hormone receptor) ovary. These changes can be mediated by the activation of Melatonin Receptor 2-MR2 (Jia *et al.*, 2016).

The aim of this study is to highlight the role of melatonin and the different light colors affecting the production performance and the concentrations of some reproductive hormones, of the local Iraqi chicken and determine the best light color effect, with and without melatonin transplantation, and diagnosis of positive and negative changes accompanying the injection process and the color of light and Interaction between them.

Materials and Methods

Implemented this experiment in the poultry farm of the Department of Animal Production / College of Agriculture/ University of Baghdad/ Abu Ghraib, on 252 birds (180 females and 72 males), Birds were fed balanced diets throughout the experiment, Contains 3194.92 (Kcal/Kg) metabolic Energy and 20% Crude Protein. Melatonin was planted at the age of 14 weeks by transplantation under the skin of the neck using the (Ralgro pellet Injector), and melatonin was produced from Productmark USA and Fulfilled by Amazon. The light used was a light-emitting diode (LED) in three colors (white, red and green) with a light intensity of 10 Watt. Productivity characteristics were calculated throughout the study. The duration of the study was divided into three periods for each period of 28 days. The amount of feed intake rate was calculated based on the equation he mentioned (Al-Fayadh and Naji, 1989), The food conversion rate was calculated according to the equation mentioned by Yasmeen *et al.* (2008), Hen Day Egg Production (H. D%) was calculated according to the formula cited by Al-Zubaidi (1986), The weight of the egg was measured using a sensitive balance, and the egg mass per chicken was calculated according to the equation mentioned by Rose (1997). The data of this study were analyzed according to Completely Randomized Designs for Factorial Experiments, and the differences between the averages were compared with the Duncan (1955) multidimensional test. The statistical program SAS (2004) was used in statistical analysis.

Feed intake rate (g / bird) = Amount of feed/Number of birds

Food conversion factor (g feed/ g eggs = Amount of feed intake (g/bird) / Egg mass rate(g)

$$\text{Hen-day egg production (H. D\%)} = \frac{\text{Average number of eggs produced over a period of time}}{\text{Average number of live birds over a period of time}} \times 100$$

Egg mass (g eggs/ Hen/ 28 day) = Egg product ratio during the period ×Average weight of eggs ×28 day

Cumulative eggs number = (Hen-day egg production (H. D%) / 100) × period Length(day)

Results and Discussion

Table 1 shows no significant differences in the rate of egg production (H.D %) for local Iraqi chickens when planting 10 mg/kg live weight under neck skin, compared to non-implantable melatonin during the first, second, third and general periods. The second factor observed in the first period and the general average was a significant increase (P<0.001) in the rate of production of the egg under the influence of red and green light colors compared to white. At the same time, light colors did not affect the rate of egg production during the second and third periods. In the same table, M0 W showed a decrease in the percentage of egg production compared to the remaining interference during the first, second, third, and general periods and at a significant level (P <0.001, P<.21, P<0.08, P <0.06) respectively. When reviewing the second period, there was a significant decrease in the egg production rate of M0 W compared to M0 G and calculated when compared with the remaining interference.

It is noted that the implantation of 10 mg/kg live weight of melatonin under the skin of the neck has significantly increased (P <0.01) in the rate of the weight of the environment (g) during the three periods and the overall rate. Exposure to red and green light increased the egg weight (g) compared to white light during the second and third periods and the overall rate. Note that the red light color exceeds the green light color in the three periods. Table 2 shows that M0 W significantly reduced the weight of egg (g) compared with other interactions, without significant differences between the other interventions, during the first period. The second time, it was observed that M10 W and M10 G scored the highest egg weight, with significant differences for M0 R, M0 G, M10 R, and M0 W. At the third time. It was found that M10 R significantly exceeded M10 G, M0 R, M0 G, M0 W, and M10 G, while M10 W significantly exceeded M0 W, M0 R, M0 G, and M10 G, while M0 W decreased while M0 decreased W was significant when compared to M0 R and M0 G. For the general average, M10 W was significantly higher than M0 W, M0 G, and M10 G and calculated with M0 R and M10 R, and M0 W recorded the lowest egg weight.

