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# EFFECTS OF LIGHT REGIMENS ON SASSO BROILERS PERFORMANCE

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**ABSTRACT:**The current investigation was designed to evaluate the effect of light regimens on broilers performance, carcass parameters, lymphoid organs, blood constituents, health parameters of Sasso broiler chicks. Two hundred and seventy chicks were randomly divided into 3 equal groups 90 chicks each (24hr continues light, C; 12hr continues light plus 12hr flash light, CF and 24hr flash light, F). All experimental chicks were housed in floor pens from one day till six weeks of age. All environmental and administrative provisions were the equivalent during the trial time. The obtained results showed that lighting regimens significantly affected growth performance, abdominal fat, plasma constituents, antioxidant markers, health parameters and performance evaluation. However, there were no significant effect on feed consumption and lymphoid organs. In addition, birds raised under continues+flash lighting program had the highest performance. Therefore, the continuous plus flash lighting program is highly recommended for Sasso broiler chicks during fattening period.

**Key words:** Sasso broiler chickens; lighting program; growth performance.

## INTRODUCTION

Lighting programs have a focal reason of controlling growth rate of broilers to allow birds to accomplish physiological development preceding maximal pace of muscle mass accretion (Lewis and Morris, 2006). Lighting regimes can influence numerous parts of avian physiology, welfare, behavior, and other factors, including blood chemistry, ocular development, and behavioral rhythms (Olanrewaju *et al.,* 2013; Schwean-Lardner *et al.,* 2013). Lighting span is a main consideration influencing broiler performance. Several examinations inspected the connection between lighting regimes and an assortment of characteristics in broilers and demonstrated that continuous lighting program is not suggested as an ideal program (Farghly and Makled, 2015; Farghly *et al.,* 2017). A decrease of action and walking or dozing during darkness may bring about decrease heat creation by 25% and increase melatonin levels (Rahimi *et al.,* 2005; Farghly *et al.,* 2016). This theses was conducted to investigate the influence of light regimes (Twenty-four hours continues lighting program, twelve hours continues plus twelve hours flash lighting program and twenty-four hours flash lighting program) on the growth performance, carcass measurements, lymphoid organs, blood constituents, health parameters (leg problems, body temperature, and mortality) and performance evaluation of broilers and developing specific practices for broiler production.

## MATERIALS AND METHODS

The current study was carried out at the Research Poultry Farm, Faculty of Agriculture, Assiut University, Assiut, Egypt. All experimental procedures were conducted according to the Local Experimental Animal Care Committee and approved by the Ethics Committee of the Department of Poultry Production, Faculty of Agriculture, Assiut University, Assiut, Egypt. The aim of this study was to evaluate the effect of light regimes on the performance of broilers under semi-intensive production.

### Experimental design, birds, and management

This research was performed with two hundred and seventy broiler chicks from a common commercial strain (Sasso). Three equal groups ninety chicks each these three groups were three different lighting programs were twenty-four hours continues light (C), twelve hours continues light plus twelve hours' flash light (CF) and twenty-four hours' flash light (F). All chicks were received at one-day old of age. Chicks were wing-banded, weighed and housed in 27 rectangular pens (2.5 m2) the stocking density was 10 birds/m2 on litter floor (wheat straw materials) situated in thermostatically controlled building to provide the required temperature. The chicks were reared under 32 °C temperature as standard brooding temperature and 55% relative humidity during the first week, then gradually reduced 2 °C every three days to reach 24 °C and 55% relative humidity. The light and dark cycles were obtained by using test light source controlled by automatic timer and dimmer to justify lighting periods and light intensity between 5 and 10 lux for each lighting group. Each pen was equipped with a feeder and a drinker. Chicks were provided with as much food and water as they wanted, and feed consumption was calculated at the end of

each week. Chicks were provided with commercial feed according to age specifications. All diets were formulated to meet or exceed NRC (1994) recommendations for essential amino acids in starter diet containing (23% protein, ME 3000 Kcal. /Kg) from day one to twenty-one days old of age and grower diet containing (21% protein, ME 3100 Kcal. /Kg) from twenty-two days to forty-two days old of age.

