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Research Article

Effects of Photoperiod Length and Light Intensity on Performance, Carcass Characteristics and Heterophil to Lymphocyte Ratio in Broilers [1]

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Abstract

The aim of this study was to investigate the effects of photoperiod length and light intensity on performance, carcass characteristics and heterophil to lymphocyte ratio in broilers. A total of 272 1 day-old male broiler chicks (Ross 308) were randomly assigned to four treatment groups based on the photoperiod length (23L:1D or increasing duration of light) and light intensity (20 lux vs. a dim, reducing intensity) with four replicates. At 42 d of age, effects of photoperiod length and light intensity on performance traits were not significant. The heterophil/lymphocyte ratio in 20 lux and dim, reducing light intensity groups were 0.30 and 0.15 (P<0.001), respectively. On the other hand, the effect of light intensity has no influence on heterophil/lymphocyte ratio. Cold and hot carcass weights and whole breast meat and wing weights were found lower in the dim, reducing light intensity group than 20 lux light intensity group. The effects of photoperiod length and light intensity on carcass characteristics were not significant, statistically. In conclusion, it can be said that body weight, feed consumption, feed convertion ratio, whole breast meat and wing weights were increased by providing the increasing photoperiod used with a 20 lux light intensity in broiler breeding.

Keywords: *Broiler, Carcass, Heterophil/lymphocyte ratio, Light intensity, Performance, Photoperiod*

Etlik piliçlerde Fotoperiyot Uzunluğu ve Işık Şiddetinin Performans, Karkas Özellikleri ve Heterofil/Lenfosit Oranı Üzerine Etkileri

Özet

Bu çalışmanın amacı fotoperiyot uzunluğu ve ışık şiddetinin etlik piliçlerde performans, karkas özellikleri ve heterofil/lenfosit oranı üzerine etkilerinin araştırılmasıdır. Bir günlük yaşta toplam 272 adet (Ross 308) erkek civcivler fotoperiyot uzunluğu (23A:1K veya giderek artan aydınlık süre) ve ışık şiddeti (20 lüks veya giderek azalan ışık şiddeti) faktörlerine göre dört gruba, dört tekrarlı olacak şekilde rastgele olarak dağıtılmıştır. Kırkiki günlük yaşta, performans özellikleri üzerine, fotoperiyot uzunluğu ve ışık şiddetinin etkileri önemsiz bulunmuştur. Yirmi lüks ve giderek azalan ışık şiddeti gruplarında, heterofil/lenfosit oranı sırasıyla 0.30 ve 0.15 olarak bulunmuş olup, gruplar arası farklar istatistik bakımdan önemli (P<0.001) çıkmıştır. Diğer taraftan, ışık şiddetinin heterofil/lenfosit oranı üzerine önemli bir etkisinin olmadığı saptanmıştır. Sıcak ve soğuk karkas ağırlık ortalaması, bütün göğüs eti ve kanat ağırlık ortalaması değerleri giderek azalan ışık şiddeti grubunda, 20 lüks ışık şiddeti grubuna göre daha düşük olarak belirlenmiştir. Tüm karkas özellikleri üzerine fotoperiyot uzunluğu ve ışık şiddetinin etkisi istatistiksel olarak önemsiz çıkmıştır. Sonuç olarak, etlik piliç yetiştiriciliğinde, 20 lüks ışık şiddeti altında, giderek artan aydınlık süre kullanımının canlı ağırlık, yem tüketimi, yemden yararlanma oranı, bütün göğüs eti ve kanat ağırlıklarını olumlu yönde etkilediği söylenebilir.

Anahtar sözcükler: *Etlik piliç, Karkas, Heterofil/lenfosit oranı, Işık şiddeti, Performans, Fotoperiyot*

INTRODUCTION

Light is an important factor in the regulation and control of production, reproduction and health of poultry. Growth rate and welfare of the broiler is influenced to a great degree by at least three components of light: photoperiod, intensity and color or wavelength of the light [1-3]. Broiler chickens have usually been reared under continuous

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(24L:0D) or near-continuous (23L:1D) photoperiods to maximize feed consumption (FC) and growth rate. It has been reported that broilers exposed to continuous or near-continuous lighting programs to provide constant visual access to feed and water, resulting in maximum FC, increased live weight gain and growth rate [4,5]. However, several studies indicated that, using continuous lighting programs might result in inadequate sleep and as a result of sleep deprivation physiological stress responses were increased [6,7]. Amid these conflicting results EU [8] have established guidelines on behalf of poultry welfare on light intensities, and amounts and durations of darkness that must be provided to broilers daily. On this contex, the use of photoperiods longer than 20 h and intensities less than 21.52 lux were restricted. Therefore, recent studies have focused on limited lighting programs (such as increasing photoperiod), as an alternative to the continuous lighting program, to improve the productivity of broilers, Rahimi et al.[9] reported that physical activity and energy consumption were low during darkness period.