As for the the of number cumulative eggs, it is clear from Table 3 that melatonin transplantation under the neck skin (10 mg/kg live weight) did not significantly affect the number of eggs accumulated (egg/chicken/ 28 days) during the first, second, third and total period. The cumulative egg number increased significantly under the effect of red and green, compared to white during the first period (P<0.001) and total duration (P<0.05) with no significant effect during the second and third periods. In terms of the interaction between the levels of workers, a significant decrease in the number of the cumulative egg due to the effect of interference M0 W compared to other interventions during the first period (P<0.001) and the third period (P<0.08). The second period shows that there is a significant effect in favor of M0 G interference when compared with M0 W and computational when compared with M0 R, M10 W, M10 R and M10 G. In transition to the total period, (P<0.05) for interference M0 R, M10 W, M10 R and M10 G when compared with M0 W and arithmetic compared to M0 G.

The results of the statistical analysis shown in Table 4 explained that melatonin implantation significantly increased the egg mass rate during the first duration (P<0.01), the third (P<0.04) and the total duration (P <0.02). The red and green light color showed a significant increase in egg mass compared with white light during the first period (P <0.0005). the second (P<0.04) and the total duration (P<0.05). Also, M0 W recorded a significant decrease in the egg mass rate during the first periods (P<0.0003), the second (P<0.03), the third (P <0.02) and the total duration (P <0.02).

We note from Table 5 that there is no significant effect on the feed intake rate for levels of melatonin implantation during the first, second, third, and total periods. As shown in the same table, the colors did not affect the rate of consumption of fodder except for the second period, which indicates that the rate of consumption of fodder significantly (P<0.03) in green color compared to white, not different from the red. In the first period, M0 R (P<0.05) was significantly higher than the M0 W and calculated from the rest of the interactions. During the second period, M0 R, M0 G, and M10 G recorded an increase (P<0.08) in the feed intake rate to M0 W and computed at M10 W and M10 R. In the third period, M0 G recorded the highest feed intake rate to M0 R and with other interactions. As for the general average, M10 G recorded a significant increase in the feed intake rate to M0 G.

Table 6 shows that the treatment of local chickens by planting 10 mg / kg live weight under the neck skin of melatonin resulted in a significant decrease (P<0.005) in the food conversion rate compared with the non-transplanted chicken during the first period and the third (P<0.01) and total duration (P<0.01), while in the second period it is noted that the cultivation of melatonin did not affect the food conversion rate. There was also a significant decrease (P<0.0004) in the food conversion rate for birds fed under red and green light colors at the expense of white light color during the first period. In the second period, the effect was not significant in food conversion rate. (P<0.01) in the third term (P<0.003). The kidney was in favor of red and green photosynthesis at the expense of white light color. It was observed from Table 9 that M0 R, M0 G, M10 W, M10 R, and M10 G significantly exceeded (P <0.0001) over M0 W in the food conversion rate during the first, second, third and total duration.

Melatonin is part of the biological system in birds and is supposed to be involved in regulating the effect of light. However, the importance of melatonin in some species of birds is not as important as light in growth, stimulation of the gonads and organization of their activity (Trivedi and Kumar, 2014), so the pineal gland (melatonin) is closely associated with light and thus their effects appear common.

Melatonin increases the levels of estrogen in the blood. Melatonin in chickens in the second production year of 300-

470 days improves egg production (Jia *et al.*, 2016). The estrogen and gonadotropin-inhibitory hormone receptor (GnIHR) (Hansen *et al.*, 2004; Lebedeva *et al.*, 2010). Although this study did not significantly increase the concentration of estrogen in the blood, it found differences in the concentration of the hormone itself.

Several studies have been conducted on the effect of melatonin on egg weight. The administration of 3 µg Mg/kg feed resulted in a significant improvement in the egg weight in laying hen compared with chicken not treated with melatonin (Taylor *et al.*, 2013).