**Measured parameters:**

Body weights were obtained at one, two, three, four, five and six weeks of age. chicks were individually weighed (±1 gram). Average daily weight gains (ADG) were obtained at one, two, three, four, five and six weeks of age. Daily body weight gains were calculated according to the following equation: ADG = (BW2 – BW1)/P Where, ADG is the daily body weight gains. BW1 is the weight at the beginning of the period. BW2 is the weight at the end of that period. P is the period in days (7 days). Feed consumption was determined and calculated as gram feed/bird/day for the same time periods. Birds were checked twice daily and weight of dead birds was used to adjust for feed consumption. Feed conversion ratio was calculated as the amount of feed consumed per unit of body weight gain for the same time periods, according to the following equation: FCR Ratio = FC/ADG Where: FC is estimated as (g feed/chick/day). ADG is estimated as (g gain/chick/day). At the end of the experiment (6 weeks of Age), twenty seven birds were randomly taken as representative samples three birds per group; one bird per replicate, the birds were individually weighed, slaughtered by cutting the neck near the first cervical vertebra and then blooded freely for 10 minutes, eviscerated to evaluate and to record carcass and measurements of the dressed carcass (carcass weight + giblets weight), edible viscera weight (Giblet = liver, heart and gizzard), breast meat yield, thigh, abdominal fat, as percentages of the preslaughter weight were also recorded. Lymphoid organs (spleen, bursa and thymus) as percentages of the preslaughter weight were also recorded. At the end of the experiment, blood samples were collected after slaughtered in heparinized tubes. Blood samples were centrifuged at 3,000 rpm for 15 min, and plasma obtained was stored at -20 °C until analysis. Plasma total protein, albumin, globulin values were obtained by subtracting the values of albumin from the corresponding values of total protein, A/G ratio and glucose. Cholesterol were determined colorimetrically using available commercial kits purchased from Spectrum Diagnostic Company (Cairo, Egypt). Total antioxidant capacity (T-AOC) and malondialdehyde (MDA) were measured according to the method described by Koracevic *et al.*, (2001). Certain health aspects (leg problems and mortality) were recorded. The leg problems scores ranged from 1 = no hock discoloration or foot pad dermatitis to 5 = total coverage with red hock discoloration or total foot pad involvement in foot pad dermatitis. Dead birds were recorded as it occurred daily, and the mortality rate (%) was calculated during the experimental period. The body temperature (◦C) was measured at six weeks of age by placing a thermometer in the cloaca for 2 min at a depth of 2 cm at midday. The Production Number (PN) was calculated on the basis of productive performance according to the formula given by Euribrid (1994):

PN = average live weight × % survivability/days (duration of fattening) × Feed Conversion Ratio: 10.

Measurement of production performance: Live weight (LW), livability (LA), slaughter age (SA) and feed conversion ratio (FCR) were accepted such as technical indicators of production, and production efficiency (PEF) was calculated with the following formula (Marcu *et al.,* **2013)**: For analysis of performance indicators such as: EPEF the following formulas were used: European Production Efficiency Factors (EPEF):

$$EPEF = \frac{\text{Viability (\%) x BW (kg)}}{\text{Age (d) x FCR (kg feed/ kg gain)}} \times 100$$

Performance index (PI) were calculated following the below mentioned formula (Jahan *et al.,* 2006):

$$PI = \frac{\text{Live weight in kg}}{\text{Feed conversion ratio}} \times 100$$

**Statistical analysis:**

Data obtained from this study were tested for the significance of vitamin D3 levels effect by ANOVA and GLM using the SAS (2009), procedure version 9.2. Duncan's multiple range test (Duncan, 1955), was used to determine differences among means when treatment effects were significant. All data percentages of this study were transformed to Arcsine values before analysis. Significant differences were considered to exist when ($P<0.05$).

**RESULTS AND DISCUSSIONS**

**Growth performance:**

There were significant effects because of lighting programs at 3 and 6 weeks of age at $P\leq0.0001$ and $P\leq0.0001$ respectively (Table 1). However, body weight of Sasso broiler chicks which exposed to a continues+flash lighting program were the same significantly affect as the effect of flash lighting program they both were better than continues lighting programs. There were significant effects due to lighting programs on weekly weight gain at 3 and 6 weeks of age at $P<0.0001$ and $P\leq0.0290$ respectively (Table 1). However, body weight gains of Sasso broiler chicks which exposed to the continues+flash lighting program were better than the other both continues and flash lighting programs. There were insignificant effects due to lighting programs on feed consumption at all ages (Table 1). There were significant effects due to lighting programs on FCR at the interval between (1-3) weeks of age at $P\leq0.0199$ (Table 1). However, feed conversion ratio of Sasso broiler chicks which exposed to a flash lighting and continues+flash lighting programs were the best lighting program. This study in agreement with Farghly *et al.,* (2019a) who reported that broiler chicks presented to flash lighting program had the highest BW and ADG values and the lowest FCR of all the groups. Also, Olanrewaju *et al.,* (2019) showed that broilers subjected to regular/intermittent photoperiod increased body weight on day 14, day 28, day 42, and day 56 of age. We in the same with Farghly *et al.,* (2019b) who reported that no significant effect on feed consumption due to lighting programs. Also, for FCR Farghly *et al.,* (2019b) who reported that hens presented to intermittent lighting program had the lowest FCR when compared with the other groups. Arowolo *et al.,* (2019) reported that different degrees of intermittent photo-period as opposed to one continuous photoperiod have been demonstrated to significantly improve broilers' feed to gain ratio up to 7.3%.