Although there is a lot of studies on photoperiod, the effect of light intensity on production is less studied in broilers. The effect of light intensity (ranging from 1 to 150 lx) on body weight (BW), FC, feed conversion ratio (FCR) and mortality in broiler chickens was reported as statistically nonsignificant by some studies [10-12]. Processed fillet weights were reported to be higher in 1.08 lux light intensity (dim light) than those kept in 161.4 lux light intensity (bright light) [13]. Deep et al.[1] observed that carcass, thighs and drums yields decreased linearly with increasing light intensity from 1 to 40 lx in broiler chickens.

The objective of this study was to evaluate the effects of photoperiod and light intensity on performance traits (body weight, feed consumption, feed convertion ratio and mortality), carcass characteristics (cold and hot carcass weights and parts weights) and physiological stress response (heterophil to lymphocyte (H/L) ratio) in broilers.

MATERIALS and METHODS

Animals and Diets

A total of 272 1-d old male broilers (Ross 308) obtained from a commercial hatchery were used in the study. From the first day, chicks were housed on deep litter of wood shavings in an experimental barn with controlled heating and hygienic and feeding patterns according to standard management requirements for broilers. Heat was provided by an electric forced draft heater in each treatment room. Birds were fed with a starter diet from 1 to 21 d of age (3060 kcal ME/kg, 23% crude protein) and a grower diet from 22 to 42 d of age (3200 kcal ME/kg, 21.5% crude protein). Feed and water were available *ad libitum* during the experiment. Two 40 W incandescent bulbs, which were controlled by a rheostat and automatic timer, used for lighting. The lights were attached 1.90 m above the floor. Light intensity was monitored at chick head level using a digital illuminometer (Datalogging light meter, Extech HD 450, Extech Instruments, USA) thrice weekly. Walls and ceilings in the rooms were painted white to ensure light intensity was consistent. The ambient barn temperature was gradually decreased from 32±1°C on d 1 to 23±1°C on the last day of fattening (d 42). The relative humidity was varied 50 to 60%.

Experimental Treatments

All the procedures used in this study were approved by Adnan Menderes University Animal Experiments Local Ethics Committee (No: 64583101/2013/088). A 2 x 2 factorial design was used with two levels of photoperiod length and light intensity treatment groups for which have four photoperiod and light intensity subgroups. Photoperiod lengths were either near-continuous (CPL) (23L:1D from 1 to 42 d) or increasing photoperiod (IPL) (23L:1D from 1 to 8 d, 14L:10D from 9 to 15 d, 16L:8D from 16 to 22 d, 18L:6D from 23 to 29 d, 20L:4D from 30 to 36 d, followed by 23L:1D from 37 to 42 d). It should be noted that 23L was applied for the last 6 d before slaughter in the increasing photoperiod group because of recent EU guidelines [8]. Light intensities were either bright (BLI) or dim, reducing (DRLI). Broilers in the BLI group were exposed to 20 lux from d 1 to 42 d while those in dim, reducing DRLI group were exposed to 5 lux from d 1 to 8, 2.5 lux from d 9 to 15 and 1.25 lux from d 16 to 42.

Traits Measured

Individual BW and FC were recorded on d 8, 15, 22, 29, 36 and 42. According to collected data, FCR was also calculated. Mortality from which cumulative mortality ratio was calculated (0-42 d) recorded at daily basis. On d 41, blood samples from a total of 160 birds that were randomly selected (40 birds (10 birds for each replication) per group were used for heterophil to lymphocyte (H/L). Blood samples were taken from the vena basilica of broilers in each photoperiod and light intensity group. Following the blood film preparation, films were painted with May-Grünwald and Giemsa dyes [14]. After 100 leucocytes were counted in light microscope with (x100) magnification, H/L ratio was calculated by dividing heterophil count to lymphocyte count. At 42 d of age, eight broilers from each pen, a total of 128 broilers were randomly selected for processing. Feed was withdrawal 12 h prior to slaughter. Slaughtering is conducted by cutting the jugular veins and carotid arteries. Broilers were then scalded for 150 s at 53°C, before mechanically plucking (35 s) and eviscerated. Whole carcasses (without neck, giblets) were weighed and recorded as hot carcass weight. Cold carcass weights were recorded after the carcasses were stored at +4°C for 24 h. Skinless, boneless breast fillets *(pectoralis major muscles)*, breast tenders *(pectoralis minor muscles)*, total breast meat, wings, whole legs (thigh and drum) and abdominal fat pads were removed from each carcass and weighed to determine carcass parts weight. Breast skin was removed and then weighted.