Li *et al.* (2014) found that the use of blue light color led to an increase in body weight with a decrease in the weight of eggs produced compared to other colors, while birds that were raised under the color of green light produced less eggs than birds that were raised under Red light. The result may be the optical stimulation of the retina receptors that are sensitive to green light that inhibits reproductive activity in birds (Mobarkey *et al.*, 2010). The proportion of egg production in birds exposed to red light (Min *et al.*, 2012) and white light color (Hassan *et al.*, 2013) and the same researcher found that the percentage of egg production did not differ when raising birds under light color white, green and blue. That the increase in the percentage of egg production when using red light may be caused by the high concentration (FSH) Follicle Stimulating Hormone (LH) Luteinizing Hormone in the blood, leading to an increase in the number of ovarian follicles. Li *et al.* (2014) showed that under-light red coloration increases the concentrations of LH and FSH in bird blood when compared with birds under blue, green or white light. The exposure of birds to the red light color increases the egg production rate (Min *et al.*, 2012). When exposed to 16 hours or 14 hours of red light + 2 hours of green light, this explains the increased concentration of FSH and E2 in the blood (Hassan *et al.*, 2013), and (Mobarkey *et al.*, 2010) noted that red light increases the percentage of egg production for the breeder. Hassan *et al.*, 2013, have shown that green and blue light colors increase the egg's weight with increasing growth rates.

Pineal gland - hypothalamus-pituitary-adrenal axis, it regulates the process of producing and releasing growth hormone in the body (Lerchl, 2002), Melatonin stimulates the secretion of growth hormone, and thus affects the productive performance of poultry with a positive effect (Çalişlar *et al.*, 2018), Thus, growth hormone may be responsible for improvement in certain productive traits such as egg weight. The exposure of birds to red light colors lead to increased concentration of thyroxine in the blood, compared to white light (Mudhar, 2016), Both growth hormone and thyroxine work on building and demise of the genital organs (Squires *et al.*, 1990), So it may have a role in improving productivity traits of laying hen.

The types of birds recognize the light in two main locations. The first is the retina, which is equipped with rods and cones that work similarly to the action of human eye retina, which is most sensitive to yellow and green optical beams, the second is: Outside the retina, photoreceptors located in several parts of the brain are activated mainly by the long-wavelength (red) (Rozenboim *et al.*, 2004), Therefore, the main cause of improved productivity traits when exposing birds to red and green light is the presence of these light-sensitive sites. That the increased concentration of FSH in the blood of birds exposed to red, red and green light with increased concentration of E2 in the blood of birds exposed to light red, red, green, red, green and blue may be the result that the long-wavelength stimulated additional optical receptors in the retina and thus its reflection on the pituitary and deep brain and influence (FSH, LH, and E2), resulting in the subsequent rapid development of the oviduct (Hartwig and Veen, 1979; Hassan *et al.*, 2013).

Zeman *et al.* (2001) noted that melatonin was added to female broiler diets a concentration of 150 mg/kg feed did not significantly affect the rate of increase in weight gain and feed intake at the age of two weeks, but the feed conversion rate was significantly improved in favor of melatonin-treated birds compared to the control treatment, with reduced heat produced (excess heat). There is a positive and a common relationship between the productive qualities of all, as the height of a particular recipe of which lead to a rise in other improvement traits in the average rate of egg production and the rate of egg weight explains the improvement in the egg mass rate represents the product of the ratio of egg production in the rate of weight.