**Carcass traits**

There were insignificant effects due to the lighting programs on carcass traits (Table 2) of Sasso chicks except, the effect on abdominal fat it was significant at *P≤0.0001* the chicks which raised under flash lighting program were lowest than other lighting groups. Same results with Farghly *et al.,* (2019a) reported that the interaction between feeding regimes × lighting programs broilers exposed to a restricted feeding regime × flashing light had the least abdominal fat rates of all the groups. Also, Metwally *et al.,* (2015) reported that light type significantly affected carcass traits. Intermittent feeding and lighting have been used to reduce excessive abdominal fat deposition (Farghly and Hassanien, 2012; Farghly and Makled, 2015).

**Some lymphoid organs**

There were insignificant effects due to the lighting programs on lymphoid organs of Sasso chicks (Table 3). This results in agreement with Farghly *et al.,* (2019a) who reported that lighting programs did not changes in spleen percentage of the broilers raised under the distinctive lighting regimes.

**Some plasma constituents**

There were insignificant effects due to the lighting programs on most of plasma constituents (Table 4). It could be observed that there were significant differences in glucose of plasma constituents at significant *P≤0.0093*. Chicks which raised under continues+flash lighting program were significantly affected on glucose they were higher than chicks which raised under the other lighting programs. Chicks raised under continues and flash lighting programs they were higher levels in cholesterol at significant *P≤0.0030* than other lighting program. Olanrewaju *et al.,* (2013) reported that in examination with the long/continuous and regular/ intermittent photoperiods, the short/nonintermittent photoperiod significantly decreased total protein (TP).

**Antioxidant parameters**

There were significant effects due to the lighting programs on antioxidant markers of Sasso chicks (Table 5). Chicks raised under continues+flash lighting program have significant (*P≤0.0001*) higher TAOC compared to other lighting programs values. Chicks raised under continues and flash lighting programs have significant (*P≤0.0001*) higher MDA value compared to other lighting program values. Similarly, Farghly et al., (2019b) reported that hens presented to intermittent lights indicated significantly increased concentration of total antioxidant capacity and decreased of MDA in comparison with the other groups.

**Health parameters**

There were significant effects due to the lighting programs on health parameters of Sasso chicks (Table 6). Chicks raised under continues and flash lighting programs they were higher in leg problems at significant *P≤0.0056* than other lighting program. There were no significant effects on mortality rate as affected by lighting programs on Sasso broiler chicks. Chicks raised under continues and continues+flash lighting programs they were higher in body temperature at significant *P≤0.0077* than other lighting program. Conversely with Farghly et al., (2019a) who reported that broilers reared under the different lighting programs had no changes on body temperature values of all the groups. Same results like Nelson et al., (2020) observed that birds in the intermittent, short-dawn/dusk photoperiod (ISD) treatment had

lower hock burn and foot pad dermatitis. Arowolo et al., (2019) reported that various degrees of intermittent photoperiod as opposed to one continuous photoperiod have been demonstrated to significantly decrease mortality rate ranging between 0.43% and 0.72%.

**Performance evaluation**

There were significant effects due to the lighting programs on performance evaluation of Sasso chicks (Table 7). Chicks raised under continues+flash lighting programs they were better in FCR at significant $P \leq 0.0014$ than other lighting programs. Chicks raised under continues+flash and flash lighting programs they were higher in PN at significant $P < 0.0001$ than other lighting program. Chicks raised under continues+flash and flash lighting programs they were higher in EPI at significant $P \leq 0.0001$ than other lighting program. Chicks raised under continues+flash and flash lighting programs they were higher in EPEF at significant $P < 0.0001$ than other lighting program. Intermittent lighting has been utilized to reduce production costs (Farghly et al 2017; Farghly and Makled, 2015).

## CONCLUSION

The obtained results of this experiment showed that continuous plus flash lighting program improved growth performance without any unfavorable impacts on physiological and behavioral or health parameters until marketing age.

