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# IŞIK YAYAN DİOTLARDAN (LED) ELDE EDİLEN MONOKROMATİK AYDINLATMANIN BROYLER PERFORMANSINA ETKİLERİ

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## ÖZET

*Bu çalışma farklı dalga boyuna sahip monokromatik ışık kaynaklarının 42 günlük yetiştirme periyodu boyunca dişi broylerin performansına etkilerinin belirlenmesi amacıyla yürütülmüştür. Çalışmada 3 farklı ışık grubu oluşturulmuş ve her gruba ait 160' ar hayvan denemede kullanılmıştır. Her grup için 4 alt grup oluşturulmuştur. Her deneme grubu birbirinden bağımsız odalara yerleştirilmiş ve her bir alt grup 4 m$^2$'lik 12 bölmeye yerleştirilmiştir (her bölmede 40 civciv). Gruplarda ortalama ışık şiddeti 10 lüks olarak ayarlanmıştır. Işık denemeleri; 1- Kontrol grubu (mini flüoresan lamba- günışığı); 2- ilk 3 hafta 560 nm dalga boyundaki yeşil ışık (G) ve son 3 hafta 480 nm dalga boyundaki mavi ışık (B)'ın kullanıldığı G-B olarak adlandırılan grup ve son olarak 3- ilk 3 hafta G ışık kaynağının kullanıldığı kalan 3 hafta ise G-B ışıklarının karışık olarak kullanıldığı ve G-GB mix olarak adlandırılan grup şeklinde planlanmıştır. Monokromatik ışık kaynağı olarak LED'ler kullanılmıştır. Denemede haftalık periyotlarla, ölüm oranı, canlı ağırlık (BW), canlı ağırlık kazancı (LBW) ve yem tüketimi (FC) değerlendirilmiştir. Araştırma sonuçlarına göre G-B ve G-GB mix gruplarında BW, LWG ve FC bakımından önemli iyileşmeler bulunmuştur. Ayrıca G-GB mix grubunda karkas ağırlığı bakımından kontrol grubuna göre önemli ilerlemeler tespit edilmiştir. Çalışma sonuçlarına göre, dişi broyler yetiştiriciliğinde yetiştirme periyodunun ilk 3 haftası G kalan 3 haftalık periyot için ise GB mix ışıklandırma modelinin uygulanması tavsiye edilebilir.*

**Anahtar Kelimeler:** *Broyler, Monokromatik ışık, Renk, Performans*

# EFFECTS OF MONOCHROMATIC ILLUMINANCE FROM LIGHT EMITTING DIODES (LED) ON BROILER PERFORMANCE

## ABSTRACT

*The objective of the current study was to determine the effects of monochromatic lighting on female broiler performance for 42 d rearing period. 480 female broiler chicks (Ross-308) were divided into three lighting treatment groups in four replicates each. All birds were housed three independent rooms previously divided by wooden bars into 12 sealed cells of 4 m$^2$ (40 chicks each one). Average light intensity was 10 lux for all groups. A 23-h photoperiod was provided for first 7 d, followed by an 18- h photoperiod through to 42 d. Lighting treatments were: 1- control daylight (mini incandescent light bulbs for 42 days); 2- 560 nm Green LED (G) for first 3 wks and 480 nm Blue LED lamps (B) lamps for remaining 3 weeks; named G-B group and last group; 3- G for first 3 wks and G-B mix for remaining 3 weeks; named G-GB MIX group. At weekly intervals, mortality, body weight (BW), live weight gain (LWG) and feed consumption (FC) was recorded on group basis. A significant increase in BW, LWG and FC was observed in broilers reared under G-B and G-GB mix lighting compared to control group. G-B and G-GB mix significantly increased carcass weight compared to control group. We suggest that green light from hatching to 21 d of rearing period and switching it to blue or green-blue mix emitted from monochromatic (LED) lamps beneficially influence performance traits of female broilers.*

**Key Words**: *Broiler, Monochromatic lighting, Colour, Performance*

## INTRODUCTION

Lighting is a powerful exogenous factor in control of many physiological and behavioural activities. Light may be the most critical of all environmental factors to birds. It is integral to sight, including both visual acuity and colour discrimination. Light allows the birds to establish rhythmicity and synchronize many essential functions, including body temperature and various metabolic steps that facilitate feeding and digestion (Olanrewaju *et al.,* 2006). In the broiler industry, chickens are usually kept on a continuous or nearly continuous lighting schedule in order to maximize growth performance (Campol and Da'villa, 2002).