Table 1 : Effect of melatonin administration with different light colors on Hen-day egg production for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting			**Hen-day egg production**			
			1	**2**	**3**	**Total Duration**
Melatonin	**M_0 Without planting**		60.79 ± 3.83	60.45 ± 3.41	55.01 ± 3.28	57.80 ± 3.13
	M_{10} Plant 10 mg / kg live weight		65.29 ± 1.27	61.03 ± 0.94	60.21 ± 1.90	62.85 ± 1.42
P-value			N.S	N.S	N.S	N.S
Light colors	**W White**		55.01 ± 3.76 ^{B}	55.64 ± 3.46	52.58 ± 3.59	54.99 ± 2.82 ^{B}
	R Red		67.24 ± 2.66 ^{A}	63.33 ± 1.87	60.90 ± 2.66	63.82 ± 2.15 ^{A}
	G Green		66.88 ± 1.24 ^{A}	63.23 ± 2.61	59.35 ± 3.28	62.17 ± 3.27 ^{AB}
P-value			0.001	N.S	N.S	0.05
Melatonin	**M_0**	**Light colors** — **W White**	47.08 ± 2.75 ^{B}	51.54 ± 6.22 ^{B}	44.82 ± 2.01 ^{B}	48.97 ± 1.76 ^{B}
		R Red	68.64 ± 5.04 ^{A}	64.29 ± 3.69 ^{AB}	61.52 ± 3.17 ^{A}	64.81 ± 3.85 ^{A}
		G Green	66.65 ± 0.99 ^{A}	65.51 ± 5.24 ^{A}	58.70 ± 5.92 ^{A}	59.63 ± 5.85 ^{AB}
	M_{10}	**W White**	62.94 ± 0.42 ^{A}	59.75 ± 2.07 ^{AB}	60.34 ± 0.41 ^{A}	61.01 ± 0.71 ^{A}
		R Red	65.83 ± 2.81 ^{A}	62.38 ± 1.73 ^{AB}	60.28 ± 4.99 ^{A}	62.83 ± 2.72 ^{A}
		G Green	67.11 ± 2.58 ^{A}	60.95 ± 1.22 ^{AB}	60.00 ± 4.29 ^{A}	64.71 ± 3.57 ^{A}
P-value			0.001	0.05	0.08	0.06

Table 2 : Effect of melatonin administration with different light colors on Egg weight for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting				Egg weight			
				1	2	3	Total Duration
Melatonin	M_0 Without planting			40.87 ± 0.53 ^{B}	40.55 ± 0.63 ^{B}	40.63 ± 0.59 ^{B}	40.68 ± 0.57 ^{B}
	M_{10} Plant 10 mg / kg live weight			42.29 ± 0.38 ^{A}	42.44 ± 0.33 ^{A}	42.47 ± 0.29 ^{A}	42.40 ± 0.29 ^{A}
P-value				0.01	0.0001	0.0001	0.0001
Light colors	W White			40.89 ± 1.02	40.77 ± 1.24 ^{B}	40.55 ± 1.02 ^{C}	40.74 ± 1.07 ^{B}
	R Red			42.17 ± 0.31	42.00 ± 0.16 ^{A}	42.50 ± 0.30 ^{A}	42.22 ± 0.23 ^{A}
	G Green			41.68 ± 0.17	41.70 ± 0.18 ^{A}	41.60 ± 0.12 ^{B}	41.66 ± 0.15 ^{A}
P-value				N.S	0.0050	0.0004	0.0043
Melatonin	M_0	Light colors	W White	38.94 ± 0.39 ^{B}	38.07 ± 0.06 ^{C}	38.37 ± 0.47 ^{D}	38.46 ± 0.29 ^{C}
			R Red	41.98 ± 0.56 ^{A}	41.79 ± 0.22 ^{B}	41.92 ± 0.18 ^{C}	41.89 ± 0.31 ^{AB}
			G Green	41.68 ± 0.28 ^{A}	41.79 ± 0.30 ^{B}	41.61 ± 0.18 ^{C}	41.69 ± 0.24 ^{B}
	M_{10}		W White	42.84 ± 1.12 ^{A}	43.48 ± 0.58 ^{A}	42.73 ± 0.52 ^{AB}	43.01 ± 0.64 ^{A}
			R Red	42.37 ± 0.34 ^{A}	42.22 ± 0.19 ^{B}	43.08 ± 0.31 ^{A}	42.56 ± 0.25 ^{AB}
			G Green	41.68 ± 0.25 ^{A}	41.62 ± 0.26 ^{A}	41.59 ± 0.21 ^{BC}	41.63 ± 0.24 ^{B}
P-value				0.006	0.0001	0.0001	0.0001