Statistical Analyses

Statistical analyses were performed by using Statistical Package for the Social Sciences for Windows (SPSS) 22.0 [15]. The data was subjected to ANOVA using the GLM procedure with photoperiod length and light intensity as the main effects along with their interactions included in the following model: xijk = $\mu + M_i + D_j + (MD)_{ij} + e_{ijk}$, where: x_{ijk} = Analyzed measurement, μ = Overall mean, M_i = Effect of photoperiod length (23L:1D and increasing photoperiod), D_j = Effect of light intensity (bright and dim, reducing), $(MD)_{ij}$ = Effect of interaction, ε_{ijk} = Residual random error. In analysis, GLM was designed to reveal the effects of photoperiod length and light intensity on performance, carcass characteristics and H/L ratios. The partial effects of photoperiod length and light intensity for each factor were analyzed with Least Squares Means Test and multiple comparisons were performed with a Duncan test [16]. Chi-square test was performed for mortality.

RESULTS

Least square means and standard errors of BW of broilers from 8 to 42 days of age were summarized in *Table 1*. Body weights of CPL group were higher than that of IPL group (P<0.01) at 15 days of age. At 42 d, there was not significant difference between CPL and IPL groups. The FC level was found as 699.19 and 683.26 g for CPL and IPL groups at 15 d (P<0.05) *(Table 2)*. The differences between light intensity groups for FC and FCR were not significant for d 0-42. The mortality rate was found as 0.74% for CPL group while there was no death in IPL group. And, there was no death in BLI group while one death (0.74%) recorded in DRLI group. It was also determined that photoperiod length and light intensity has no significant effects on mortality ratio. Least square means and standard errors of live weights, carcass characteristics and parts weights and H/L ratio of broilers were given in *Table 3*. The differences between light intensity groups for H/L ratio were found significant (P<0.001) statistically.

DISCUSSION

On d 15, average BW was 24.68 g (4.50%) less (P<0.01) in IPL group than CPL ones. This difference at BW's can be explained by the suppression of FC's for birds subjected to increasing light IPL group. It was determined that the increasing photoperiod treatment had caused a decrease in FC, which resulted in reduced BW at d 0-15. On d 42, average BW was 30.64 g less in CPL group than IPL ones. There was no significant difference between

Table 1. *Influences of photoperiod length and light intensity on body weights of broilers [1]*

Tablo 1. *Fotoperiyot uzunluğu ve ışık yoğunluğunun etlik piliçlerde canlı ağırlık üzerine etkileri [1]*

Treatment Main Effects	Body Weight (g)											
	n	d 8	n	d 15	n	d 22	n	d 29	n	d 36	n	d 42
Photoperiod length												
Near Continuous (CPL)	136	194.57	135	548.98[a]	135	1020.22	135	1685.79	135	2315.23	135	2916.72
Increasing (IPL)	136	196.87	136	524.30[b]	136	998.55	136	1681.42	136	2329.11	136	2947.36
Light intensity												
Bright (BLI)	136	198.70[a]	136	543.45[a]	136	1004.71[b]	136	1688.43	136	2318.32	136	2944.70
Dim, reducing (DRLI)	136	192.74[b]	135	529.83[b]	135	1014.05[a]	135	1678.78	135	2326.03	135	2919.38
SEM[2]		0.91		2.47		4.62		8.78		13.75		17.24
Photoperiod length x light intensity												
CPL + BLI		199.82		560.97		1027.94		1714.71		2340.06		2980.63
IPL + BLI		189.31		525.93		981.49		1662.15		2296.54		2908.77
CPL + DRLI		197.58		537.00		1012.49		1656.88		2290.41		2852.80
IPL + DRLI		196.16		522.67		1015.60		1700.69		2361.64		2985.96
SEM[3]		1.83		4.92		9.25		17.57		27.51		34.47
Significance of main effects	P value											
Photoperiod length		0.209		0.006		0.314		0.583		0.779		0.463
Light intensity		0.001		0.001		0.020		0.803		0.614		0.375
Photoperiod length x light intensity		0.013		0.037		0.008		0.006		0.051		0.003