In modern broiler husbandry, the use of coloured lighting systems has been increasing. Domestic fowl have a better eye-sight than humans (Lewis and Morris, 1998). They can detect a broader spectrum of colours, especially in the ultra-violet range. Birds also react to light that enters the body through other pathways than the eyes, affecting biorhythm and growth. There are indications that coloured lighting can lead to faster growth: broilers in green light grew faster than broilers in red or white light. Blue light resulted in faster growth than red or white light from 20 days of age (Rozenboim *et al.,* 1999). In green or blue light more satellite cells for muscles were produced than in red or white light, and more muscle-tissue was produced (Halevy *et al.,* 1998).

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Many studies have tested the effects of light source on performance. Growth of broilers reared under fluorescent lamps was equal to or slightly better than that of birds under incandescent lamps (Rozenboim et al., 1999).However, the use of incandescent lamps in poultry houses is still common in spite of high energy expenditure. As far as we aware, there are little study which investigated the effects of LED (light emitting diodes) and their colours on broiler performance.

The purpose of the present study was to investigate the effect of monochromatic lighting from light emitting diodes on female broiler performance

## MATERIALS AND METHODS

Fertile eggs were provided by the AKYEM poultry Corporation in Turkey. Four hundred and eighty female broiler chicks from Ross 308 parent stock flock – at 32 wk of age were hatched in research hatchery facilities of Selcuk University. Upon arrival, the chicks were divided into three lighting treatment groups (n=160), in four replicates each (n= 40). Each group was housed to different lighting proof compartments of broiler house of the research facilities of the university. Each room previously divided into 4 wooden sealed cells of 3 $m^2$ (3x1 m). The same environmental conditions were provided to the groups in order to eliminate room effects. Each room in the all compartments was thermally and photopically isolated by the wooden bedding material. The feed formulations were prepared according to NRC (1994), and feed and water were supplied continuously.

The temperature was fixed at 30 $^0$C for first 4 d, and then reduced by 1 $^0$C every 2 d until it reached 21 $^0$C on day 23, which was maintained until the end of experiment. The mean relative humidity was maintained between 55–65 % during whole rearing period.

Monochromatic (LED) lamps were hung 1.5 m above from the floor. Light intensity was measured in each cell in 8 constant locations at bird eye level using a digital luxmeter. The light intensity was 10 lux at the height of birds' eye level. A 23-h photoperiod was provided for first 7 d, followed by an 18- h photoperiod through to 42 d. Three spectra and their mixture were tested in the study. Trial procedure was as follow:

Three spectra and their mixture were tested in the study. Trial procedure was as follow:

1. Mini incandescent light bulbs (40-W; daylight) for whole period of 42 days; named *control* (CON) group.

2. 560 nm Green LED lamps (peak wave length of 560 nm, half-band width between 552 and 565 nm) (G) for first 3 weeks (wks) and 480 nm Blue LED lamps (peak wave length of 480 nm, half-band width between 470 and 490 nm) (B) for remaining 3 wks; namely G-B group.

3. G for first 3 wks and green-blue (mix) monochromatic lamps for remaining 3 weeks; namely G-GB MIX group. (The peak lengths of the light sources were introduced in the previous paragraph.).

At weekly intervals, mortality, body weight and food intake were recorded on group basis. All birds were fed with diets in meal form with starter diet with 13.4 kJ ME /kg, 22 % crude protein (CP) from 1 to 21 d of age and followed by a grower ration with 13.6 kJ ME /kg, 20 % CP up to the end of the experiment (42 d old). At the end of the trial, 12 birds from each treatment group were randomly selected and slaughtered. Carcass weight, carcass yield and muscle weight of whole carcass were determined.

A completely random design was used at this trial. The data were analyzed using General Linear Model's procedure for analysis of variance (Minitab, 1998). The differences among the group means were analysed by commercial software by using Duncan's Multiple Comparisons Range Test (Mstat-C, 1989).

## RESULTS AND DISCUSSION

Body weights (BW), live weight gains (LWG), feed consumption (FC) and feed conversion ratio (FCR) were presented in Table 1. An increase in BW, LWG and FC was observed in broilers reared under G-B and G-GB mix compared to control group (P<0.01). There were found no significant differences in BW, LWG and FC between G-B and G-GB mix treatment groups for 42 d rearing period. FCR values were similar in all treatments. Furthermore, there were no significant differences in mortality among all groups; mortality averaged 3 % over entire experimental period (data not presented).