Table 3 : Effect of melatonin administration with different light colors Cumulative eggs number for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting				Cumulative eggs number			
				1	2	3	Total Duration
Melatonin	M_0 Without planting			17.02 ± 1.07	16.92 ± 0.95	15.40 ± 0.92	48.56 ± 2.63
	M_{10} Plant 10 mg / kg live weight			18.28 ± 0.36	17.09 ± 0.26	16.86 ± 0.53	52.79 ± 1.19
P-value				N.S	N.S	N.S	N.S
Light colors	W White			15.40 ± 1.05 ^{B}	15.58 ± 0.97	14.72 ± 1.01	46.19 ± 2.37 ^{B}
	R Red			18.83 ± 0.74 ^{A}	17.73 ± 0.52	17.05 ± 0.74	53.61 ± 1.81 ^{A}
	G Green			18.73 ± 0.35 ^{A}	17.70 ± 0.73	16.62 ± 0.92	52.22 ± 2.75 ^{AB}
P-value				0.001	N.S	N.S	0.05
Melatonin	M_0	Light colors	W White	13.18 ± 0.77 ^{B}	14.43 ± 1.74 ^{B}	12.55 ± 0.56 ^{B}	41.13 ± 1.48 ^{B}
			R Red	19.22 ± 1.41 ^{A}	18.00 ± 1.03 ^{AB}	17.23 ± 0.89 ^{A}	54.44 ± 3.23 ^{A}
			G Green	18.66 ± 0.28 ^{A}	18.34 ± 1.47 ^{A}	16.44 ± 1.66 ^{A}	50.09 ± 4.91 ^{AB}
	M_{10}		W White	17.62 ± 0.12 ^{A}	16.73 ± 0.58 ^{AB}	16.90 ± 0.12 ^{A}	51.25 ± 0.60 ^{A}
			R Red	18.43 ± 0.79 ^{A}	17.47 ± 0.48 ^{AB}	16.88 ± 1.40 ^{A}	52.78 ± 2.28 ^{A}
			G Green	18.79 ± 0.72 ^{A}	17.07 ± 0.34 ^{AB}	16.80 ± 1.20 ^{A}	54.35 ± 3.00 ^{A}
P-value				0.001	0.05	0.08	0.06

Table 4 : Effect of melatonin administration with different light colors on Egg mass (g eggs/ Hen/ 28 day) for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting				Egg mass(g eggs/ Hen/ 28 day)			
				1	2	3	Total Duration
Melatonin	M_0 Without planting			699.00 ± 50.11 ^{B}	689.35 ± 45.38	629.09 ± 43.87 ^{B}	1983.14 ± 125.97 ^{B}
	M_{10} Plant 10 mg / kg live weight			772.82 ± 14.06 ^{A}	724.82 ± 9.48	716.13 ± 23.95 ^{A}	2237.26 ± 45.71 ^{A}
P-value				0.01	N.S	0.04	0.02
Light colors	W White			633.93 ± 56.04 ^{B}	638.11 ± 50.09 ^{B}	601.99 ± 55.27 ^{B}	1892.70 ± 141.57 ^{B}
	R Red			793.26 ± 28.44 ^{A}	744.52 ± 19.57 ^{A}	724.59 ± 31.96 ^{A}	2262.32 ± 68.79 ^{A}
	G Green			780.55 ± 15.29 ^{A}	738.61 ± 32.00 ^{A}	691.24 ± 38.07 ^{AB}	2175.59 ± 114.32 ^{A}
P-value				0.0005	0.04	0.05	0.02
Melatonin	M_0	Light colors	W White	513.26 ± 30.37 ^{B}	549.56 ± 66.86 ^{B}	481.98 ± 27.19 ^{B}	1581.61 ± 54.63 ^{B}
			R Red	806.00 ± 55.50 ^{A}	751.71 ± 39.29 ^{A}	721.72 ± 34.45 ^{A}	2279.24 ± 123.02 ^{A}
			G Green	777.74 ± 7.63 ^{A}	766.80 ± 63.10 ^{A}	683.57 ± 67.65 ^{A}	2088.56 ± 205.69 ^{A}
	M_{10}		W White	754.59 ± 14.78 ^{A}	726.67 ± 15.21 ^{A}	722.01 ± 11.52 ^{A}	2203.79 ± 21.29 ^{A}
			R Red	780.52 ± 28.31 ^{A}	737.34 ± 17.89 ^{A}	727.47 ± 62.54 ^{A}	2245.40 ± 90.78 ^{A}
			G Green	783.36 ± 33.20 ^{A}	710.43 ± 18.53 ^{A}	698.92 ± 51.11 ^{A}	2262.61 ± 124.36 ^{A}
P-value				0.0003	0.03	0.02	0.02