[1] Data presented as the least square means, [a,b] Means with different superscript letters in the same row differ (P<0.05), [2] Pooled SEM for main effects, [3] Pooled SEM for interaction effects

Table 2. *The least square means for cumulative feed consumption and feed conversion between days 8 and 42*
Tablo 2. *Sekizinci-42. günler arasında kümülatif yem tüketimi ve yemden yararlanma oranlarına ait en küçük kareler ortalamaları*

Treatment Main Effects	Cumulative Feed Consumption (g/bird)							Cumulative Feed Conversion (g of feed/g of gain)					
	n	d 0-8	d 0-15	d 0-22	d 0-29	d 0-36	d 0-42	d 0-8	d 0-15	d 0-22	d 0-29	d 0-36	d 0-42
Photoperiod length													
Near- Continuous (CPL)	8	163.55	699.19[a]	1363.47	2374.00	3544.81	4732.49	1.09	1.39[b]	1.40	1.45	1.56	1.65
Increasing (IPL)	8	165.81	683.26[b]	1350.10	2379.28	3582.66	4809.98	1.09	1.43[a]	1.42	1.44	1.56	1.64
Light intensity													
Bright (BLI)	8	169.14[a]	688.01	1356.83	2398.85	3583.19	4797.75	1.09	1.38[b]	1.41	1.46	1.58	1.65
Dim, reducing (DRLI)	8	160.22[b]	694.43	1356.74	2354.44	3544.27	4744.71	1.08	1.44[a]	1.40	1.43	1.54	1.64
SEM[1]		1.40	3.32	5.88	13.72	23.85	33.97	0.01	0.01	0.00	0.01	0.01	0.01
Photoperiod length x light intensity													
CPL + BLI		169.00	698.54	1379.30	2437.63	3629.93	4856.48	1.09	1.36	1.41	1.46	1.58	1.66
IPL + BLI		169.28	677.49	1334.35	1360.36	3536.46	4739.02	1.09	1.41	1.42	1.46	1.57	1.65
CPL + DRLI		158.09	699.84	1347.63	2310.67	3459.69	4608.50	1.08	1.42	1.39	1.44	1.54	1.64
IPL + DRLI		162.34	689.03	1365.85	2398.21	3628.85	4880.92	1.09	1.45	1.41	1.43	1.55	1.64
SEM[2]		2.79	6.63	11.75	27.45	47.69	67.94	0.01	0.01	0.01	0.01	0.02	0.02
Significance of main effects				P value						P value			
Photoperiod length		0.434	0.033	0.278	0.851	0.443	0.276	0.854	0.011	0.055	0.722	0.837	0.809
Light intensity		0.008	0.352	0.995	0.132	0.430	0.450	0.582	0.001	0.155	0.068	0.082	0.472
Photoperiod length x light intensity		0.491	0.455	0.020	0.011	0.017	0.014	1.000	0.339	1.000	0.859	0.632	0.903

[a,b] Means with different superscript letters in the same row differ (P<0.05), [1] Pooled SEM for main effects, [2] Pooled SEM for interacion effects

photoperiod groups in terms of final BW, FC and FCR. This finding was found to be consistent with other studies [17-19]. Similary, Downs et al.[4] reported that BW and FC in continuous photoperiod was higher than increasing photoperiod group at early ages. But, at the market age (d 56), photoperiod treatment has no significant effects on BW and FC. Similarly, in other studies the effect of photoperiod on FCR was found to be statistically not significant [4,11,13,17,20]. There was photoperiod length x light intensity interaction on BW of broilers at different periods of growth, except for 36 d. As Downs et al.[4], Lien et al.[11], Çoban et al.[21] reported that the photoperiod length has no statistically significant effects on mortality. It might be arised from the genetic selection of metabolic and skeletal disorders. However, Schwean-Lardner et al.[22] indicated that when photoperiod increased linearly from 14 to 23 h, mortality would gradually increase. It also has been noted that rapid growth rates in the early stages of rearing along with increasing lighting programmes resulted in increased mortality [5,23]. It was determined that the increasing photoperiod length had led to an increase in hot and cold carcass weight, whole leg and abdominal fat pad weights and a decrease in whole breast weights, but this has not reached statistically significance. These findings were in consistent with other studies reporting that decreases in breast meat and increases in wing and leg weights were caused from increasing photoperiod programs [4,17]. Similarly, as reported in some studies that the extension of the light period from 18 h to 23 h [11] and from 14 h to 23 h [22] resulted in heavier whole breast. Lewis et al.[24] also indicated that continuous lighting increased the weight of breast meat. However, a reduction (0.2%) in breast yield during an increasing photoperiod program was reported by Newcombe et al.[25]. The diversity of carcass parts might be explained by some growth retardation of legs and wings by light limitation at early ages. On the other hand, photoperiod has no effect on H/L ratio. Similar results were reported in some studies carried out in broilers in which the effect of photoperiod on H/L ratio were statistically non-significant [11]. However, Coban et al.[21] had recorded lower H/L ratio in 16L:8D photoperiod group than counterparts subjected to continuous lighting (P<0.001).