## ACKNOWLEDGEMENTS

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**Table (1):** Effects of light regimens on growth performance of Sasso broiler chicks.

| Treatments | body weights (weeks) | | | body weight gain (weeks) | | | feed consumption (g/b/d) | | | feed conversion ratio (g feed/ g gain) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 day old | 3 | 6 | 1 | 3 | 6 | 0 – 1 | 1 – 3 | 3 – 6 | 0 – 1 | 1 – 3 | 3 – 6 |
| Continues (C) | 39.03 ±0.19 | 623.39 ±5.18[b] | 1231.61 ±10.52[b] | 8.84±0 .07 | 37.17±0 .65[b] | 25.75±0 .93[b] | 18.22± 0.40 | 51.31± 1.87 | 77.66± 0.75 | 2.06±0 .04 | 1.40± 0.09[a] | 3.14±0 .19 |
| Continues+Flash (CF) | 39.37 ±0.24 | 673.69 ±6.24[a] | 1329.00 ±7.22[a] | 8.55±0 .10 | 44.91±0 .88[a] | 28.42±0 .98[a] | 18.27± 0.43 | 51.29± 1.57 | 77.07± 0.51 | 2.14±0 .05 | 1.15± 0.05[b] | 2.76±0 .13 |
| Flash (F) | 39.15± 0.28 | 663.36± 6.48[a] | 1316.98 ±8.93[a] | 8.66±0 .09 | 43.62±0 .93[a] | 29.14±0 .86[a] | 18.32± 0.39 | 50.74± 0.92 | 76.50± 0.67 | 2.12±0 .05 | 1.17±0. 05[b] | 2.67±0 .10 |
| *P*- value | 0.6095 | <.0001 | <.0001 | 0.0758 | <.0001 | 0.0290 | 0.9849 | 0.9556 | 0.4644 | 0.5540 | 0.0199 | 0.0708 |

[a - b] Means in the same columns with different superscript are significantly different (P≤0.05).

**Table (2):** Effects of light regimens on carcass traits of Sasso broiler chicks.

| Treatments | Carcass traits | | | | | | |
|---|---|---|---|---|---|---|---|
| | Live BW (g) | Carcass % | Breast % | Thigh % | D. carcass % | Giblets % | Abdominal fat % |
| Continues (C) | 1219.44±15.58 | 66.23±0.62 | 21.95±0.59 | 13.54±0.61 | 71.10±0.74 | 4.87±0.22 | 2.19±0.03[a] |
| Continues+Flash(CF) | 1251.67±35.18 | 68.18±0.66 | 22.05±0.56 | 12.41±0.56 | 73.02±0.66 | 4.84±0.12 | 2.15±0.06[a] |
| Flash (F) | 1222.78±23.19 | 66.94±0.79 | 22.49±0.57 | 13.00±0.68 | 71.77±0.90 | 4.83±0.23 | 1.71±0.03[b] |
| *P*- value | 0.6326 | 0.1535 | 0.7812 | 0.4463 | 0.2238 | 0.9915 | <.0001 |

[a - b] Means in the same columns with different superscript are significantly different P≤0.05.

**Table (3):** Effects of light regimens on lymphoid organs of Sasso broiler chicks.

| Treatments | Lymphoid organs | | |
|---|---|---|---|
| | **Spleen%** | **Bursa%** | **Thymus%** |
| Continues (C) | 0.15±0.01 | 0.16±0.01 | 0.09±0.03 |
| Continues+Flash (CF) | 0.16±0.01 | 0.16±0.01 | 0.11±0.03 |
| Flash (F) | 0.18±0.01 | 0.13±0.01 | 0.08±0.01 |
| P- value | 0.2796 | 0.0812 | 0.7147 |

All values were not significant (P≤0.05).

**Table (4):** Effects of light regimens on some plasma constituents of broiler chicks.

| Treatments | Some plasma constituents | | | | | |
|---|---|---|---|---|---|---|
| | **Total protein (g/dl)** | **Albumin (g/dl)** | **Globulin (g/dl)** | **A/G ratio** | **Glucose (mg/dl)** | **Cholesterol (mg/dl)** |
| Continues (C) | 4.13±0.09 | 1.70±0.09 | 2.42±0.04 | 0.71±0.04 | $16.29\pm0.42^{b}$ | $167.62\pm3.50^{a}$ |
| Continues+Flash (CF) | 4.27±0.10 | 1.72±0.08 | 2.56±0.04 | 0.67±0.03 | $17.85\pm0.37^{a}$ | $153.94\pm3.71^{b}$ |
| Flash (F) | 4.22±0.07 | 1.79±0.07 | 2.43±0.06 | 0.74±0.04 | $16.38\pm0.29^{b}$ | $171.67\pm2.92^{a}$ |
| *P*- value | 0.4807 | 0.7244 | 0.1207 | 0.4751 | 0.0093 | 0.0030 |

[a - b] Means in the same columns with different superscript are significantly different (P≤0.05).