Table 5 : Effect of melatonin administration with different light colors on Feed intake rate (g / bird) for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting				Feed intake rate(g / bird)			
				1	2	3	Total Duration
Melatonin	M_0 Without planting			2314.44 ± 22.06	2306.80 ± 13.23	2214.91 ± 19.85	6747.55 ± 132.18
	M_{10} Plant 10 mg / kg live weight			2320.67 ± 15.58	2319.29 ± 12.63	2215.98 ± 15.03	6931.12 ± 76.99
P-value				N.S	N.S	N.S	N.S
Light colors	W White			2297.94 ± 19.31	2284.99 ± 14.91 ^{B}	2219.82 ± 20.36	6898.65 ± 118.54
	R Red			2340.36 ± 24.50	2314.15 ± 15.97 ^{AB}	2189.09 ± 9.18	6843.60 ± 25.00
	G Green			2314.36 ± 24.50	2339.98 ± 6.80 ^{A}	2237.43 ± 27.38	6775.77 ± 212.18
P-value				N.S	0.03	N.S	N.S
Melatonin	M_0	Light colors	W White	2272.90 ± 17.46 ^{B}	2262.03 ± 19.81 ^{B}	2202.99 ± 42.14 ^{AB}	6929.73 ± 262.88 ^{AB}
			R Red	2382.06 ± 33.94 ^{A}	2323.39 ± 10.56 ^{A}	2172.47 ± 11.72 ^{B}	6877.93 ± 17.96 ^{AB}
			G Green	2288.37 ± 29.91 ^{AB}	2334.97 ± 7.74 ^{A}	2269.26 ± 19.15 ^{A}	6435.00 ± 257.44 ^{B}
	M_{10}		W White	2322.97 ± 30.54 ^{AB}	2307.95 ± 13.83 ^{AB}	2236.64 ± 3.66 ^{AB}	6867.56 ± 13.42 ^{AB}
			R Red	2298.66 ± 10.50 ^{AB}	2304.91 ± 32.84 ^{AB}	2205.70 ± 2.75 ^{AB}	6809.27 ± 40.30 ^{AB}
			G Green	2340.36 ± 37.83 ^{AB}	2345.00 ± 12.08 ^{A}	2205.61 ± 48.67 ^{AB}	7116.54 ± 206.62 ^{A}
P-value				0.05	0.08	0.05	0.05

Table 6 : Effect of melatonin administration with different light colors on Food conversion factor (g feed/ g eggs) for local Iraqi chicken (mean ± standard error) in three periods and Total Duration

