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THE EFFECT OF USING DIFFERENT LIGHTING COLORS ON SOME PRODUCTIVE AND BEHAVIORAL QUALITIES IN BROILERS CHICKS

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Abstract
The experiment was conducted on a group of 200 one-day-old Ross 308 broilers chicks that divided into four groups, each group containing two repeaters. Each group of 25 birds was exposed under the same conditions to different lighting colors as follows: green GLG, blue BLG, White WLG and a combination of green and blue G-BLG. The influence of light colors on the productive and behavioral indicators of broilers has been studied. The results indicated significant effect (P<0.001) of light color on performance productive of broiler chicks at 35 days old. The calm state was also observed on birds exposed to green and blue and the mixture of blue and green colors Comparison with the white color lighting range.

Keywords: lighting colors, productive, behavioral, broiler.

Introduction
Light was considered one of the important environmental factors that affect the production performance of broiler chickens. Lighting is essential for the success of commercial poultry production projects (Patil *et al.*, 2016). Light affects many physiological and behavioral aspects of broiler chickens, including vision, color discrimination, body temperature, nutrition, and digestion (Utshav, 2019). Light regulates various hormonal activities and influences growth and maturation in living organisms (Utshav, 2019). Therefore, poultry breeders must consider several critical factors when designing a lighting program to increase growth rate, allow maximum feeding time, and ensure appropriate feed consumption (Klaba *et al.,* 2016). Changes in lighting program intensity, color duration, and light wavelength all had an effect on avian behavior, health, and production. Poultry breeders are always on the lookout for innovative and cost-effective poultry management techniques that can improve production quality. One area of interest is lighting programs and tools, as they have been shown to have a positive impact on poultry production. However, despite this potential, only a limited number of studies have focused on this area, such as Olanrewaju et al. (2016). Recent research by Archer (2018b,c) suggests that there may be a correlation

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between the color of light used and the energy consumed by poultry for weight gain, as well as the coefficient of food conversion.In one experiment, the mix of blue and green light helped to relax the birds and reduce their motor activity.(Aline and colleagues, 2020).and there have been numerous scientific studies and researches that have dealt with the impact of lighting, the number of hours of light, its source, and intensity gradation in the field of poultry breeding and management (Pandey, 2019; James *et al.*, 2018; Abd-Elhamed *et al.*, 2020), On the other hand, the feeding efficiency increased and the percentage of feed conversion was higher in birds exposed to blue lighting compared to birds exposed to white and red lighting. (Carvalho *et al.*, 2013). In another experiment, caring for broiler hens under the effect of a light combinations (blue -green) resulted in a considerable rise in their intake of feed and, as a result, an increase in weight as compared to standard incandescent light. (Gharahveysi *et al.*, 2020) Therefore, this study aims to present research that evaluates the impact of light color on some growth performance and behavioral responses in broiler chicks.

Material and Methods

The study was carried out at the chicken farm at Basra University's College of Veterinary Medicine in Basra, Iraq. In 28 March to 31May 2017, in this investigation, 200 Ross 308 one-day-old broiler chicks were employed. From day one until 35 days of age, the chicks were grown under controlled settings. chicks of broiler were divided into four light groups and raised in separate rooms (3 x 3 x 4 m), with an average of 50 chicks in each room under LED illumination color lamps. White light WG is used as a control, followed by blue light group BLG (560 nm), green light group GLG (408 nm), and blue-green mix group light. Were randomly housed in two duplicates of eight one×two m wooden sealed pens. At bird head height, All the light sources had the same intensity of five watts. /m2 (20 lux). Daily light period of 24 hours. The room temperature began at 34°C and was gradually dropped by 2°C each week to 22°C after 35 days. The chicks were fed three nutritional pellet rations, which included beginning, grower, and finishing diets. Total dietary metabolic energy was 2925, 3111, and 3171 kcal/kg for the beginning grower and finisher, respectively, with crude protein levels of 22.21, 20.14, and 18.08%. In each pen, half-cylinder plastic feeders were set. The birds were given unlimited amounts of food and water. Moreover, diets were developed to fulfill the NRC's (1994) nutritional requirements for poultry. Each pen had a nasal water consumption mechanism that was manually adjusted as the birds matured to guarantee their water supply was kept at the right level.

Studied Productive Qualities

1-To get final body weight, birds were individually weighed at the beginning (one day old weight ODW) and the end of the experiment using a digital balance for each treatment, Utilization of feed was determined daily. The following performance in terms of growth characteristics were computed using the conventional method: Feed conversion ratio (FCR) = FI/BWG; body weight increase (BWG) = FBW/IBW.

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2-The behavior of birds in light groups was measured by conducting a free-range test, which was applied as follows characters free-range (FR) examination: An FR arena with 1×1.5 m measurements was utilized. For every separate bird and behaviors, testing Measurements were taken during a 3-minute testing session.
A perpendicular and horizontal line was used to divide the field into 4 similar zones like square shape. Each individual chick was always placed in an enclosed area. A recording device was utilized for recording the total quantity of visited area, delayed responses to the initial step, motionlessness length (sitting and standing duration), and taking walks time, bites targeted to the arena's ground or surfaces, and the rate of droppings. (Mohamed, Abou-Ismail *et al*. 2017).