Table 1. Effects of traits on body weights, live weight gains and feed conversion rates (Means±SEM)

| | Light colour | | | |
|---|---|---|---|---|
| **Variable** | **G-B** | **G-GB MIX** | **CON** | **P** |
| **BW, g** | 2048.11 $^a$ ±34.9 | 2030.14 $^a$ ±63.5 | 1642.22 $^b$ ±34.4 | **<0.01** |
| **LWG, g** | 2010.63 $^a$ ±34.9 | 1992.82 $^a$ ±63.5 | 1605.6 $^b$ ±34.4 | **<0.01** |
| **FC, g** | 3824.00 $^a$ ±56.8 | 3784.25 $^a$ ±86.4 | 3211.83 $^b$ ±27.4 | **<0.01** |
| **FCR** | **1.90±0.01** | **1.90±0.02** | **2.00±0.05** | **NS** |

*" $^{a,b,}$Row means with different superscripts differ significantly at P <0.01".*

*NS: Not significant*

The effects of light colour on some carcass characteristics were presented in Table 2. G-B and G-GB mix groups had heavier regarding to carcass weight rather than control group (P<0.01). As percentage of live body weight, carcass weights and percent abdominal fat weights of whole carcass were similar among all experimental groups.

The hypothesis tested in current study was that the source and colour of light during the rearing period affects broiler performance. The data in current study showed that monochromatic lighting and its colour played a large role in broiler production and performance. Switching green light to blue or green light to green-blue lights mix after 21 d of rearing period improved performance traits of broilers. Within a period of 42 d rearing periods BW, LWG, FC and some carcass traits were enhanced in the case of using green, blue and green-blue colours of monochromatic light sources. These results were supported by Rozenboim *et al.,* (1999) who stated that green and blue light stimulate growth performance of broilers, and Rozenboim *et al.* (2004) reported that green light stimulated growth of birds at early age, and shifting birds to a different light environment at 10 or 20 d of age might further stimulated growth of broilers. In present study, some performance parameters including FCR and mortality were the similar among the groups.

Table 2. Effects of treatments on carcass weights, percent fat weights and carcass rates of female broilers at slaughter reared under 3 different light spectra (Means±SEM)

| | Light colour | | | |
|---|---|---|---|---|
| **Variable** | **G-B** | **G-GB MIX** | **CON** | **P** |
| **Carcass wt, g** | 1400.71[a]±34.5 | 1315.44 [a] ±34.0 | 1109.85 [b] ±38.2 | **<0.01** |
| **Abdominal fat, %** | 2.40±0.2 | 2.41±0.3 | 1.72±0.1 | **NS** |
| **Carcass wt of body wt, %** | **70.46±0.5** | **70.14±0.7** | **69.87±0. 6** | **NS** |

*" [a,b]Row means with different superscripts differ significantly at P <0.01".*

*NS: Not significant*

These findings were in agreement with those of Rozenboim *et al.* (2004) and Lewis and Morris (1999). The results of our research confirmed that green and blue monochromatic lights had positive effects on growth performances of broilers. Olanrewaju *et al.* (2006) found that light colour is the third major aspect (intensity, duration and wavelength) of lighting schedule and blue light has a calming effect on birds whereas green light accelerates muscle growth. Prayitno *et al.,* (1997) showed that blue or green light was preferable to red or white light for broilers because it kept the birds calmer than conventional light sources. Data in this study indicated that monochromatic lighting and its spectra did not play any negative side effects on mortality of broilers. These results might have been a result of the duration of the lighting regimes rather than light source and colour which were used in the study. As known, 23 L: 1 D hours lighting schedule is quite prevalent most of the broiler production enterprises around the world. The results of present study indicated that types of light source had an important role to improve broiler performance. These results were supported by previous studies which reported similar body weights and food intakes for broilers raised under blue, green, red or white fluorescent tubes to 56 days of age by Wathes *et al.* (1982) or minimal differences were found in broilers grown under blue, green, red, yellow fluorescent tubes or incandescent lamps to 63 days of age by Wabeck and Skouglund (1974). Finally, light colour might be more effective to maximize broiler performance using monochromatic lamp instead of fluorescent and incandescent light sources.

## CONCLUSIONS

The present study shows that improved growth can be achieved using green for first 21 d and switching it ultimate blue or blue- green mix colours from monochromatic (LED) lighting sources for the remaining periods in female broilers.

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