Factors affecting				Food conversion factor(g feed/ g eggs)			
				1	2	3	Total Duration
Melatonin	M_0 Without planting			3.46 ± 0.27 ^{A}	3.48 ± 0.26	3.67 ± 0.26 ^{A}	3.52 ± 0.25 ^{A}
	M_{10} Plant 10 mg / kg live weight			3.01 ± 0.06 ^{B}	3.20 ± 0.04	3.13 ± 0.12 ^{B}	3.11 ± 0.06 ^{B}
P-value				0.005	N.S	0.01	0.01
Light colors	W White			3.77 ± 0.34 ^{A}	3.71 ± 0.35	3.85 ± 0.35 ^{A}	3.76 ± 0.32 ^{A}
	R Red			2.97 ± 0.09 ^{B}	3.12 ± 0.08	3.05 ± 0.14 ^{B}	3.04 ± 0.09 ^{B}
	G Green			2.97 ± 0.06 ^{B}	3.19 ± 0.12	3.29 ± 0.19 ^{B}	3.14 ± 0.10 ^{B}
P-value				0.0004	N.S	0.01	0.003
Melatonin	M_0	Light colors	W White	4.46 ± 0.31 ^{A}	4.25 ± 0.55 ^{A}	4.60 ± 0.23 ^{A}	4.40 ± 0.33 ^{A}
			R Red	2.98 ± 0.18 ^{B}	3.11 ± 0.18 ^{B}	3.03 ± 0.16 ^{B}	3.04 ± 0.16 ^{B}
			G Green	2.94 ± 0.04 ^{B}	3.09 ± 0.24 ^{B}	3.38 ± 0.29 ^{B}	3.11 ± 0.17 ^{B}
	M_{10}		W White	3.08 ± 0.09 ^{B}	3.18 ± 0.08 ^{B}	3.10 ± 0.04 ^{B}	3.12 ± 0.03 ^{B}
			R Red	2.95 ± 0.09 ^{B}	3.13 ± 0.03 ^{B}	3.08 ± 0.27 ^{B}	3.04 ± 0.11 ^{B}
			G Green	3.00 ± 0.13 ^{B}	3.30 ± 0.07 ^{B}	3.20 ± 0.31 ^{B}	3.16 ± 0.15 ^{B}
P-value				0.0001	0.05	0.004	0.001

References

Al-Fayadh, H.A. and Naji, S.A. (1989). Poultry product technology. Univ. of Baghdad, Ministry of Higher Education.

Althusser, L. (1971). Ideology and Ideological State Apparatuses (Notes towards an Investigation). http://blogs.uoregon.edu/j610drstabile/files/2014/03/Althusser-Ideology_and_ISAsbook-1fwvmil.pdf.

Al-Zubaidi, S.S.A. (1986). Poultry management. Al-Basrah University Press. Iraq.

Çalışlar, S.; Yeter, B. and Şahin, A. (2018). Importance of Melatonin on Poultry. KSÜ Tar Doğa Derg 21(6): 987-997.

Duncan, D.B. (1955). Multiple range and Multiple F test. Biometrics. 11: 1–42.

FAO, Food and Agriculture organization. (2012). Economic studies- Iraq. http://www.fao.org. data of access: 14/1/2012.

Hansen, K.K.; Beck, M.M.; Scheideler, S.E. and Blankenship, E.E. (2004). Exogenous estrogen boosts circulating estradiol concentrations and calcium uptake by duodenal tissue in heat-stressed hens. Poultry science. 83: 895-900.

Hartwig, H.G. and Van Veen, T. (1979). Spectral characteristics of visible radiation penetrating into the brain and stimulating extraretinal photoreceptors. Journal of comparative physiology, 130(3): 277-282.

Hassan, M.R.; Sultan, S.; Choe, H.S. and Ryu, K.S. (2013). Effect of monochromatic and combined light color on performance, blood parameters, ovarian morphology and reproductive hormones in laying hens. Ital. J. Anim. Sci. 12: e56.

Hotzel, M.J.; Walkden-Brown, S.W.; Fisher, J.S. and Martin, G.B. (2003). Determinants of the annual pattern of reproduction in mature male Merino and Suffolk sheep: responses to a nutritional stimulus in the breeding and non-breeding seasons. Reprod Fertil Dev 15: 1-9.

Jia, Y.; Yang, M.; Zhu, K.; Wang, L.; Song, Y.; Wang, J. and Liu, G. (2016). Melatonin implantation improved the egg-laying rate and quality in hens past their peak egg-laying age. Scientific reports, 6: 39799.