Statistical Analysis

The data were analyzed using a fully randomization model (CRD) as defined by SPSS (2019). Duncan's multiple ring test was used to perform significant testing for differences between each of the two means for every researched attribute. The formula was: Yijk = M + Li + eijk
Where: Yijk = observation on the ij individual
M = overall mean
Li = light influence
Eijk = random error

Results

1. **Productive qualities:**

Table 1 shows the influence of color light on broiler productivity and performance at 35. There was a significant influence(P≤.001) on light color on broiler finally body Wight and body Wight gain. The FBW and BWG of the GLG, BLG, and B-GLG birds were considerably greater than the WLG, and FCR with the chickens bred under the BLG having the highest FI and FCR, followed by the BGLG, GLG, and WLG.
Table No. 1 shows the effects of light color on the productive performance of broilers at 35 days old in each color light group.

Traits	ODW (g)	FBW (g)	BWG (g)	FCR	FI (g)
WLG	37.88a	1775.54c	1851.22ab	2.42b	4452.56b
BLG	38.00a	1989.62b	1963.74b	2.71b	4678.35a
GLG	37.46a	1990.65ab	2102.43a	2.55b	4524.94b
B-G LG	37.28a	2204.41a	2206.28a	1.89a	4611.63a
p Value	0.216	.001*	.001*	.028*	.001*

Means within a column and effects that lack common superscripts differ significantly at (p≤0.001). ODW: the weight of the chicken when it is one day old; FBW: final body weight; BWG: body weight gain; FI: Feed intake; FCR: Feed conversion

ratio; WLG: white light Group; BLG: blue light group; GL: green light group; B-G LG: mixer of green and blue light.

2. **behavioral qualities:**

Table 2 shows the effects of light color on Free-range test of broilers at 35 day old, Rearing broilers in various types of lighting had a significant effect (P ≤.001) on their behavior in the FR test, as measured by a situation to an initial move, mobility frequency, mobility resting, mobility walking , scratching pecking, and waste products, When compared to the BLG, GLG, and B GLG treatments, the birds in the WLG treatment had the highest latency to first step, mobility frequency, immobility resting, and number of droppings, but the fewer number of came to regions,, mobility walking, and biting. Furthermore, the WLG birds had the less biting percentage and the highest Waste percentage when compared with BLG, GLG, and B GLG treatments birds.

Table 2 shows the effects of light color on Free-range test of broilers at 35 day old.

Traits	SIM	MF	IR	MW	SP	WP
WLG	6.55a	30.21b	63.60a	90.38b	1.44b	0.75a
BLG	2.42b	48.72a	37.42b	130.12a	1.60a	0.75a
GLG	2.76b	58.12a	39.83b	129.57a	1.29a	0.71a
B-G LG	1.72bc	40.36ab	21.76c	201.43c	1.84a	0.74a
p Value	.001*	.001*	.001*	.001*	.001*	0.00

Means within a column and effects that lack common superscripts differ significantly at (P<0.001). SIM; Situation to an initial move, MF; mobility frequency, IR; immobility resting, MW; mobility walking, SP; scratching pecking, WP; waste products. WLG: white light Group; BLG: blue light group; GL: green light group; B-G LG: mixer of green and blue light

Discussion

Development production and performance indices (FBW and BWG), efficient use of feed, and feeding effectiveness (FI and FCR) were considerably enhanced in broilers fed within mixed color groups BLG, GLG, and mixture of them compared to WLG, with the highest performance recorded in broilers reared under mixed color lighting. These findings are consistent with previous study that indicated employing fluorescent lamps in chicken homes without having a significant impact on product growth or production characteristics. (Riber, 2015; Mohamed, *et al.* 2017). These findings might be linked to an increase in the size and number of connective tissue satellite cells. (Halevy *et al.* 2006) in broiler maintained under B-GLG, BLG, and GLG conditions, which led in larger weight gains (Rozenboim *et al.* 2004). The blue LED group showed a highly significant (p≤0.01) increase in live body weight and body weight growth. Soliman *et al.* (2019), Furthermore, Mohamed *et al.* (2017) revealed that broiler grown under blue and green light had larger body weights.

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The weight of body or weight increase was compared to white light. Furthermore, Balabel *et al.* (2017) showed that adopting an alternate cycle between green and blue light colors in broiler farms is highly recommended to achieve excellent growth productivity.