**Table (5):** Effects of light regimens on antioxidant markers of broiler chicks.

| Treatments | Antioxidant markers | |
|---|---|---|
| | **T AOC** | **MDA** |
| Continues (C) | $3.71\pm 0.14^{b}$ | $16.07\pm 0.42^{a}$ |
| Continues+Flash (CF) | $4.93\pm 0.18^{a}$ | $12.84\pm 0.43^{b}$ |
| Flash (F) | $4.01\pm 0.14^{b}$ | $15.79\pm 0.52^{a}$ |
| *P*- value | 0.0001 | 0.0001 |

[a - b] Means in the same columns with different superscript are significantly different (P≤0.05).

**Table (6):** Effects of light regimens on health parameters of broiler chicks.

| Treatments | Health parameters | | |
|---|---|---|---|
| | **Mortality rate** | **Leg problems** | **Body temperature** |
| Continues (C) | 0.89±0.35 | 1.72±0.15[a] | 41.92±0.12[a] |
| Continues+Flash (CF) | 0.56±0.29 | 1.28±0.09[b] | 42.03±0.07[a] |
| Flash (F) | 0.22±0.15 | 1.94±0.15[a] | 41.51±0.14[b] |
| *P*- value | 0.2567 | 0.0056 | 0.0077 |

[a - b] Means in the same columns with different superscript are significantly different P≤0.05.

**Table (7):** Effects of light regimens on performance evaluation of broiler chicks.

| Treatments | Performance evaluation | | | |
|---|---|---|---|---|
| | **FCR** | **PN** | **PI** | **EPEF** |
| Continues (C) | 1.81±0.03[a] | 148.86±8.36[b] | 68.30±1.89[b] | 148.86±8.36[b] |
| Continues+Flash (CF) | 1.65±0.04[b] | 192.91±4.73[a] | 81.02±1.99[a] | 192.91±4.73[a] |
| Flash (F) | 1.63±0.03[b] | 188.74±5.55[a] | 81.02±1.78[a] | 188.74±5.55[a] |
| *P*- value | 0.0014 | <.0001 | <.0001 | <.0001 |

[a - b] Means in the same columns in with different superscript are significantly different P≤0.05.

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## الملخص العربى
## تأثير برامج الإضاءة على أداء دجاج التسمين ساسو

محمد فرغلى علم الدين فرغلى، محمد متولى أحمد حامد،
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أجريت هذه الدراسة على مئتان و سبعون طائر من سلالة ساسو التسمين التجارية لتقييم تأثير برامج إضاءة مختلفة على اداء طيور ساسو التسمين، خصائص الذبيحة، الغدد الليمفاوية، بعض مكونات بلازما الدم، بعض الصفات الصحية. قسمت الطيور عشوائيا الى ثلاث مجاميع تسعون طائر لكل منها من عمر يوم وحتى 42 يوم. تم اسكان طيور الثلاث مجاميع تحت ثلاث برامج إضاءة مختلفة: برنامج اربعة وعشرون ساعة إضاءة مستمرة - برنامج اثنا عشر ساعة إضاءة مستمرة وإثنا عشر ساعة إضاءة وميض - برنامج اربعة وعشرون ساعة إضاءة وميض. الصفات المدروسة خلال هذه التجربة كانت متوسط وزن الجسم، متوسط الزيادة اليومية لوزن الجسم، العلف المستهلك يوميا لكل طائر، معامل تحويل العلف (علف/زيادة وزن الجسم)، خصائص الذبيحة، الغدد الليمفاوية، بعض مكونات بلازما الدم، بعض الصفات الصحية، تقييم الأداء، لدورة التسمين.

وجدت تأثيرات معنوية على وزن الجسم و معامل التحويل وتقييم الأداء ولا يوجد اى تأثيرات عكسية على الغدد الليمفاوية. كان أداء الطيور التى تعرضت للإضاءة المستمرة والوميض معا أعلى قيمة فى تقييم الأداء. من هذه النتائج يمكن التوصية بتربية دجاج التسمين من سلالة الساسو ببرنامج الإضاءة المستمرة والوميض معا.