Lebedeva, I.Y.; Lebedev, V.A.; Grossmann, R. and Parvizi, N. (2010). Age-dependent role of steroids in the regulation of growth of the hen follicular wall. Reproductive Biology and Endocrinology. 8: 15.

Lerchl, A. (2002). The melatonin hypothesis: An introduction. Wissenschaft. Forschungsgemeinschaft Funk.16: 1-20.

Lewis, P.D. and Morris, T.R. (2000). Poultry and colored light. World's Poultry Science Journal, 56(3): 189-207.

Lewis, P.D.; Middleton, B.A. and Gous, R.M. (2006). Exogenous melatonin modifies rate of sexual maturation in domestic pullets. Poultry science. 85: 117-122.

Li, D.; Zhang, L.; Yang, M.; Yin, H.; Xu, H.; Trask, J.S. and Zhu, Q. (2014). The effect of monochromatic light-emitting diode light on reproductive traits of laying hens. Journal of Applied Poultry Research, 23(3): 367-375.

Min, J.K.; Hossan, M.; Nazma, A.; Jae, C.N.; Han, T.B.; Hwan, K.K. and Ok, S.S. (2012). Effect of monochromatic light on sexual maturity, production performance and egg quality of laying hens. Avian Biology Research, 5(2): 69-74.

Mobarkey, N.; Avital, N.; Heiblum, R. and Rozenboim, I. (2010). The role of retinal and extra-retinal photostimulation in reproductive activity in broiler breeder hens. Domestic Animal Endocrinology, 38(4): 235-243.

Mudhar A.S. and Abu, T. (2016). The Effect of Color light and Stocking Density on Some Enzymes and Hormones of Broilers and Layers. MRVSA. 5(1): 26-37.

Rani, S. and Kumar, V. (2014). Photoperiod regulation of seasonal reproduction in higher vertebrates. Indian J. Exp. Biol., 52: 413-419.

Ravindran, V. (2013). Poultry feed availability and nutrition in developing countries. Poultry development review. 60-63.

Rose, S.P. (1997). Principles of Poultry Sciences. CAB. International, Walling Ford, London.

Rozenboim, I.; Biran, I.; Chaiseha, Y.; Yahav, S.; Rosenstrauch, A.; Sklan, D. and Halevy, O. (2004). The effect of a green and blue monochromatic light combination on broiler growth and development. Poultry science, 83(5): 842-845.

SAS. (2004). Statistical Analysis System, User's Guide. Statistical. Version 7th ed. SAS. Inst. Inc. Cary. N.C. USA.

Sogorescu, E.; Zamfirescu, S.; Rosoiu, N.; Anghel, A. and Nadolu, D. (2011). Seasonal variations of plasma testosterone levels and testicular volume in Carpathian bucks. Afri J Agric Res., 6: 6735-6740.

Solangi, A.H.; Rind, M.I.; Solangi, A.A.; Shahani, N.A.; Rind, A.N. and Solangi, S.H. (2004). Influence of lighting on production and agonistic behaviour of broiler. Journal of Animal and Veterinary Advances, 3(5): 285-288.

Squires, E.J. (2003). Applied animal endocrinology. CAB International. Wallingford. Oxon OX10 8DE. UK.83 – 85.

Taylor, A.C.; Horvat-Gordon, M.; Moore, A. and Bartell, P.A. (2013). The effects of melatonin on the physical properties of bones and egg shells in the laying hen. PloS one. 8: e55663.

Trivedi, A.K. and Kumar, V. (2014). Melatonin: an internal signal for daily and seasonal timing. Indian Journal of Experimental Biology (IJEB), 31(3): 425-437.

Yasmeen, F.; Mahmood, S.; Hassan, M.; Akhtar, N. and Yaseen, M. (2008). Comparative productive performance and egg characteristics of pullets and spent layers. Pakistan Veterinary Journal, 28(1): 5.

Zeman, M.; Buyse, J.; Herichova, I. and Decuypere, E. (2001). Melatonin decreases heat production in female broiler chickens. Acta Veterinaria Brno.70: 15-18.