At d 42, light intensity was not determined to have significant effect on BW. Similarly, Kristensen et al.[10], Blatchford et al.[12], Deep et al.[1], Ahmad et al.[2] reported that light intensity has no significant effects on BW at market age. Newberry et al.[26] also found no influence between light intensity groups (180 and 6 lux) on BW. However, Charles et al.[27] found improved BW and FCR with low light intensities (5.4 lux) compared to birds given more light (150 lux). BW differences can be attributed to increased activity of broilers exposed to high bright light. The FC level was found as 169.14 and 160.22 g for BLI and

Table 3. *The least square means for carcass parameters, carcass part weights and heterophil/lymphocyte (H/L) ratios in treatment groups*

Tablo 3. *Deneme gruplarındaki etlik piliçlerin karkas parametreleri, karkas parça ağırlıkları ve heterofil/lenfosit oranlarına ait en küçük kareler ortalamaları*

Treatment Main Effects	Live Weight (g)	Hot Carcass Weight (g)	Cold Carcass Weight (g)	Whole Breast Weight (g)	Breast Skin Weight (g)	Fillets Weight (g)	Tenders Weight (g)	Whole Leg Weight (g)	Thighs Weight (g)	Drums Weight (g)	Wing Weight (g)	Abdominal Fat Pad Weight (g)	H/L Ratio
Photoperiod length													
Near- Continuous (CPL)	2930.00	2271.91	2241.20	711.37	59.68	595.85	115.53	840.09	583.70	256.39	182.58	42.26	0.21
Increasing (IPL)	2955.61	2280.16	2249.29	704.20	61.44	587.92	116.28	851.05	589.50	261.55	178.91	44.99	0.24
Light intensity													
Bright (BLI)	2947.14	2293.16	2258.66	720.83	60.20	602.42	118.41	840.88	583.22	257.66	182.58	44.10	0.30[a]
Dim, reducing (DRLI)	2938.47	2258.91	2231.83	694.74	60.92	581.35	113.39	850.25	589.97	260.28	178.92	43.14	0.15[b]
SEM[1]	25.17	20.44	20.02	7.41	1.13	6.46	1.37	8.84	6.20	2.99	1.66	1.21	0.02
Photoperiod length x light intensity													
CPL + BLI	2966.28	2327.94	2294.81	743.51	61.47	624.49	119.03	839.10	581.73	257.37	186.09	41.75	0.32
IPL + BLI	2928.00	2258.39	2222.52	698.15	57.90	580.35	117.80	842.67	585.67	255.42	179.07	46.46	0.28
CPL + DRLI	2893.72	2215.88	2187.59	679.23	58.94	567.21	112.03	841.08	584.72	257.95	179.07	42.77	0.09
IPL + DRLI	2983.22	2301.94	2276.06	710.25	63.95	595.49	114.76	859.42	594.28	265.14	178.76	43.52	0.20
SEM[2]	50.13	40.71	39.88	14.75	2.25	12.86	2.73	17.61	12.54	5.94	3.31	2.40	0.03
Significance of main effects							**P value**						
Photoperiod length	0.612	0.840	0.840	0.629	0.437	0.540	0.783	0.537	0.641	0.389	0.272	0.260	0.334
Light intensity	0.863	0.404	0.504	0.081	0.752	0.105	0.069	0.597	0.587	0.661	0.273	0.691	<0.001
Photoperiod length x light intensity	0.207	0.059	0.051	0.011	0.061	0.006	0.470	0.677	0.821	0.445	0.314	0.415	0.026