The results showed that blue pure color LED lighting improved production efficiency when opposed to white lighting. These gains might be linked to blue light's soothing effect, which channeled energy into feed ingestion and the growth rate when compared to other hue groups and white lights. According to Abdel-Azeem and Borham, (2018) employing blue light (single or mixed) offers various advantages. who concurred with our findings when investigating the effects of LED red, blue, green, white, and mixed lighting and discovered that blue LED lights with a bird density of 10/m2 were able to maintain broilers quiet with a combined impact on production productivity? According to Zhang *et al.*, (2012) achromatic blue LED light increased body weight and pectoral muscle development in chickens. Furthermore, Archer, (2018a) discovered that blue LED lights generate chills and can boost weight gain and food conversion ratio, as well as reduce the influence of anxiety and panic. Son and Ravindran, (2009) and Assaf *et al.* (2015), on the other hand, found no statistically significant effect on the weight increase of broilers fed three distinct hues of light (white, blue, or red). Rierson,(2011)found that broilers that received blue light had considerably greater FCR than birds acclimated to white and red light.

Cao *et al.* (2012) observed that broilers exposed to blue or green light had a greater growth rate and carcass quality than those exposed to red and white light. The explanation for the increase in growth characteristics and productive performance in chickens might be attributed to the influence of lighting hue and intensity on the secretion of growth hormones in the body, according to the findings of a study Zhang *et al.* (2016) they investigated the effects of white, red, green, and blue LED lights on broiler development. They discovered the hormone GHRH proteins in the hypothalamus and plasma GH levels rose by 6.83-31.36% in broilers grown under the use of blue and green illumination. The researcher found that the exposure of broilers to colored lighting (green or blue) led to a significant increase in the secretion of growth hormone and pituitary hormones compared to chickens raised under white lighting (Yu, *et al.*2018).

While higher feed untaken and minimize of FCR in broilers raised within the color of B-GLG, and GLG compared with WLG may be due to the relaxing impact caused by BLG and GLG that makes poultry less energetic and anxious (Mohamed *et al.* 2014; Mohamed, Abou-Ismail, *et al.* 2017), The low-intensity LED lighting, which were convenient for the bird's eye, decreased his stress level and may have helped it. This is explained by the fact that the activity of the body falls significantly under dim illumination, and therefore the energy expenditure for this Activity lowers, resulting in an increase in feed intake and, consequently, productive efficiency in birds. The results of this experiment show that birds exposed to colored lighting experience less fear and stress, which corresponds to Fahmy and Borham (2018), and we can attribute this to a

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decrease in the level of the hormone cortisol and an increase in the concentration of the hormone melatonin. As it is consistent with Pandey *et al.* (2019) conclusion. These results corresponded with, (D. Xie. 2008). In addition, this is the opposite of the researchers ' results (El-Hammady *et al.*, 2014; Rozenboim *et al.*, 2004).

Broiler hens spent the most time resting under red light (80.893.31%), then blue light (76.714.48%), green light (76.253.72%), and white light (77.284.21%). Nevertheless, significantly different, broiler chicks exposed to red demonstrated more frequent resting behavior than other hues (blue, green, white), possibly indicating a preference for red. Kim *et al.* (2012).

Light hue has a tremendous impact on broiler behavior in general. A strong light will encourage activity; however, lowering the brightness of the lighting will regulate aggressive activities that might lead to predation. Anja, (2015). It was additionally reported that the influence of blue or green illumination, or their combination, affects the well-being and health of birds via influencing stress hormones and antioxidants in chicken blood. Li *et al.* (2015). They also suggested using a mix of green and blue LED lighting to boost broiler immunological activity. Zhang *et al.* (2014). According to Senaratna *et al.* (2016), either green or blue illumination is superior over red or white light for broilers because it calms the poultry and is preferred by the chickens themselves. Broiler hens favored blue or green illumination over red or white lighting, according to studies. (Prayitno *et al.*1997). This finding contradicts the findings of Murphy and Preston (1988), who found that broiler birds displayed 61% resting habits independent of lighting. The distinction between our research and others, the duration spent walking in broiler chicks was higher under green light (13.432.30%), than in white (10.462.21%), and blue (6.781.92%), but there was no significant difference between the different light hues. Pecking activity in broiler chicks exposed to blue light was greater ($P>0.05$), subsequently followed by white (12.262.55%), and green (10.332.24%). Kim *et al.*2012. At 33 to 34 d, the impact of bright color was larger. on depiction manners. Birds grown in white light spent more time wandering than those exposed in other color groups (white: 8.15%, green: 3.41%, blue 1.29%). Birds raised within the blue illumination spend a greater proportion of their time unranked/resting than chicks raised under reddish illumination. These findings may be connected to the enhanced mobility behaviors displayed by birds reared in green and white illumination, as those grown in red light show. Blue light was inactive for a longer period. Green or white light color (blue: 79.96%, green: 75.65%, white 75.65%). The duration for which chicks stayed engaged in mobility and resting behaviors was affected by the light color. Broilers grown under blue light spend a greater proportion of their time injured/resting. Remonato *et al.* (2022). Light color had an enormous effect on broiler behavioral patterns. When compared to green or blue light, white light enhanced activity, but blue light enhanced relaxing manners. Additionally, anxiety and nervousness stages decreased for birds brought up under blue illumination, indicating that light color might be an important tool for managing broilers.

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