[a,b] *Means with different superscript letters in the same row differ ($P<0.05$),* ***Whole breast*** *= combined weight of right and left pectoralis major and minor.* ***Fillet*** *= combined weight of right and left pectoralis major;* ***Tender*** *= combined weight of right and left pectoralis minor,* [1] *Pooled SEM for main effects,* [2] *Pooled SEM for interacion effects*

DRLI groups at 8 d (P<0.01). In the following weeks, there was no significant effect of light intensity on FC. Similarly, Downs et al.[4], Lien et al.[11], Charles et al.[27] reported that there was no effect of light intensity on FC. Kristensen et al.[10] also reported no effect of intensities varying from 53.80 lux to 64.56 lux as in contrast to 107.6 lux to 124.82 lux was observed on FC. Whereas, Lien et al.[13] found that FC increased gradually by providing 1.75 vs. 162 lux of light intensity. Inconsistencies between studies are most probably related to the amount of light intensity. Also, it can be concluded that light intensity varying from 1.25 to 20 lux have no significant effect on FC. Similarly, light intensity did not have any effect on FCR. Similar results were reported by various authors about light intensity in different growth periods [4,11,13,27]. Buyse et al.[28] reported that increasing light intensity from 5 to 51 lux has no significant effect on FCR. According to, Deep et al.[1], Ahmad et al.[2], Kristensen et al.[10], Lien et al.[11], and Lien et al.[13] light intensity has no significant effect on mortality. However, Newberry et al.[26] observed an increase in mortality due to light intensity ranging from 6.45 to 194 lux. The differences between studies regarding the effect of light intensity on mortality may be arised from timing, severity and duration of light intensity and combined effect of light intensity with other management factors. The cold carcass weight of broilers reared at BLI group was higher (2258.66 g) than DRLI group (2231.83 g). Similary, Lien et al.[11] reported that higher cold carcass weight has been reported in broilers reared under 10.76 lux compared to 1.08 lux (P<0.01). Parallel to this result, several authors reported that there were no significant differences in abdominal fat pad weight among light intensity groups [1,4,13]. In another study in which Deaton [29] used two levels of light intensity (2 or 52 lux) found that the proportion of abdominal fat pad was unaffected by light intensity. In contrast, Charles et al.[27] reported that carcasses of broilers exposed to 150 lux had a lower percentage of fat than those exposed to 5 lux. Moreover, it was determined that light intensity has no effects on the most valuable part of the carcass in breast meat [1,4,11,13]. This study revealed that whole leg, thigh and drum weights were not affected by light intensity. Likewise, Downs et al.[4] reported an 1.35% improvement in 56-d whole leg weight when female broilers were exposed to 2.69 lux (777.7 g), as in contrast to 21.52 lux (767.2 g), with no influence on whole leg weight. Although wing weight was not influenced by light intensity, an increase of wing weight in broilers exposed to low light intensity has been indicated by other studies [1,4,13]. Likewise Deep et al.[1], light intensity has no significant effect on the weight of breast skin. The genotype and gender of broilers, severity of light intensity and light intensity in combination with some environmental factors can be responsible for the differences in some studies regarding to the effect of light intensity on carcass part weights. Interaction effect of photoperiod length and light intensity on many carcass parts weights were not significant. The H/L ratio is a sensitive indicator of stress, and 0.2, 0.5 and 0.8 characterize low, optimum and high levels of stress, respectively [30]. In this study, the highest H/L ratio (0.30) was obtained for broilers in BLI group, whereas the broilers in DRLI group had the lowest H/L ratio (0.15). This result suggests that broilers in light intensity indicated a low level of stress. However, Lien et al.[11] reported no effect of light intensity on the H/L of 40-days old female broilers.

These results indicated that increasing photoperiods have negative effects on FC in d 0-15. However, in later periods, it was determined that broilers exposed to increasing photoperiods has reached similar BW's. As to light intensity, the birds exposed to a dim, reducing light intensity showed a reduced BW in d 8, 15 and 22. On the other hand, BWs rebounded by d 42 to weights similar to those for birds on bright light intensity. The low levels of H/L ratios indicated that light intensity was a non-stressful event by broilers. Increasing photoperiod and 20 lux light intensity would appear to produce the best BW benefits for the commercial broiler producers, as well as the 20 lux light intensity did promote heavier whole breast meat and wing weights. It's believed that further studies should be designed to understand the physiological pathways and welfare status of broilers exposed to different photoperiods and light intensities.

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